Abstracts
Acre-Chafin

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0252 ASIH STOYE ECOLOGY & ETHOLOGY IV, Friday 14 July 2017

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Movements and Demography of *Cycleptus elongatus* in the lower Colorado River, TX

Alteration of flow regime, e.g., timing, duration, flashiness, and magnitude of discharge, has serious implications to fluvial specialists inhabiting large rivers that have evolved flow-dependent life histories. Blue Sucker *Cycleptus elongatus*, is one such species that is considered vulnerable throughout its range due to its habitat requirements and life-history traits. However, the relationships between stream discharge and habitat use and recruitment in *C. elongatus* have not been thoroughly examined, particularly in southern portions of its range. The primary objectives of this research were to assess effects of varied streamflow levels, regulated by water releases from upstream reservoirs, on *C. elongatus* movement, habitat use, and recruitment in the lower Colorado River downstream of Austin, Texas. Radio and acoustic telemetry was used to characterize movement in response to river discharge changes. Results suggest large-scale movements are related to season and flow regime prior to a relocation event. Furthermore, home range and minimum displacement are correlated with riffle density. Additionally, fin-ray sections (n = 105) taken from specimens during mark-recapture efforts were used to estimate age and associate relative year-class strength with historical flow regimes. Preliminary results suggest the population in the lower Colorado River has had limited recruitment, and stronger cohorts appear to be associated with years with higher discharge. This work will provide critical information regarding conservation and protection of *C. elongatus* in Texas and inform water management policy decisions affecting instream flows in the lower Colorado River.

0543 Reptile Behavior, Friday 14 July 2017

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Home Range and Movements of the Reticulate Collared Lizard (*Crotaphytus reticulatus*) in South Texas

The Reticulate Collared Lizard, *Crotaphytus reticulatus*, is one of the largest species of lizards in Texas. It is restricted to the South Texas Plains Ecoregion, mainly along the western edge of the Rio Grande Valley, in which the western extent of the South Texas Sandsheet gives way to areas of gravelly soils and lime-stone caliche hills dominated by dense thornscrub. This species is uncommon within its Texas distribution, but

populations are believed to be stable, as much of their known habitat occurs within large ranches. The ecology and natural history of *C. reticulatus* is poorly understood and detailed studies on home range size and movements have not been conducted. The recent development of the Eagle Ford Shale, in this region is a new potential threat, and the ways in which energy development will impact this species are unknown. We conducted a two-year telemetry study at two sites on the San Antonio Viejo Ranch in Jim Hogg and Starr counties of Texas. Preliminary results suggest males have larger home ranges than females; however, this was not significant (t=-1.6151, P=0.15). Here we add the results of a second year of telemetry research to more completely determine the home range size and movements of *C. reticulatus* in South Texas.

0251 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Cory Adams, Daniel Saenz

Southern Research Station, USDA Forest Service, Nacogdoches, TX, USA

Effects of Chinese Tallow Catkins on a Spring Breeding Anuran

Chinese tallow (*Triadica sebifera*) is an aggressive invasive species that has become a major component of the landscape in the southeastern United States. Recent studies have demonstrated that Chinese tallow leaf litter can cause mortality in amphibian larvae and eggs by causing drastic changes in water chemistry. The effects of the leaf litter on water chemistry are short lived and thus are primarily a threat to winter breeding species and species that overwinter as larvae. As a result, a large subset of species may escape any adverse effects of Chinese tallow leaf litter simply due to reproductive phenologies that keep eggs and larvae out of the water at a time when leaf litter is present. For this study, we examine the potential impacts of Chinese tallow catkins (elongate clusters of pollen producing flowers), as these structures tend to abscess and fall from trees in large quantities in late spring. We exposed Gulf Coast toad larvae (*Incilius nebulifer*) to various concentrations of Chinese tallow catkins and determined water chemistry and tadpole survival. Toad tadpole survival was very low and mortality occurred very quickly in our trials. We found that catkins had a more pronounced effect on deoxygenation of the water than the leaf litter. Our findings suggest that Chinese tallow catkins have the potential to threaten summer and spring breeding amphibians in much the same manner as leaf litter in the fall and winter.

0715 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Michelle E. Adcock[1], Zachary C. Adcock[1], J. Steve Godley[2]

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Tail loss in Sympatric Sirenid Salamanders from Rainey Slough, Florida

Tail loss in sirenid salamanders may be caused by intraspecific aggression, interspecific aggression, or predatory interactions. We evaluated the frequency of tail loss in three

sympatric species of sirenids (*Siren intermedia, Siren lacertina,* and *Pseudobranchus axanthus*) in a water hyacinth (*Eichhornia crassipes*) community at Rainey Slough, Glades County, Florida from 1974 through 1979. We determined if correlations exist between the frequency of sirenid tail loss and intra- and interspecific density of sirenids and the density of some potential predator species. Frequency of tail loss was 18% in 537 *S. intermedia*, 15% in 474 *P. axanthus*, and 4% in 100 *S. lacertina*. Both *P. axanthus* and *S. lacertina* tail loss was not significantly correlated with any of the measured variables. However, *S. intermedia* tail loss was significantly correlated with intraspecific density and the density of total predators. Our findings suggest that *S. intermedia* may be intraspecifically more aggressive than either *S. lacertina* or *P. axanthus*.

0716 Herp Reproduction & Life History I, Thursday 13 July 2017

Zachary C. Adcock, Michael R.J. Forstner

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Reproductive Ecology of Federally Threatened Jollyville Plateau Salamanders (*Eurycea tonkawae*) with Comments on Management Implications

Jollyville Plateau Salamanders (*Eurycea tonkawae*) are small, neotenic salamanders that occupy aquifer and spring habitats in Travis and Williamson Counties, Texas. The U.S. Fish and Wildlife Service listed *E. tonkawae* as threatened in 2013, but basic life history data that are critical for informing management and conservation policies are limited for this taxon. We conducted monthly to bi-monthly *E. tonkawae* surveys at six sites in four federal critical habitat units from 2013 to 2016. We recorded total length (TL), snout-vent length (SVL), and microhabitat for each captured salamander and non-invasively inspected its body cavity for oocytes. We captured a total of 815 *E. tonkawae*, of which, 45 were gravid females. The minimum size of a gravid female was 23.6 mm SVL, and gravid females contained between 1 – 21 visible oocytes. The percentage of gravid females across all sites peaked from November to February, and the percentage of juveniles and subadults peaked approximately two to three months later. We found gravid females disproportionately abundant at some sites, suggesting differential reproductive effort. However, juvenile abundance was proportional among sites. We never observed eggs, strongly suggesting that oviposition occurs subsurface. Smaller size class salamanders may be avoiding adults, as chi-square goodness of fit tests revealed that juveniles and subadults selected different microhabitat structure types than adults. Future management and policy decisions should consider the potential importance of all types of microhabitat structure and subsurface habitat for the reproductive ecology of this taxon.

0015 Fish Morphology, Saturday 15 July 2017

Dominique Adriaens[1], Jens De Meyer[1], Mathias Bouilliart[1], Joachim Christiaens[1], Claude Belpaire[2], Sam Van Wassenbergh[3], Anthony Herrel[3], Jonna Tomkiewicz[4],

Peter Lauesen[4], Gregory Maes[5], Ron Dirks[6], Pascal Boeckx[1], Lieven Bervoets[7], Adrian Covaci[7], Govindan Malarvannan[7], Akihiro Okamura[8], Jelle Dhaene[1], Luc Van Hoorebeke[1], Barbara De Kegel[1]

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European Eels ... the Story of their (tough) Life

Several species of *Anguilla* eels are known for their spectacular life history, with a cross-Atlantic migration as they undergo their ontogenetic transformations. Confronted with all kind of challenges, including the one having to catch prey, European eels start as non-feeding preleptocephalus larvae. At early feeding, they are equipped with a seemingly poorly functional jaw system that supports odd-ball teeth. Once they reach the glass eel stage, migration starts up-river and phenotypic transformation starts towards the yellow eel phenotype. During this phase, a trophic segregation starts to emerge that is reflected in a divergent phenotype of broad- versus narrowheaded morphs. If everything goes well, they finally transform into silver eels that stop feeding and spend the rest of their life swimming and spawning, until death do them part. In this presentation, an overview is given of structural and functional challenges pre-leptocephali undergo with their protruding teeth and poorly ossified jaws. The implications of the divergent head phenotypes on feeding performance is discussed, linking it to genetically directed scenarios underlying this pattern. Mapping that onto trophic ecology and pollution levels, suggests possible consequences on the closing of their life cycle.

0183 Herp Biogeography & Phylogeography I, Sunday 16 July 2017

Ishan Agarwal[1], Aaron Bauer[1], Tony Gamble[3], Varad Giri[2], Uma Ramakrishnan[2]

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A complex biogeographic history for the eyelid geckos (Eublepharidae, *Eublepharis*)

Eublepharids are peculiar among gekkotans for their large size and longevity, many species exceeding lengths of 100 mm snout to vent and living over 20 years. The Saharo-Arabian and Indian representative of this family, *Eublepharis* includes six recognized species, distributed from Turkey eastward into India. *Eublepharis* spp. are familiar in the pet-trade, with *Eublepharis macularius* a model organism in many laboratory studies. Despite this, the relationships between species and the evolutionary history of the genus are not known, with published sequences for only a single wild caught *Eublepharis.* We sequenced three nuclear markers and ND2 for wild-caught *Eublepharis* from across their range and a diversity of pet-trade samples to reconstruct evolutionary relationships and

evaluate diversity within the genus. *Eublepharis* is strongly supported as monophyletic, though basal relationships are not resolved. Phylogenetic reconstructions alternately place *Eublepharis angramainyu* or *E. hardwickii* as sister to other *Eublepharis*, neither topology receiving strong support in any analyses. Recognized species exhibit ND2 divergences of >6% from each other, and genetic data also suggest the possible validity of two synonyms and demonstrate deeply divergent lineages within *Eublepharis angramainyu* and *E. hardwickii*. Biogeographic reconstructions suggest a Saharo-Arabian or Indian origin for *Eublepharis* in the Oligocene-Miocene, with either a single dispersal out-of-India or two dispersals out-of-India, respectively. There is evidence for hybridization in pet-trade *Eublepharis* spp. with nuclear-mitochondrial discordance, suggesting a re-evaluation of source populations of '*Eublepharis macularius*' in laboratory studies.

0779 Herp Physiology, Saturday 15 July 2017

Joseph Agugliaro, Ayham Khrais

Fairleigh Dickinson University, Florham Campus, Madison, NJ, USA

Seasonal Changes in Metabolic Rate and Immune Function in the Rubber Boa (*Charina bottae*)

As part of ongoing research examining seasonal variation in metabolic rate in a laboratory population of Rubber Boas (*Charina bottae*), we investigated potential seasonal changes in the thermal sensitivity of innate immune performance. We sought to test two competing hypotheses: 1) that immune performance would be downregulated during artificial hibernation as an energy conservation strategy; or 2) that immune performance would be enhanced, especially at lower acute temperatures, to compensate for the otherwise suppressive effects of low temperature on ectotherm immune function. We quantified the bacteria-killing ability of plasma as a function of acute temperature (7, 16, and 25°C) during the simulated active season and artificial hibernation in a repeated-measures design (n = 7 individuals). In addition, we conducted differential leukocyte counts via light microscope inspection of blood smears prepared during the simulated active season and artificial hibernation. We found that plasma bacteria-killing ability was significantly affected by season, acute temperature, and snake body mass. After adjusting for the positive effect of body mass on plasma bacteria-killing ability via ANCOVA, bactericidal activity was uniformly depressed across all sampled acute temperatures during artificial hibernation, relative to the simulated active season. Within each season, plasma bacteria-killing ability increased with increasing acute temperature. Snakes also exhibited a significant increase in the relative number of heterophils and a significant decrease in the relative number of lymphocytes during artificial hibernation. Observed variation in immune parameters will be discussed in the context of seasonal and individual variation in metabolic rate.

0670 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Matthew Ajemian, Michael McCallister, Adam Schaefer

Florida Atlantic University, Harbor Branch Oceanographic Institute, Fort Pierce, FL, USA

Elasmobranchs in peril? Shark and ray assessment in the southern Indian River Lagoon

Elasmobranchs (i.e., sharks and rays) are thought to fulfill integral ecological roles in subtropical and warm-temperate estuaries. Unfortunately, a substantial data gap surrounds the status of the elasmobranchs inhabiting the Indian River Lagoon (IRL), an "estuary of national significance" that has experienced a variety of recent anthropogenic impacts. To assess these potential threats we initiated a comprehensive fishery-independent survey (bottom longline, gillnet) to characterize elasmobranch diversity, abundance, and population health in the IRL and adjacent waters. Since July 2016, we've sampled and tagged several hundred individuals from Sebastian to St. Lucie Inlet, comprising 14 total species. Additionally, two critically endangered Smalltooth Sawfish (*Pristis pectinata*) have been collected in the St. Lucie region, spurring concerns about exposure of this species to this highly stressed estuary. Continued surveys as well as acoustic tracking of individual movements via the collaborative Florida Atlantic Coast Telemetry network will help shed light on IRL importance and impacts on these sensitive species.

0160 General Herpetology, Sunday 16 July 2017

Ayesha Akram, Muhammad Rais

PMAS-Arid Agriculture University Rawalpindi, Rawalpindi, Punjab, Pakistan

Taxonomic Review, Revised checklist and Photographic Identification Guide of Frogs (Family Dicroglossidae) of Sub-tropical scrub and Pine Forest (District Rawalpindi and Islamabad Capital Territory), Pakistan

The taxonomy of frog species of the family Dicroglossidae of Pakistan has been mainly studied using conventional taxonomic methods such as examination of morphological characters which do not solve many taxonomic and species identification issues. We have reviewed the available literature to present chronology of taxonomic developments of some dicroglossid frogs, provided a revised checklist and illustrated photographs for quick species identification. We believe that the genera *Fejervarya*, *Nanorana*, *Allopaa*, *Euphlyctis* and *Sphaerotheca* require detailed molecular taxonomic studies. The review showed that *Euphlyctis* and *Fejervarya* species complex need to be genetically analyzed and compared with those found in other south-east Asian countries. We believe that the genus *Sphaerotheca* has at least one more species in Pakistan which has not been reported. Likewise, there still exists confusion regarding the genus *Fejervarya*/ *Limnonectes* and *Sphaerotheca*/ *Tomopterna*. Generic status of *Nanorana* is established to some extent but more molecular and morphological data will be helpful for better

understanding. The genus *Allopaa* (*Paa*) (*Rana*) displays a unique combination of morphological characters and merits further investigation based on molecular data. We believe molecular taxonomy could lead to identification of a few more new species or subspecies from Pakistan.

0079 Fish Systematics, Saturday 15 July 2017

Fernando Alda[1], Victor A. Tagliacollo[3], Maxwell J. Bernt[2], Brandon T. Waltz[2], William B. Ludt[1], James S. Albert[2], Prosanta Chakrabarty[1]

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Phylogenomics of Neotropical electric fishes (Gymnotiformes)

Resolving evolutionary relationships among groups that have undergone ancient and rapid radiations is a longstanding challenge in phylogenetic systematics. Next-generation sequencing and phylogenomics are a promising tool to resolve deep relationships and answer these difficult questions. Despite allowing for the analysis of thousands of loci and the reconstruction of their independent evolutionary histories, these methods are not exempt from analytical and methodological complications resulting in gene-tree error (not inferring the best fit substitution models, anomalous gene trees, incomplete lineage sorting, etc.). In this study, we test the utility of genomic markers from ultraconserved elements (UCEs) to resolve the ancient relationships (~100 my) among families of Neotropical electric fishes (Gymnotiformes). We compared Gene Genealogy Interrogation and Gene Data Interrogation methods to assess the best analytical procedures of genomic data filtering that will allow us to generate a robust hypothesis for the order; something that no molecular study has yet been able to provide. Based on our genomic data set of >1300 UCE loci from 46 taxa representing all families and major lineages of Gymnotiformes, we generated a novel phylogenomic hypothesis for the order. Based on this new tree we will discuss macroevolutionary implications for the biogeography and rapid diversification of Neotropical fishes, and the origin of electric organs and complex behavioral traits such as electrocommunication.

0722 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Rachel Alenius, Dean Williams

Texas Christian University, Ft. Worth, TX, USA

Variable Diet of an Ant Specialist, the Texas Horned Lizard (*Phrynosoma cornutum*), Living in Small Texas Towns

The Texas horned lizard (*Phrynosoma cornutum*) is considered a threatened species in Texas due to substantial range declines over the past several decades. The disappearance of many populations is attributed to habitat loss, pesticide use, invasive fire ants (*Solenopsis invicta*), and the loss of harvester ants (*Pogonomyrmex spp.*), considered an essential food source for horned lizards. We analyzed diets of Texas horned lizards in two small Texas towns where the ratio of horned lizards to harvester ant mounds (4 lizards/mound) exceeds what has been considered sustainable (0.17 lizards/mound). We used visual identification of exoskeletons and DNA barcoding to identify prey items in fecal pellets. Our results suggest diets are highly variable in these residential areas, consisting of a wide range of ants and other arthropod species, especially the surface foraging Nasutiform termite (*Tenuirostritermes cinereus*), carpenter bees (Genus: *Ceratina*), and ground beetles (Family: Carabidae). In some areas lizards appear to consume these termites almost exclusively, despite relatively high densities of harvester ants. DNA barcoding of scat allowed us to identify both soft and hard-bodied prey to species level and revealed these lizards also consume a variety of spiders and Lepidoptera (probably as caterpillars). Most samples contained few, if any, harvester ants, suggesting harvester ants are not necessarily an essential diet item. Similar studies should be conducted in relatively undisturbed areas of southern Texas to determine if this diet breadth is specific to residential areas, or if Texas horned lizard diets are more variable than previously assumed.

0147 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Landon Allen, Jennifer Deitloff

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Comparing Population and Sex Differences in Head Shape for Four Populations of Red-Back Salamanders (*Plethodon cinereus*) in Pennsylvania

Morphological variation of a species varies with development, body size, sex, and phenotypic plasticity. Often morphological variation is correlated with many ecological factors such as geographic location, environmental conditions, intensity of competition, and others. Different geographic locations, and differences in ecology of those locations, can result in morphological differences in Plethodontid salamanders. *Plethodon cinereus* has a broad geographic range and exhibit variation in morphology. Head shape is a common characteristic used to evaluate morphological differences in *P. cinereus*. Head-shape morphology can be influenced by ecological differences among populations or between sexes. This study investigated differences in lateral and ventral head-shape morphology of *P. cinereus* among four populations in Pennsylvania and among sexes (male, gravid females, and non-gravid females) using geometric morphometrics. We tested the hypotheses that head morphology differs among populations and sexes of *P. cinereus*. We found support for these hypotheses, because these groups differed in head-shape variation. We concluded that since populations were located further from one another, they experienced different environmental factors, and thus differ in this

measurement of morphology. Furthermore, sexes differed as well. This could be due to different ecological pressures or difference in behavior such as behavioral aggression.

0278 Fish Genetics, Saturday 15 July 2017

S. Elizabeth Alter[1], Fernando Alda[3], Matthew Aardema[2], Prosanta Chakrabarty[3], Melanie Stiassny[2]

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How did the cichlid lose its sight? Comparative genomics and phylogenetics of the riverine lamprologines (Cichlidae, Lamprologini)

Lamprologines are a hyperdiverse clade of cichlid fishes endemic to the Congo basin. They are emblematic of both the ecological and behavioral diversity of African cichlids and the phylogenetic uncertainties that often characterize this group. While most research attention has focused on lamprologine diversity in Lake Tanganikya, lamprologines are also found in rivers, where some species exhibit some of the most unusual morphologies found amongst the clade. Foremost among these is the lower Congo endemic *Lamprologus lethops*, the world's only known blind and depigmented cichlid. To better understand the evolutionary history of this remarkable lineage, we 1) assessed the phylogenetic framework and biogeographic history of this group using ultraconserved elements (UCEs); and 2) sequenced the genomes of *L. lethops* and the syntopic *L. tigripictilis*, and compared them with the previously sequenced *Neolamprologus brichardi* genome. Phylogenetic inference using 165 individuals and 387 UCE loci (237,996 bp) indicates that the riverine cichlids nest within the "non-ossified" lamprologines as expected based on previous work, but the placement of *L. lethops* within the genus is unexpected. Comparison of the *L. lethops* genome with other fish genomes reveals a rapid rate of positive selection relative to *L. tigripictilis*. Genes undergoing positive selection in *L. lethops* include a number involved in embryonic development, skeletal and cartilage remodeling, and neurological pathways.

0911 LFC Physiological Performance I, Saturday 15 July 2017

Carlos Alfonso Alvarez-González

Universidad Juárez Autónoma de Tabasco, Tabasco, Mexico

Digestive Physiology in Fish Larvae

Digestive physiology as tool for the understanding the mechanisms that fish larvae are able to hydrolyze nutrients and assimilate micro-molecules are very important to improve the capacity to obtain energy and enhance growth and survival during larviculture. Considering the above mentioned, the use of biochemical, molecular and histological techniques allow determining the best feeding schedule, handling

procedures and weaning process. Several studies have demonstrated that depending on the development type, indirect, direct or transitional, are important differences between the development and functionality of the digestive system (stomach, pyloric caeca and intestine) and accessory organs (pancreas and liver). In this sense, freshwater and marine fish larvae are quite different in sense of ontogeny and the time that they transform to juvenile stage; also the type, quantity and nutritional quality of the food (live or compound) is very important. In conclusion, an integrative morpho-physiological study must be done to improve the culture of fish larvae and to guarantee the production of fry for its culture on a commercial scale.

0343 Fish Genetics, Saturday 15 July 2017

Kayla Anatone[1], Barry Chernoff[1], Michelle Kraczkowski[2], Abrial Meyer[1], Chloe Nash[3]

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Barriers to Gene Flow for Two Species of Dace (*Rhinichthys*) in Three Connecticut Streams

Understanding the nature of barriers to gene flow is crucial in determining the evolutionary potential of a species. Barriers fragment habitats, reduce inter-population connectivity, decrease effective population size (N_e), and modify gene flow between neighboring populations. In freshwater lotic ecosystems, populations of fishes can be fragmented by geological barriers such as waterfalls or by inconspicuous barriers such as patchy habitats. Fragmentation of river systems or habitats can erode genetic diversity within populations of fishes. The overarching goal of this study is to determine if waterfalls are the principal barriers that shape genetic diversity of stream fishes. Previous studies of salmonids indicated that waterfalls had such an effect. We studied two riffle-dwelling minnows, Blacknose Dace, *Rhinichthys atratulus*, and Longnose Dace, *Rhinichthys cataractae*, in three tributaries of the Connecticut River using microsatellites and the mitochondrial gene, *nd2*. Based on the genetic discontinuities found among all populations, it was concluded that gene flow is minimal between populations, whether waterfalls are present or not. The data supports the idea that ecological behavior and effective home range size of a species determines the extent to which fragmentation modifies patterns of gene flow.

0051 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

James Anderson

University of Hawaii, Honolulu, Hawaii, USA

Functional Use of Magnetic Information in Shark Navigation Behaviors

The precise nature of elasmobranch magnetic field perception has remained an unanswered question for some time. Recent lab based studies using both sharks and rays have helped to elucidate the parameters of magnetic field perception, and have cast more light on the mechanisms by which this is achieved. However, the ability to perceive a stimulus, or physically respond to a stimulus, does not confer functional use of that ability. Scalloped Hammerhead sharks have been suggested to navigate via geomagnetic topotaxis - by which sharks may navigate to a specific location through discrimination and recognition of local gradients in the geomagnetic field. Here we present results to date of lab-based behavioral choice experiments designed to demonstrate the functional capability of Scalloped Hammerhead sharks to locate a specific magnetic structure given a range of options.

0352 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017; AES GRUBER AWARD

James Anderson

University of Hawaii, Honolulu, Hawaii, USA

Navigation by Magnetic Field Information in Elasmobranch Fishes - How Environment Shapes Functionality and Capability

The environment in which an organism lives critically influences and shapes its evolutionary development. These influences have wide ranging results, including genetic differentiation, speciation, and phenotypic plasticity, which promote not only the diversity of lifeforms themselves, but diversity of the physiological mechanisms by which organisms thrive in their ecological niches. Environment thus influences ecological adaptations via convergent and divergent evolutionary processes. The earth's magnetic field is a multi-faceted environmental phenomenon that persists throughout the living world, and is argued to provide organisms with the key information needed for true navigation. The physical receptors of magnetic field information, and the physiological means and mechanisms by which organisms have been proposed or demonstrated to transduce magnetic field information vary widely across taxa. Despite this variation, proposed magneto-sensory systems across taxa are based on three principal mechanisms. Orientational and navigational behaviors in elasmobranch fishes have long been argued to be facilitated by magnetic field information. However, the physiological mechanisms for magnetoreception in the group remain the subject of much debate. Recent and ongoing lab based studies have begun to shed light both on the parameters of the magnetic field that elasmobranchs can perceive, and the physical means and mechanisms by which they do it. Here, we use support from pertinent studies, past and current, to explore the interplay between the three proposed mechanisms for magnetoreception and the physical and magnetic environment. We further examine the extent to which this interplay lends support to the functional use of putative magnetoreceptor structures.

0071 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Thomas Anderson[2], Brittany Ousterhout[4], William Peterman[3], Jacob Burkhart[1], Freya Rowland[1], Dana Drake[5], Lori Eggert[1], Ray Semlitsch[1]

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Comparative insights on spatiotemporal dynamics of co-occurring ambystomatid salamanders

In the last major project developed by Ray Semlitsch, we investigated population dynamics of ambystomatid salamanders, focusing specifically on whether source-sink and hot spot models were appropriate characterizations of their spatial dynamics. From 2012-2014, we surveyed 201 ponds at Fort Leonard Wood, MO to obtain demographic data for ringed (*Ambystoma annulatum*) and spotted salamanders (*A. maculatum*), including reproductive effort, occupancy, larval abundance, larval size, and genetic structure. We found that larval abundance of each species was predicted by several local and landscape-scale processes, but different factors were important for each species. Additionally, a drought that occurred in the middle year of sampling affected subsequent availability of ponds for ringed salamanders and limited recruitment in spotted salamanders. We observed substantial year-to-year variability in larval abundance for each focal species, with most ponds having very few larvae and only a couple producing large numbers of larvae and metamorphs, consistent with the hot spots model. While genetic differentiation between populations followed an isolation-by- distance pattern in both focal species, only ringed salamanders exhibited strong genetic spatial structure, separating out into two distinct clusters. We also found ponds differentially contributed to spatial connectivity of ringed salamanders at variable spatial scales, and that average metamorph body size and the number of dispersers influenced the likelihood a pond functioned as a source or sink population. Overall, by combining demographic and genetic information, we found strong support for the existence of source-sink dynamics of ambystomatid salamanders.

0602 Fish Ecology I, Sunday 16 July 2017

Michael J. Andres[1], Mark S. Peterson[1], E. John Anderson[2], J. Read Hendon[2]

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Spatiotemporal Variation in the Parasite Community of the Bay Anchovy Across Mississippi Sound, USA

Bay Anchovy (BA), *Anchoa mitchilli*, is a small engraulid that is the second most numerically abundant forage-fish species in northern Gulf of Mexico estuaries. As an estuarine resident, it lives in low to full salinity and functions as a link between the mesozooplankton community and higher trophic levels, including pelagic transients. As such, this species is capable of serving as a final or intermediate host for parasite species in various estuarine habitats. We hypothesized there were small-scale differences in the BA parasite community based on natural and anthropogenic spatiotemporal environmental variation. Anchovies and environmental data were collected monthly from locations within the Mississippi Sound and fish were examined for parasites. The prevalence and mean abundance of parasite species that used BA as the final host were seasonally and spatially similar except in the low salinity locations of Biloxi Bay where the prevalence and abundance of these parasites were lower but more species rich. Species that use BA as an intermediate host generally matured in transient species (coastal sharks, mackerels, and jacks) and were most prevalent and abundant during warmer, saltier months when those hosts were present. However, two locations associated with the deep Pascagoula ship channel had temporally-persistent and elevated infections of some trophically-transmitted species, suggesting these saltier deep channel bottom locations may promote the persistence of trophically-transmitted parasite species during the cooler and less saline months. Our data indicates parasite communities can aid in the discrimination of BA populations based on environmental variation within the broader Mississippi Sound estuary.

0724 Reptile Conservation, Sunday 16 July 2017

Kimberly M. Andrews[1], Oscar Brenes[2], Richard G. Bauer[1], Lance Paden[1], Luis Deivi Castillo[2]

[1]University of Georgia, Athens, GA, USA, [2]Reserva Playa Tortuga, Ojochal, Osa, Costa Rica

Tricks of the Trade in Researching and Managing Healthy Crocodilian Populations

Management of crocodilian populations involves understanding the ecological dynamics and devising solutions to mitigate the anthropogenic impacts that have already or are projected to alter those dynamics. We present research from our field sites at Jekyll Island, Georgia, USA and the Térraba River/Sierpe wetlands complex in the Osa Region of Costa Rica. Our focal species are American alligators (*Alligator mississippiensis*), American crocodiles (*Crocodylus acutus*), and spectacled caiman (*Caiman crocodilus*). We used visual count surveys and mark-recapture to characterize population levels and structure. Further, we collected tissue and blood samples for contaminants (metals and organics) analysis of to contribute to whether these habitats are viable for long-term persistence and reproductive health. We present findings from freshwater, brackish, and marine systems and how activity is partitioned spatially and temporally among individuals and species. We report results to date regarding observed mercury and lead levels in adult and juvenile animals. One of the leading challenges of studying

these large, evasive animals is capturing them in habitats that can be difficult to access and maneuver, and processing them in manners safe for them and the handlers. As part of our findings, we present technical details on our field survey methods, capture equipment, and how to mitigate behavioral acclimation and capture avoidance. Lastly, we discuss our research on human dimensions measuring risk perceptions, evaluation of communication tools to increase awareness and acceptance, and our management alternatives to removing animals deemed as nuisances by the local communities.

0043 Herp Morphology & Development, Saturday 15 July 2017

Robin Andrews

Virginia Tech, Blacksburg, VA, USA

Developmental Origin of Limb Size Variation in Lizards

In many respects, reptile hatchlings are fully functional, albeit miniature, adults. This means that the adult morphology must emerge during embryonic development. This insight emphasizes the connection between the mechanisms that generate phenotypic variation during embryonic development and the action of selection on post-hatching individuals. To determine when species-specific differences in limb and tail lengths emerge during embryonic development, we compared allometric patterns of early limb growth of four distantly related species of lizards. The major questions addressed were whether early embryonic limb and tail growth is characterized by the gradual (continuous allometry) or by the abrupt emergence (transpositional allometry) of size differences among species. Our observations supported transpositional allometry of both limbs and tails. Species-specific differences in limb and tail length relative to body length were exhibited when limb and tail buds first protruded from the body wall. Genes known to be associated with early limb development of tetrapods are obvious targets for studies on the genetic mechanisms that determine interspecific differences in relative limb length. Broadly comparative studies of gene regulation would facilitate understanding of the mechanisms underlying adaptive variation in limb size, including limb reduction and loss, of squamate reptiles.

0024 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Ariadne Angulo[1], Phillip J Bishop[2]

[1]IUCN SSC Amphibian Specialist Group, Toronto, Canada, [2]IUCN SSC Amphibian Specialist Group, University of Otago, Dunedin, New Zealand

Providing a Global Framework for Translating Amphibian Research into Conservation Action

Amphibian declines and extinctions are a globally-scaled phenomenon, with species impacted in virtually every continent where amphibians are found. The drivers of these losses are varied and can act both alone and/or in synergy. Given the scale and complexity of the issue, integrating both global and regional perspectives and approaches is an important priority. The International Union for Conservation of Nature's (IUCN) Amphibian Specialist Group (ASG) is a global network of amphibian scientists and experts who donate their time and expertise to provide the scientific foundation to inform amphibian conservation action around the world. The ASG (www.amphibians.org/asg/) currently uses a three-pronged approach to identify research and conservation priorities and to develop like-minded sub-groups with similar interests: i) the Amphibian Conservation Action Plan (ACAP) and its Working Groups, ii) ASG's Regional Groups, and iii) the Amphibian Red List Authority (RLA). The ACAP Working Groups are thematic in nature, with each Working Group focusing on a specific theme relevant to amphibian conservation and identifying the key challenges, as well as strategic mid- to short term priorities; the ASG Regional Groups are focused on the challenges and opportunities in the context of a particular region or country, and the Amphibian RLA seeks to update and maintain the amphibian database on The IUCN Red List of Threatened Species. We will discuss how ASG's structure and strategy are helping inform global amphibian conservation action and some of the challenges and opportunities ahead.

0283 Fish Conservation II, Sunday 16 July 2017

Caroline Arantes, Kirk Winemiller

Texas A&M University, College Station, TX, USA

Relationship between Forest Cover and Fish Diversity in the Amazon River

Tropical River floodplains are highly threatened by land cover changes and support high biodiversity and important ecosystems services, but the extent to which changes in floodplains land cover affect fish biodiversity remains unknown. Here, we combined fish and environmental data collected in situ and satellite-mapped landscape features to evaluate how fish species with different ecological strategies and assemblage structure respond to deforestation in floodplains of the Amazon River. We surveyed 462 floodplain habitats distributed along a gradient of land cover conditions, from nearly pristine to severely deforested. We employed an integrative approach that simultaneously considers different aspects of fish biodiversity to facilitate mechanistic interpretations of the influence of land cover. Spatial patterns of fish biodiversity in tropical floodplain rivers were strongly associated with forest cover as well as local environmental conditions associated with landscape gradients. Several species and functional groups based on life history, feeding, swimming/microhabitat-use strategies were positively associated with forest cover. Other species, including some that would be considered habitat generalists and species directly dependent on autochthonous resources (e.g., planktivores), were most common in areas dominated by herbaceous vegetation or open water habitats associated with the opposite extreme of the forest

cover gradient. β diversity and the degree of uniqueness in species combinations within habitats also were associated with forest cover. Our results suggest that deforestation of floodplains results in spatial homogenization of fish assemblages and reduced functional diversity at both local and regional scales.

0800 Fish Reproduction & Development, Saturday 15 July 2017

Miguel F. Arciria Correa[1], René A Gulfo Ávila[1], Fredys F. Segura-Guevara[1], Angel L. Martínez-González[1], Glenys Tordecilla-Petro[2], Charles W. Olaya-Nieto[1]

[1]Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences, University of Cordoba, Lorica, Córdoba, Colombia, [2]Institución Educativa Lácides C. Bersal. Alcaldía municipal., Lorica, Córdoba, Colombia

Reproductive biology of Morrúa *Geophagus steindachneri* in the Cienaga de Betancí, Sinu River System

To study the reproductive biology of Morrúa *Geophagus steindachneri* in the Cienaga de Betancí, Sinu River System, 393 individuals were collected. Total length (TL) ranged between 6.5-16.3 (9.9 ± 1.5) cm and total weight (TW) ranged between 4.0-76 (19.1 ± 9.4) g. The gonads were placed in Gilson solution, the Vazzoler scale was applicated and sexual proportion, sexual maturity index, spawning season, length at first maturity, oocytes's diameter and fecundity were estimated. 212 individuals females, 171 males and 10 undifferentiated were found, with sexual proportion female: male of 1.2:1, different from expected, and sexual dimorphism in size, since males reach larger sizes than females. Sexual maturity index indicate that there spawns between January and September. The length at first maturity was estimated in 10.4, 10.9 and 10.5 cm TL for females, males and combined sexes, respectively, oocytes's average diameter was 2474 mm and average fecundity estimated by spawning was 52 oocytes. The results achieved suggest that Morrúa is a fish with partial spawning and prolonged spawning season during the year independently of the water level of Cienaga de Betancí, with large oocytes and low fecundity.

0770 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Friday 14 July 2017

Umilaela Arifin[1], Stefan Hertwig[2], Eric Smith[3], Djoko Iskandar[4], Alexander Haas[1]

[1]Centrum für Naturkunde, Universität Hamburg, Hamburg, Germany, [2]Naturhistorisches Museum der Burgergemeinde Bern, Bern, Switzerland, [3]Amphibian & Reptile Diversity Research Center Department of Biology, University of Texas at Arlington, Arlington, USA, [4]School of Life Sciences & Technology, Institut Teknologi Bandung, Bandung, West Java, Indonesia

The Phylogenetic Systematics and Diversity of the Asian Frog Genus *Huia* Yang 1991 (Amphibia: Ranidae) Revisited

The systematics and phylogenetic position of the Asian frogs of the genus *Huia* has been unstable through time and has not been resolved convincingly. Currently, five valid species (*H. cavitympanum, H. masonii, H. sumatrana, H. modigliani*, and *H. melasma*) are known under this genus, all of them associated with cascading, clear streams and possess gastromyzophorous tadpoles. In extensive fieldwork we compiled broad samples from Java and Sumatra including the hitherto most comprehensive taxon sample of *Huia*. We analyzed DNA sequences (mtDNA: 12S, 16S, and nucDNA: Rag1, Tyr, POMC) from *Huia* and taxa that are believed to be close relatives (i.e. *Amolops*, *Meristogenys*, and other riparian ranids) in order to solve current phylogenetic uncertainties. Confirming the previous hypotheses, *Huia* species were not forming a monophyletic group because the type species (*H. cavitympanum*) was more closely related to *Meristogenys* from Borneo than other species in *Huia*. Our analysis discovered that the genus *Huia* is more diverse than previously thought with two new candidate species from Sumatra and Java. Furthermore, we could show the existence of another well-delimited genus from Sumatra that possess gastromyzophorous larva, but is clearly distinct from *Huia*. This study is yet another example of previously underestimated Southeast Asian frog diversity. We believe that thorough sampling is a key point to have better understanding of true frog diversity in the hotspot region (e.g. Southeast Asia).

0464 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jonathan Armbruster[1], Nathan Lujan[2], David Werneke[1], Devin Bloom[3]

[1]Auburn University, Auburn, AL, USA, [2]University of Toronto Scarborough, Toronto, ON, Canada, [3]Western Michigan University, Kalamazoo, MI, USA

The *Characidium declivirostre* group with description of two new species (Characiformes: Crenuchidae)

Steindachner described two species of *Characidium* with large pectoral fins: *C. crandellii* from the Cotinga River, Brazil, and *C. declivirostre* from the Cuyuni River, Venezuela. We have amassed many specimens of fast-water *Characidium* and performed a review of the species of the *C. declivirostre* group. We identify four morphotypes within the group, including two new species. *Characidium crandelli* occurs in the upper Orinoco, Negro, and Essequibo river systems; it differs from the other four species by having a falcate dorsal fin (vs. rectangular), 12 circumpeduncular scales (vs. 10), and wide tri- to pentacuspid proximal teeth (vs. narrow, peglike, tricuspid teeth). *Characidium declivirostre* is found in Guiana Shield draining sections of the Orinoco basin; it differs from *C. crandelli* and *Characidium* sp. 1 by having three unbranched pectoral rays (vs. 4); and from *Characidium* sp. 2 by having a different color pattern (<10 rectangular blotches vs. ≥10 narrow bars) and by having the lateral line scales occupying at least 33% of the scale length with pores exposed (vs. 25% or less and pores covered by preceding scales). *Characidium* sp. 1 is rare and found throughout the Essequibo River basin; it differs from all other species by having two unbranched leading pelvic rays. *Characidium* sp. 2 is known from the upper Ireng River; it differs from all other species by having ≥10 narrow

bars on (vs. almost square blotches or mottling). The *Characidium declivirostre* group is endemic to rivers that formed the Proto-Berbice and Proto-Essequibo river systems.

0717 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Alexandre Ascenso, João Carlos Costa, Ana Lúcia Prudente

Museu Paraense Emílio Goeldi, Coordenação de Zoologia, Belém, Pará, Brazil

Taxonomic revision of the *Erythrolamprus reginae* complex (Serpentes: Dipsadidae)

We provide a taxonomic revision of the South American snake *Erythrolamprus reginae* based on external morphology and hemipenial characters. We propose a new taxonomic arrangement by elevating the two nominal subspecies (*Erythrolamprus reginae reginae* and *E. r. macrosomus*) to species level, defining *E. r. semilineatus* as junior synonym of *E. reginae*, and recognizing the validity of the historically related taxa *E. dorsocorallinus*, *E. oligolepis* and *E. zweifeli*. In addition, a population occurring in the Northern Amazonian portion of the Amapá state, in Brazil, is herein described as a new species. Therefore, our concept of the *Erythrolamprus reginae* group embraces six species (e.g. *Erythrolamprus dorsocorallinus*, *E. macrosomus*, *E. oligolepis*, *E. reginae*, *E. zweifeli*, and the new species described here) diagnosed based on pholidosis, coloration and hemipenial morphology. Finally, we provide an identification key to the species of this group and discuss some of the morphological features that may represent synapomorphies of the group and help to elucidate its relationships with other *Erythrolamprus* taxa.

0736 Herp Systematics I, Sunday 16 July 2017

Alexandre Ascenso[1], Ana Lúcia Prudente[1], Fernando Rojas-Runjaic[2]

[1]*Museu Paraense Emílio Goeldi, Coordenação de Zoologia, Belém, Pará, Brazil,* [2]*Pontifícia Universidade Católica do Rio Grande do Sul, Laboratório de Sistemática de Vertebrados, Porto Alegre, Rio Grande do Sul, Brazil*

Morphological and molecular phylogeny of the *Erythrolamprus reginae* group

In the *Erythrolamprus reginae* group are included the subspecies *E. reginae reginae* (Linnaeus, 1758), *E. reginae semilineatus* (Wagler, 1824) and *E. reginae macrosomus* (Amaral, 1935), besides of *E. zweifeli* (Roze, 1959), *E. oligolepis* (Boulenger, 1905), and *E. dorsocorallinus* (Esqueda *et al*. 2007), and a new species which has been described by Ascenso *et al*. (*in prep*.) from Serra do Navio, states of Amapá, Brazil. These taxa present distribution cis-Andean, occurring from Trinidad and Tobago, and the Venezuelan Llanos, as well as in the Amazon basin of Brazil, Colombia, Ecuador, Peru and Bolivia, and Atlantic Forest, Cerrado and relictual tropical rainforests of the Forest Atlantic in the northeast Brazilian, to the Chacos from Paraguay and Argentina. Besides, this group present a great morphological similarity with the subspecies of the *E. epinephelus* group,

mainly by color pattern, which has been used to define a grouping for morphological similarity formed by these groups. Further, one of the aims of this work is to propose a phylogenetic hypothesis for the *Erythrolamprus reginae* group, estimating the divergence time of the species, and to test which diversification hypotheses can better explain the speciation processes of these groups. In addition, we will include morphological data of the external (color pattern and pholidosis) and internal (oral glands, jaw adductor musculature, cranial osteology and hemipenial morphology) characters, for a Total Evidence analysis of this group.

0416 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Emily Asp, Eric Koepfler, H. Erin Rickard, Louis Keiner, Scott L. Parker

Coastal Carolina University, Conway, SC, USA

The Effect of Artificial Light on Orientation of Hatchling Loggerhead Sea Turtles (*Caretta caretta*)

Sea turtle hatchlings primarily utilize sight to detect differences in elevation and light intensity present along the horizon to navigate from the nest to the water's edge. Since hatchlings respond to positive phototaxis, the addition of artificial lights can intensify visual misdirection, often resulting in disorientation (aimlessly wandering in circular paths) or misorientation (moving in distinct paths away from ocean). Extensive research has been done on effects of high levels of artificial light but little on effects of comparatively lower levels of artificial light on hatchling sea turtle orientation. This study examined these lower intensity areas to identify if there is a threshold of artificial light above which hatchling orientation is negatively affected. During the 2016 nesting season, a Geovision GV-FER5303 non-illuminating infrared camera recorded hatchling trajectories at twenty-one nests of loggerhead sea turtles from areas varying in light intensity along the Grand Strand region of South Carolina. Individual and group dynamics for hatchling speed, sinuosity, and range of movement were measured from each nest to determine if parameters associated with orientation were significantly affected by total radiance values present at the time of emergence. Of the hatchlings observed, 18.7% (n=226) were severely disoriented/misoriented and required assistance locating proper seaward orientation. Of these hatchlings, 79% (n=179) were from areas of high total radiance during new moon conditions, while 0% were from areas of very high total radiance during full moon conditions. Results may help inform current management practices to enhance hatchling survival efforts near northern limit of loggerhead nesting beaches.

0334 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Erica Knowles Atkins, R.J. David Wells, Jaime Alvarado-Bremer

Texas A&M University at Galveston, Galveston, TX, USA

Genetic Diversity of the Bull Shark (*Carcharhinus leucas*) in the Gulf of Mexico Inferred from Mitochondrial DNA

The bull shark (*Carcharhinus leucas*) is a common worldwide tropical and subtropical species in marine, estuarine, and freshwater habitats. They are the only shark species capable of tolerating long-term exposure to freshwater and have been found in both rivers and lakes. *C. leucas* is an important fishing species both commercially and recreationally, in addition to being a major predator for many marine sport fishing species. This has created a need for understanding genetic dispersal from population to population to design proper conservation and management plans. This study is examining genetic diversity of the bull shark within the Gulf of Mexico using the Control Region of the mitochondrial genome. DNA was extracted from tissue samples and PCR and sequencing were performed. Sequences were then aligned in Geneious. The data shows significant population differentiation between Pacific and Gulf of Mexico samples. A comparison of samples from Central America and the Gulf of Mexico also reveal significant differentiation. Notably, the genetic diversity within the Gulf of Mexico is much lower, with roughly 60% of the individuals sharing a single haplotype. This suggests a recent bottleneck has occurred in this population.

0201 Turtle Conservation, Saturday 15 July 2017

Roy Averill-Murray, Kimberleigh Field

US Fish and Wildlife Service, Reno, NV, USA

Population Augmentation as a Recovery Strategy for the Mojave Desert Tortoise (*Gopherus agassizii*)

Declines in Mojave Desert tortoise populations led the species to be listed as Threatened under the Endangered Species Act in 1990. Much work is focused on removing threats and improving tortoise habitat within conservation areas. However, tortoises are still displaced by development or other human activities from habitat that is less important for species recovery. Historically, these tortoises have been moved out of harm's way into nearby habitat irrespective of its location relative to recovery areas. Meanwhile, even with successful threat mitigation within conservation areas, it will likely require decades for depleted tortoise populations to rebound to sustainable levels because it takes about 15 years for juvenile tortoises to reach maturity and begin producing offspring of their own. Therefore, the U.S. Fish and Wildlife Service is developing a strategic population-augmentation program. We are identifying specific locations within conservation areas or other important habitat to focus efforts to more quickly increase tortoise numbers. Positive short-term results from desert tortoise translocations include no homing tendencies when moved long distances, establishment of home ranges, comparable survival and reproductive output to resident tortoises, and detectable increases in population density. This suggests that a targeted augmentation program will provide a "boost" to depleted tortoise populations where we are focusing

management efforts. Monitoring these tortoises will also provide a means to evaluate the success or effectiveness of those management efforts.

0046 General Ichthyology II, Sunday 16 July 2017

Seung Eun Bae, Jin-Koo Kim

Pukyong National University, Busan, Republic of Korea

Significant Population Genetic Structure of the Grass Puffer (*Takifugu niphobles*) in Korean Waters: Evidence of Cryptic Species or Population Subdivision?

Various molecular markers help to reveal the genetic structure of populations and elucidate Evolutionary Significant Units or Management Units. The order Tetraodontiformes is known as one of the most systematically advanced groups. The genus *Takifugu* consists of approximately 25 species, which are taxonomically closely related due to fairly recent speciation in the Northwest Pacific. Color patterns are generally used to distinguish *Takifugu* species, and this has led to taxonomic confusion. More detailed information is required, therefore, to define the boundaries between *Takifugu* species. The grass puffer *Takfigufu niphobles*, one of the smallest *Takifugu* species, is known to spawn in different seasons according to location (May to July in Japan vs. October to February in Hong Kong). A previous study has also revealed that grass puffers collected from Jeju Island and Gyeonggi-do in Korea fell into two distinct groups based on mtDNA COI sequences. This study aims to clarify the genetic diversity and population genetic structure of the grass puffer in Korean waters. A total of 149 specimens from eight locations around Korea were analyzed using molecular methods. Analysis showed two distinct groups (d = 1.6-2.3%): the eastern-southern group and the western-southern group. The genetic distance between these groups was similar to that between other *Takifugu* species (1.8-3.0% from *T. pardalis* and 1.9-3.0% from *T. xanthopterus*). However, the two groups coexisted in the southern part of Korea, making secondary contact between them a possibility. Further research is needed using microsatellite loci to determine the extent of contemporary gene flow between them.

0090 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Sarah Bailey[1], William Clark[1], Robert Weaver[2]

[1]Western Wyoming Community College, Rock Springs, Wyoming, USA, [2]Independent contractor, Ellensburg, USA

Influence of parasites on life history characteristics of Western Sagebrush Lizards (*Sceloporus graciosus*)

The limited energy available to organisms is traded off between growth, reproduction, and self-maintenance, according to need. Parasitic infections constrain energy

allocations, as significant amounts must be apportioned to immune function. Individuals were sampled from two locations, an urban and a rural site. Assessments were made of immune characteristics, glucose levels, diet, and parasite incidence. We used general linear models (GLM) and t-tests to evaluate relationships between body measurements and immune features with location, reproductive status (male or female), diet, and parasite load. No significant variation was noted in glucose levels between males and females sampled at both locations. When assessing glucose variations among sites, both males ($P = 0.002$) and females ($P = 0.02$) at the rural site were observed to have lower levels than individuals at the urban site. Individuals sampled from the urban site had a significantly greater malaria incidence rate than those sampled from the rural site ($p = 0.015$). Our findings that increased glucose levels are correlated with human disturbance corroborates the results of a 2003 study by Jessop et al., in which increased glucose levels were observed in capture stressed crocodiles. A 1995 study by Dunlap and Schall, found that malaria and glucose levels are negatively correlated in Western fence lizards. Summer of 2017 collection will aim to reveal any relationships between glucose levels and infection incidence. By assessing the effects of human disturbance and parasitic infections on glucose levels, this study helps to elucidate the energetic response of environmentally and immunologically stressed reptiles.

0150 Reptile Behavior, Friday 14 July 2017

Troy Baird[1], Joshua York[0]

[1]University of Central Oklahoma, Edmond, Oklahoma, USA, [2]University of Oklahoma, Norman, Oklahoma, USA

Sexual Selection on Male Collared Lizard Broadcast Display Behavior Enhances Offspring Survivorship

Unraveling selective mechanisms underlying the evolution of male behaviour in the context of intrasexual competition and mating choices that may also be adaptive for females is a major challenge for evolutionary biologists. We combined behavioral observations with genetic parentage analysis to test if displays broadcast by male collared lizards promote fitness because they advertise resource holding power to competitors, promote matings, and/or are under selection for offspring survival. Frequent display by territorial males correlated positively with the frequency that they courted females, but not how often they contested male rivals, suggesting that displays function to attract mates. We found directional sexual selection for frequent courtship on the number of females that males mated with, but not for the number of offspring sired or offspring survivorship. Instead, the frequency with which territorial males performed displays was under positive directional selection for offspring survival. Selection on display rate in non-territorial males was negative for all fitness measures, suggesting marked differences in how males utilizing different tactics compete for matings. Together our results support the hypothesis that territorial males use frequent broadcast display to advertise genetic qualities to females that increase offspring survival, and that non-territorial males acquire matings through stealth.

0052 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Friday 14 July 2017

Erica Baken, Dean Adams

Iowa State University, Ames, Iowa, USA

Life in Trees: Macroevolution of Morphology and Diversity in Arboreal Plethodontid Salamanders

Arboreality has evolved more than 18 times in the lungless salamanders (Plethodontidae), and nearly 25% of the species in this family are at least partially arboreal. Arboreal microhabitats potentially present salamanders with a unique suite of ecological challenges associated with locomotion and osmoregulation, but to date the effects of living in this unique microhabitat remain unknown. To investigate the macroevolutionary effects of selection associated with arboreality, we examined morphological shape disparity and species diversification rates across the phylogeny of Plethodontidae. Arboreal species displayed significantly lower shape disparity in linear body proportions, constraining them to a smaller region of morphospace as compared to terrestrial species ($p = 0.003$). This suggests that arboreal life exhibits strong selection on morphology, and raises the possibility that the distinct evolutionary transitions to arboreality may coincide with morphological convergent evolution. In examining species diversification rates between arboreal and terrestrial lineages, we found no evidence that speciation or extinction rates vary with microhabitat. However, we did find differential transition rates between microhabitats: the back-transition rate (from arboreal to terrestrial life) is more than ten times higher than the transition rate to arboreal life. Thus, while the rate of species diversification is no different between arboreal and terrestrial salamander lineages, fewer arboreal species persist over time, as there is a macroevolutionary tendency for species to re-acquire a terrestrial condition. Overall, our findings shed light on the extent to which life in trees constrains macroevolution in plethodontid salamanders, and suggests several evolutionary hypotheses to be examined in future studies.

0295 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Sarah Baker[1], Matthew Allender[0]

[1]Illinois Natural History Survey, Champaign, IL, USA, [2]University of Illinois, College of Veterinary Medicine, Urbana, IL, USA

Comparison of Testing Methods for Snake Fungal Disease

Snake fungal disease (SFD) is an emerging fungal pathogen infecting both wild and captive snake species. The causative agent of SFD has been identified as *Ophidiomyces ophiodiicola*, a keratinophilic soil inhabiting fungus. Clinical signs of SFD include abnormal scales and skin lesions, but testing is required for confirmation. Diagnosis requires either identifying the fungus directly in tissues or demonstrating evidence of

pathogen with clinical signs. Historically, this is performed using skin biopsies or swabs and qPCR for *O. ophiodiicola* DNA detection. We tested the agreement of qPCR of biopsies and swabs in free-ranging Eastern Massasauga Rattlesnakes (*Sistrurus catenatus*) in Illinois from 2014-2016. All snakes were captured each year during the spring egress period as part of a long-term monitoring project. All individuals exhibiting clinical signs of SFD were swabbed and a punch biopsy was taken from affected areas. DNA was extracted similarly from each sample and concentration of DNA was determined using spectrophotometry. Quantitative PCR was then used to test for the presence of *O. ophiodiicola*. Fungal copy numbers amplified were standardized per ng of total DNA in the sample. Our data shows near total agreement (mean difference: 4.86 fungal copies higher in swabs) between the two methods. As such we suggest SFD testing be done using swabs/qPCR as it is less invasive for the animal, but further evaluation is still needed to determine the sensitivity and specificity of all available assays.

0294 Reptile Conservation, Sunday 16 July 2017

Sarah Baker[1], Michael Dreslik[1], Christopher Phillips[1], Matthew Allender[2]

[1]Illinois Natural History Survey, Champaign, IL, USA, [2]University of Illinois, College of Veterinary Medicine, Urbana, IL, USA

Impact of Snake Fungal Disease on Population Viability

Snake fungal disease (SFD) is an emerging fungal pathogen infecting both wild and captive snake species. The causative agent of SFD has been identified as *Ophidiomyces ophiodiicola*, a keratinophilic soil inhabiting fungus. Clinical signs of SFD include swelling, abnormal scales, and skin lesions. The last extant population of Eastern Massasauga Rattlesnakes (*Sistrurus catenatus*) in Illinois has an annual SFD prevalence rate of 15-22% and evidence suggests mortality rates may be greater than 90%. Eastern Massasaugas were listed as federally threatened under the Endangered Species Act in 2016, and thus the impact of disease on the viability of wild populations is of great conservation concern. We used data from 15 years of demographic population monitoring and five years of SFD surveillance to conduct a population viability analysis (PVA). We used the Meta-Model Manager extension of Vortex PVA software to merge our demographic PVA model with the SFD disease dynamics model developed in the Vortex Outbreak extension. Our results show that SFD increases the probability of extinction of the Illinois population, and thus is likely a threat to the persistence of the species range wide.

0484 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

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A New Locality and Habitat Type for the Rare Lizard, *Leiocephalus onaneyi* (Guantánamo Striped Curlytail)

Only seven individuals of the lizard *Leiocephalus onaneyi* (Guantánamo Striped Curlytail) are known to science. All are from the type locality, loma de Macambo, a remote mountain top (elevation 160m, karst limestone, thorny bushes, agaves, and grass) in the Cuban province of Guantánamo. Garrido (1973) described this species from 3 individuals. Díaz and Cádiz (2012) observed four and photographed a live lizard and the habitat. We observed this species at two localities at Naval Station Guantanamo Bay (NSGB). At the first, we saw 2-3 adults and at least one juvenile during multiple short (30-45 min) visits in Sept - Nov 2015, and Jan - Feb 2016, and at least 10 - 12 while at the site (KAB only) for 6-8 hours over a two week period Dec 2016 - Jan 2017. One was observed at a second site, near Cable Beach, June 2016. The estimated distance (Google maps), between the first locality at NSGB and Loma de Macambo is 51 km (following topography). Elevation, habitat and geology at NSGB are different than the type locality. The elevation of the NSGB sites were 61.5m and 7.7m. Habitat was open (few to one tree/shrub) and dominated by grasses, predominantly the invasive sandspur grass (*Cenchrus myosuroides*). Karst is not present at NSGB. Our sites were mostly sedimentary rock (conglomerates). The discovery of this lizard at NSGB is significant as a second and possibly third population of this rare, endemic lizard listed by Cuba as Critically Endangered, is now known.

0054 AES GRUBER AWARD II, Thursday 13 July 2017

Judith Bakker[1], Owen Wangensteen[1], Demian Chapman[2], Germain Boussarie[3], Dayne Buddo[5], Tristan Guttridge[6], Heidi Hertler[7], David Mouillot[3], Laurent Vigliola[4], Stefano Mariani[1]

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Environmental DNA Reveals Tropical Shark Diversity and Abundance in Contrasting levels of Anthropogenic Impact

The conservation of sharks and their functions in an ecosystem relies heavily on our ability to assess and monitor their distribution and abundances. Yet, the assessment of mobile species in marine environments remains challenging, often invasive, resource-intensive and dependent on taxonomic expertise. The advent of parallel sequencing technologies offers new, powerful tools for biodiversity assessment. This includes the retrieval, amplification and sequencing of fragments of environmental DNA (eDNA) shed by organisms in aquatic habitats, with the possibility to rapidly gauge vast amounts of information on taxonomy and community structure. Here we employ this novel, rapid and non-invasive eDNA metabarcoding approach, specifically targeted to compare shark diversity and abundance, across a range of impacted vs protected/remote areas in both tropical Pacific and Atlantic regions. We detect tens of shark species whose geographical distribution and relative abundance coincide with

established knowledge on biogeographic patterns and levels of anthropogenic pressure and conservation effort. These findings indicate that eDNA metabarcoding can be effectively employed to study shark diversity. Further developments in this field have the potential to drastically enhance our ability to assess and monitor elusive oceanic predators such as sharks, which are particularly difficult to quantify by means of traditional methods, and lead to improved conservation strategies.

0303 AES Ecology III, Sunday 16 July 2017

Charles Bangley[1], Matthew Ogburn[1], Robert Fisher[2], Carla Curran[3], Robert Aguilar[1], Michael Goodison[1], Kierra Heggie[1], Anson Hines[1]

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Migratory Behavior of Cownose Rays (*Rhinoptera bonasus*) on the U.S. Atlantic Coast

The Cownose Ray (*Rhinoptera bonasus*) is a highly migratory batoid that is seasonally abundant in estuarine habitats. However, little is known of the migratory connections between summer habitat within estuaries and other locations along the U.S. Atlantic coast. To gain baseline data on the timing and extent of Cownose Ray migrations, 48 mature rays were tagged with 69 kHz acoustic transmitters during the summers of 2014-2016 at locations within Chesapeake Bay and the Savannah River. Mean daily position (latitude and longitude) was calculated for each ray from May 2014 through May 2017, and the distance traveled (km) and velocity (km/day) were measured between each daily position. Hidden Markov modeling was used to determine whether migratory behavior states could be classified based on movement data from tag detections. The most explanatory model classified behavior into "Migratory" and "Resident" states based on distance traveled, turning angle (radians), and velocity. Resident behavior primarily occurred during the summer and winter. Rays originally tagged in Savannah, Maryland Chesapeake waters, and Virginia Chesapeake waters occupied significantly different latitudes and longitudes during the summer, but differences in spatial positions and movement behaviors were not significant during the winter. These findings suggest that Cownose Ray population structure on the U.S. Atlantic coast may be influenced by fidelity to summer habitats, but overwintering habitat is shared among multiple subpopulations. In addition, analysis of spatial positions during summer residence periods may be useful in identifying essential habitat areas for Cownose Rays.

0114 Herp Ecology I, Friday 14 July 2017

Mitch Barazowski, Neil Ford, Josh Banta, Marsha Williams, John Placyk

University of Texas, Tyler, Tyler, TX, USA

Integrating habitat suitability modeling and radio telemetry to describe habitat use of the Western Massasauga, *Sistrurus t. tergeminus*, in Texas

Habitat suitability modeling using the software package MaxEnt is a popular method for describing the habitat of rare species. MaxEnt uses "presence only" data to develop models; however presence data are highly skewed towards areas of high detection probability and these areas may not represent the full range of habitat use. Thusly, predictions from models developed using only data from areas with high detection probability may not represent all suitable habitat. This study tested the ability of MaxEnt models developed using three different data sets to accurately describe Western Massasauga (*Sistrurus t. tergeminus*) habitat at a local scale. Models were evaluated by their ability to predict high suitability values at locations of known snake occurrence. The first model was developed using only presence data from areas with the highest detection probability (i.e., roads). This model was only able to identify half of the locations where snakes actually occurred as highly suitable. A second model was developed using presence data from one season of radio telemetry and road surveys. This model performed well, and when interpreted alongside telemetry observations, it indicated that the most suitable habitat for Western Massasaugas in the western rolling plains of Texas are areas with level uplands, well-drained loamy, sandy soils, with mixed grasses, Sand Sage prairies and mesquite savannahs. A model developed using the locations of the snakes' brumation sites showed that the snakes selected distinct wintering habitat based on the burrowing suitability of the soil.

0787 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Evan Bare[1], Andrew Gluesenkamp[3], Jaime Peña[2], Jannifer Stabile[4], Richard Kline[1]

[1]University of Texas Rio Grande Valley, Texas, USA, [2]Gladys Porter Zoo, Texas, USA, [3]San Antonio Zoo, Texas, USA, [4]Field Projects International, California, USA

Habitat Requirements and Genetic Comparison of the Black-Spotted Newt in Texas and Mexico

The black-spotted newt (*Notophthalmus meridionalis*) is a cryptic amphibian ranging from Southern Texas to Veracruz, Mexico. It is listed as threatened by the state of Texas and is listed as endangered in Mexico. Two subspecies (*N. m. meridionalis* and *N. m. kallerti*) are recognized based on a handful of morphological characteristics. However, morphological, genetic, and ecological aspects of these taxa have not been studied in detail. We conducted surveys and collections of black-spotted newts within the reported range in Texas and from a population in Altamira, Tamaulipas, Mexico. We revisited locations of historic records and documented habitat characteristics where newts were found. Analysis of mtDNA sequences revealed a difference of greater than 3% between Texas and Mexican samples. These results provide a genetic basis for the continued recognition of two subspecies within *N. meridionalis*.

0688 Amphibian Conservation IV, Sunday 16 July 2017

William J Barichivich[1], Jonathan Chandler[2], Katherine M O'Donnell[1], Terry Peacock[2], Joe Reinman[2], Susan C Walls[1]

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Status of the Frosted Flatwoods Salamander, *Ambystoma cingulatum*, at St Marks National Wildlife Refuge, FL

The federally threatened frosted flatwoods salamander, *Ambystoma cingulatum*, once ranged across the coastal plain of the southeastern United States from Apalachicola, Florida to Charleston, South Carolina. Despite this species' listing in 1999, its distribution has continued to decline - now known to occur on a few isolated public lands. A comprehensive survey effort by the Florida Fish and Wildlife Conservation Commission (FWC) from 2002-2006 identified St Marks National Wildlife Refuge and adjacent Flint Rock Wildlife Management Area as "strongholds" for the species with 50 breeding ponds observed during the survey. In February 2014 we initiated a multi-year occupancy survey of these ponds. To maximize detectability in the dense sawgrass that dominates many ponds, we used plastic minnow traps (vs. dip-net surveys) to capture larvae. In 2016 and 2017 surveys we "baited" traps with glow sticks to increase capture rates. Among all surveys from 2014-2017 (4 seasons), we detected larvae in 62% of the historical breeding ponds. While many sites appear to contain ideal wetland habitat (i.e., bunch-grasses and forb dominated) we detected larvae in several suboptimal wetlands, which could indicate this species is more resilient than previously thought. Each year the larval capture rate increased, as did the number of ponds where we detected larvae. We believe these increases reflect both a population-level trend and increasing sampling effectiveness. This work underscores the importance of annual monitoring, accounting for imperfect detection, and including seemingly mediocre sites in survey efforts.

0847 Herp Systematics I, Sunday 16 July 2017

Anthony Barley[1], Adrián Nieto Montes de Oca[2], Robert Thomson[1]

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Elucidating the evolutionary history of Mexico's most 'problematic' lizards

As one of the few known groups of unisexual vertebrates (in which ~1/3 of all known species are formed by hybridization events and are made up of only females that reproduce asexually), whiptail lizards (genus *Aspidoscelis*) are evolutionarily unique. Hybridization and introgression have also been documented between multiple different bisexual whiptail species, and thus, they are an ideal system for understanding the influence of both hybridization and gene flow on the speciation process and the maintenance of evolutionary lineages. Even basic insights, however, require a robust phylogenetic framework and estimate of species boundaries, which have previously

been difficult to resolve. Early taxonomists lamented the difficulty of identifying species boundaries in this group due to large phenotypic variation within populations, small phenotypic differentiation between many species, and phenotypic intergradation between many adjacent populations. Here, I will present the results of recent research in which we attempt to infer species boundaries and resolve the complex, reticulate evolutionary history of two groups of bisexual whiptails and one group of parthenogenetic whiptails from southern Mexico using genomic data.

0852 Herp Environment, Saturday 15 July 2017

Arthur Barraza[1], Lisa Komoroske[2], Camryn Allen[2], Varenka Lorenzi[3], Daniel Lawson[4], Jeffrey Seminoff[2], Tomoharu Eguchi[2], Robin LeRoux[2], Christopher Lowe[1]

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Comparing Persistent Organic Pollutants and Trace Metals In Green Sea Turtles (*Chelonia mydas*) Inhabiting Two Urbanized Habitats in Southern California

Two foraging aggregations of east Pacific green sea turtles (*Chelonia mydas*) inhabiting Long Beach (LB) and San Diego (SD), and are potentially exposed to persistent organic pollutants (POP) and trace metal contamination (TMC). Characterizing contaminant loads of these two turtle aggregations is important towards understanding the possible negative effects of anthropogenic contaminants. To calibrate POP and TMC methodology, turtles that have stranded in the LB and SD areas had their liver, heart, kidney, muscle, and fat tissue extracted and analyzed using GCMS and ICPMS. Preliminary results on stranded animals indicate undetectable (MDL 1 – 0.18 ng/g) to moderate amounts of POP contamination (123.00 – 9.51 ng/g wet mass total POPs in necropsy tissues) in both aggregations. Preliminary results indicate possible differences in TMC between animals in SD and LB. The stranded individual from LB had high cadmium contamination (221.49 µg/g wet mass) in kidney tissue compared with another stranded individual from SD (53.26 µg/g wet mass). Live green sea turtles from LB (n = 14 turtles) and SD (n = 23 turtles), were captured, measured and had blood and scute samples obtained for contaminant comparison. POP contamination will be determined using blood plasma with a modified soxhlet extraction via GCMS. TMC will be determined using red blood cells and scute samples with acid digestion and ICPMS. Blood, plasma and scute samples will be used to corroborate the preliminary results found in stranded samples, and to assess POP and TMC contamination loads, and differences between animals in both locations.

0850 Turtle Conservation, Saturday 15 July 2017

Kyle Barrett[1], Theresa Stratmann[2], Thomas Floyd[3], Michael Knoerr[1]

[1]Clemson University, Clemson, SC, USA, [2]Gothe University, Frankfort, Germany, [3]Georgia Department of Natural Resources, Social Circle, GA, USA

Assessing bog turtle distribution and status for populations in the South: the role of habitat, history, and predation

Bog turtles are a federally threatened species largely restricted to bogs and fens, and further limited to high-elevation wetlands within the southeastern U.S. portion of the species' range. Bog turtle population declines have highlighted the need to assess distribution and habitat requirements. Toward this end we have engaged in several years of wetland surveys in prospective bog turtle habitat throughout Georgia and the Carolinas. Our efforts have established a number of parameters that predict occupancy (large wetland size, abundant emergent vegetation, lower pH, and less flooding of the wetland). Among those sites that are occupied, we determined that a different set of parameters predict bog turtle abundance. Specifically, bog turtles are more abundant in wetlands with less woody vegetation and those that have experienced lower levels of historical disturbance. In North Carolina we have learned that even among wetlands with high abundance, some sites appear to suffer from low recruitment. Our most recent efforts are focused on assessing the role of nest predation in limiting nest success. Preliminary data suggest that low recruitment sites suffer from higher nest mortality as a result of mesopredators. Collectively, our data highlight the benefits of using a broad range of field techniques to gather information that can aid conservation of a rare and cryptic species in decline.

0208 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

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The herpetofauna of the highlands of the Serranía de Perijá (Colombia-Venezuela border)

Located in northwestern South America, the Serranía de Perijá is an Andean ecosystem, mainly forested, forming the north borderland between Colombia and Venezuela. This range possesses several parallel chains from North to South, with abrupt relief and encaustic valleys. According to this physiography it is traditionally divided into three sectors: the Montes de Oca to the north; the Serranía de Valledupar in the center; and the Serranía de Motilones to the South. The available information on their herpetofauna was compiled (1920-present) to produce a taxonomic inventory. Results were analyzed through publication number, sampling level and specimens deposited in museum collections. It yielded 53 amphibian and 95 reptile species (14 and 24 families, respectively). Some of these species have a wide distribution in northern South America

such as *Sibon nebulata* and *Xenodon severus*, among others. The taxonomic composition of this herpetofauna shows affinities with that of the Cordillera de Mérida, which is possibly due to the common geological origins of both ranges. Examples of this biogeographic affinity are the reptiles *Erythrolamprus pseudocorallus* and *Anolis jacare*. There are also some elements shared with the Colombian Cordillera Oriental, which is adjacent to the Serranía de Perijá: *A. euskalerriari*, *Plesiodipsas perijanensis* and *Centrolene daidaleum*, as well as species of Caribbean affinities like *Rhinobotrhyum bovalli* and *Dendrophidion percarinatum*. The highlands of Perijá comprise an altitudinal fringe of cloud forest, from above 1400 to 3000 m, and Páramo environment between 3000 and 3700 m. This zone harbors at least 14 species of reptiles and 21 amphibians.

0350 Herp Ecology II, Friday 14 July 2017

Paul Bartelt, Alyse DeVries

Waldorf University, Forest City, Iowa, USA

Response of Eastern Tiger Salamanders to Restored Wetlands on an Agricultural Landscape in North Central Iowa

Wetland drainage has predictable effects on amphibian populations; but, how soon after restoration will amphibians colonize wetlands? How do they use the intervening row-crop matrix to find these restored "islands" of wetlands? We measured occupancy and movement patterns of Eastern Tiger Salamanders (a species of conservation concern in Iowa) among recently restored wetlands in Winnebago County, IA. In 2014, we used visual encounter surveys and unbaited minnow traps to estimate occupancy in 45 ponds among 19 restored wetlands, including 14 ponds among 5 wetlands that were restored in 2013. Each pond was surveyed at least twice. Combining results from both visual and trapping surveys, naïve estimates of salamander occupancy was 60% (27/45) of all ponds and 67.7% (21/31) of older ponds (2-20 years old). Occupancy models (ψ) showed that salamanders occupied 74+/-21% of all ponds and 90+26% of older ponds. In 2015 and 2016, we used radio-telemetry, GPS, and a GIS to map movement and habitat use patterns of 35 salamanders. We tracked each salamander for 8-108 days (56+/-35 SD) and made a total of 313 observations; they made daily movements of 0-135 m and traveled a total of 50-708 m from their breeding ponds. Fourteen (40%) salamanders were eaten by predators; two were killed by agricultural equipment. We found them in wetlands and the surrounding restored prairie habitats in 35% and 60%, respectively, of our observations; only three salamanders traveled into agricultural fields, accounting for 6% of our observations. They occupied burrows during 85% of our observations.

0261 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jeffrey Bartman[2], Nathan Kudla[1], Danielle Bradke[1], Jennifer Moore[1]

[1]*Grand Valley State University, Grand Rapids, Michigan, USA,* [2]*Eastern Michigan University, Ypsilanti, Michigan, USA*

Work Smarter, Not Harder: Comparison of Visual and Trap Survey Methods for the Eastern Massasauga Rattlesnake (*Sistrurus catenatus*)

Understanding and monitoring population demographics of rare and endangered species is important for implementing effective conservation and management programs. However, low detection rates, particularly for reptiles that are often characterized by cryptic behavior and coloration, can preclude accurate and precise demographic estimates. One such reptile is the Eastern Massasauga Rattlesnake (*Sistrurus catenatus*), which is declining in every state and province in which it is found. Past population demographic studies of this species have relied on visual mark-recapture survey methods or radio telemetry, which are labor intensive. Other common snake capture techniques (e.g., artificial cover objects, ACOs) have seen little use in Eastern Massasauga population studies. We explored the effectiveness of using ACOs and funnel traps to supplement visual survey methods for this species at a site in southwestern Michigan. Funnel traps (2.64 snakes/h) were approximately six times more efficient than visual surveys (0.41 snakes/h, $P < 0.001$) for capturing male and female massasaugas (combined), and approximately 28 times more efficient for capturing males (funnel = 2.37 snakes/h, visual = 0.084 snakes/h, $P = 0.004$; funnel = 0.263 snakes/h, visual = 0.324 snakes/h, $P = 0.641$ for males and females respectively). Wooden coverboards (1.11 snakes/h) were approximately 3.5 times more efficient than visual surveys (0.32 snakes/h) for capturing females ($P = 0.029$). We recommend the use of these trapping techniques, in addition to visual surveys, as efficient methods for capturing and monitoring Eastern Massasaugas. Our data provide guidance to allow sampling methods to be tailored according to specific study goals.

0245 Herp Systematics I, Sunday 16 July 2017

Aaron M. Bauer[1], Ian G. Brennan[2], Ishan Agarwal[1], Luis M.P. Ceriaco[1], Matthew P. Heinicke[3], David C. Blackburn[4]

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Unexpected Diversity in Southern Angolan Lineages of the *Pachydactylus* Group (Squamata: Gekkonidae)

The *Pachydactylus* group is a diverse clade of geckos that includes at least 66 species in the genera *Pachydactylus*, *Chondrodactylus*, and *Elasmodactylus*. Members of the group dominate the southern African gecko fauna, but are replaced by *Hemidactylus* and other gecko genera in Central Africa. Although northern Namibia is a hotspot for the group, diversity in Angola, the northwestern limit of the clade's distribution, has been regarded as relatively depauperate. Recently collected material from the southern Angolan

provinces of Namibe and Benguela, however, have revealed unexpected diversity in both *Pachydactylus* and *Chondrodactylus*. Nominal Angolan *Pachydactylus* species are *P. caraculicus*, *P. scutatus*, *P. punctatus*, *P. oreophilus* (all also in Namibia), and *P. angolensis* (an Angolan endemic). In multilocus molecular phylogenetic analyses all but the first two of these exhibit deep, species level divergences accompanied by conspicuous morphological differences. *Pachydactylus oreophilus* and *P. punctatus* are represented in Angola by different lineages than in Namibia and both these and *P. angolensis* show further specific level differentiation between Namibe and Benguela provinces. The large-bodied species *Chondrodactylus pulitzerae* exhibits deep substructure, with several species-level lineages in Namibe + Namibia, Benguela and central Angola, whereas Angolan *C. fitzsimonsi* are highly divergent from "conspecifics" in central and northern Namibia. In all, at least 13 species of *Pachydactylus* group geckos inhabit Angola. Cladogenesis in the region was likely promoted by the isolation of suitable rocky substrates and the effects of past riverine barriers.

0574 SSAR SEIBERT ECOLOGY I, Thursday 13 July 2017

Richard Bauer[1], Gregory Skupien[2], Kimberly Andrews[1], Terry Norton[3]

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Spatial Patterns of Male American Alligators (*Alligator mississippiensis*) on a Developed Georgia Barrier Island

American alligators (*Alligator mississippiensis*) historically occupied freshwater habitats such as isolated wetlands, lakes, rivers, swamps, and floodplains in coastal and inland sites. Due to the loss of many aquatic habitats, alligators have resorted to inhabiting human-made lagoons on golf courses and other aquatic habitats in close proximity to developed areas. Alligators inhabiting these systems exhibit novel behaviors and have been documented using human-made habitats such as culverts and storm drains to move across the landscape. Additionally, human-wildlife conflicts are more likely to occur in developed areas where alligators are present. As such, a more detailed understanding of the spatial ecology of alligators in human-dominated landscapes is needed in order to reduce the risk to humans while maintaining population viability of alligators. Our objective was to determine movement patterns and habitat selection of adult male alligators inhabiting Jekyll Island, a developed barrier island off the coast of Georgia. We attached GPS loggers to ten adult (>1.8 meter) male alligators and recorded positions hourly for an average of 318 days (range 86 – 632 days). Data was analyzed using dynamic Brownian bridge movement models and autocorrelated kernel density estimators to process the large amount of GPS data collected (average 1,935 relocations per individual). Movement patters and habitat selection were found to be highly variable among individuals and seasons. Alligators utilized a combination of both natural and man-made aquatic systems, as well as exhibiting large movements through unsuitable permanent habitats such as maritime forests and ocean areas.

0145 LFC Phenotypic Variation II, Thursday 13 July 2017

Hannes Baumann, Jacob Snyder, Christopher Murray

University of Connecticut, Groton, CT, USA

Quantifying Offspring CO_2-Sensitivity in a Fish: A Meta-Analysis of Experimental Variability

To better anticipate how marine fish cope with ongoing ocean acidification (OA), experimental studies comprise an important first step needed to distinguish CO_2-sensitive from CO_2-tolerant traits. Despite progress from the rapid expansion of OA experiments over the recent past, robust conclusions remain elusive, in part because trait responses to high CO_2 are often subtle and thus hard to discern from other sources of phenotypic variability without sufficient within- and across experiment replication. Here, we look back at six years and 15 separate experiments testing the early life CO_2-sensitivity of survival and growth in the Atlantic silverside (*Menidia menidia*), an important forage fish and model in OA research. We used measured survival and growth rates in embryos and larvae from experiments performed at 24°C and two consistently employed CO_2 treatments (ambient: ~500 µatm, high CO_2: ~2,200 µatm) to calculate log-transformed response ratios and compare responses across experiments. In addition, we computed within-experiment coefficients of variation for survival and growth under contrasting CO_2-scenarios to calculate the level of replication needed to discern trait responses of varying magnitude. Our analyses suggest that subtle but potentially important trait responses to high CO_2 remain undetectable at typically employed replication levels, while highlighting the urgent need for replicating OA experiments both within and across research groups.

0711 General Ichthyology II, Saturday 15 July 2017

James Beach

University of Kansas, Lawrence, KS, USA

Supporting Biological Collections Informatics with Specify Software for the Long Run

The Specify Software Project produces and supports Specify, a biological collections data management platform for curation, digitization and data publishing. The Project is a descendent of the MUSE Project which together have been funded for 30 years by the U.S. NSF. About 500 collections world-wide use Specify for specimen data processing. Our latest generation is Specify 7, a web application hosted by the Specify Cloud server, or by institutions for themselves. During 2017, we are engaging with various groups and segments of the international collections community to envision and develop a path toward sustainable community-supported collections cyberinfrastructure. Specifically we are launching a campaign to identify a sustainable revenue model, as well as actual

sources of financial support, for the ongoing software engineering of Specify, its helpdesk support, and associated data management services, without NSF grant funding. This presentation will discuss options for community governance and ongoing financial support for biological collections software and associated informatics activities. We will solicit feedback on the community software vision and organizational models described in this presentation.

0873 General Herpetology, Sunday 16 July 2017

Christopher Beachy

Southeastern Louisiana University, Hammond, LA, USA

How plethodontid lunglessness informs a perspective on ancestral state reconstruction for life cycle evolution

Plethodontids diversity in life cycle exceeds that of any other group of amphibian. This should not be surprising given that the family far exceeds all other salamander families in terms of species diversity. This species diversity is a direct consequence of life cycle diversity: the evolution of direct-development and paedomorphosis has resulted in species richness. Why has the plethodontid complex life cycle been the only one in all the Animalia to produce both of the derived life cycles? In several recent papers, it has been suggested that the ancestral life cycle in plethodontids was direct-development. This suggestion contrasts with a more traditional hypothesis that the ancestral plethodontid has a life cycle that included a post-hatching metamorphosis. I discuss how the seemingly most important feature of plethodontids, i.e., lunglessness, informs a view of life cycle evolution in this family of salamanders. It is clear that lunglessness is a feature that enables persistence in flowing water, and this suggests that the ancestral life cycle is one that includes larvae. This can enable a view that maintains an older philosophical perspective to be used to understand plethodontid biology, i.e., outgroup comparison to establish an ancestral condition.

0516 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Noemi Becza, Emily Seiter, Sarah Bolton, Ralph Saporito

John Carroll University, University Heights, Ohio, USA

Quantifying Alkaloid Defenses from Dendrobatid Poison Frogs Using a Transcutaneous Amphibian Skin Stimulator (TAS)

The skin of dendrobatid poison frogs contains a diversity of alkaloids that serve as a defense against predation and microbial infection. The ecology and evolution of these defenses are of particular interest to biologists, especially given the tremendous variation with frog species, sex, age, size, as well as geographic location and over time.

To date, the extraction, identification, and quantification of alkaloids has largely required that frogs be sacrificed, a non-preferred endpoint that has become increasingly more difficult given the CITES protective status of dendrobatids. Although some studies have safely extracted alkaloids from frogs using a Transcutaneous Amphibian Skin Stimulator (TAS), this approach has been limited by providing only qualitative alkaloid data. Herein, we quantitatively extract, identify, and compare alkaloid richness and quantity using a TAS method and standard method of whole skin extraction in the dendrobatid frogs *Oophaga pumilio* and *Oophaga granulifera* from Costa Rica. Our results suggest that alkaloid richness using the TAS method is almost identical to that obtained in whole frog skin extractions. Furthermore, the quantity of alkaloids measured using the TAS method ranges from 25%–60% of the total quantity measured in whole frog skin extracts; however, alkaloid quantity using the TAS method is directly proportional to the total quantity of alkaloid present in whole frog skin extractions. Our findings suggest that the TAS method can be used to extract, identify, and quantify alkaloid defenses in individual frogs, which may reduce the need to sacrifice as many frogs when studying the chemical ecology of dendrobatids.

0780 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Christine Bedore

Georgia Southern University, Statesboro, Georgia, USA

Visual ecology of elasmobranch fishes

Sensory systems represent an interface between animals and their environment. As such, sensory physiology is shaped by a species ecology; sensitivity and resolution of each modality reflect the physical and biological environments in which the sensory system functions. Among elasmobranchs, these parameters are most well-studied in the visual system. Irradiance, spectral composition, temperature, and behavior all impart selective pressures on elasmobranch visual systems. For example, deep sea species possess adaptations for blue-dominated and low-light habitats, such as large eyes and blue-shifted visual pigments. This review will illustrate the breadth of visual adaptations in elasmobranch fishes, highlight the ecological implications of physiological adaptations of elasmobranch visual systems, and identify future avenues of vision research within an ecological and comparative context.

0462 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Christine Bedore[1], Kady Lyons[2]

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Applications of Physiological Ecology in Elasmobranch Research

The inclusion of physiology into ecological studies, and vice versa, recognizes that both the animal and the environment impact each other. Approaching physiological ecology as a single discipline can be challenging for researchers working with large, and often migratory, predators. Traditional physiological tools limit both the number and size of animals that can be used in laboratory-based experiments. The continuous development of new technologies has increased the number of tools available and offers alternative methodologies to study classic ecology questions that also have a basis in physiology. Using the symposium as a platform, we seek to 1. bridge gaps between ecologists and physiologists through a single session that incorporates both disciplines, 2. emphasize the importance of collaboration between these two fields, and 3. provide a gateway for those collaborations and cross-talk to occur. Speakers in the symposium will review the history of physiological ecology in elasmobranch research, illustrate the utility of advanced and innovative technologies, as well as identify outstanding questions in elasmobranch biology that can be answered using an integrative approach. Keeping a physiological perspective as we study ecology informs us of the limitations of animals within the scope of their environment. This is of critical importance if we consider that the conservation status of many species of elasmobranchs is tenuous at best. Combining physiological tools with ecological questions will help us better address the conservation needs of multiple species, guiding us towards the better management solutions to promote species conservation.

0479 ASIH STOYE GENERAL HERPETOLOGY, Thursday 13 July 2017

Anat Belasen, Tim James

University of Michigan, Ann Arbor, MI, USA

How does long-term habitat fragmentation affect disease susceptibility? Examining the relationships between geography, host genetics, and disease in a Brazilian Atlantic Forest frog

Human impacts on natural systems often promote disease emergence, but the ecological and evolutionary mechanisms by which this occurs are poorly understood. When humans divide and reduce natural areas through a process known as *habitat fragmentation* (*e.g.*, by building roads or clear-cutting forests for agriculture), the disjunct patches of forest that remain contain small, isolated wildlife populations. These populations can consequently become inbred very rapidly. Inbreeding can hypothetically increase disease susceptibility, but empirical tests of this phenomenon in natural settings are lacking. Time since fragmentation is an important consideration; the extent of inbreeding and loss of genetic diversity in a given fragmented population increases over time. Land-bridge islands offer interesting model systems for understanding the genetic effects of habitat fragmentation. Land-bridge islands are patches of land that were naturally fragmented by rising sea levels following the Last Glacial Maximum (~12-20,000 years ago). Isolated land-bridge island populations represent relicts of once-contiguous populations, and thus demonstrate the potential long-term effects of fragmentation. We examined whether disease susceptibility was

affected by fragmentation in the Brazilian Atlantic Forest frog *Thoropa taophora* (Cycloramphidae). Our data suggest that inbred island populations host more infections, and may be at increased risk for future disease. The results of this study provide insights for the management of anthropogenically fragmented wildlife populations.

0119 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Mauro Belleggia[1], Agostina Villa[2], Jorge Colonello[3], Daniel E. Figueroa[4], Agustin Giberto[1], Claudia Bremec[1]

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Let's Go Hunt: The Diet of The Narrowmouthed Catshark *Schroederichthys bivius*, from the Patagonian Continental Shelf

The narrowmouthed catshark *Schroederichthys bivius* is an endemic species of the southwest Atlantic and southwest Pacific continental shelf. It is distributed from Brazil to Argentina and Chile. In Argentina it occurs from 50 to 360 m depth. Food habits of *S. bivius* were studied based on analysis of stomach contents. Specimens were collected from two research cruises carried out by (INIDEP) during winter 2016 and summer 2017 on the southern Patagonian continental shelf (41oS - 48oS). Prey items were identified to the lowest possible taxon, counted and weighed. The percentage of the index of relative importance (%IRI) was used to evaluate the contribution of each prey. The hypothesis that the consumption of each prey group is influenced by total length, sex, maturity stage or season was assessed by fitting generalized linear models (GLM). From the 309 catsharks analyzed, all stomachs (100%) contained food. The %IRI revealed that the species fed mostly on cephalopods (36.90%) and crustaceans (33.18%), followed by fish (20.36%) and polychaetes (24%). The consumption of polychaetes and crustaceans decrease as the narrowmouthed catshark grew in size, and they were consumed more during winter than summer. On the other hand, the consumption of cephalopods increased with the total length of *S. bivius* and they were consumed more in summer than in winter. The trophic level was estimated 3.94.

0614 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Katherine Bemis[1], James Tyler[2], William Bemis[3], Eric Hilton[1]

[1]*Virginia Institute of Marine Science, Gloucester Point, VA, USA,* [2]*Smithsonian Institution, Washington, DC, USA,* [3]*Cornell University, Ithaca, NY, USA*

Comparative Anatomy of the Dentition of Molidae (Ocean Sunfishes) and Diodontidae (Porcupinefishes): New Insights from Ontogeny and Patterns of Tooth Replacement

As part of a broad study on the evolution of dental morphology in Tetraodontiformes, we compared the development and replacement of dental tissues in *Mola mola* and *Diodon hystrix* in specimens ranging from larvae to adults using osteology, histology, and micro-CT scanning. Unlike other living Tetraodontoidea (Triodontidae, Molidae, Diodontidae, Tetraodontidae), both the upper and lower jaws of Molidae and Diodontidae are completely fused at their midlines in even the smallest larvae studied. Adults of both families have a beak along the jaw margin. The beak of *Mola mola* wears away from the oral surface; replacement material is added from a single large pulp cavity at its base. There are no discrete units within the beak, and it is uniformly mineralized. In contrast, the beak of *Diodon hystrix* consists of stacks of small discrete plates surrounded by less dense matrix. New plates form from beneath existing stacks. Posteriorly and between the dentaries of adult *Diodon hystrix* are large paired crushing plates, termed triturating plates, that are replaced from beneath; nothing comparable is present in adult *Mola mola*. In contrast to adults, larval and juvenile molids and diodontids have a paired series of individual triturating teeth each of which has a large pulp cavity. During ontogeny, these discrete teeth are lost in *Mola mola*, whereas in *Diodon hystrix* they develop into the large triturating plates. From similar beginnings, the individual triturating teeth of larval molids and diodontids develop into very different forms in adults.

0621 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Katherine Bemis[1], James Tyler[2], William Bemis[3], Kishor Kumar[4], Rajendra Rana[5], Thierry Smith[6]

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A Gymnodont Fish Jaw with Remarkable Molariform Teeth from the Early Eocene of Gujarat, India (Teleostei, Tetraodontiformes)

The lower jaw of a gymnodont fish collected from the early Eocene Cambay Shale Formation that is exposed at the Tadkeshwar lignite mine near Vastan in Gujarat Province, western India, has fused dentaries without a beak and a remarkable series of inner trituration teeth that are unique among all known fossil and living Tetraodontiformes. The teeth are molariform with raised “spokes” radiating inward

from the emarginated peripheral edge of the crown. Tooth development is intraosseous, with new teeth developing in spongy bone before they erupt and attach to the dentary by pedicels. Although many of the 110 tooth loci in the fossil have lost their teeth, in life the teeth would have grown to fit tightly together to form a broad and continuous crushing surface. The estimated age of the early Eocene Cambay Shale vertebrate fauna is ca. 54.5 Ma, making the jaw the second oldest confirmed gymnodont fossil. We describe it as a new genus and species, and place it in its own new family of Gymnodontes.

0453 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

William E. Bemis[1], Eric J. Hilton[2], Gavin J. P. Naylor[3]

[1]Cornell University, Ithaca, New York, USA, [2]Virginia Institute of Marine Science, Gloucester Point, Virginia, USA, [3]University of Florida, Gainesville, Florida, USA

Anatomy of the Smalltooth Sand Tiger (*Odontaspis ferox*) and notes on the evolution of Lamniformes: Results from a dissection party

The order Lamniformes (Mackerel Sharks) includes 15 extant species, >150 nominal species known only as fossils, and many iconic forms including the White Shark, *Carcharodon carcharias*. As part of a holistic approach to understand conflicting signals in anatomical and molecular datasets, we are using this charismatic group as an example of how to reconcile signal conflicts without obscuring the underlying biological mechanisms responsible for conflicting character distributions. We are undertaking a detailed review of the comparative anatomy and molecular systematics of Lamniformes. Our preliminary systematic datasets show conflicting signals between anatomy and molecules for two historically recognized lamniform sub-groups: the three extant species of Thresher Sharks (Alopiidae) and the three extant species of Sand Tigers (Odontaspidae), which are variably non-monophyletic based on our preliminary molecular studies. A new specimen of the little known Smalltooth Sand Tiger, *Odontaspis ferox*, recently became available, and, in conjunction with our larger project, we took this opportunity for a group dissection of the specimen as a way to document the anatomy of this rarely collected species. The results of this dissection, to take place in late March 2017 (i.e., after this abstract is due), will be presented. We will discuss our anatomical observations of this specimen, place them in the context of our existing anatomical character data matrix, and discuss how this matrix bears on lamniform phylogenetics.

0631 Amphibian Conservation IV, Sunday 16 July 2017

Nathan Bendik, Laurie Dries

City of Austin, Watershed Protection Department, Austin, Texas, USA

Time Series Analysis of Barton Springs Salamander Counts

Eurycea sosorum is an obligate aquatic species restricted to the Barton Springs segment of the Edwards Aquifer and occurs at its highest abundances at four spring outlets within a public park and swimming pool near downtown Austin, Texas. Population monitoring efforts have been ongoing since 1993, and these efforts have supported the federal listing under the ESA as well as the development of management guidelines and a Habitat Conservation Plan. We analyzed data from 10 years of monthly population count surveys to understand the endogenous and exogenous factors that influence the population dynamics of this microendemic species. Using multivariate autoregressive state-space models, we address the following questions: (1) Is reproduction driven by pulses in aquifer recharge/discharge or seasonality? (2) Are drivers of surface abundance related to seasonality, surface habitat conditions, or spring discharge? (3) What is the strength of density-dependence for each size class? (4) Do adults negatively interact with juveniles? We did not find evidence of negative effect of adults on juveniles, while the strength of a density-dependent effect varied by size class. We found that juvenile abundance was positively associated with lags of up to 10 months in spring discharge/recharge, indicating that long-term aquifer-scale dynamics may play an important role in determining *E. sosorum* population variability. Additionally, we found a negative association between sediment deposition and the abundance of juveniles and sub-adults, reaffirming management actions that aim to reduce habitat sedimentation.

0875 LFC Phenotypic Variation II, Thursday 13 July 2017; LFC SALLY L. RICHARDSON BEST STUDENT PAPER

Raven M.C. Benko[1], R. Christopher Chambers[2]

[1]*Western Washington University, Bellingham WA, USA,* [2]*NOAA / Northeast Fisheries Science Center, Highlands NJ, USA*

Sources of Variation in Early Life Traits of Atlantic Silverside, *Menidia menidia*

Identifying the sources of phenotypic trait variation is critical to determining the potential for adaptive responses to environmental change. We used a quantitative genetics approach to partition the observed variation in early life history (ELH) traits of Atlantic Silverside, *Menidia menidia*, a forage fish common in inshore waters of the eastern USA. Adults in ripe condition were collected in Sandy Hook Bay, New Jersey and stripped spawned in the laboratory. A paternal half-sibship, hierarchical mating design was implemented and repeated several times during the study. Our largest mating design (D1) used 10 males, each mated to two females with three replicate sets of full-sib offspring. Multiple ELH traits were scored, including egg size; size, age, and survival rate at hatching; and size of larvae at 15 days post-hatch. A smaller design, D2, mated each of 2 males to 2 females (three replicates) and assessed the effects of parentage and two thermal embryo habitats (16 and 22 °C). Design D1 had sufficient power to decompose the variance in each ELS trait into fractions due to mother, father,

and genetic variance components, including trait heritability, h^2. We found significant differences among females in sizes of eggs (R^2=0.59) and larvae at hatching (R^2=0.52). Female average egg size was predictive of average size of larvae at hatching (R^2=0.59). The magnitude of the maternal effects lessened with larval age, trait h^2 varied between size and age traits, and the multiple environment (D2) design suggested the possibility of genotype by environment interactions.

0370 ASIH STOYE ECOLOGY & ETHOLOGY II, Thursday 13 July 2017

Stephanie Benseman, Larry Allen

California State University, Northridge, Northridge, CA, USA

The Secret Life of Baby Giants: The Recruitment of the Endangered Giant Sea Bass

Life history information on a species is critical to maintain successful management of that fishery. Little is known about the complete life history of giant sea bass (*Stereolepis gigas*), due to the over exploitation of their fishery in the early 1900's, and depressed populations have prevented much detailed research. This study has finally filled in the gaps of the early life history of the juvenile giant sea bass by 1) determining distribution and general ecology for the young-of-the-year of *S. gigas* in the wild, 2) estimating growth rates, based on site aggregations in the wild, and otoliths analysis in the lab, and 3) finally determining pelagic larval duration and general temporal scale of their spawning period. Field observations have already discovered several previously unknown behaviors, including the "kelping" mimicry and burying behavior, distinct distribution patterns across southern California primarily adjacent to underwater canyons, annual and daily temporal distribution, as well as documentation of their morphological changes. The lab finding confirmed diet through gut content analysis, as well as determining a growth curve and planktonic larval duration through otolith analysis. Early developmental processes and recruitment patterns are crucial for completing the life history for any species, allowing us to make increasingly intelligent decisions about current fisheries management policies as well as future conservation efforts. This study is the only one of its kind to do so for this endangered species making it a key component to their life history, and a baseline for future work on *S. gigas* and similar species.

0622 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Rex Bergamini, Erika Nowak

Northern Arizona University, Flagstaff, AZ, USA

Stable Isotope Analyses in Two Federally-listed Gartersnake Species: A Proposal

Understanding and mitigating environmental insults, including habitat loss, invasive species and loss of prey species, is critical to the recovery of federally-listed species. Indeed, nonnative species are often cited as detrimental to the recovery of listed species. Recovery efforts are often hindered by an absence of information about reclusive species, including trophic relationships, transfer of energy and position. Our field and captive breeding studies with narrow-headed gartersnakes (*Thamnophis rufipunctatus*) and northern Mexican gartersnakes (*T. eques megalops*) identify three dietary questions: 1) In the absence of native prey species, are nonnative species essential for the viability of either *Thamnophis* species?; 2) Do *T. rufipunctatus* shift prey species from fishes to anurans following catastrophic events that extirpate local fish populations?; and 3) Do *T. rufipunctatus* in captive breeding programs experience trophic shifts from hatchery fish diets? Our preliminary data suggest that nonnative salmonids are an important surrogate prey species for *T. rufipunctatus*; however, it is not known if anuran species are consumed. In *T. e. megalops*, the importance of invasive ranids or endemic bufonids as fauna essential for population viability is unclear. Here we propose identifying the trophic level hierarchy of *Thamnophis* spp. food webs by collecting snake tail clips and/or sheds for stable isotope discrimination of carbon (i.e., ^{12}C, ^{13}C; dietary sources), nitrogen (i.e., ^{14}N, ^{15}N; trophic position), and sulfur (i.e., ^{32}S, ^{34}S; specific prey species). Identifying trophic positioning will inform snake husbandry practices as well as management practices that eradicate nonnative species to facilitate the recovery of listed species.

0224 Herp Systematics II, Sunday 16 July 2017

Justin Bernstein[1], Aaron Bauer[1], Hinrich Kaiser[2], Sven Mecke[3]

[1]Villanova University, Villanova, PA, USA, [2]Victor Valley College, Victorville, California, USA, [3]Philipps-Universität Marburg, Marburg, Germany

Complex and Cryptic: A multilocus phylogeny of Asian Pipe Snakes (Serpentes: *Cylindrophis*) and the taxonomy of *Cylindrophis ruffus*

The understudied Asian pipe snakes (Cylindrophiidae) are a monotypic family of 14 described species, all within the genus *Cylindrophis*. With their wide distributions and speculations of interspecific relationships being based solely on morphology, little is known about the true species richness, fine-scale geographic patterns, and evolutionary history of *Cylindrophis*. Recent studies have led to taxonomic revisions, descriptions of new species and species groups, and the evidence of species complexes within *Cylindrophis ruffus*. Although morphological characters of allopatric populations of different *Cylindrophis* species support the conclusions of these studies, other types of data, such as CT scans and molecular evidence, are required. A preliminary Bayesian Inference tree of the 16s gene shows relationships that coincide with morphological data and recent taxonomic revisions and descriptions. There is evidence that *C. ruffus* is a species complex with distinct clades from Vietnam, Malaysia, and Myanmar. Furthermore, the geographically disjunct *C. maculatus* from Sri Lanka, which has a color pattern and scale characters distinct from its congeners, is recovered as the sister lineage

to all other sampled *Cylindrophis*. Moderately deep substructuring is recovered between the Malaysia and Vietnam populations of the recently described *C. jodiae*. Additionally, the Wetar and Timor-Leste populations of *C. boulengeri* are identical. Previous hypotheses grouping *Cylindrophis* based on dorsal scale counts are not borne out by our data. More genes and samples are being added to this dataset and are expected to reveal more cryptic diversity, insight into the phylogenetic history of *Cylindrophis*, and additional taxa are expected to be described.

0463 ASIH STOYE GENERAL ICHTHYOLOGY I, Thursday 13 July 2017

Maxwell J. Bernt, James S. Albert

University of Louisiana at Lafayette, Lafayette, LA, USA

Phylogeny and Historical Biogeography of the Ghost Knifefishes (Gymnotiformes: Apteronotidae)

The Apteronotidae is the most species-rich and morphologically-disparate family of electric knifefishes (Gymnotiformes), with roughly 100 species in 15 genera. Apteronotids are found throughout the humid Neotropics from Panama to northern Argentina, but are most diverse and abundant in the main channels of large rivers in the Amazon Basin. The presence of diverse, sympatric assemblages in deep river channels in conjunction with disparate trophic morphologies is a pattern suggestive of adaptive radiation. Although there have been many recent advances in gymnotiform phylogenetics, no study has yet specifically assessed the temporal and geographical context of apteronotid diversification. We use a species-dense time-calibrated phylogeny and biogeographic model testing to estimate ancestral species ranges and ultimately infer the effects of geologic history on apteronotid evolution. Our results indicate relatively ancient origins of the family, but with rapid diversification occurring in the subfamily Apteronotinae only after the early Miocene (ca. 23 MA). This spike in diversification is coincident in time and place with the Pebas megawetland system hypothesized to have covered an extensive portion of northwestern South America. The influence of this massive lacustrine habitat on the evolution of a largely riverine clade is unclear, but we suggest that the radiation of the Apteronotinae is most closely associated with the large-scale transition from a lacustrine to a riverine system with subsequent Andean uplift and formation of the modern Amazon.

0011 General Ichthyology II, Sunday 16 July 2017

Tim Berra[1,2], Dion Wedd[2]

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Salinity and spawning of nurseryfish, *Kurtus gulliveri*, in the Adelaide River of northern Australia with notes on electrofishing and the only photo of a male carrying eggs.

Nurseryfish are unique among fishes in that the males carry the fertilized eggs on a supraoccipital hook on their head. In an attempt to learn where, when, and at what salinities spawning occurs, an ichthyoplankton net was towed at 14 stations in the Adelaide River from the mouth (38 ppt) to the most upstream sections of the river (0.1 ppt). Larval nurseryfish (5-27.5 mm SL) were collected, preserved and measured, and water chemistry parameters were recorded with each sample. Larvae were found in the mid-reaches of the river during July-October, most commonly at salinities between 13.6-0.5 ppt. Salinities increased as the dry season progressed. Larvae were not taken at salinities higher than 19 ppt, nor did they occur in the upper-most reaches of the river system during this time of the dry season. What nurseryfish do and where they occur during the massive influx of freshwater runoff during the wet season (November-April) remains a mystery. Electrofishing for nurseryfish proved to be ineffective in the Adelaide River due to its extraordinary turbidity which made recovery of stunned fish difficult and fresh material of males carrying eggs remains elusive. Two historic photographs showing males carrying eggs are described.

0315 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Keith Berven

Oakland University, Rochester, MI, USA

Patterns and Trends in the Population Dynamics of Wood Frogs Based on a 33-year Study in Southeastern Michigan

For organisms with bi-phasic life cycles, such as pond breeding amphibians, vital rates in both the aquatic and terrestrial portion of the life cycle can contribute to population dynamics. To date, most amphibian population studies have focused on only one of the stages in the life cycle making it difficult to interpret the underlying causes of long-term patterns in amphibian population dynamics. Here I present the results of a 33-year population study of Wood Frogs, for both the aquatic and terrestrial stages, from a population in SE Michigan. Adult male and female population sizes from 1985-2005, although fluctuating dramatically, remained relatively constant through the period (mean = 4112). In contrast, during the last eleven years (2006-2016), the total number of breeding adults has declined by 75% (mean=2532). However, during this period of population decline, terrestrial vital rates, including adult survival, adult body size at first reproduction, clutch size and recruitment (male and female juvenile survival) have actually increased reflecting the compensatory effects of lower population size previously reported for this population. In contrast, vital rates in the aquatic stage—larval survival and the number of metamorphic juveniles produced each year have

decreased dramatically (30% and 52% respectively) indicating that the observed decline in population size is largely due to factors associated with the aquatic larval stage as opposed to the terrestrial stage. These results attest not only to the value of long-term studies, but also to the importance of including both the aquatic and terrestrial phases of the life cycle.

0579 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017; AES GRUBER AWARD

Jennifer Bigman[1], Nicholas Wegner[2], Nicholas Dulvy[1]

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Does respiratory morphology explain the speed of life?

The total amount of energy devoted to survival, growth, and reproduction governs the speed of life, or the position of a species on a continuum of slow to fast life histories. Energy availability is ultimately governed by metabolic rate, which is the rate of resource uptake and allocation. Thus, metabolic rate likely shapes life histories, and environmental factors such as temperature act to shape metabolic rate. Yet, few studies have explicitly explored the relationships among metabolic rate, environmental factors, and life history. As metabolic rate is most commonly assessed by measuring oxygen consumption in the laboratory, this methodology often precludes collecting metabolic data for large-bodied, aquatic organisms. Previous work has suggested that metabolic rate and respiratory morphology are linked, and that respiratory morphology, such as the surface area of the lungs or gills, can act as a proxy for metabolic rate. Furthermore, the structures of the respiratory system have been theoretically connected to growth and life histories, but this has not been explicitly tested. Here, we test the connections among metabolic rate, gill surface area, temperature, activity level, and life history traits of elasmobranchs. First, we establish the allometric relationships of metabolic rate and respiratory surface area and compare them statistically. We then examine how temperature and activity level relates to gill surface area. Finally, we test the hypothesis that gill surface area in elasmobranchs is related to life histories. We present preliminary results and conclusions.

0835 AES Ecology II, Sunday 16 July 2017

Joseph J. Bizzarro[1], Aaron B. Carlisle[2], Wade D. Smith[3], Enric Cortés[4]

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Trophodynamics and Ecological Impacts of Eastern North Pacific Sharks

To better understand and advance knowledge of shark trophic ecology in the eastern North Pacific (ENP), we synthesized and reviewed the literature concerning trophic relationships, trophodynamics, and ecological impacts of 73 species that occur in this region. We also conducted a meta-analysis of the standardized diet compositions and trophic levels of ENP sharks and then utilized the results to define trophic guilds and examine sources of dietary variability among predator (e.g., taxon, total length, habitat) and prey (i.e., cephalopods, fishes, marine mammals) categories using a variety of quantitative multivariate techniques. Owing to the substantial differences in taxonomy, size, and distribution of ENP sharks, their trophic relationships are highly variable. In addition, the trophic ecology of ENP sharks has been poorly studied compared to those of some other regions (e.g., western North Atlantic, Australia, South Africa), with only a few well-studied species (e.g., white shark, blue shark, leopard shark). We review the growing body of literature that documents the behaviors and movement patterns of ENP sharks that have been attributed to foraging across a range of spatial and temporal scales, ranging from tidal and diel patterns to larger scale movements and migrations. We then take a more holistic look at the ecological roles of ENP sharks, including their direct and indirect predatory impacts, and the role of sharks as prey. Finally, we examine current approaches to fisheries management in the ENP that incorporate trophic information on sharks, and suggest possibilities for further exploration and development.

0551 Amphibian Biology, Ecology, & Conservation, Sunday 16 July 2017

David Blackburn, Edward Stanley

University of Florida, Gainesville, FL, USA

A Digital Encyclopedia of Frogs

For any taxon, it can be difficult to get access to particular species, especially when they are only found elsewhere in the world. Even when specimens can be obtained on loan from museums, destructive sampling to study internal anatomy would be irresponsible for rare species or unique specimens, including type material. We are using microCT-scanning to create high-resolution (typically 10–50 micron) digital specimens that can both be shared quickly and efficiently and dissected digitally. Our current efforts focus on documenting the breadth of phenotypes found in frogs across the world. To date, we have scanned representatives of all living species and more than half of all anuran genera (including >500 species). We aim to create contrast-enhanced CT-scans of a representative specimen of all anuran families. We are making both 3D mesh files and image stacks of each specimen freely available on-line to scientists, students, educators, and the general public to facilitate exploration of anatomical phenotypes and to use in addressing a broad range of research questions in comparative anatomy, paleontology, and phenotypic evolution.

0131 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

William Blair[1], Stefan van der Voort[2], David Edds[1]

[1]Emporia State University, Emporia, Kansas, USA, [2]Beetzlaan 72K, 3762 CG Soest, The Netherlands

Morphological Analysis of *Badis* (Osteichthyes: Badidae) from Nepal

The Indo-Burmese percomorph genus *Badis* has undergone considerable expansion over the past 15 years, with descriptions of 20 new species, bringing the total species count to 24. One previous study examined morphology of *Badis* from Nepal, but it included analysis of specimens from only a single river drainage. We surveyed fishes throughout Nepal, and found *Badis* spp. in all three of the country's widely separated major river drainages, but only in slow-flowing and often vegetated waters of the lowlands. We quantified the morphology of 172 of these specimens using digital calipers and a dissecting microscope, and we used principal component analysis (PCA) on morphometric, meristic, and color pattern characters to investigate differences among individuals. Regression analysis confirmed allometric growth of young *B. badis* in the Gandaki River drainage. PCA had high loadings on morphology, including head length, snout length, orbital diameter, and interorbital width, but not on meristics or color patterns. Scatterplots of PCA axes showed differences among river drainages, including the presence of *B. andrewraoi*, previously know only from India.

0760 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brian Blais, John Koprowski

University of Arizona, Tucson, AZ, USA

Tools of the Trade: Herpetofauna as Models for Conservation

Wildlife conservation and management requires focused, detailed information about a species distribution, demography, and systematics to assist with science-based, informed actions. There are numerous tools that researchers and managers use to gain knowledge about species and communities, including those at-risk. Augmentation of novel techniques can reduce environmental impact and costs for stakeholders and wildlife managers. Diverse taxonomic groups, such as amphibians and reptiles, make excellent models for conservation management action. Herpetofauna are indicators of environmental health, play roles in ecosystem food chains, and are important for human health and medicine. Wide scale declines of herpetofauna are well documented. Roughly 1/3 of the global amphibian species are threatened, and adequate knowledge bases do not exist for many other herpetofauna assessments. We use herpetofauna models to outline the efficacy of three novel tools for conservation. We look at how conservation genetics and genomics have shed light on a grassland bioindicator species (*Opheodrys vernalis*); how post-reintroduction, non-invasive radio telemetry yields

insight into the spatial dynamics, behavior, and microhabitat usage of an enigmatic, threatened species (*Thamnophis rufipunctatus*); and how citizen science can harvest data *en masse* (Anura). These tools are invaluable to managers and researchers, and subsequent data can be used to inform strategic conservation decisions.

0797 Lightning Talks II, Friday 14 July 2017

Brian Blais[1], John Koprowski[1], Stuart Wells[2]

[1]*University of Arizona, Tucson, Arizona, USA,* [2]*Phoenix Zoo, Phoenix, Arizona, USA*

Non-invasive Conservation: Novel Radio-Telemetry Techniques and Environmental DNA Sampling for Threatened Narrow-headed Gartersnakes (*Thamnophis rufipunctatus*)

Wildlife conservation and management requires focused, detailed information about a species distribution, demography, and dynamics to assist with science-based, informed actions. There are numerous tools that researchers and managers use to gain knowledge about species and communities, including enigmatic and declining species. Augmentation of novel techniques can reduce environmental impact and costs for stakeholders and wildlife managers. I am researching the efficacy of *ex situ* conservation programs and their roles in species reintroductions by monitoring populations post-release. Specifically, I am surveying a population of conservation translocated, narrow-headed gartersnakes (*Thamnophis rufipunctatus*) in central Arizona. This is part of a collaborative conservation effort between the Phoenix Zoo, Arizona Game and Fish Department, U.S. Fish and Wildlife Service, and University of Arizona to recover this threatened species. I am using a novel, non-invasive (externally attached) radio telemetry technique to assess spatial and temporal movements, microhabitat selection, and behavior within this population. Precise telemetry also enables me to track survival and reproduction events. Adaptively managing and optimizing *ex situ* resources can facilitate successful conservation programs for other taxa. Additionally, I am investigating the use of environmental DNA (eDNA) sampling and metabarcoding to simultaneously detect narrow-headed gartersnakes, their primary prey (fish), and threat species such as non-native fishes, crayfish, and bullfrogs. This technique, applied across the species range, can provide insight into real time occupancy and community attributes that impact narrow-headed gartersnakes. Together, these tools allow me to provide science-based information for conservation decisions towards the recovery of the species.

0745 ASIH STOYE ECOLOGY & ETHOLOGY III, Friday 14 July 2017

Gareth Blakemore, Kristina Bozanich, Chris Feldman

University of Nevada, Reno, Reno, NV, USA

We Want a Shrubbery! Cheatgrass (*Bromus tectorum*) Modified Habitat has Altered the Thermal Landscape for Reptiles in the Great Basin.

In the Great Basin, widespread invasion by cheatgrass has resulted in the alteration of landscape structure and ecosystem function. By usurping resources and modifying habitat, this invader has been implicated in reductions of species abundance and diversity for several taxa. Though a pattern of biodiversity loss resulting from the shift in habitat is clear, the mechanisms and landscape scale implications remain unknown. In particular, there is almost no information on whether and how cheatgrass impacts reptile communities. We propose that areas invaded by cheatgrass will show reductions in abundance and diversity and that several mechanisms act in synergy to reduce habitat quality for reptiles. Specifically, the loss of shrub cover in cheatgrass dominated areas results in fewer thermal microhabitats and temperature gradients for effective thermoregulation. To test this hypothesis, we developed operative temperature models of the western fence lizard (*Sceloporus occidentalis*). Our models contain iButton temperature loggers and mimic the conductance, reflectance, and absorbance of a lizard. Models record the temperatures a lizard would experience in various microhabitats. We deployed models at paired sites (cheatgrass dominant vs. native shrub habitat) in northwestern Nevada. We found that cheatgrass sites are, on average, significantly hotter than native-shrub sites. Our preliminary results identify a plausible mechanism of biodiversity loss due to cheatgrass invasion: modified temperature regimes and loss of thermal microhabitats. Given that over 10% of the Great Basin has been converted to cheatgrass monocultures, we expect significant regional declines in reptile abundance, diversity and connectivity between isolated populations in intact shrub habitat.

0689 Herp Behavior, Thursday 13 July 2017

Annelise Blanchette, Ashleigh Minetti, Ralph Saporito

John Carroll University, University Heights, OH, USA

Cryptic and Conspicuous Antipredator Strategies in the Aposematic Frog *Dendrobates auratus*

Crypsis and aposematism are often considered alternative antipredator strategies in which cryptic organisms rely on camouflage and immobility to avoid predator detection, whereas aposematic organisms use conspicuousness and movement to advertise chemical defenses that deter predation. Aposematic organisms are considered bold when compared to cryptic prey; however, recent evidence suggests that boldness and conspicuousness may reside on a spectrum within aposematic species. The present study examined how antipredator behaviors of Pacific and Caribbean populations of *Dendrobates auratus* in Costa Rica are correlated with frog color, pattern, and alkaloid defenses. Antipredator behavior was measured as (1) escape during simulated predation trials using a bird model and (2) boldness via timed emergence from a cover object into a novel environment. Frogs in the Pacific population were less bold when emerging from a cover object and exhibited deimatic body raising in response to a simulated bird

predator, both of which were correlated with greater patternation, less conspicuous green coloration, and fewer alkaloid defenses when compared to frogs from the Caribbean population. The differences in behavior and morphology observed between these frog populations suggest that there is a continuum of antipredator strategies – ranging from more cryptic to more conspicuous – within a frog species exclusively considered to be aposematic. The presence of seemingly alternative antipredator strategies within an aposematic species highlights that crypsis and aposematism are not mutually exclusive, but instead allow for a spectrum of solutions aimed at avoiding and deterring predation.

0125 Fish Conservation I, Sunday 16 July 2017

Rebecca E. Blanton, Mollie F. Cashner

Austin Peay State University, Clarksville, TN, USA

Conservation Genetics of the Kentucky Arrow Darter, *Etheostoma spilotum* (Percidae)

The federally threatened Kentucky Arrow Darter (KAD) is restricted to 47 streams of the Kentucky River system in Kentucky. Recent and drastic population loss attributed to anthropogenic activities has been documented across its range. The impact of these losses on overall KAD population connectivity and genetic diversity is not known. We evaluated contemporary and historical levels of genetic diversity, population structure, and effective genetic population size among 12 populations of KAD using eleven microsatellite loci and the mitochondrial ND2 gene. Several broadly shared ND2 haplotypes and evidence of low-levels of genetic diversity among haplotypes suggest absence of long-standing isolation within and among river systems. However, contemporary patterns of genetic diversity and estimates of K (STRUCTURE) suggest little to no recent gene flow among the localities examined. Only individuals from sites within 3 km of each other were recovered as a single cluster, while all other sample localities were recovered as distinct populations with little to no admixture among clusters. Although there was a significant IBD effect, several sites had higher than expected pairwise F_{ST} values, suggesting genetic isolation is not driven exclusively by distance between populations. Moreover, effective genetic population estimates were low, particularly compared to census size estimates, and three populations showed signs of a recent bottleneck. Results suggest recent loss of gene flow, a high degree of population structure at the within-river system scale, and a reduction in population sizes. Thus, contemporary population losses throughout the range have had measurable effects on genetic connectivity within the species.

0836 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Nickolas Boehme, John Peterson

University of Wisconsin-Platteville, Platteville, Wisconsin, USA

Analysis of frog vocalizations throughout the day at different wetlands occupied by state-endangered Blanchard's Cricket Frog

Amphibian population decline is a phenomenon that is occurring on a global scale. Blanchard's Cricket Frog (*Acris blanchardi*) is endangered in Wisconsin and it is not clear why. This species is currently only monitored for presence/absence every five years by surveyors that must visit sites. We suggest that surveys using automated recording devices could improve our understanding of this species. We used automated recording devices to investigate how time of day and wetland sites influence the calling activity for male *A. blanchardi*, as well as, *Lithobates clamitans* and *Hyla versicolor*. We monitored recordings at five different sites in southwest Wisconsin in 2014 and 2015 that included habitats varying from natural oxbows to constructed wetlands. We documented temporal and interspecific variation using the standard amphibian call index and detection frequency and observed variation within 24 hours averaged across a month at the peak of their calling season. Average call index and detection frequencies displayed similar trends across 24 hours. Sites where frogs reached lower maximum average call indices called later in the evening. We cannot determine why frogs call later at these sites, but we hypothesize why this may occur. Although we only surveyed five wetlands, *A. blanchardi* displayed higher vocalizations at natural wetlands, compared to constructed wetlands. More work needs to be conducted to determine if this trend occurs across more wetlands within this species' range.

0324 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Derek Bolser, Erin Reed, Mark Lopez, Brad Erisman

The University of Texas at Austin Marine Science Institute, Port Aransas, Texas, USA

Considerations for individual growth modeling in exploited fishes: a case study with the gulf corvina (*Cynosion opthonopterus*)

The relationship between age and size has long been crucial to fisheries assessments. Typically, parameters from some form of the von Bertalanffy growth model play a large role in stock status determination in most current stock assessments. Rooted in bioenergetics, the von Bertalanffy growth model is intended to provide a biologically-relevant representation of the relationship between age and size in the population being assessed. However, despite a foundation in biological relevance the model is not robust to external factors that influence growth and population structure. Furthermore, some growth models used instead of von Bertalanffy (e.g. Schnute 1981) are based more on statistical fit than biological relevance. Thus, sampling design and model fitting approach inherently influence model output. Taken at face value, growth patterns and parameter estimates influenced by such factors may be unrealistic, leading to inappropriate and potentially dangerous inferences about stock status. Here, we use the Gulf Corvina (*Cynoscion othonopterus*) as a model species to compare the performance of

several individual growth models (von Bertalanffy, Gompertz, logistic, Schnute, and Schnute-Richards) on the characterization of age and growth in a highly-exploited species. We discuss the influence of exploitation, sampling, model fitting approach, and biology on our results, and urge for more discretion in the model selection process beyond measures of statistical fit.

0460 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Luis Bonachea, Kylie Hogan, Olivia Bogdan, Robert Lipke, Ryan Daly

University of Pittsburgh, Johnstown, PA, USA

Body Size and Metabolic Rate Scaling in a Population of Allegheny Mountain Dusky Salamanders, *Desmognathus ochrophaeus*, from Southwestern Pennsylvania

Metabolic rate is a valuable tool for studying the growth, reproduction, thermoregulation, and stress responses of organisms. The goal of this study was to examine body size and metabolic rate scaling in a population of Allegheny Mountain dusky salamanders (*Desmognathus ochrophaeus*) on the University of Pittsburgh at Johnstown campus. Salamanders were located, measured, and briefly held at their collection site. Metabolic rate was measured using a gas oxygen probe in a sealed respirometer. Metabolic rate scaled linearly with mass and mass specific metabolic rate also varied significantly with ambient temperature. The current study estimated the mean standard metabolic rate of this population at 15°C at 94.16 µL O2/hr*g (std.dev=12.84). This value is considerably higher than other standard metabolic rate measurements published for this species. Geographic variation in metabolic rate could not be explained by differences in elevation or latitude across populations.

0225 AES Conservation & Management II, Saturday 15 July 2017

Ramón Bonfil[1], Alexis Janosik[2], Oscar Uriel Mendoza-Vargas[3], Melina Ricaño-Soriano[4], Ivet Valladolid-Salazar[5], Nichelle VanTassel[2]

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Needle in a Haystack: Preliminary Results of Using eDNA to Find the Last Sawfishes in Mexico

Large population declines and range contraction have raised global concern over the survival of the five species of living sawfishes. Smalltooth and largetooth sawfishes (*Pristis pectinata* and *P. pristis*) are Critically Endangered species whose former range included Mexico. A 2015 nation-wide interview-based survey –the first-ever study

devoted to sawfishes in Mexico– showed that they were abundant pre-1990s and suggested both might be nearly or already extirpated from Mexican waters. In early 2016 a juvenile smalltooth sawfish was captured by commercial fishers and delivered to the Veracruz Aquarium, where it currently resides. During August-November 2016 we used direct methods (fishing gear, drones) and environmental DNA (eDNA) to try to find smalltooth or largetooth sawfishes in the estuary of Tecolutla, Veracruz, most of the course of the Usumacinta River, the coastal lagoons and estuaries of Tabasco, as well as in Bahía de Chetumal and Bahía de la Ascensión in Quintana Roo, all areas where sawfishes were formerly abundant. Species-specific mitochondrial cytochrome *c* oxidase subunit I (COI) primers were used to identify and confirm *Pristis spp*. No sawfishes were found through direct methods in any of the surveyed areas. However, water samples tested positive for *Pristis* DNA at some of the sampled sites. Our preliminary results suggest that eDNA might be a viable alternative to determine presence of sawfishes under very low abundance situations. Efforts to survey the entire former range of smalltooth and largetooth sawfishes in Mexico should be given priority as a first step towards the recovery of their populations.

0846 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Michelle Boone, Samantha Rumschlag, Amelie Davis, Melissa Youngquist

Miami University, Oxford, OH, USA

The impact of land use on amphibian presence in human-dominated systems: Does increased cultivation reduce amphibian presence on the exurban landscape?

Agricultural cropland accounts for ~20% of land use and ~80% of pesticide application in the US, which has major implications for native species; however, taxa like amphibians persist in human-dominated systems where land transformation and pesticide use are prevalent. The objectives of this study were to examine if percent cultivation or other landscape features surrounding ponds influenced the likelihood of presence of four summer breeding anurans. We examined the relative importance of upwind land use (aerial deposition hypothesis) and land use in a circular buffer (runoff hypothesis), as well as the importance of regional and local land-use/land-cover, in predicting amphibian presence or absence at a pond. Our central prediction was that increasing cultivation would reduce the likelihood of amphibian presence, while increasing amounts of uncultivated forest habitat would increase amphibian presence. We conducted field call surveys at 191 randomly selected ponds across three north-south transects and one west-east transect in Ohio, as well as a more detailed study with 96 randomly selected sites in one Ohio county. Preliminary analyses suggest areas with more forest cover were positively associated with amphibians, while areas dominated by humans (including cultivated and developed habitats) were negatively associated

with amphibian presence. Creation of ponds in human-dominated landscape may benefit many amphibian species and counteract some of the effects of habitat conversion and degradation; however, our study suggests that all land uses are not equally beneficial to summer breeding amphibians and that restoration to native habitats may be important for keeping common species common.

0335 SSAR SEIBERT ECOLOGY I, Thursday 13 July 2017

Timothy Borgardt

Southeastern Louisiana University, Hammond, LA, USA

Habitat Preference, Movement Patterns, and Behavior of the Timber Rattlesnake in southeastern Louisiana

Crotalus horridus has one of the largest distributions of any of the North American rattlesnakes. It is considered vulnerable, imperiled, or critically imperiled in 20 of the 30 states that it occurs in, mostly because of anthropogenic factors. The movement patterns and foraging behaviors of this species have been extensively studied throughout much of its northern range. It has been shown that sex, reproductive status, temperature, prey availability, and habitat type all influence snake behavior. Understanding the behavior of the Timber Rattlesnake and how these factors affect it can have a large impact on the conservation of the species. Utilizing the knowledge gained from research like this can shed light on what the best management strategies might be. Since there has been no prior research of this kind on *C. horridus* in Louisiana, this study will be important in understanding a species whose habitat is becoming more fragmented due to urbanization. Using radio telemetry, this study will attempt to compare the movement patterns, habitat usage, body temperature, and foraging behaviors of a population of *C. horridus* in Orleans Parish, a relic bottomland hardwood habitat, to that of populations in the northern part of its range. It will also determine if movement patterns, body temperatures, and foraging behaviors differ between sexes and reproductive condition, and if habitat usage changes across behaviorally-based seasons (foraging, breeding, hibernation).

0575 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Luke Bower, Kirk Winemiller

Texas A&M University, College Station, Texas, USA

Fish assemblage convergence along environmental gradients and microhabitats in small freshwater streams

Convergence of functional traits across evolutionary and biogeographically distinct assemblages suggests key, repeated mechanisms that play a role in structuring

assemblages along environmental gradients. However, few studies at the assemblage level have involved analyzing quantitative data collected using standardized methods at both regional and microhabitat scales to study possible convergence. In this study, the hypothesis that patterns of trait-habitat relationships converge across zoogeographic regions as a result of universal environmental filters acting on functional traits four distinct zoogeographical regions was tested at multiple scales and zoogeographic regions using various functional traits reflecting aspects of habitat use, trophic position, defense ability, and life history. Convergence of functional groups, based on diet and habitat use, and convergence along environmental gradients, such as depth, substrate, and flow, were analyzed using various multivariate techniques. After controlling for taxonomic position, significant trait similarity was found among all functional groupings across all four regions was found. In addition, there was no significant difference between the slopes when testing the correlation among functional traits and environmental gradients for all regions, suggesting similar trait-environment relationships across all zoogeographic regions. Fourth-corner analysis also revealed similar trait-habitat relationships across all zoogeographic regions. Together these results imply common environmental filters acting to influence fish assemblages at both the local and regional scales.

0362 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Beth Bowers, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Warming Oceans Shift Migratory Range of the Blacktip Shark

Tens of thousands of blacktip sharks, *Carcharhinus limbatus*, migrate south from their summer mating grounds in Georgia and the Carolinas each year. They overwinter off the coast of southeastern Florida and aggregate in densities of over 800 sharks km^{-2} in peak season, late February. Their seasonal occurrence in southeastern Florida is strongly correlated with sea surface temperatures below 25°C. In a previous study from 1948, blacktip sharks were noted to move north of Cape Hatteras, NC "only as a rare stray." We hypothesize that their migratory pattern has shifted poleward as global oceans have warmed. We instrumented 51 blacktip sharks with acoustic transmitters and passively tracked them in collaboration with the Florida Atlantic Coast Telemetry and Atlantic Cooperative Telemetry networks. We detected 78.4% of the instrumented sharks at various acoustic receivers located along the eastern seaboard of the U.S. Of those, 47.5% were detected north of Cape Hatteras. Two individuals were detected as far north as Long Island, NY, and one of those was subsequently detected back at the point of release the following season. This indicates that the northern boundary of the blacktip migration extends to at least the coast of Long Island, NY and suggests that the migratory route of blacktip sharks has shifted poleward over the past seven decades. The seasonal influx of these sharks at increasingly higher latitudes may cause cascading effects through the trophic levels of commercially harvested species.

0803 LFC Contributed I, Friday 14 July 2017

Noelle Bowlin[1], Andrew Thompson[1], William Watson[1], Philip Hastings[2]

[1]NOAA Southwest Fisheries Science Center, La Jolla, California, USA, [2]Scripps Institution of Oceanography, UCSD, La Jolla, California, USA

Ontogenetic Vertical Distribution of Mesopelagic Fishes and the Development of Diel Migration

Mesopelagic fishes provide a model system to study questions about the ontogeny of habitat selection because of the complex variety of habitats they use throughout their life histories. Adults of many species are known to undergo daily vertical migrations (DVM) between productive surface waters where they are vulnerable to visual predators and deeper waters with fewer predators but where food is less common. Much less is known regarding the behavior and depth distribution of their early life history stages. Generally, mesopelagic fishes begin life as pelagic eggs near the surface in the epipelagic. Upon hatching, like other new larvae, they must locate and capture prey after yolk-sac depletion. During ontogeny, larval mesopelagic fishes move deeper in the water column to their juvenile and adult habitats, and some species, establish their DVM behavior. While some studies have found that depth occurrence of some mesopelagic fishes is associated with size or developmental stage, it is unclear if the progression from the surface waters is gradual or abrupt and at what life history stage(s) the transitions begin and are completed. Here we discuss the analysis of discrete depth samples of fish larvae identified to species from multiple cruises over multiple years and document the depth distributions of early life history stages of common mesopelagic fishes in the California Current system to infer information on habitat use. Results suggest that these larvae occur deeper in the water column than previously thought and that onset of DVM behavior begins during larval stages in some species.

0391 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Danielle Bradke[1], Eric Hileman[2], Jeffrey Bartman[3], Nathan Kudla[1], Lisa Faust[4], Jennifer Moore[1]

[1]Grand Valley State University, Allendale, MI, USA, [2]Northern Illinois University, DeKalb, IL, USA, [3]Eastern Michigan University, Ypsilanti, MI, USA, [4]Lincoln Park Zoo, Chicago, IL, USA

Effective Versus Census Population Size for a Threatened Pitviper (*Sistrurus catenatus*) in Southwest Michigan

Destruction and fragmentation of wildlife habitat often results in small, isolated populations that are highly susceptible to extirpation. Yet, in many cases estimates of population size are lacking, precluding accurate assessments of population viability and sound conservation recommendations. The eastern massasauga (*Sistrurus catenatus*) is a

federally listed pitviper that has been extirpated throughout much of its historic range due to agricultural conversion of wetland habitat and other synergistic threats. Further, among extant massasauga populations, population size is generally unknown, making site-specific effective management difficult. In this study, we focused on the importance of estimating genetic effective population size (N_e) and census population size (N_c) for eastern massasaugas at two sites in southwest Michigan. For each population, we used mark-recapture models to estimate N_c and the linkage disequilibrium method to estimate N_e. Our results revealed small N_c, with approximately 108 (95% CI = 87-165) and 148 (95% CI = 102-295) adults estimated at our study sites in Cass County and Barry County, respectively. Estimates of N_e were even smaller: approximately 29.5 (95% CI = 22.2-40.5) for Cass County and 44.2 (95% CI =29.7-73.4) for Barry County. Additionally, N_e/N_c ratios were similar across study sites, suggesting some stability in this ratio for eastern massasaugas, at least for populations in close proximity. Although we did not detect high levels of inbreeding or relatedness in either population, we caution that these small populations could become increasingly vulnerable to extirpation due to unpredictable threats such as disease and climate change.

0157 LFC Contributed III, Saturday 15 July 2017

W. Howard Brandenburg[1], Darrel E. Snyder[2], Steven P. Platania[1]

[1]*American Southwest Ichthyological Researchers, Albuquerque, New Mexico, USA,* [2]*Larval Fish Laboratory, Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, Colorado, USA*

Guide to larval and early juvenile cyprinids of the middle and lower Pecos River (New Mexico and Texas)

The Pecos River, the largest tributary of the Rio Grande, has a diverse assemblage of native cyprinids, including numerous pelagic-broadcast spawning species. Alterations to the river (e.g., flow manipulation, river channelization, river fragmentation, non-native introductions, and degraded water quality) have negatively impacted native fish abundance and distribution including extirpations, range reductions, and federal/state protections. The pelagic-broadcast spawning cyprinids have been among the most adversely affected by the degradation of this riverine ecosystem. Conservation activities and management of these fishes are currently limited by significant gaps in knowledge of their early life history. An essential tool being developed for fish biologists is an illustrated identification guide, and accompanying computer-interactive key, which details the early ontogeny of cyprinids in the middle and lower Pecos River (New Mexico and Texas). Based on prior larval fish identification guides and computer-interactive keys developed by the Larval Fish Laboratory at Colorado State University, this guide expands upon descriptions of cypriniform fishes from the American Southwest. Utilizing over 36 morphometric, 18 meristic, and 49 pigmentation characters, along with a suite of size-to-development relationships, the comprehensive guide (to be completed by December 2017) will provide a foundation for species identification of the smallest and most vulnerable life stages. The guide will help facilitate future research

and monitoring of the distribution, abundance, reproductive success, and early recruitment of Pecos River cyprinids.

0077 Lizard Ecology, Sunday 16 July 2017

Casey Brewster, Steven Beaupre

University of Arkansas, Fayetteville, Arkansas, USA

The impact of woody vegetation encroachment on body size and reproduction in the Eastern Collared Lizard *(Crotaphytus collaris)*

Anthropogenic fire suppression in the past century has resulted in deterioration of Ozark glade habitats through woody vegetation encroachment. In turn, Eastern Collared Lizard (*Crotaphytus collaris*) populations in Arkansas and Missouri have experienced substantial declines. We monitored seven *C. collaris* populations in Northern Arkansas from 2013-2016. Populations were categorized into two glade-types: intact glades (three sites) and encroached glades (four sites) based on woody vegetation density estimates. Relative to intact glades, lizards in encroached glades had reduced age/sex-specific body size (0-4 year old SVL and mass), growth (0-1 year old SVL), delayed age of maturity (by one year in 70% of females sampled) and reduced age-specific clutch size/clutch frequency (up to a 45% decrease in annual population fecundity). Our data suggest that dense woody vegetation increases % shade cover, in turn, reducing the availability of environmental temperatures suitable for surface activity. Finally, we potentially exclude four explanatory mechanisms that link woody vegetation density to reduced body size and reproduction (lizards had similar prey availabilities, mean body temperatures during activity, movement rates and frequencies of meal presence between glade-types). Our findings offer a compelling (albeit incomplete) argument that fire suppression results in increased shading, increased thermal constraints, smaller age-specific body sizes and reduced female reproduction; ultimately resulting in population declines in encroached Ozark glades.

0308 AES Conservation & Management II, Saturday 15 July 2017

Karyl Brewster-Geisz[1], Guy DuBeck[1], Jacqueline Wilson[1], Sarah McLaughlin[2], Tobey Curtis[2]

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U.S. Atlantic shark management: what do the terms "overfished" and "overfishing" mean for sharks?

Defining and classifying the stock status of Atlantic shark populations is challenging, varies with the entities conducting such reviews, and results in differing levels of practical implications. The Highly Migratory Species Management Division of the

National Marine Fisheries Service (NMFS) is responsible for the management of the U.S. federal shark fisheries in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea. Under National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), NMFS "...shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry." In 2016, NMFS revised how the Agency should implement that National Standard, including clarifications for the definitions of the terms "overfished" and "overfishing." If a stock is determined to be overfished or experiencing overfishing, the Magnuson-Stevens Act dictates certain actions by NMFS to rebuild the stock and prevent overfishing. Many shark scientists frequently cite International Union for the Conservation of Nature (IUCN) classifications, such as "endangered" or "vulnerable," when referencing the status of species managed by NMFS. However, the Magnuson-Stevens Act does not use the same standards or definitions as IUCN, and NMFS does not rely on IUCN classifications for species or populations. We will explore how Magnuson-Stevens Act and IUCN terms differ, and describe how these stock status classifications are reflected in U.S. Atlantic shark fisheries management.

0310 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Karyl Brewster-Geisz[1], Guy DuBeck[1], Delisse Ortiz[3], John Carlson[2], Simon Gulak[4], Alyssa Mathers[4], Michael Enzenauer[4]

[1]NOAA Fisheries, HMS, Silver Spring, MD, USA, [2]NOAA Fisheries, Panama City Lab, Panama City, FL, USA, [3]ERT, Inc., Portland, OR, USA, [4]Riverside, Inc., Panama City, FL, USA

The Atlantic Shark Research Fishery: a Success in Fisheries Management

The Highly Migratory Species Management Division of the National Marine Fisheries Service (NMFS) is responsible for the management of the U.S. federal shark fisheries in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea. In 2006, NMFS finalized a stock assessment on sandbar sharks (*Carcharhinus plumbeus*) that indicated large reductions in fishing mortality was needed to rebuild the stock. This species had been the primary species in the directed shark fishery since its inception in the 1980s. The reductions needed could have resulted in the end of both the primary U.S. shark fishery and fishery dependent data collection. Instead, NMFS reduced trip limits for most species and established the shark research fishery. The shark research fishery allows 5 and 10 fishermen to fish for sandbar sharks with 100 percent observer coverage. The rest of the shark fishermen continue to fish for sharks with trip limits substantially smaller than those in place before 2008. We are now in the tenth year of the shark research fishery. Data collected from the shark research fishery have been used in several stock assessments and have improved shark management. Additionally, shark fishermen outside the research fishery have found ways to fish for other sharks, and the Agency has found ways to keep that fishery open year round in most regions. Overall, NMFS has found that this approach to fishery management has allowed the collection of

fishing data to improve assessments and management while also allowing fishermen to land sharks and minimize regulatory discards.

0842 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

McKenna Bristow, Caitlin Gabor, Mar Huertas

Texas State University, TX, USA

Characterization of sex pheromone response in *Poecilia latipinna*

Pheromones are crucial chemical signals that elicit an immediate physiological response in conspecifics, including the coordination of mating behavior. Pheromones are detected via olfaction, and have multiple origins, such as urine and feces. We sought to identify behaviors triggered by conspecific olfactory chemical signals (i.e. pheromones) in the live-bearing fish *Poecilia latipinna*. Poeciliids are known to have sensitive olfactory senses and, in several species, males release urine upstream from females during courtship. We hypothesized that *P. latipinna* use urinary pheromones in courtship. We identified/described the urinary behavior of mature male and female *P. latipinna* in the presence of conspecifics of the opposite sex by recording the frequency and duration of urine pulses released by *P. latipinna* after being injected with Patent Blue dye tracer. We also recorded the number of mating attempts by males and approaches by females in the presence of mature adults. Moreover, to link behavior with urinary olfactory signals, fish were either made anosmic (by burning or plugging the olfactory epithelia) or "sham" (operated on but olfactory epithelia is intact and functional) and again measured urine pulses and mating attempts. Preliminary results showed that olfactory signals play a role in coordinating courtship in *P. latipinna*.

0769 Lightning Talks II, Friday 14 July 2017

Colin Brocka, John Koprowski

University of Arizona, Tucson, AZ, USA

Home on the Range: Terrestrial Ecology of the Endangered Sonoran Tiger Salamander

Ecological and behavioral knowledge is essential for the conservation of species at risk of extinction. Approximately 32% of amphibians are threatened or endangered. To develop effective conservation strategies for at-risk amphibians, efforts must be made to understand their ecological requirements. The Sonoran Tiger Salamander (*Ambystoma mavortium stebbinsi*) is a federally endangered subspecies of tiger salamander endemic to the San Rafael Valley of southeastern Arizona. Cattle tanks created by ranchers have taken the place of natural springs in the area, and are now primary breeding sites for salamanders. The subspecies was listed as endangered in 1997 due to highly restricted

distribution, dependence on human-constructed environments, invasive species, genetic swamping by non-native salamanders, and risk of frequent die-offs due to disease. The ecology of metamorphosed salamanders outside of breeding tanks is virtually unknown, yet this stage is the only means of responding to pond drying or die-offs and thus is critical to conservation and maintenance of metapopulation dynamics. We will use radio-telemetry and habitat measurement to assess terrestrial movement patterns, habitat preference, and life history of *A. m. stebbinsi*. The results of this project will provide essential data regarding the terrestrial requirements and ecology of the subspecies. This information is paramount to the development of effective management strategies to conserve and maintain the Sonoran Tiger Salamander.

0372 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Ciara Brodie, Sean Graham

Sul Ross State University, Alpine, TX, USA

Surrogate Riparian Habitat Use of the Big Bend Slider Turtle (*Trachemys gaigeae*) in the Chihuahuan Desert

The Rio Grande has been in decline for nearly a century, conservation efforts to restore riparian habitat have had limited success. The Big Bend slider turtle (*Trachemys gaigeae*) is endemic to the Rio Grande, has the fewest published studies of the species in this genus, and is listed as vulnerable to extinction due to range contraction and loss of habitat. Anthropogenic water sources have been found to serve as surrogate habitat for species facing degradation of their historical riverine habitats. A comparative study of turtles inhabiting the Rio Grande and golf course water hazard ponds in the Chihuahuan Desert was conducted in the summer months of 2015 and 2016. Relative abundance, sex ratios, body condition and innate immunity were assessed for 62 slider turtles (*T. gaigeae*) and 98 softshell turtles (*Apalone spinifera*). *Trachemys* spp. captured at the golf course were more abundant, and had higher body condition indices than those captured in the adjacent Rio Grande. *A. spinifera* were more abundant in the river, and did not differ in body condition compared to *A. spinifera* captured at the golf course. There were no detected differences in innate immunity or expected sex ratios. In this arid desert, the water hazards at Lajitas serve as surrogate riparian habitat for at least one species of turtle, and warrants further considerations for conservation efforts of vulnerable Big Bend species.

0286 Snake Biology II & Snake Genomics, Sunday 16 July 2017

Bob Brodman

Saint Joseph's College, Rensselaer, Indiana, USA

Comparison of Mark-Recapture Methods for Snakes

Mark-recapture is commonly used to estimate wildlife population size. Snakes are often marked by clipping or burning marks ventral scales or by using PIT tags. This study evaluated the effectiveness of these methods by double marking snakes with small cauterizing kits to give unique marks on ventral scales and also uniquely coded PIT tags. Snakes were surveyed periodically from April to September each year using 64 cover boards placed in a 2 ha restored prairie next to a wetland. Three species were marked, *Thamnophis sirtalis*, *Storeria dekayi*, and *Pantherophis vulpinus*. A total of 355 snakes were captured 562 times, and 17 of these were captured in multiple years. PIT tags were lost in 7 snakes, and cautery marks were unreadable in 3 snakes. This accounts for a loss of just 2% of PIT tags and 1% of cautery marks. The estimates of population sizes ranged from 120-140 *T. sirtalis*, 40-80 *S. dekayi*, and 12-17 *P. vulpinus*.

0735 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; LFC BLAXTER BEST STUDENT POSTER

Michelle Bromschwig, Polly Hajovsky, Simon Geist

Texas A&M University - Corpus Christi, Corpus Christi, TX, USA

Comparing the Ichthyoplanktonic Food Web Near Three Coastal Inlets in the Texas Coastal Bend

The availability of food in terms of quantity and quality is an important factor regulating survival of early life stages, as it determines the rate of development of bodily function and somatic growth. Understanding food web interactions is thus an important component of determining essential fish habitat needs during the larval stage. Many estuarine fish and invertebrate species in Texas possess a life cycle in which spawning occurs in coastal Gulf of Mexico (GoM) waters. The offspring (eggs, larvae, and/or juveniles) then return through coastal inlets into their estuarine nursery habitats. In the Texas Coastal Bend, three inlets allow for inflow of larvae, differing in size and water displacement volume. The amount of larval supply relative to inlet size and geographic position, as well as the food web processes are not well known. In this study, the ichthyoplanktonic food web near the three coastal inlets will be investigated, with special focus on abundant species. Three parallel, snapshot sampling episodes during fall, winter, and spring spawning seasons were conducted to collect larval fish and zooplankton at the inlets. Ichthyoplankton net catches are analyzed for species composition and density, and larval diet is determined for selected species through gut content analysis. Prey availability will then be matched with gut content data to assess feeding selectivity, and food web interactions will be investigated via δ13C and δ15N stable isotope analysis of fish larvae and potential prey items.

0481 Fish Morphology, Saturday 15 July 2017

Allison Bronson[1], Henry Towbin[2]

[1]*American Museum of Natural History, New York, NY, USA,* [2]*Lamont Doherty Earth Observatory, Columbia University, New York, NY, USA*

Critical point drying improves contrast for CT scanning of soft tissue

X-ray Micro-computed tomography (CT) has revolutionized the study of internal anatomy, but imaging animal tissue is difficult due to low-density contrast between soft structures. Phosphotungstic acid and iodine are the primary stains used to enhance soft tissue contrast in vertebrates. Critical point drying (CPD), a process most often used to prepare arthropods or small tissue samples for electron microscopy without collapsing cells, has had limited application for scanning vertebrates. We stained and critical point dried cichlid heads to measure improvements in contrast of soft tissue structure while retaining the sharp density contrast of bone. We compared specimens that were stained, those that were critical point dried, and those that used both treatments. Image quality was determined on the basis of sharp contrast between tissues and high signal-to-noise ratios. Our work reveals that critical-point-dried specimens enhance the contrast of soft tissue, due to a clear density difference between dried tissue and surrounding air. This allows for improved three-dimensional segmentation and rendering. An added benefit of this technique is that it also prepares samples for scanning electron microscopy, enabling the study of anatomy at a much finer scale.

0536 Herp Ecology II, Friday 14 July 2017

George Brooks[1], Houston Chandler[2], Thomas Gorman[3], Carola Haas[1]

[1]*Virginia Polytechnic Institute, Blacksburg, VA, USA,* [2]*The Orianne Society, Statesboro, GA, USA,* [3]*Washington Department of Natural Resources, Olympia, WA, USA*

A Dynamic, Spatially Explicit Occupancy Model for the Endangered Flatwoods Salamander, *Ambystoma bishopi*

For organisms with patchy distributions, occupancy models must account for both spatial and temporal dynamics to accurately quantify the status and long-term viability of populations. To date, most occupancy models focused on either the spatial component, such as species distribution modelling, or colonization-extinction dynamics, predicted from metapopulation theory. Only recently have the two been combined into a single framework. Here we describe a spatially explicit, dynamic occupancy model that incorporates local extinction, dispersal and colonization, and imperfect detection that we applied to populations of the Reticulated Flatwoods Salamander, *Ambystoma bishopi*. To corroborate our findings, the model output was compared with Moran's Eigenvector Mapping, and boosted Regression Tree analyses performed on the same data. Proximity to other occupied sites was the strongest predictor of occupancy. Connectivity among sites declined rapidly as distance increased, declining towards zero for sites more than 1km apart. No evidence of positive spatial autocorrelation existed at distances greater than 1.3km. In addition to geography, the area of herbaceous groundcover within pond basins was positively correlated with occupancy. All other habitat variables considered (pond area, pond depth, and average hydroperiod), had no

discernible relationship with occupancy status. With limited movement and genetic data, this model provides the first information on connectivity among populations. Additionally, it provides an upper limit of dispersal distance (~1km), a crucial piece of information for managers attempting to define management units and for repatriation of historic sites. This model has broad applications to patchily distributed, data-poor species that exhibit stochastic population dynamics.

0494 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Olivia Brooks, Alayna Tokash, Willem Roosenburg

Ohio University, Athens, Ohio, USA

Decomposition rates of Diamondback Terrapins (*Malaclemys terrapin*) in crab pots

Commercial crabbers in the Maryland waters of the Chesapeake Bay fish with crab pots annually from 1 April to 15 December. Efforts to recover abandoned crab pots and record their contents while the fishery is closed have rarely documented the remains of Diamondback Terrapins (*Malaclemys terrapin*) despite well-established high rates of terrapin crab pot captures. This study provides one explanation why *M. terrapin* remains are rarely recorded during crab pot roundups. To avoid catching additional terrapins, we placed deceased terrapins inside crab pots containing bycatch reduction devices (BRDs) and recorded daily their decomposition rate on a scale of one to eleven: fresh (1), odor present (2), odor present and decomposition of flesh (3), decomposition of flesh (4), decomposition of flesh and degradation of scutes (5), degradation of scutes (6), degradation of scutes and decomposition of shell (7), decomposition of shell (8), decomposition of shell and deossification (9), deossification (10), and gone (11). We conducted our study in July with water temperatures of 27 C and above. In warmer summer-time water temperatures, younger *M. terrapin* individuals (< five years) decompose completely within four to five days while older individuals (> four years) decompose within five to seven days. A fall cool-water replication of our experiment indicates that carcasses persist for longer periods of time, but only larger individuals may endure for prolonged periods. Thus finding *M. terrapin* carcasses in "ghosts pots" is rare due to their high decomposition rate.

0889 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Taston Brookshire

Southeastern Louisiana University, Hammond, LA, USA

Tadpole Life History Study at Assimilation Wetlands and River Diversions

Anuran larvae are infamous for being extremely plastic in their development and morphology. Few field studies have delved into the effects of anthropogenic nutrient shifts (river diversions and assimilation wetlands) and how they affect a tadpole's

development. Tadpoles are able to shift key points in life such as time of metamorphosis depending on the environment. In this life history study growth rate, metamorphic size, and larval period at two different types of wetland augmentations (Bonnet Carre & Caernarvon river diversion, and St. Tammany & Hammond assimilation wetlands) will be measured. It is expected that the wetlands in question that receive additional nutrients will have accelerated growth and metamorphose earlier than the adjacent wetlands with no input. The shift up in primary production from the excess of nutrients introduced into the wetlands could translate into a more optimal growth pattern for a tadpole.

0050 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Amy Brower, Alexis Janosik

University of West Florida, Pensacola, Florida/ Southeast, USA

Using environmental DNA to detect lionfish in estuarine habitats of the Northern Gulf Coast

Once an introduced or "non-native" species establishes residency and becomes harmful to an environment, it is then considered an invasive species. Invasive species pose a threat to current biodiversity and alter the way the community structure works in the ecosystem. Two invasive species of high concern are *Pterois volitans* (Red lionfish) and *Pterois miles* (Devil firefish). Commonly known as lionfish, these species were artificially introduced to the Western Atlantic Ocean. Today, lionfish can be found all throughout the Northern Gulf of Mexico and even as far south as the Amazon outflow in Brazil. Lionfish have been recently observed invading estuary systems even though they are not traditionally euryhaline species. Confirming presence of a species in estuarine environments can be costly in terms of resources and can be difficult due to environmental conditions and fishing methods required. The purpose of this study is to detect the presence of lionfish in various locations throughout river systems and estuarine environments of the Northern Gulf Coast using environmental DNA (eDNA). Four different estuarine environments were sampled seasonally. Preliminary results show that *P. volitans* has invaded estuarine environments and river systems in the Northern Gulf Coast. Further, this study will provide information on seasonal differences and potentially differences in salinity tolerances of invasive lionfish in estuaries in the Northern Gulf Coast. Together, this information can be used to aid in management techniques for estuaries that are home to both commercially and ecological important species.

0137 Turtle Conservation, Saturday 15 July 2017

Donald Brown[1], Madaline Cochrane[2], Ron Moen[2]

[1]*West Virginia University, Morgantown, West Virginia, USA,* [2]*Natural Resources Research Institute, Duluth, Minnesota, USA*

Standardized Design for Wood Turtle Population Monitoring in the Upper Midwest, USA

Population monitoring is a fundamental component of wildlife management. The wood turtle (*Glyptemys insculpta*) is a species of conservation concern because of population declines across the species' distribution. We developed and tested a survey and analysis design to assist agencies in the Upper Midwest, USA, with establishment of long-term monitoring programs for wood turtle populations. In spring of 2016, we conducted 8 replicate population surveys at 8 candidate long-term monitoring sites in northeastern Minnesota, USA. Using field survey data and simulation models, we assessed the influence of distance from river surveyed, number of survey replications, and number of sites on abundance estimates; we also delineated important survey covariates. We estimated site-level abundances and compared survey designs using a multinomial *N*-mixture model that included a removal sampling observation process. Mean abundance estimates were similar when distance from river surveyed was at least 25 m, but increasing survey distance to 40 m increased precision of estimates. Mean abundance estimates were similar with ≥6 survey replications. Air temperature was an important predictor of survey-specific detection probability, with maximum detectability at 19-23° C. Simulations indicated that 75% of mean abundance estimates were within ± 8% of true abundance when ≥15 sites were surveyed. The wood turtle survey and analysis design we developed and tested was effective for estimating abundance of wood turtle populations in northeastern Minnesota, and we encourage its use as a template for wood turtle monitoring programs in the Upper Midwest.

0142 Herp Ecology I, Friday 14 July 2017

Kyle Brown[1], Amelia Russell[1], Michaela Lambert[2], Tracey Tuberville[3], Melissa Pilgrim[1]

[1]*University of South Carolina Upstate, Spartanburg, South Carolina, USA,* [2]*University of Kentucky, Lexington, Kentucky, USA,* [3]*University of Georgia Savannah River Ecology Lab, Aiken, South Carolina, USA*

Bioaccumulation of ^{137}Cs in Florida Green Watersnakes (*Nerodia floridana*) inhabiting former nuclear cooling reservoirs on the Savannah River Site

The Savannah River Site (SRS) is a 780-km^2 United States Department of Energy (USDOE) property with a history of radiocesium (^{137}Cs) contamination in reservoirs associated with the nuclear reactor cooling process. Radiocesium is a long-lived, gamma-emitting radionuclide that can bioaccumulate in biota. The Florida green watersnake (*Nerodia floridana*) is a primarily piscivorous species with trophic links to terrestrial and aquatic food webs. Large intraspecific size variation and a preference for permanent still waters, including cooling reservoirs on the SRS, make *N. floridana* an ideal model for studying bioaccumulation of ^{137}Cs in a top predator. Our study

quantified ^{137}Cs concentrations in *N. floridana* captured from three SRS reservoirs (Par Pond, Pond B, & Pond 2) with unique contamination histories, and determined if snake ^{137}Cs body burdens increased with body size. We used a NaI gamma detector to determine each snake's ^{137}Cs body burden. Average ^{137}Cs body burden of snakes from Pond B (0.67 Bq/g ±0.05) was significantly higher than the average ^{137}Cs body burden of snakes from Par Pond or Pond 2 (0.09 Bq/g ±0.05 & 0.03 Bq/g ±0.02, respectively; $p<0.01$). Of the three locations sampled, Par Pond and Pond B showed significant positive relationships between body size and ^{137}Cs body burdens ($r^2 = 0.56$, $p < 0.01$ & $r^2=0.29$, $p<0.01$, respectively). Our results indicated that *N. floridana* can be a useful model organism for examining the fate and persistence of radionuclides in aquatic ecosystems.

0395 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

T. Kelly Brown, Joel Trexler

Florida International University, Miami, Florida, USA

From Alpha to Beta: Quantifying Metacommunity Dynamics through Diversity Analysis

Small fish and macroinvertebrate communities are a critical food source for wading bird populations in the Florida Everglades. Quantifying metacommunity dynamics in these populations is essential for understanding the effects of anthropogenic change on the Everglades landscape and for creating accurate forecast models to guide management and restoration efforts. We analyzed trends in aquatic animal diversity over 11 years, from 2005 through 2016, at 136 sampling sites spread over 5,000 square kilometers in the Florida Everglades. The dataset contains 4991 total samples with an average of 525 samples per year. The monitoring area is comprised of 22 landscape units that differ in hydrological cycle, land cover, and heterogeneity. Gamma diversity, measured as species richness at the landscape unit level, ranged from a low of 35 species to a high of 90 species. Alpha diversity, measured as species richness at each sampling site, ranged from 2 to 22 species. Beta diversity was analyzed using a Morisita-Horn index pairwise comparison of all sampling sites. The Morisita-Horn index accounts for differences in both species richness and relative abundance. Averaged across the entire time series, beta diversity was highly variable but did show a positive correlation with distance between sites. These results support a combination of both species sorting and mass effects metacommunity dynamics. We partitioned both spatial and temporal variance in beta diversity to quantify the role of specific ecological drivers including hydroperiod, landscape type, and life history type.

0468 Fish Reproduction & Development, Saturday 15 July 2017

Nancy J. Brown-Peterson, Trevor Moncrief

University of Southern Mississippi, Ocean Springs, MS, USA

Does Depth Influence Red Snapper Reproductive Biology Metrics?

Adult Red Snapper commonly occur on artificial reef structures from 10-100 m depths in the northern Gulf of Mexico (nGOM), but variations in female reproductive potential by depth is unknown. We sampled Red Snapper using standard vertical long line gear monthly from April-November 2016 on artificial reefs (oil-gas platforms, rigs-to-reefs structures, state deployed structures) at three depth zones (shallow, <20 m; mid, 20-60 m; deep 60-100 m) off Mississippi in the nGOM. Females were significantly larger ($p<0.001$) at deep platform reefs, and there was a significant difference ($p=0.006$) in distribution of reproductive phases between shallow and deep platforms, with a higher percentage of spawning capable and actively spawning fish at deep platforms and more immature and early developing females at shallow platforms. However, there were no significant differences in size or reproductive phase distributions between shallow and mid-depth deployed structures or between platforms and deployed structures at all three depth zones. Interspawning interval calculated using the percentage of actively spawning females was every 1.74 days at mid depths, significantly ($p<0.001$) shorter than in deep and shallow zones. In contrast, interspawning interval using the POF method showed more frequent spawning (every 1.64 days, $p<0.001$) in deep water. Spawning capable females were present at deep reefs from April through October, at mid reefs from April-September and at shallow reefs only in April and May. These data suggest reefs >20 m deep provide important reproductive habitat for Red Snapper in the nGOM, and that the spawning season is prolonged at the deepest reefs.

0855 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Scott Buchanan, Jason Kolbe, Johanna Wegener, Jess Atutubo, Nancy Karraker

University of Rhode Island, Kingston, RI, USA

Comparing the Population Genetic Structure of Eastern Painted Turtles (*Chrysemys p. picta*) and Spotted Turtles (*Clemmys guttata*) in Rhode Island

Molecular techniques can be used to test hypotheses regarding genetic connectivity on the landscape and to identify populations at higher risk of extirpation due to reduced gene flow. Given variation in habitat specificity, vagility, and sensitivity to disturbance, landscape composition may impact gene flow differently among turtle species. We used microsatellite markers to compare population genetic structure of two sympatric turtles, the Eastern Painted Turtle and Spotted Turtle, that have different habitat specificity and life history characteristics. We predicted that the Eastern Painted Turtle, a habitat generalist, would exhibit higher gene flow and less genetic structure compared to the Spotted Turtle, a habitat specialist. We genotyped 702 Eastern Painted Turtles from 28 populations, and 148 individual Spotted Turtles from 11 populations, at 18 and 17 microsatellite loci, respectively. Turtles were sampled opportunistically from wetlands selected along a stratified-random gradient of forest cover, associated with a larger

study of freshwater turtle landscape ecology. For each species, we used F-statistics to quantify genetic variation and gene flow within and among populations. We used a Bayesian clustering technique to test predictions that roads serve as barriers to gene flow in the state. We contrast results for the two species and discuss the implications for conservation and management.

0905 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Luis Burgos, Emily Taylor

California Polytechnic Institute, San Luis Obispo, California, USA

How does recent thermal history affect the critical thermal maximum of the small diurnal lizard, *Sceloporus occidentalis*?

With temperatures rising globally, researchers are constantly seeking to describe possible ramifications of the changing climate. Ectotherms are excellent model organisms for climate change studies because of their heavy reliance on the environment for thermoregulation. Studies have historically used the critical thermal maximum, a key variable reflecting thermal tolerance, to establish predictive models for extinctions. However, recent findings in marine invertebrates suggest that these thermal maxima, which have been considered as fixed variables, may in fact be plastic and dependent on the organism's recent thermal history. If this is the case, then historical data, literature, and predictive models studying the effects of climate change may not be wholly accurate, given that the vast majority of studies are conducted on laboratory-acclimated individuals. We tested the critical thermal maximum of the Western fence lizard, *Sceloporus occidentalis*, in all four seasons, both within several hours of collection and after a short period of laboratory acclimation. We will present findings on how season and acclimation impacted the critical thermal maximum, which has ramifications for the accuracy of numerous models examining how climate change is expected to impact thermoregulation and survival of lizard populations.

0418 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Samantha Burke[1], Katherine E Bemis[2], William E Bemis[1]

[1]Cornell University, Ithaca, New York, USA, [2]Virginia Institute of Marine Science, Gloucester Point, Virginia, USA

Development and Replacement of Oral Teeth in Balistidae and Monacanthidae (Tetraodontiformes)

As part of a broad survey of dental morphology and tooth replacement patterns across Tetraodontiformes, we closely compared the dentition of the Grey Triggerfish, *Balistes capriscus* and the Planehead Filefish, *Stephanolepis hispidus* using dry skeletal material, dissections, micro-CT scanning, and histology. We also examined dentition in dry

skeletons for 24 additional species (7 balistids; 16 monacanthids). Balistids and monacanthids have outer (OS) and inner series (IS) teeth on the premaxillae and OS teeth on the dentary. Adjacent teeth contact each other mesially and distally. Occluding upper and lower teeth create a distinctive shearing and crushing surface. The tooth formula for balistids examined is 4OS + 3 IS/4OS; all monacanthids examined are 3OS + 2IS/3OS. Teeth are deeply socketed, and functional teeth ankylose to the bone. Tooth development is intraosseous in an alternate pattern. New tooth germs enter the bone via well-demarcated replacement pores on the lingual surfaces of the premaxillae and dentaries (OS teeth) and labial surface of the premaxilla (IS teeth). Replacement teeth develop directly beneath functional teeth and emerge through the loci of existing teeth. Pulp cavities extend nearly to the tip even in ankylosed functional teeth. Patterns of individual, alternate tooth replacement in balistids and monacanthids are likely plesiomorphic for tetraodontiforms because similar patterns are observed in outgroups. Understanding these patterns in balistoids will help interpret evolution of dental structures in other tetraodontiforms that have very different dentitions, including beaks formed of fused elements (triodontids, molids, diodontids, tetraodontid), and massive triturating plates (diodontids).

0666 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Jacob Burkhart, Chelsey Kroese, Raymond Semlitsch, Lori S. Eggert

University of Missouri, Columbia, MO, USA

Genetic Diversity of the Ringed Salamander (*Ambystoma annulatum*)

Range wide studies are important for understanding species distributions. Such studies provide a basic understanding of habitats utilized, the range of climatic conditions tolerated (e.g., temperature, elevation, humidity), the potential species interactions, and resources utilized. Our study uses both microsatellite and genomic markers to investigate the range wide genetic diversity in the Ringed Salamander (*Ambystoma annulatum*), an Ozark and Ouachita Mountain endemic species that is of conservation concern across all portions of its range. We tested the patterns of genetic diversity and structure across the Ringed Salamander's range to assess areas of greatest genetic diversity and to infer putative refugial areas in this species. Using microsatellite genotypes of 498 individuals from 20 localities and SNPs from 99 individuals from 10 localities across the Ringed Salamander's distribution, we observed significant differentiation between the Ozark and Ouachita Mountains with substructure within the Ozark Mountains. Genetic diversity was highest in areas with the largest tracts of contiguous forested habitat. Given the low mitochondrial DNA diversity observed in previous studies, our results suggest that contemporary landscape alterations are influencing observed Ringed Salamander genetic structure and diversity.

0219 LFC Nutrition, Friday 14 July 2017; LFC SALLY L. RICHARDSON BEST STUDENT PAPER

Corinne Burns, Lee Fuiman

University of Texas Marine Science Institute, Port Aransas, TX, USA

What Your Momma Gave You: Importance of Maternally Invested Nutrients for Larval Performance of Southern Flounder

Docosahexaenoic acid (DHA, 22:6(n-3)), an essential fatty acid, is critical during larval development for proper neural and visual development, and embryos and newly-hatched larvae rely on maternally derived DHA in the yolk to meet their nutritional requirements. The amount of DHA a female deposits into eggs can change due to variations in maternal diet. The objective of this study was to determine whether the amount of DHA contained in southern flounder (*Paralicthys lethostigma*) eggs affects behavioral performance that larvae need to survive in nature. Larvae reared from eggs containing different amounts of DHA were used in behavioral assays to measure responsiveness to a visual predatory stimulus and routine foraging behavior at 15 and 35 days posthatching (dph). At 15 dph, larvae from eggs containing high amounts of DHA responded to the predatory stimulus more often than larvae from eggs containing low amounts of DHA. The reverse was true at 35 dph: larvae from eggs containing low amounts of DHA responded more often than larvae from eggs containing high amounts of DHA. Analyses of whole body fatty acid composition of larvae indicated that, at both ages, DHA, as well as the ratio of omega-3 to omega-6 fatty acids, and the ratio of DHA to arachidonic acid in the body combine to influence a larva's anti-predator performance. Since these long-chain fatty acids come from the diet, there may be a connection between maternal nutrition and embryonic nutrition influencing larva whole body fatty acid composition and ultimately responsiveness of larvae to predation.

0833 Amphibian Conservation III, Sunday 16 July 2017

Angela Burrow, John Maerz

University of Georgia, Athens, GA, USA

The Contribution of Wetland Succession to Declines of Threatened Amphibians in the Longleaf Pine Ecosystem

The longleaf pine ecosystem (LLP) was once the dominant vegetation of the Coastal Plain, and embedded within the LLP were numerous isolated wetlands that supported a high proportion of regional biodiversity including many amphibian species. Historically, habitat conversion for agriculture and development was the primary threat to these wetlands, but today remnant isolated wetlands are often overgrown and hydrologically altered due to fire exclusion or incompatible, cool season fire regimes. In the absence of warm season fires when wetlands are dry, shrubs and trees succeed

herbaceous plants, which alters wetland productivity via effects on light and detritus quality. In turn, wetland productivity determines larval amphibian performance including survival and size at metamorphosis, which are large determinants of amphibian population growth. Therefore, the objectives of our work are to quantify the effects of hardwood encroachment on the growth, development, and survival of gopher frog (*Lithobates capito*) and ornate chorus frog (*Pseudacris ornata*) tadpoles and metamorphs. Tadpoles will be reared in outdoor aquatic mesocosms containing either leaf litter of an encroaching hardwood or a grass/sedge with and without a shading treatment. Metamorphs will be released into terrestrial field pens in degraded, restored, and working long leaf pine forest uplands and their growth and survival will be tracked. The results of this research will be utilized to inform management and restoration of long leaf pine wetlands.

0775 LFC Nutrition, Friday 14 July 2017; LFC SALLY L. RICHARDSON BEST STUDENT PAPER

Wren Busby, Ione Hunt von Herbing

University of North Texas, Denton, Texas, USA

Multi-strain Probiotic Effects on Growth, Mortality, Food Conversion Ratios (FCRs), and Behavior in Red drum (*Sciaenops ocellatus*)

Bacteria are important to a functional digestive system, and the use of probiotics, defined as "good bacteria," has become more common in the last 10 years to help re-establish the gut flora after treatment of antibiotics. Little work, however, has been done using probiotics in commercial marine fish culture, e.g. in red drum. Red drum (*Sciaenops ocellatus*) a commercially important carnivorous marine fish has a short gut and rapid food transport. Rapid digestion and assimilation rates are important to rapid growth. The goals of the current study were to determine the effects of probiotics on growth & mortality rates, food conversion ratios (FCRs), behavior, and to evaluate gut health. The individuals treated with probiotics ($1.0x10^8$ CFU/g) until day 56 had an overall increased growth of 33.7% compared to controls, larger than probiotics till day 28, but not significantly different. FCR calculations show the control fish require almost double the amount of feed to make 1 g of tissue mass compared to probiotics treated fish. Behavior was compared on an aggression index created in the lab based on observations. Future work will include quantifying the effects of probiotics on the diversity of the red drum gut microbiome using deep sequencing studies. Together these investigations will provide an index of health of the red drum while being treated with probiotics. This will aid us in determining if probiotics is a viable and sustainable alternative to antibiotics as a growth and fish health enhancer.

0379 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Nancy Buschhaus[1], Russell Milam[1], Adrianne Smith[1], Cy Mott[2], Robin Baker[3], Howard Whiteman[3]

[1]University of Tennessee-Martin, Martin, TN, USA, [2]Eastern Kentucky University, Richmond, KY, USA, [3]Murray State University, Murray, KY, USA

Salamander size structure, bat activity, and inter-ecosystem subsidies in pond ecosystems

Trophic cascades in aquatic systems have been shown to influence terrestrial communities via inter-ecosystem subsidies, but how these interactions are affected by predator size-structure is unknown. Size variation of aquatic predators can potentially influence the availability of emergent insects that are then consumed by terrestrial bats. In ponds with high salamander size variation, the smallest salamanders may be cannibalized by largest, decreasing predation pressure on aquatic insect larvae that, in turn, emerge in greater quantities for bats. To explore these interactions, we hypothesized that bat activity at ponds in western Kentucky and the western slope of the Colorado Rocky Mountains would be related to salamander size variation. We quantified bat activity and bat species richness with Wildlife Acoustics SM2BAT+ detectors and used SonoBat 3.1 with manual vetting to assign species identification. We captured salamander larvae, *Ambystoma talpoideum* (KY) and *Ambystoma mavortium nebulosum* (CO), via seines, analyzed their size variation using ImageJ, and used these data to categorize each pond as high, medium, and low size variation. We collected emerging aquatic invertebrates using emergence traps and identified captured insects. We identified the presence of 9 species of bats in KY and 15 species of bats in CO. We found a significant relationship between bat activity and salamander size variation in CO but not in in KY. Emergent insects analyses are ongoing. Our results suggest that predator size-structure can impact inter-ecosystem interactions.

0023 Herp Reproduction & Life History I, Thursday 13 July 2017

Joseph Butler, J. David Lambert, Daniel Murphy

University of North Florida, Jacksonville, Florida, USA

Concentrations and Nest Preferences of Carolina Diamondback Terrapins, *Malaclemys terrapin centrata*, in Northeast Florida

The major objective of this study was to locate population concentrations and nesting areas of Carolina Diamondback Terrapins in the four northeastern-most counties of Florida (Nassau, Duval, St. Johns, and Flagler). We used head counts from the boat and walking surveys of shorelines and high spots that could possibly support nesting in order to establish terrapin presence. During the walking surveys we searched for crawls, intact and raided nests, live terrapins, dead terrapins, and terrapin bones. In an effort to evaluate whether woody plant presence affected nest site choices, we recorded the occurrence of 10 common woody species during each walking survey and compared areas where nesting did and did not occur. Further, to determine if soil characteristics

influenced nesting we analyzed soil samples from most places we stopped. We collected 410 terrapin records in 2013 and 2014. Most were from Nassau County (281) and only two are from Flagler County. Most records were in the form of depredated nests (213) and we captured only four live terrapins. The woody plant data suggested that significantly more nesting occurred when Christmas Berry (*Lycium carolinianum*) was present, and nesting was less likely when either Wax Myrtle (*Myrica cerifera*) or Oak (*Quercus* spp.) were present. Soils with high levels of potassium were more frequently used for nesting than those with low levels, however concentrations of sodium and phosphorus and pH levels did not differ between nesting and non-nesting samples. Soil grain size had no effect on nesting preferences.

0159 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Sky Button

University of Florida, Gainesville, FL, USA

Using Species Distribution Models to Predict Climate Change Impacts on a Unique Evolutionary Arms Race

Species distribution models are frequently used to model climate change-induced changes in habitat suitability. However, the influences of climate change on predator-prey co-evolution are rarely considered in these models. Newts of the genus *Taricha* and multiple gartersnake species (genus *Thamnophis*) are engaged in a unique evolutionary arms race, in which tetrodotoxin (TTX) potency in newts and TTX-resistance in newt-feeding gartersnakes have evolved parallel to one another. The extent to which *Thamnophis* species exhibit TTX-resistance is largely dependent on whether these snakes co-occur with *Taricha* species and encounter them regularly. Sierra gartersnakes (*Thamnophis couchii*) and Sierra newts (*Taricha sierrae*) are ideal species for modelling the impacts of climate change on this relationship, because their ranges in Sierra Nevada overlap substantially, and because *Thamnophis* species exhibit more TTX-resistance where they co-occur with *Taricha* species. Both species are likely to be impacted by the rapid pace of climate change in Sierra Nevada. Using ensemble-based species distributions models formed using weighted model averages, I discuss likely changes in TTX-resistance across the range of *T. couchii* resulting from predicted changes in sympatry between *T. couchii* and *T. sierrae* under different emissions scenarios.

0591 Herp Reproduction & Life History II, Thursday 13 July 2017

Nathan Byer[1], Brendan Reid[2], M. Zachariah Peery[1]

[1]University of Wisconsin - Madison, Madison, WI, USA, [2]American Museum of Natural History, New York City, NY, USA

Perspectives on maternal selfishness: does female risk influence nesting behavior in the Blanding's Turtle?

Evolutionary theory predicts that organisms should behave in a manner that maximizes their fitness. However, competing selective pressures may exert opposing influences on fitness components, which may force individuals to make behavioral decisions that balance these tradeoffs. One such tradeoff is that between adult survival and reproductive success, where behaviors associated with reproduction increase the risk of adult mortality. Turtles are expected to prioritize current survival over current reproductive success, as lifetime reproductive success is generally tied to longevity. However, this hypothesized "selfish" behavior has rarely been demonstrated, particularly in a landscape context. We used information on habitat selection, nesting ecology, and movement ecology to investigate how female Blanding's Turtles in Wisconsin balance factors that affect adult and nest survival. Female Blanding's Turtles were tracked from home wetlands to nest locations to determine patterns of movement and nest placement. During these movements, we quantified predation risk to nesting turtles by using baited camera traps, and thermal constraints upon nesting turtles using temperature data loggers placed throughout the landscape and on tracked turtles. In 2016, nest survival was approximately 52%, but varied between nesting areas; furthermore, females differed in distances moved to get to nesting areas. Predation risk and thermal conditions varied spatially, and females encountered more diverse predator communities further away from water. These results suggest that nesting behavior by turtles may be constrained by spatially-explicit patterns of risk. We plan to investigate these patterns further using long-term mark-recapture and nesting databases collected at our study site.

0706 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Nathan Byer[1], Brendan Reid[2], Richard Seigel[3], M. Zachariah Peery[1]

[1]UW-Madison, Madison, WI, USA, [2]American Museum of Natural History, New York City, NY, USA, [3]Towson University, Towson, MD, USA

Moving beyond apparent success: techniques for analyzing nest survival data

For nest-laying organisms such as birds and turtles, nest depredation is often the main cause of poor recruitment. While determining the effects of nest depredation on population persistence continues to be a conservation priority, efforts to quantify nest survival are often confounded by differences in detection probability for successful and unsuccessful nests. Avian ecologists have developed a wide range of analytical techniques designed specifically to account for this potential source of bias when quantifying patterns of nest survival. Although these techniques are commonly used in avian field studies, they have not been as widely adopted in herpetological research. In an effort to demonstrate the utility of these techniques, we briefly reviewed the range of nest survival analysis techniques currently available. We also applied the logistic exposure model developed by Shaffer (2004) to estimate and characterize patterns of

nest survival for Blanding's and Bog Turtles, both of which are species of conservation concern. We quantified individual-,group-, and time-specific covariates for each nest, and used an information theoretic approach to select combinations of explanatory variables that best explained observed patterns of nest depredation. Using these methods, we documented striking interspecific differences in patterns of nest depredation, including opposing effects of nest age on depredation probability for each species. We suggest that more modern nest success analysis techniques can serve as powerful tools for examining patterns of nest depredation and survival, and encourage the adoption of these techniques for herpetological field studies.

0838 AES Ecology III, Sunday 16 July 2017

Michael Byrne[1], Heidi Dewar[3], Suzanne Kohin[3], Jeremy Vaudo[1], Bradley Wetherbee[2], Mahmood Shivji[1]

[1]Nova Southeastern University, Dania Beach, FL, USA, [2]University of Rhode Island, Kingston, RI, USA, [3]NOAA Southwest Fisheries Science Center, La Jolla, CA, USA

Juvenile Shortfin Mako Shark Habitat Use in the Eastern North Pacific

Understanding habitat selection has significance to both basic ecology, as well as species management. In the case of large pelagic sharks, the ability to predict distributions based on environmental conditions would allow for understanding how populations may interact with fisheries, how distribution may change in the face of climate alterations, and how environmental factors drive spatial population structure. We used a large satellite tracking dataset to construct a model of juvenile shortfin mako (*Isurus oxyrinchus*) habitat use in the eastern North Pacific Ocean. We used generalized additive mixed models (gamm) to model the number of tracking days within $0.5^{o} \times 0.5^{o}$ grid cells monthly for individual sharks as a function of geographic (i.e. depth, bottom topography, distance to coast) and oceanographic (sea-surface temperature, primary productivity) habitat variables. The model was parameterized using 67 sharks tagged during 2003 – 2009, with individual tracking durations ranging from 1 – 26 months. Primary productivity, sea-surface temperature, and depth all influenced mako shark space use. The final model was able to capture broad-scale seasonal shifts in distribution, as well as the sharks' affinity for the California Current. We used 18 sharks tagged during 2010 – 2014 to assess the final model's predictive ability, and found that on average 6.2%, 10.7%, 21.6%, and 61.6% of monthly tracking locations were located within model-predicted low, medium, high, and very-high use regions respectively. The modelling framework used here is flexible and can be easily applied to any species for which sufficient tracking data exists.

0829 NIA Contributed/Fish Ecology, Friday 14 July 2017

Bárbara Calegari[1], Alberto Akama[2], Richard Vari[3], Carl Ferraris[4]

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Systematics of *Trachelyichthys*: Exploring Biodiversity

The taxonomy of the Auchenipteridae has greatly improved due to revisionary studies of many genera in the last two decades. However, some groups still await for more encompassing studies seeking to clarify generic limits and to describe species still unknown. This is the case of *Trachelyichthys*, currently represented by two valid species, *T. decaradiatus* from Guyana (Rupununi River basin), and *T. exilis* from Peru (Nanay River, upper Amazon basin), both known from only a few specimens. The rarity of available material of both species in museum collection, necessary to compare with different morphotypes existing along the Brazilian Amazon basin, has hampered the recognition of new species. In order to uncover the diversity of this group of fishes we conducted a revisionary study of the genus, revealing two new species of *Trachelyichthys* from the upper Negro River basin (*Trachelyichthys* sp. nov. 1), and Jufari River (*Trachelyichthys* sp. nov. 2), also a blackwater tributary to the latter basin, in Brazil. *Trachelyichthys* sp. nov. 1 differs from congeners by various features, such as the unique uniform brown coloration of the body, four pterygiophores free from the supraneural plus pterygiophores supporting the branched dorsal-fin rays, an elongate posterior process of suprachleitrum, and the posterior nuchal plate expanded lateroventrally. *Trachelyichthys* sp. nov. 2 is distinguished from congeners by a combination of a black stripe on the flank, three free pterygiophores supporting the branched dorsal-fin rays, posterior nuchal plate not expanded lateroventrally, further on a series of morphometric proportions.

0785 ASIH STOYE GENERAL ICHTHYOLOGY III, Friday 14 July 2017

David Camak, Thomas Turner

University of New Mexico, Albuquerque, NM, USA

Estimating Levels of Introgression between Gila Trout (*Oncorhynchus gilae*) and Rainbow Trout (*O. mykiss*) using Next-generation Sequencing Data

Gila trout (*Oncorhynchus gilae*) is a federally protected species in the family Salmonidae and is confined to headwater streams in the Gila and San Francisco Rivers in New Mexico and Arizona. Currently, there are five recognized relict and genetically distinct lineages of Gila trout found in the upper Gila River and San Francisco River drainages based on various genetic markers. Understanding levels of introgression is crucial for management and conservation of genetic diversity. Previous genetic data suggested admixture with nonnative Rainbow Trout (*O. mykiss*) and native Gila Trout individuals

from the Iron Creek lineage. Despite shared allozyme and microsatellite alleles between the Iron Creek lineage and Rainbow Trout, mtDNA analyses indicate no shared haplotypes. Gila and Rainbow Trout are close relatives that shared a recent common ancestor (~ 2 mya). Shared alleles could result from common recent ancestry rather than introgression. We used next-generation sequencing to increase resolution of genetic variation and gain better insight into levels of introgression between the two species. About thirty individuals from each relict Gila Trout lineage and source Rainbow Trout lineages were sequenced and genotyped. Initial results are consistent with previous data, indicating five distinct Gila Trout lineages with varying levels of diversity within each lineage. There was no indication of substantial introgression among the five relict Gila Trout lineages and Rainbow Trout. However, initial results may underrepresent introgressed alleles, especially if introgression has been low. Additional analyses will be performed to better disentangle ancestral polymorphism from low-level introgression.

0368 ASIH STOYE CONSERVATION II, Friday 14 July 2017

D. Cooper Campbell, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Mysteries of the gene pool: Population genetics of springfish and poolfish (Goodeidae: *Crenichthys* and *Empetrichthys*)

Most species of springfish and poolfish (Goodeidae: Empetrichthyinae), *Crenichthys* and *Empetrichthys*, are protected at the state and/or federal levels. Their imperiled status is due to a combination of anthropogenic effects and their natural disjunct distribution across the pluvial White River basin. Despite their endangered status, there has been no investigation into the genetic variation across the distribution of these fishes. Therefore, the objectives of this study were to analyze population genetic structure within *Crenichthys* and *Empetrichthys* to better understand genetic differentiation among populations and to identify management units. Tissue samples from 19 different populations of *Crenichthys* and *Empetrichthys*, representing all extant species and subspecies, were included in this study. We collected RAD-Seq data from 380 individuals to generate a comprehensive SNP dataset and conducted multiple population genetic analyses (i.e. STRUCTURE, F_{ST}, etc.) to examine population genetic structure within and across the populations. The results indicate significant differences among some populations, but limited or no genetic differentiation for others. In light of these results, a modified management approach may need to be undertaken to protect and manage the remaining populations, particularly if future stocking effort is needed to preserve the remaining genetic diversity.

0284 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

D. Cooper Campbell, James Erdmann, Courtney Weyand, Anna Gruszkiewicz, Zach Nikolakis, Elyse Parker, Jerry Kattawar, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Forensic ichthyology: Identifying the type basin of *Bryconops affinis* (Characiformes: Iguanodectidae)

The Neotropical ichthyofaunal province extends from the Isthmus of Tehuantepec in southern Mexico to the La Plata estuary in northern Argentina. This area harbors an extraordinary diversity of freshwater fishes (>5,600 species), with the Characiformes being one of the dominant groups. As previous researchers have noted, the descriptions of many species and genera of characids are vague or poorly defined. One such species, the Orangefin Tetra, *Bryconops affinis* (Characiformes: Iguanodectidae), was described by Günther in 1864 from a single paragraph containing counts for five characters and a brief description of qualitative morphometry from the holotype. The type locality is listed as "British Guiana" (=Guyana), with the type locality and river basin unknown. The objectives of this study were (1) to quantify intraspecific morphological variation (nine meristic and eight qualitative characters) of *B. affinis* among multiple river basins located in Guyana, including the Potaro and Kuribrong Rivers (Essequibo drainage), the Takutu and Ireng Rivers (Amazon drainage), and the Berbice River (independent drainage); and (2) to determine the type river basin of the *B. affinis* holotype from Guyana. Several meristic characters, including the number of pored lateral line scales and pectoral rays, as well as several pigment characters, are variable across the range. The results from this intraspecific morphological variation study will be summarized and presented.

0402 Herp Systematics I, Sunday 16 July 2017

David Cannatella

University of Texas, Austin, Texas, USA

Fossils and the Deep-Time Dimension of Frog Evolution

Phylogenetics reveals macroevolution in time and space. Understanding the time dimension relies on fossil ages as a starting point for calibrating the phylogeny to estimate divergence times. Distressingly, the inferred age of a clade may vary greatly across studies. For example, estimates of the age of the most recent common ancestor of Pipidae range from 165 to 100mya, and the time of its divergence from Rhinophrynidae spans 193 to 140mya. Moreover, confidence intervals for these ages are typically very broad. This lack of precision may derive from factors such as uncertainty about fossil ages, paucity of characters, and weak or misleading phylogenetic signal in the genetic data. However, other explanations have not been considered sufficiently, such as the phylogenetic placement of fossils, methods of calibration, and the models of the processes of tree generation. I will examine the phylogeny of frogs, focusing on selected clades for which reconsideration of fossils and the analytical methods re-frame the story of frog evolution.

0564 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Mariah Cardoza, Samantha Hughes, Jennifer Deitloff

Lock Haven University of Pennsylvania, Lock Haven, PA, USA

Effect of Silver Nanoparticles on Tadpoles of *Xenopus laevis*

Nanoparticles are commonplace in many of today's consumer products including pesticides, sunscreens, camera film, and many more. However, not much is known regarding long term effects of these chemicals past initial exposure into an environment. Nanoparticles can have detrimental effects on aquatic environments and the organisms that live within them. To study the effects that nanoparticles have on development, we treated *Xenopus laevis* tadpoles with various concentrations (control, low, and high) of silver nanoparticles (AgNPs) over an eight week period. We recorded length and developmental stage every week. Using a Repeated Measures ANOVA, we tested the hypothesis that AgNPs have a negative impact on tadpole development. We predicted that the high concentration would have a more significant impact than the low concentration. We concluded that AgNPs had a negative effect on the development of *Xenopus*. This data combined with previous research leads us to conclude that nanoparticles will have negative effects on similar species and on aquatic environments even though these concentrations are not lethal.

0553 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Friday 14 July 2017

Mariah Cardoza[1], Michael Wines[2], Jennifer Deitloff[1]

[1]Lock Haven University of Pennsylvania, Lock Haven, PA, USA, [2]West Side Park Middle School, Newark, NJ, USA

Effect of Silver Nanoparticles on Larval *Ambystoma mexicanum*

Silver nanoparticles (AgNPs) are used in a variety of industries as an antimicrobial agent. However, little is known of the long-term effects of this chemical to individual species and to the overall health of natural environments. Different nano-chemicals have detrimental effects in aquatic environments. To study these potential effects, we dosed larval *Ambystoma mexicanum* (axolotl) with various concentrations (control, low and high) of AgNPs for an eight week period. We measured length and mass of larval salamanders each week. Using Repeated Measures ANOVA, we found that changes in length and mass over this eight week period significantly differed between treatment groups. While animals in the high concentration group did not gain length or mass, the control and low concentration groups increased in length and mass over time. From these results, we can conclude that at high doses the AgNPs had a negative effect on development of *A. mexicanum* and could potentially have similar effects on other aquatic

species in ecosystems that are exposed to AgNPs. Without regulation of AgNP waste, aquatic systems may be at risk of these potentially harmful particles. Although not lethal at these specific concentrations, we observed that AgNPs can have detrimental effects on species within aquatic environments.

0782 Amphibian Biology, Ecology, & Conservation, Sunday 16 July 2017

Gerardo Carfagno[1], Lucas Thompson[2], Andrea Sitton[2], Kurt Andresen[2], Taylor Bury[2], Laura Lee[2], Kevin Lerner[2], Peter Fong[2]

[1]Manhattan College, Riverdale, NY, USA, [2]Gettysburg College, Gettysburg, PA, USA

Results of Experimental Gold Nanoparticle Exposure in Wood Frog (*Lithobates sylvaticus*) and Bullfrog (*L. catesbeianus*) Tadpoles

Man-made nanoparticles are environmental contaminants of emerging concern, but their impacts on aquatic environments are not well understood. This may be of special interest for many amphibian species which have shown substantial declines in the wild. We tested the effects of cetyltrimethylammonium bromide capped gold nanoparticles on wood frog (*Lithobates sylvaticus*) tadpole development. Exposure to environmentally relevant concentrations of gold in the laboratory significantly reduced time to metamorphosis, but had no effect on tadpole mass at metamorphosis. We also measured gold nanoparticle uptake after twenty-one days of laboratory exposure in wood frog and bullfrog (*Lithobates catesbeianus*) tadpoles, two closely related and geographically overlapping species with different developmental strategies. We found that wood frogs accumulated significantly more gold than bullfrogs. Also, bullfrog tadpoles raised in combination with wood frogs accumulated significantly more gold than controls. In all gold-exposed tadpoles, gold was found to be concentrated in the anterior region of the body. However, gold concentrations fell below the level of detection in wood frogs after fifteen days in gold-free water. To our knowledge, this is the first report on the effect of engineered nanoparticles on amphibian tadpole development. Our study also highlights the importance of avoiding generalizing potential toxicological effects based upon one model species.

0559 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Aaron Carlisle[1], Mark Denny[1], Nishad Jayasundara[2], Adrian Gleiss[3], Elliot Hazen[4], Salvador Jorgensen[5], Kady Lyons[6], Heidi Dewar[4], Christopher Lowe[6], Barbara Block[1], Steven Bograd[4]

[1]Hopkins Marine Station of Stanford University, Pacific Grove, CA, USA, [2]University of Maine Orono, Orono, ME, USA, [3]Murdoch University, Perth, WA, Australia, [4]NOAA/NMFS Southwest Fisheries Science Center, Monterey/La Jolla, CA, USA,

[5]*Monterey Bay Aquarium, Monterey, CA, USA,* [6]*California State University Long Beach, Long Beach, CA, USA*

Warm Sharks in a Cold Ocean: Examining Thermal Physiological Boundaries Underlying Lamnid Shark Distribution

Lamnid sharks are one of the few marine organisms that have evolved endothermy, a trait that confers a variety of physiological and ecological advantages over ectothermic taxa. Their ability to generate heat and maintain elevated body temperatures is directly linked to body size. This change in endothermic capacity likely results in ontogenetic shifts in thermal sensitivity that influence the distribution and migration of these sharks. To evaluate ontogenetic shifts in endothermic capacity and understand how these changes may influence the distribution and ecology of lamnid shark, we developed a novel thermal balance model that incorporates physiological, anatomical, and behavioral factors for three species of lamnid sharks (*Carcharodon carcharias, Isurus oxyrinchus, Lamna ditropis*). We then validated the model with empirical data on the thermal distribution of these species from the eastern North Pacific. Our results provide a mechanism that defines species-specific lower thermal limits across ontogeny. Understanding how the endothermic capacity of lamnid sharks changes through ontogeny provides a mechanistic basis for predicting how the distribution of sharks changes seasonally and ontogenetically as oceanographic conditions change and helps to explain their large-scale migratory behaviors.

0066 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brad Carlson

Wabash College, Crawfordsville, IN, USA

Hormonal Correlates of Personality in Box Turtles

Intraspecific variation in animal personality (especially boldness) is ubiquitous and critical for mediating interactions with the environment. Characterizing the hormones associated with variation in behavior is valuable for identifying the physiological mechanisms that drive personality differences as well as illuminating the consequences of variation in personality for other traits. Box turtles are an excellent model for studying personality, as previous work has shown that they exhibit highly consistent individual differences in boldness. I measured the baseline and stress-induced levels of corticosterone (stress hormone) and testosterone (androgen), which are expected to covary with behavior and introduce physiological trade-offs. Preliminary data indicate that physiological stress responses were minimal for all turtles tested at cooler temperatures, while bold turtles (but not shy turtles) exhibited stronger stress responses at warmer temperatures. Notably, bold turtles often tend to maintain higher body temperatures. This contrasts with "coping style" theory developed in endotherms and highlights the added complexity of studying personality in ectotherms, for which stress responsiveness may be highly temperature dependent.

0065 Turtle Behavior, Friday 14 July 2017

Brad Carlson

Wabash College, Crawfordsville, IN, USA

The Ecology of Personality in Box Turtles

It is increasingly apparent that individual animals exhibit consistent patterns of behavior that contrast with conspecifics ("personality"). Such phenotypic diversity is potentially important for understanding the ecology of wild populations, yet its consequences and causes remain poorly understood. To address this, I examined the relationships between differences in boldness in free-ranging box turtles and several ecologically significant variables. Repeated behavioral assays on individual wild turtles revealed highly consistent variation in boldness (response to perceived threat). Furthermore, this variation in personality type was correlated with body temperatures experienced in the field and injuries on the shells: bolder turtles maintained higher body temperatures but had more injuries, suggesting a trade-off between thermoregulatory benefits and predation risk. This trade-off may in part explain how such diverse behavioral strategies are able to coexist in the same population. Box turtles may be a valuable model system for identifying the ecological causes and consequences of variation in personality.

0313 Lightning Talks II, Friday 14 July 2017

Paula Carlson[1], Katy Duke[2], Stacia White[3], Alan Henningsen[4]

[1]Dallas World Aquarium, Dallas, TX, USA, [2]Ripley's Aquariums Myrtle Beach, Myrtle Beach, SC, USA, [3]The Deep, Hull, UK, [4]National Aquarium, Baltimore, MD, USA

A special day for a special group of fishes with saws

Sawfishes are the most imperiled group within the Class Chondrichthyes. All five species are endangered (*Anoxypristis cuspidata, Pristis clavata)* or critically endangered (*Pristis zijsron, Pristis pectinata, and Pristis pristis*). Some populations have been extirpated from many parts of their former range. Global collaboration is necessary between all stakeholders to provide a unified effort to conserve sawfishes. Zoological institutions, such as zoos and aquariums, serve as educational conduits for conservation messages, reaching millions of visitors, and are well-poised to fully engage in this effort and collaboration. We seek to initiate a greater awareness of sawfish and their status, as well as kick off a collaborative campaign, and are pleased to announce the inaugural International Sawfish Day: October 17, 2017. Our goal is to make this an annual event. Participating institutions will provide educational components on the biology and conservation status of sawfishes concurrently from individual locations.

0589 Lightning Talks II, Friday 14 July 2017

Evin Carter[1], Eric Riddell[2], Michael Sears[2], Brad Shaffer[3], Benjamin Fitzpatrick[1]

[1]University of Tennessee, Knoxville, TN, USA, [2]Clemson University, Clemson, SC, USA, [3]University of California, Las Angeles, CA, USA

Bounded hybrid superiority may limit the scope of hybrid invasion

Hybridization between previously isolated populations can result in meaningful and sometimes rapid evolutionary change. Transgressive segregation, or the production of novel phenotypes in hybrid offspring, can facilitate immediate evolutionary change by permitting exploitation of a different or broader set of environmental conditions than parental lines. Life history complexity can in turn play a major role in determining the importance of exogenous selection by increasing ecological interactions through space and time. Barred Tiger Salamanders (I-BTS, *Ambystoma mavortium*) were introduced to central California in 1950s and hybridized with the imperiled native California Tiger Salamander (N-CTS, *A. californiense*). The narrow hybrid zone is strongly associated with landscape features, but there is currently no definitive mechanism to explain this pattern. We measured physiological traits expected to influence fitness in amphibians under three temperatures reflecting major life history events. As we build our knowledge of the ecological and genomic processes occurring in this system, it has been sufficiently complex to not fit neatly within the confines of existing hybrid zone models. We found standard metabolic rate alone may explain several previous observations of hybrid invasion success, and may be consistent with a bounded hybrid superiority model during the initial contact between I-BTS and N-CTS, with N-CTS favored in terrestrial but not aquatic environments. In conjunction with previous observations, our results suggest I-BTS x N-CTS hybrids represent an ecologically distinct, yet genetically quite variable, unit. Complete partitioning is impeded by a lack of reproductive barriers within a shared resource (*i.e.*, breeding ponds) wherein hybrids outperform N-CTS.

0489 LFC Contributed I, Friday 14 July 2017

Lauren E. Carter[1], David E. Richardson[1], Kiersten L. Curti[2]

[1]NOAA Fisheries, NEFSC, Narragansett, RI, USA, [2]NOAA Fisheries, NEFSC, Woods Hole, MA, USA

Development of a Population Wide Index of Spawning Stock Biomass for Atlantic Mackerel

The Northwest Atlantic Mackerel stock spawns in both U.S and Canadian waters. The U.S has declared the status of the unit stock as unknown, while Canadian assessment of the stock's northern contingent indicates biomass at a historic low. An Atlantic Mackerel abundance index derived from the Northeast Fisheries Science Center's (NEFSC) spring bottom trawl survey, used in a recent U.S.-Canadian assessment, remains high, but is contradicted by other information about the stock status, prompting the need for an additional fisheries independent index. Here we describe the development of an egg index for U.S waters. This study focuses on an archive of unidentified eggs collected

during NOAA NEFSC's MARMAP and ECOMON surveys. Fish eggs were sorted, identified to species, and developmentally staged. Over the 25+ year time frame in which data was collected, a northward shift in egg distribution has occurred from a majority of spawning occurring in the Southern New England region to now predominantly in the Western Gulf of Maine. Additionally, annual egg totals have decreased two orders of magnitude from 200 trillion in the 1970s. The biomass of spawners in U.S. waters estimated from the egg data stands at less than 1000 mt as of 2015, an order of magnitude less than the biomass of spawners in Canadian waters. The new data series, when combined with ongoing Canadian egg abundance surveys, will provide the first range-wide abundance index for the entire northwest Atlantic stock from 1977-1987 and 2000-present with hope of continuing the index into the future.

0534 AES GRUBER AWARD IV, Friday 14 July 2017

Madeline Self Cashion, Nicolas Bailly, Daniel Pauly

Sea Around Us, Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, British Columbia, Canada

A Shark by any Other Name: Catch Reporting Quality in the Mediterranean Sea

One in four Chondrichthyan fishes is threatened with extinction, according to the IUCN Red List. Their primary threat is overfishing, but data deficiency makes conventional fishery science methods of stock assessment difficult, if not impossible for many species. Over 20% of shark species are Data Deficient, in part because the taxonomic resolution of existing catch statistics is often so low that researchers are unable to identify species-level trends of abundance. Less than 25% of the shark catch reported to the FAO is identified below the genus level; the other 75% is lumped into more ambiguous categories like, “sharks, rays, skates, etc. not elsewhere included”. Detailed fisheries catch statistics are a prerequisite to effective management, but are influenced by a country’s geopolitical and economic stability. A new indicator, the Context-Adjusted Fisheries Statistics Indicator ($STAT_{rep}$), compares the taxonomic resolution of reported catches between countries within a given region that exploit the same species. Using this method, we have tracked the effectiveness of different reporting systems by plotting national $STAT_{rep}$ scores in a time series (i.e. 1950-2014). In the Mediterranean Sea, an area of special concern for shark conservation, reporting quality of shark catches has increased. Until 1964, only two shark species were officially reported and only by a single country, Malta. This contrasts to 2014, when thirteen countries report catching thirteen species. Our results suggest that governments are influenced by the reporting behaviour of foreign governments in the same region. Countries should strive for high-quality reporting to promote sustainable fisheries.

0384 AES GRUBER AWARD II, Thursday 13 July 2017

Grace Casselberry[1], Andy Danylchuk[1], John Finn[1], Bryan DeAngelis[2], Gregory Skomal[3]

[1]University of Massachusetts Amherst, Amherst, MA, USA, [2]The Nature Conservancy, Narragansett, RI, USA, [3]MA Division of Marine Fisheries, New Bedford, MA, USA

Using Network Analysis to Examine the Spatial Ecology of the Shark Community in Buck Island Reef National Monument, St. Croix, USVI

Marine protected areas (MPAs) are becoming an increasingly popular marine conservation tool, particularly for elasmobranchs. Although Buck Island Reef National Monument (BIRNM), St. Croix, United States Virgin Islands, is one of the oldest MPAs in the US, information on the movement ecology of sharks in its waters is lacking. From June, 2013 - November, 2016, nurse (*Ginglymostoma cirratum*; n = 10), lemon (*Negaprion brevirostris*; n = 5), tiger (*Galeocerdo cuvier*; n = 5), and Caribbean reef (*Carcharhinus perezi*; n = 12) sharks were acoustically tagged and monitored using a passive acoustic telemetry array. Network analyses were used to evaluate the extent to which tagged sharks utilized the MPA, while bipartite graphs coupled with community detection algorithms were used to quantify spatiotemporal dynamics of sharks in BIRNM. Spatial networks for individual sharks displayed behavioral differences among species and individuals. Although preliminary, the results of this study indicate that BIRNM provides varying degrees of protection for all species tagged. Individual spatial networks revealed that most individuals used the array widely over prolonged periods of time, with 23 tagged sharks remaining within the MPA boundaries for six months or longer. Two lemon sharks and one Caribbean reef shark were present for the entire duration of the study. Bipartite graphs show similarities in array use within species, particularly for tiger and lemon sharks, while nurse and Caribbean reef sharks displayed greater individual differences.

0451 AES Conservation & Management I, Saturday 15 July 2017

Jose I. Castro

NOAA, NMFS, St. Petersburg, Florida, USA

The Origins and Rise of Shark Biology in the 20th Century

Historically, the knowledge of sharks has always lagged far behind the knowledge of bony fishes and other vertebrates. In the 1950s there were only a handful of researchers studying sharks. In the second half of the 20th century four factors combined to spark interest in sharks, make shark research feasible, and engender shark biology and shark conservation. These factors were: 1) Generous funding of research on shark attacks and the use of sharks for military purposes by the Office of Naval Research. 2) A rise in popularity of recreational shark fishing and the development of marking tags that could be used to identify individual sharks. 3) The opening of China to commerce with the United States resulting in a new American shark fishery and active shark-fin markets. In turn, the rapid growth of the shark fin fishery and the geometric increase in the landings

resulted in conservation concerns, and the eventual need for fishery regulations. 4) The release of the movie "Jaws" engendered a fear of sharks and started a shark killing craze that became an ecological disaster. In a decade or two (~1995-2010), an unusual transformation occurred in the perception of sharks, which went from being feared animals to protected and even totemic animals. When sharks ceased to be fishes and became totemic animals, much of shark biology evolved into advocacy. Today, much research is mainly concentrated on a few species of sharks, such as the totemic white shark and the "charismatic" whale shark.

0058 Herp Physiology, Saturday 15 July 2017

Alessandro Catenazzi, Robin Warne

Southern Illinois University Carbondale, Carbondale, IL, USA

Rapid Acclimation of Critical Thermal Maximum in a Tropical Montane Frog

We tested the hypothesis that tropical mountain frogs can quickly acclimate their Critical Thermal Maxima (CTM) when exposed to moderate increases in temperature. Our hypothesis is supported by our previous studies and field observations suggesting plasticity of CTM in tropical frogs distributed along a wide elevational gradient from the Amazon lowlands to the Andean mountaintops. Specifically, we measured operative and body temperatures, and CTmax of a terrestrial frog distributed across more than 1600 m in the eastern slopes of the Andes. These data allowed us to formulate specific predictions regarding this organism's response to a moderate temperature increase during a translocation experiment of high elevation individuals to the lower elevational bound of the species distribution range. We predicted that translocated individuals would rapidly acclimate their CTM to values approaching the CTM of local individuals. In order to determine whether acclimation occurred as physiological response affecting the whole organism, we measured variation in corticosterone concentrations. Our experimental approach improves upon past comparative studies, and reveals considerable acclimation capacities for this frog, a result that has important implications for assessing the vulnerability of tropical amphibians to climate warming.

0226 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Friday 14 July 2017

John Cavagnaro

Villanova University, Villanova, PA, USA

UV coloration in diurnal geckos of the genus *Lygodactylus*: influence of habitat and visual system on color evolution

Perception of ultraviolet (UV) light, mediated by the SWS1 opsin, is widespread in reptiles. Many species reflect UV light as part of their coloration, but its role is

understudied, because humans cannot perceive it. The UV reflectance of geckos in particular has not been investigated. The nocturnal ancestry of geckos has left them with a unique trichromatic visual system, with opsins sensitive to UV, blue, and green light, but not red. I have used objective multispectral photography and cone-catch modeling to determine how different signals stimulate the gecko visual system, so that their coloration can be interpreted in a biologically relevant context. I specifically focus on the sexually dimorphic coloration displayed by members of the diurnal genus *Lygodactylus* Gray, 1864. Several species in the genus exhibit a yellow head with a blue-grey (and UV) body, a pattern which has evolved convergently in other, independently diurnal clades. This indicates that the yellow-headed phenotype is an efficient signal for the gecko visual system in a diurnal light environment. I find that to the gecko visual system, the UV-blue-grey body has a higher chromatic contrast against many natural backgrounds than the yellow head, and that there is substantial contrast (with implications for signaling) between the head and body, especially in the UV channel. One species in particular, the critically endangered *L. williamsi*, has evolved bright blue coloration with a strong UV component, highlighting the importance of UV reflectance for signaling in this clade.

0530 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Eloise Cave, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Effect of Deepwater Horizon Crude Oil on Olfactory Responses in the Atlantic Stingray, *Dasyatis sabina*

Crude oil causes both lethal and sublethal effects on marine organisms, but the impact upon sensory function remains largely unexplored. The elasmobranch fishes rely upon the effective functioning of their sensory systems for prey, mate, and predator detection. The objective of this study was to test the effect of crude oil upon the olfactory sensitivity of a benthic marine predator, the Atlantic stingray, *Dasyatis sabina*. Stingrays were exposed to a 10% dilution crude oil solution, which replicates the concentration measured empirically in coastal areas following the Deepwater Horizon oil spill. An electro-olfactogram (EOG) technique was employed to quantify the response of the stingrays to five amino acids with different characteristics: Cysteine-polar, Alanine-non-polar, Phenylalanine-aromatic, Glutamic acid-acidic, and Arginine-basic. The magnitude of the EOG response for all amino acids was significantly depressed by 26% to 157% in oil-exposed animals compared to control animals held in pristine water. Additionally, the EOG response onset was significantly slower, and the clearing time was protracted in oil-exposed individuals. As a result, stingrays inhabiting an area where an oil spill has occurred will experience reduced olfactory sensitivity. This could ultimately lead to the stingray failing to detect prey, mates, or predators, which would detrimentally impact fitness and could contribute to premature death. This study is the first to quantify the effects of crude oil on the olfactory system of elasmobranchs.

0405 Herp Systematics I, Sunday 16 July 2017

Luis M. P. Ceriaco[1], Mariana P. Marques[2], Ishan Agarwal[1], Suzana Bandeira[3], Matthew P. Heinicke[4], David C. Blackburn[5], Aaron M. Bauer[1]

[1]Villanova University, Villanova, Pennsylvania, USA, [2]Museu Nacional de História Natural e da Ciência, Lisboa, Portugal, [3]Instituto Nacional de Biodiversidade e Áreas de Conservação, Luanda, Angola, [4]University of Michigan, Dearborn, Michigan, USA, [5]University of Florida, Gainesville, Florida, USA

Southwestern African *Poyntonophrynus*: Morphological and Molecular Analyses Reveal Hidden Diversity in Southwestern Angola

Ten species are currently recognized in the East and southern African toad genus *Poyntonophrynus*. The genus reaches its northwestern distribution limit in southern Angola. Recent expeditions to Benguela and Namibe provinces in this region resulted in the collection of three taxa assignable to this genus: *P. dombensis*, *P. grandisonae*, both from near their type localities, and a third, undescribed, species from the Serra da Neve inselberg in Namibe Province. Although *P. dombensis* shows the typical characters of the genus, the other species exhibit opposite extremes of tympanic morphology. *Poyntonophrynus grandisonae* has an extraordinarily large tympanum, whereas the undescribed species lacks all external trace of an ear. Preliminary morphological and molecular analyses suggest that the species from Serra da Neve is deeply nested within *Poyntonophrynus*, but multi-gene phylogenetic analyses show deep divergence between *P. grandisonae* and other *Poyntonophrynus*. Implications of the phylogenetic relationships for character state evolution and historical biogeography are discussed.

0410 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Friday 14 July 2017

Tyler Chafin, Marlis Douglas, Michael Douglas

University of Arkansas, Fayetteville, AR, USA

Differential introgression suggests a mosaic hybrid zone in *Gila* of the Colorado River Basin

Contemporary stream hierarchy of the Colorado Plateau reflects a volatile drainage evolution shaped by tectonism and climate. These provided alternating periods of drainage segregation and amalgamation, and thus a complex evolutionary theater for fish lineages to isolate, adapt, or merge. The resulting phylogenetic histories are reticulated and thus evolutionary processes remain difficult to segregate and infer. However, increased affordability of genomic approaches allows for alternative scenarios of lineage diversification to be statistically evaluated. We used reduced-representation genomic methods to examine patterns of admixture among three divergent lineages of *Gila* endemic to the Upper Colorado River: Roundtail chub (*Gila robusta*), Humpback

chub (*Gila cypha*), and Bonytail (*Gila elegans*). A hypothesis-testing framework was employed to: (a) infer biogeographic and demographic processes driving lineage evolution; (b) evaluate historical and contemporary introgression among inter-specific populations; and (c) characterize intra-specific differentiation. Our analyses highlight the porous nature of 'species boundaries' and extend conservation initiatives by clarifying intra- and inter-specific delineations.

0594 Herp Systematics II, Sunday 16 July 2017

E. Anne Chambers[1], Harry W. Greene[2], David M. Hillis[1]

[1]University of Texas at Austin, Austin, Texas, USA, [2]Cornell University, Ithaca, New York, USA

Species Delimitation in Geographically Variable Taxa: A Re-examination of the American Milksnakes (*Lampropeltis triangulum* complex)

Many recent taxonomic revisions have relied heavily on genetic data, often analyzed largely or exclusively using coalescent model-based methods. The assumptions and limitations of these methods are well known, but they are often not taken into account. We describe a protocol for species delimitation in parapatrically-distributed species that incorporates evidence from multiple sources. We test this protocol in a historically problematic species complex, the American milksnakes (*Lampropeltis triangulum* complex), using available genetic, morphological, behavioral, and biogeographic data. We demonstrate how limitations in sampling and analyses can lead to over-splitting of geographically variable species and to an underestimation of gene flow. We recommend a reduction in the number of recognized species, and note that subspecies designations are useful for distinguishing geographic variation within species. We recommend that coalescent-based species delimitation studies incorporate thorough analyses at contact zones between putative species, and evaluate and synthesize all available evidence before making taxonomic revisions.

0004 LFC Phenotypic Variation II, Thursday 13 July 2017

R Christopher Chambers

NOAA / Northeast Fisheries Science Center, Highlands NJ, USA

Thermal Reaction Norms of Early Life Stages of Mid-Atlantic Estuarine Fishes

Species from coastal and estuarine habitats are likely adapted to extreme seasonal or even daily temperature variations and perhaps have sufficient plasticity to tolerate the higher, more variable temperatures as the climate warms. Although rate processes of ectotherms are expected to increase with temperature, the scope and shape of various biological responses to a wide range of temperatures are poorly known but may vary among species, populations, and spawning habitat. We examined the plasticity of responses in key early life-stage (ELS) features in multiple coastal and estuarine species of the Mid Atlantic Bight including flatfish, silverside, killifish, tomcod, and sturgeons in an attempt to find generalities. Responses include survival to hatch, thermal tolerance range, embryonic period duration (EPD), developmental rate (DR, a derivative of EPD), size and condition at hatching, and persistence of yolk-sac larvae. In general, all species examined were eurythermal with tolerances ranging from 13 °C in winter-spawning taxa (winter flounder, Atlantic tomcod) to over 22 °C in summer-spawning ones (Atlantic silverside, mummichog). Empirically derived thermal tolerances extended beyond temperatures likely to be encountered currently in nature or those projected by climate-change models. EPD ranged five to nearly ten-fold within taxa. DR was typically

a linear or slightly convex function of temperature except at thermal extremes, supporting the use of constant water temperature at habitat average and associated DR to predict hatching in a variable thermal regime. Size at hatching typically decreased with increasing temperature which may be a critically important, sub-lethal response to ocean warming.

0434 AES Genetics, Systematics, & Biogeography, Sunday 16 July 2017

Alayne Chappell[1], Dovi Kacev[2], Andrew Nosal[1], Kevin Feldheim[3], Daniel Cartamil[1]

[1]Scripps Institution of Oceanography, La Jolla, California, USA, [2]NOAA SWFSC, La Jolla, California, USA, [3]Field Museum, Chicago, Illinois, USA

Population Structure and Genetic Diversity in Southern California Thresher Sharks (*Alopias vulpinus)*

In both the US and Mexico, the Common Thresher shark (*Alopias vulpinas*) is targeted in commercial and recreational fisheries, and considered one of the most important commercially-caught sharks in both areas. Exploitation peaked during the 1980s and 90s but has since waned. Common Thresher sharks found in the Eastern Pacific along the US and Mexico coasts are thought to comprise one homogenous population spanning from British Columbia, Canada to Baja California (BC), Mexico. Despite being historically overfished, a recent stock assessment found that overfishing is not currently occurring in California waters. However, catch data from the same population in Mexico is difficult to obtain and actual catch is not fully incorporated into the assessment. Genetic relatedness analyses can provide further insight into the health and demographic history of this population. Genetic data were collected from 551 adult and juvenile Common Thresher sharks off the coast of California and BC, from 11 different years from 1997 to 2012. All individuals were genotyped at 11 independent microsatellite loci for analyses. The results of this study have implications for bilateral management of Common Thresher sharks between the US and Mexico with particular consideration for sensitive nursery areas spanning both jurisdictions.

0892 Snake Biology I, Sunday 16 July 2017

Matt Charnock

N/A, Austin, Texas, USA

A Window into the Limbless Giants of Papua Island (New Guinea)

The island of New Guinea (Papua Island) is one of the most biodiverse slices of terra firma left on our ever-shrinking planet. Beyond the birds of paradise and tree kangaroos, in the upper-story and atop the leaf litter below live giants. Large, limbless, and enigmatic—the three giant pythons of Papua Island. The scrub python complex (*Morelia*

amethistina, *Morelia* sp.), Boelen's pythons (*Morelia boeleni*), and papuan pythons (*Liasis papuana*) have largely alluded both the academic and hobby circles for decades; Boelen's pythons and scrub pythons collected from Papua New Guinea and Irian Jaya, however, have seen spikes in commercial popularity in the past two-decades. (Papuan pythons were heavily imported into the United States in the mid-70's in a failed attempt to cement them as a hobby staple.) Interestingly enough, there's the equivalent of mitochondrial bread crumbs we're now just finding that are giving us a view into a wider window into these snakes. Subspeciation is likely occurring in all three species given described phonetic differences regarding populations separated topographical ebbs and flows, examples of ophiophagy between scrub and papuan pythons, and metabolic abnormalities seen in Boelen's and Oksibil scrub pythons living in high elevations. Like other endemic species to Papua Island, human greed is taking a demoralizing toll on wild populations. But, knowledge is a power and currency all to itself; visibility and comprehension is key to sustainable change. And to peer through a window is the first step into changing and comprehending a world not your own.

0203 Fish Ecology II, Sunday 16 July 2017

Paul Chittaro[1], Rich Zabel[2], Chris Grandin[4], Dayv Lowry[3]

[1]Ocean Associates contractor at NWFSC, Seattle, WA, USA, [2]NWFSC, NOAA, Seattle, WA, USA, [3]WDFW, Seattle, WA, USA, [4]DFO, Nanaimo, Canada

Investigating Declines in Body Size of Salish Sea Pacific Hake Following Fishery Closure

Fishing restrictions and closures may provide a necessary window of time for recovery, but they do not ensure that the population will rebound. For example, the population of Pacific hake (*Merluccius productus*) in inland waters of Puget Sound, Washington, USA, has failed to recover despite the closure of the commercial fishery in 1991. We reconstructed size-at-age of Pacific hake from Puget Sound and nearby Georgia Strait populations and found that individuals grew similarly in the first year of life. However, fish collected from the degraded Puget Sound population grew 2 to 3 times less during the second, third, and fourth summers relative to those from Georgia Strait. Also, Pacific hake from Puget Sound that hatched before the fishery closure grew, on average, 33% and 42% more during their second and third summers, respectively, than those that hatched after the closure. To investigate this decline in size-at-age of Puget Sound hake and explain variability in size-at-age of hake collected from Puget Sound and Georgia Strait we used a generalized linear modeling approach that included data of competitive and predatory pressure as well as the environmental conditions experienced by the fish.

0508 Reptile Behavior, Friday 14 July 2017

Rulon Clark[1], Malachi Whitford[1], Grace Freymiller[1], Tim Higham[2]

[1]San Diego State University, San Diego, CA, USA, [2]University of California Riverside, Riverside, CA, USA

Leaps and Bounds: High Speed Predator-Prey Interactions Between Sidewinder Rattlesnakes and Desert Kangaroo Rats

Viperids recorded under laboratory conditions can reach exceptional levels of performance when striking at prey. However it is generally not known how this performance may translate to predatory success under natural conditions, when attempting to kill prey that may have coevolved with snakes to avoid strikes. Kangaroo rats, which are largely sympatric with rattlesnakes throughout the arid regions of North America, can use their disproportionately large hind legs to create a powerful, extremely rapid jump accompanied by acrobatic twists and kicks that allow them to avoid envenomation. We used high speed cameras to record 32 predatory strikes from free-ranging sidewinder rattlesnakes (*Crotalus cerastes*) attempting to envenomate desert kangaroo rats (*Dipodomys deserti*). We quantified the speed, acceleration, timing, and trajectory of movements of both rattlesnakes and kangaroo rats, along with a series of environmental variables, to determine how ecological factors and physical performance interact to determine the outcome of high-speed predatory attacks by rattlesnakes striking from ambush.

0399 Lightning Talks II, Friday 14 July 2017

Natalie Claunch, Christina Romagosa

University of Florida, Gainesville, Florida, USA

Do reptilian invaders shed armor to conquer new lands?

A suit of armor protects against unseen attacks, but weighs heavy. A shield is carried to protect against specific, anticipated attacks, and is more versatile. The immune system can be roughly seen as both armor and shield against pathogens, and just as warriors vary in their selection of armor and shields, vertebrates vary in immune investment. When a species is displaced into a new environment, it will encounter many new pathogens (including parasites), however, the innate immune armor may be too heavy to advance in battle; species may mount inappropriate inflammatory responses to innocuous substances at a cost to reproduction and dispersal. For invasive vertebrates, it may be beneficial to shed much of the inflammatory armor against non-specific pathogens to invest in reproduction, yet still carry an acquired immunity shield to deflect known pathogens from previous exposures. While suppressing inflammation leaves an invader vulnerable to sustained parasite and pathogen infection, it may award the invader with the ability to reproduce before succumbing to infection. Patterns of inflammation-suppression have been observed among nonnative species at the invading range-edge(s), but comparisons to their populations in the native range are lacking. Additionally, glucocorticoid hormones, known immunosuppressants, may mediate

invasive phenotypes. This project aims to assess inflammatory responses and glucocorticoid hormone patterns across 20 nonnative reptile species in their nonnative and native range(s) to understand whether native-range plasticity can predict potential invasive phenotypes. To amass range-pair comparisons, I aim to collaborate with researchers working in the native range of focal species.

0768 General Herpetology, Sunday 16 July 2017

Jarad Cochran[1], Naya Eady[1], David Haskins[1], Melissa Pilgrim[2], Tracey Tuberville[1]

[1]Savannah River Ecology Lab, University of Georgia, Athens, Georgia, USA, [2]University of South Carolina Upstate, Spartanburg, South Carolina, USA

Influence of Coal Combustion Residues on Metabolic Rates and Immune Responses in Eastern Mud Turtles (*Kinosternon subrubrum*)

Coal combustion is a major energy source in the US. Coal combustion residues (CCRs), the waste product of coal combustion, contains potentially toxic trace elements that can negatively impact animal physiology (e.g., lower immune responses, and/or alter metabolic rates). Before 1980, the US primarily disposed of CCRs in aquatic settling basins known as constructed wetlands. Many animals use constructed wetlands as habitat and can be exposed to CCRs, potentially affecting their physiology. To investigate the effects of CCRs on Eastern Mud Turtles (*Kinosternon subrubrum*), we sampled 30 turtles exposed to CCRs and 17 unexposed turtles captured in 2015-2016 from the Savannah River Site (Aiken, SC, US). For captured turtles, we (1) quantified accumulation of CCRs in claw and blood samples (2) evaluated CCRs effects on metabolic rates via flow through respirometry, (3) used bacterial killing assays to assess influences of CCRs on immune responses, and (4) compared differences in hemogregarine parasite loads. Claw arsenic, selenium, and strontium levels were significantly higher in turtles from contaminated sites. Blood selenium and strontium levels were significantly higher in turtles from contaminated sites. CCR-exposed turtles had significantly lower metabolic rates than reference turtles at 35 oC. Average bacterial killing efficiency for both groups was greater than 98%. Average parasite loads did not significantly differ between CCR-exposed and reference turtles (0.03461 ± 0.02 and 0.06153 ± 0.03, respectively). Our results show that turtles accumulate CCRs from the environment, and accumulation of CCRs is associated with changes in turtle physiological functions when additional stressors are present.

0485 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Adam Cohen[1], Dean Hendrickson[1], Tomislav Urban[2], David Walling[2], John Gentle[2], Gary Garrett[1], Melissa Casarez[1], F. Douglas Martin[1]

[1]*University of Texas, Integrative Biology, Austin, Texas, USA,* [2]*University of Texas, Texas Advanced Computing Center, Austin, Texas, USA*

Update on the Fishes of Texas Project

The Fishes of Texas project (www.fishesoftexas.org), originating in 2006, remains the most reliable (quality controlled) and data rich site for acquiring occurrence data for Texas fishes, holding over 124,000 records from 42 institutions. Among many discoveries, the project is responsible for detecting at least 3 freshwater species not previously known from Texas. We continue making improvements, but substantial updates so far have been onerous for our developers for various reasons. A recent major update reduces coding redundancies, points the website to a new massively restructured and more fully normalized PostgreSQL database (was MySQL), and places the code in a versioning environment. These changes have little immediate effect on user experience, but will greatly accelerate development. PostgreSQL allows for complex spatial queries and users will be able to quickly map occurrence data alongside many more political/environmental layers than currently possible. While our database/web designers have been implementing these changes and fixing bugs etc., we've been preparing resources for them to integrate into the website. Some highlights to expect: (1) new updates to the state Species of Greatest Concern list; (2) expert opinion-determined nativity spatial layers for all freshwater fishes displaying in our new mapping system; (3) dynamic statistical summaries; (4) new data types from the literature (>14500 records), citizen science (>4500), anglers (>32000), and agency databases (>800000); (5) new museum records, many derived from our gap sampling (17000, 4 museums); (6) more specimen examinations (>400) and photographs (1000); (7) document archive with smart text search tools (currently in beta testing using TPWD fisheries reports). So be patient and keep your eyes open for updates.

0302 Herp Reproduction & Life History I, Thursday 13 July 2017

Kristina Cohen, Karen Warkentin

Boston University, Boston, MA, USA

Different Hatching Mechanisms but Similar Escape-hatching Processes in Two Neotropical Treefrogs

Environmentally cued hatching (ECH) is widespread in anurans. Across lineages that vary in reproductive mode, embryos adaptively alter hatching timing in response to threats and opportunities. Yet we know little about how frogs hatch and less about hatching regulation. Most frogs have hatching gland cells (HGCs) that gradually secrete a hatching enzyme that digests the vitelline membrane. We compared the hatching mechanisms of two Neotropical treefrogs with terrestrial eggs that both hatch early to escape threats. *Agalychnis callidryas* hatch rapidly to escape snakes, and have a derived hatching mechanism with 2 types of HGCs that retain enzyme and release it acutely. *Dendropsophus ebraccatus* hatch to escape dehydration and ant attacks, but their eggs expand gradually, indicating prolonged enzyme release. In addition, *D. ebraccatus*

acutely release enzyme to escape predator attacks. Thus, two anurans with different underlying hatching mechanisms employ the same mechanism of regulation to escape acute threats. Investigating how diverse anurans regulate hatching through convergent or homologous mechanisms will elucidate how ECH has evolved within this diverse group.

0158 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

James Collins

Arizona State University, Tempe, AZ, USA

Amphibians in the 21st Century: The Challenge of Integrating Discovery and Loss, Conservation and Husbandry

Several paradoxes characterize modern amphibian biology. At a time when new species continue to be discovered, populations and species are going extinct as a result of land use change, infectious disease, invasive alien species, and certainly in the near future climate change. Understanding these causes and perhaps mitigating the losses will require research, which of course entails discovery even in a time of extinction. One solution to the anticipated loss of species, a solution provoked especially by emergence of infectious diseases, is moving amphibians from native habitats into conservation facilities. But this husbandry solution, at least for the foreseeable future, means species must remain in captivity unless there are major discoveries that alter this fate. There are arguments that revolutionary breakthroughs in gene editing and its application in a technology such as gene drives offer a powerful tool for sustaining biodiversity. These advances, however, raise complex questions about what counts as natural, and what are acceptable ways for applying new technologies to alter populations and communities to sustain species. I will discuss integrating the four themes of discovery, loss, conservation, and husbandry as an ongoing challenge confronting 21st century students of amphibian biology. Accepting this challenge is one way to envision adapting to the rapid pace of global change. It is a way that offers hope for conserving species, but it is a route that will require hard decisions relative to how intrusive we are willing to be in shaping Earth's biodiversity.

0292 LFC Multi-Stressor Effects, Friday 14 July 2017

Louise Cominassi[1], Marta Moyano[1], Guy Claireaux[2], Patrcik Quazuguel[3], Sarah Howald[4], Felix Christopher Mark[4], José-luis Zambonino[3], Myron Peck[1]

[1]Hamburg University (IHF), Hamburg, Germany, [2]UBO, Brest, France, [3]IFREMER, Brest, France, [4]AWI, Bremahaven, Germany

Combined Effects of Ocean Acidification and Warming on the Swimming Capacity of European Sea Bass Larvae

Swimming ability is a key determinate of Darwinian fitness in fish as it influences a number of fundamental performance traits including the ability to acquire food and to avoid predators. Reductions in swimming ability, therefore, may have important population-level consequences. As an integrated measure of the functioning of a variety of interlinked physiological systems, swimming ability is also considered to be a good indicator of fish health. We examined the effects of ocean acidification and warming (OAW) on growth, development (*e.g.*, morphology, ossification) and critical swimming speed (*Ucrit*) of European sea bass (*Dicentrarchus labrax*) larvae. From an age of 2 days post hatch (dph) onward, larvae were exposed to a combination of three CO_2 levels (400, 800, 1200 µatm; pH 8.1, 7.8, 7.6) and two temperatures (15, 20°C). Larval stage duration was 35% longer at 15°C (60 days) compared to 20°C (45 days). Thermal effects on growth and development were stronger than those of CO_2 levels, although the rate of ossification increased with increasing pCO_2. Swimming ability increased rapidly with larval size, but inter-individual variability was large. For larvae reared at 20°C, *Ucrit* reached a plateau around 13 mm in standard length, resulting in lower *Ucrit* at metamorphosis (3.5 cm s^{-1}) compared to 15°C-reared larvae (6.3 cm s^{-1}). Overall, our data suggest that swimming ability during larval development in European seabass is impacted more by exposure to warm temperature and less by exposure to high CO_2 levels.

0877 Texas and Mexican Blindcats/Desert Fishes, Saturday 15 July 2017

Kevin W. Conway[1], Megan Osborne[2], Megan Bean[3], David Portnoy[4]

[1]Texas A&M University, College Station, TX, USA, [2]University of New Mexico, Albuquerque, NM, USA, [3]Texas Parks & Wildlife Dept., TX, USA, [4]Texas A&M University Corpus Christi, Corpus Christi, TX, USA

The plight of the Rio Grande Shiner, *Notropis jemezanus*, in the lower Rio Grande along the Texas/Mexico border

The Rio Grande Shiner (*Notropis jemezanus*) is endemic to the Rio Grande drainage of the southwestern United States and Mexico. It has been extirpated from the main stem of the Rio Grande in New Mexico and exhibits a fragmented range in the upper Pecos River in New Mexico and the main stem of the Rio Grande along the Texas/Mexico border. We provide an overview of US museum holdings for *N. jemezanus* and report on recent sampling efforts for this species along the main stem Rio Grande from the Big Bend region downstream to Laredo. Examination of museum voucher specimens indicates that records of *N. jemezanus* from the lower Pecos River and Devils River in Texas are based on mis-identifications of *Notropis megalops*. Recent field efforts by our group throughout the Rio Grande along the TX/Mexico border have produced only four individuals of *N. jemezanus*. The Rio Grande Shiner is now extremely rare and we

predict that the future of this species will be bleak without immediate conservation intervention.

0830 ASIH STOYE ECOLOGY & ETHOLOGY IV, Friday 14 July 2017

Christina Coppenrath, Jacob Lasala, Matia Gingras, Noi Meersohn, John Baldwin

Florida Atlantic University, Davie, FL, USA

Identifying Important Foraging Grounds for Florida's Nesting Leatherback Turtles (*Dermochelys coriacea*)

The migratory behavior of North Atlantic leatherback turtles (*Dermochelys coriacea*) has been documented in the Wider Caribbean, but the migratory movements of leatherbacks nesting in South Florida are relatively understudied. Our knowledge of their migrations is currently limited to ten nesting females tracked from the east coast of Florida. Most of them moved north along the Gulf Stream or to the central North Atlantic, while one travelled to the coast of Western Africa. The results of this study bring to light the need for larger sample sizes in order to identify and determine the relative importance of the different foraging areas for the leatherbacks nesting in South Florida. As Florida's nesting population has been experiencing increased nesting numbers (10-11% per year since 1979), it is important to know which geographic areas are providing the energy sources necessary for vitellogenesis, migration, and nesting. Here, we analyzed 훅13C and 훅15N stable isotopes in whole blood and skin samples from leatherbacks nesting in South Florida and compared those data from previous studies in the Atlantic in order to gain insight into their foraging ecology. In addition to the original three foraging grounds, two new ones were identified for the South Florida population using k-means cluster analysis. We also tested whether the observed isotopic signatures were correlated with mtDNA haplotypes to examine the relationship between migratory foraging behavior and ancestral nesting site fidelity. A better understanding of where active nesters are feeding will help identify areas that should be protected in the future.

0504 Amphibian Conservation I, Sunday 16 July 2017

Sarah Corey-Rivas

New Mexico Highlands University, Las Vegas, NM, USA

Population-Level Variation in Southern Rocky Mountain Boreal Toad Susceptibility to *Batrachochytrium dendrobatidis*

Response to emerging disease can be difficult to predict from host population to population even within the same species. In the last few decades, the global panzootic lineage of the fungal pathogen, *Batrachochytrium dendrobatidis* (*Bd*), has threatened the survival of many amphibian species. Studies of the pathology, immunology and transcriptomics of host susceptibility to *Bd* infection demonstrate a remarkable range of

host responses across different species. The boreal toad, *Anaxyrus boreas*, is susceptible to *Bd* infection and many populations have declined after the arrival of *Bd*. However, *Bd*-positive boreal toads persist in some populations within the Southern Rocky Mountain lineage. In this study, I collected eggs from sibling clutches of wild boreal toads from a purportedly *Bd*-tolerant Utah population of boreal toads and eggs from a known *Bd*-susceptible Colorado population. I conducted a *Bd* challenge trial with lab-reared toads using a global panzootic *Bd* isolate originating from boreal toads of Colorado. The purportedly *Bd*-tolerant Utah toads exhibited mild clinical presentation of infection while carrying a range of *Bd* loads. Over the 34 day infection period, trends in *Bd* infection load, body condition, and clinical presentation of infection indicate that population-level genetic differences likely are responsible for variation in *Bd*-tolerance. Management of *Bd*-threatened boreal toad populations may consider underlying genetic variation as a major contributing factor to *Bd* susceptibility, in addition to local ecological factors. Strategies to increase immunogenetic diversity and gene flow will provide significant conservation payoffs especially for geographically isolated populations.

0849 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Erin Cork, John Maerz, Jeffrey Hepinstall-Cymerman

Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia, USA

Investigating Habitat Associations of the Gopher Frog, *Lithobates capito*, in South Georgia

The gopher frog, a species of concern in Georgia, has suffered population declines corresponding with the loss and alteration of southeastern longleaf pine ecosystems. Identifying habitat associations and remaining suitable habitat for the gopher frog are essential first steps for implementing effective conservation management to sustain the species. This study will investigate gopher frog site occupancy throughout the Alapaha River Wildlife Management Area (ARWMA) using automated recording devices, dipnetting surveys, and egg mass surveys. We predict wetland characteristics such as hydroperiod, canopy cover, presence of fish, and proximity to other wetlands will be significant variables for predicting site occupancy by gopher frogs. Our objectives are 1) to identify site- and landscape-level habitat characteristics of known localities harboring viable gopher frog populations throughout Georgia; 2) to assess site and landscape characteristics of occupied sites within ARWMA; 3) to create wetland inventories for amphibian species at ARWMA; 4) to develop a habitat suitability model for gopher frogs that identifies networks of suitable wetlands and terrestrial habitat throughout ARWMA; and 5) to develop a management plan for the Georgia Department of Natural Resources with the objective to improve breeding wetlands and upland habitats likely to be used by gopher frogs and to increase connectivity between these habitats. By evaluating habitat characteristics of localities where gopher frogs are detected, we can develop a more localized habitat modeling approach that can direct agencies towards

focusing resources (prescribed burns, thinning, planting, surveying) on areas most likely to promote persistence of gopher frog populations within managed landscapes.

0336 HL GRADUATE RESEARCH AWARD, Friday 14 July 2017

Decio Correa, Mathew Leibold

The University of Texas, Austin, TX, USA

Unraveling the Role of Evolutionary History on Skin and Gut Microbial Communities of Anuran Amphibians

Host-associated bacterial communities (microbiomes) are thought to provide numerous benefits to their host. Amphibians have symbiotic skin microbiome that harbors a broad range of bacteria, including some capable of combating the frog-killing fungus *Batrachochytrium dendrobatidis*. Likewise, the amphibian gut microbiome can be very important for nutrient acquisition. We investigated how the evolutionary history relates to the composition of the skin and gut microbiome of anuran amphibians. We hypothesized that 1) the similarity of the skin microbiomes across anurans correlated with their phylogenetic relatedness since the chemical composition of anuran skin can be evolutionarily conserved and it might thus affect the microbiome; and that 2) similarity in anuran gut microbiomes would not be correlated with phylogenetic relatedness because of the generalist diet of most species. We sampled 27 anuran species from six families and found that, as hypothesized, the evolutionary relationship between anurans explained more than 80% of the variation of their skin microbiome but less than 15% the variation in gut microbiomes Evolutionarily conserved microbiomes have been observed in other animals, but it is often likely due to the vertical or horizontal transmission of the microbiome, an unlikely case in anurans. Our results provide another mechanism for the conserved pattern: environmental filtering by some attribute + phylogenetic conservation of that attribute. These results can help the planning of current conservation and management strategies aiming at manipulating amphibian skin microbiome to prevent or eliminate diseases that are driving amphibians extinct worldwide.

0344 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Decio Correa[1], Denise Rossa-Feres[2], Ricardo Sawaya[3]

[1]The University of Texas, Austin, TX, USA, [2]Universidade Estadual Paulista, São José do Rio Preto, SP, Brazil, [3]Universidade Federal de São Paulo, Diadema, SP, Brazil

Metacommunity Structure of Tadpoles and Adult Anurans: Integrating Traits, Space, Environment, and Evolutionary History

Larval and adult stages of complex life cycle organisms usually live in different environments, being subject to distinct environmental and evolutionary agents. Therefore, to fully comprehend the community assembly of those organisms it is critical to evaluate both life stages together. We sampled a metacommunity of tadpoles and adult anurans in Southeast Brazil to investigate how characteristics of water bodies affect the phenotypic and phylogenetic diversity of anurans. Additionally, we evaluated evidence for environmental filtering acting on community assembly based on association among phenotypic traits, phylogeny, space, and environmental variables. Water body characteristics related to calling site acted as environmental filters for adult anurans. However, there was no evidence for filtering influencing the tadpole communities, even though they were associated with ponds that favor their development, such as temporary ponds with open canopy cover. The adult traits considered were phylogenetically conserved, with most diversity concentrated in a few nodes on the phylogeny. On the other hand, phenotypic diversity of tadpoles was widespread throughout the phylogeny. Since adults are affected by environmental filters, i.e., phenotypically similar anurans occur in similar environments, and tadpoles do not, we hypothesize that the higher phenotypic diversity of tadpoles, when compared to the adults, could be related to resource exploration in environments with unpredictable interactions. Moreover, the community assembly of anurans is likely determined by an interplay between environmental filters for adults and water bodies favorable to tadpole development and survival.

0825 ASIH STOYE GENERAL ICHTHYOLOGY III, Friday 14 July 2017

Joel Corush, Evin Carter, Benjamin Fitzpatrick

University of Tennessee, Knoxville, TN, USA

Effects of Diadromous Life Histories on Genetic Diversity and Population Structure in Fishes

Phylogenetic comparative methods have shown that diadromous fishes, or those with an obligate scheduled movement between marine and freshwater, have a high rate of diversification compared to completely marine and freshwater taxa. A high propensity for speciation leads to the prediction that diadromous species will often have disjunct populations with restricted gene flow and a strong pattern of isolation by distance. We reviewed the literature to find datasets with which to test this prediction. We compared genetic diversity (allelic richness and heterozygosity) between species as well as genetic distance vs. geographic distance between populations within each species for species representing marine, freshwater, and all forms of diadromy (anadromous, catadromous and amphidromous). Our results indicate that not all forms of diadromy follow the same patterns of population subdivision. Amphidromous species tend to be more similar to freshwater taxa, which have high levels of isolation by distance. Anadromous and catadromous taxa which closely resemble marine taxa, have a smaller increase in genetic difference with increased geographic distance. These results illustrate how

variation in life history might increase or decrease diversification via effects on geographic structuring of populations.

0858 AES Life History, Sunday 16 July 2017

Charles F. Cotton[1], R. Dean Grubbs[1], Bryan Keller[1], Austin Heil[1], Alyssa Mathers[2], Shannon Rolfe[3]

[1]Florida State University Coastal and Marine Lab, St. Teresa, FL, USA, [2]NOAA Fisheries Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL, USA, [3]3University of Central Florida, Orlando, FL, USA

Comparing life histories of sympatric deep-water dogfishes (*Squalus cubensis* and *S. cf. mitsukurii*) from the northern Gulf of Mexico

Over half of all extant shark species reside in the deep ocean (> 200 m), yet very little information exists on the life histories of these species. In conjunction with a project to examine the ecological effects of the 2010 Deepwater Horizon oil spill, dogfishes were collected near Desoto Canyon in the northern Gulf of Mexico using demersal longlines in depths ranging from approximately 200-600m. Samples and data from 243 Cuban dogfish (*Squalus cubensis*, SCUB) and 323 undescribed dogfish (*S.* cf. *mitsukurii*, SMIT) were collected to describe the reproductive biology and mode of embryonic development, and determine growth model parameters for these species. Maximum lengths (SCUB male (M) = 46 cm TL, female (F) = 58 cm TL; SMIT M = 65 cm TL, F = 82 cm TL) and length-based maturity ogives ($TL_{50\%\ maturity}$) varied considerably between these species (SCUB M = 38.7 cm, F = 48.1 cm; SMIT M = 54.4 cm, F = 66.2 cm). Both species were found to have concurrent ovarian cycles and seasonal measurements of embryonic size distributions suggest annual, synchronous mating for SCUB and aseasonal mating for SMIT. Fecundity ranged from 1-4 pups (mean = 2.5) for SCUB and 5-10 pups (mean = 7.1) for SMIT. Age was determined by counting growth bands deposited on the enamel caps of both dorsal finspines. Growth model parameters were estimated using multiple length-at-age models, with results suggesting relatively fast growth and less "conservative" life histories compared with other deep-water elasmobranchs.

0112 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Erin Crandall, Christopher Rowe

University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory, Solomons, MD, USA

Metabolic Response of Larval *Lithobates sphenocephalus* and *Hyla chrysoscelis* to Increased Temperatures

Metabolic rate (MR) increases with temperature in ectotherms within an organism's critical thermal range. With global temperatures rising, it is important to evaluate whether the thermal metabolic responses (TMR) of individuals could lead to effects on higher levels of organization. My research focuses on larval amphibians because the biotic and abiotic conditions larvae experience in breeding pools can influence recruitment and have population-level effects. Temporary breeding pools are often resource-limited, leading to severe inter- and intra-specific competition. Increased temperatures (and thus MR) will elevate per capita resource requirements, potentially exacerbating the competitive interactions. Furthermore, if the TMR is species-specific, the unique effect of temperature on MR of each species could alter the competitive hierarchy. In southern Maryland, Cope's Grey Tree frogs ("GTF"- *Hyla chrysoscelis*) and Southern Leopard Frogs ("SLF"- *Lithobates sphenocephalus*) are often sympatric in breeding sites where they compete for limited resources. My research evaluates the species-specific TMR of larvae of these species during acute exposure to a range in temperatures. I am also investigating whether chronic acclimation to elevated temperatures alters the acute TMR. The acute TMR differed between the species such that the Q10 (relative change in MR over a 10 C interval) was significantly higher for SLF than for GTF. Thus as temperature increases, resource requirements increase more for SLF than for GTF, potentially affecting the competitive interaction. The chronic acclimation study is underway; I expect that acclimation will shift the TMR somewhat, but that the pattern of thermal sensitivity will follow the acute exposure.

0070 Reptile Conservation, Sunday 16 July 2017

Brian Crawford[1], Clint Moore[3], John Maerz[2], D. Todd Jones-Farrand[4], Mike Harris[5]

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Range-wide Status Modeling to Accelerate Conservation of At-Risk Species in the Longleaf System

The U.S. Fish & Wildlife Service is commissioned with reviewing the status of more than 300 wildlife species in the Southeast for potential listing under the Endangered Species Act. The longleaf pine (*Pinus palustris*) ecological system supports many priority at-risk species designated for review, including five species of herpetofauna: the gopher tortoise (*Gopherus polyphemus*), gopher frog (*Lithobates capito*), striped newt (*Notophthalmus perstriatus*), southern hognose snake (*Heterodon simus*), and Florida pine snake (*Pituophis melanoleucus mugitus*). With federal, state, and other partners, we are assessing the statuses of these five at-risk species to inform where and how to invest in

conservation resources. This work addresses three objectives: 1) synthesize species data and expert knowledge from previous research, monitoring, and management efforts, 2) develop comprehensive, range-wide models of current species distribution and persistence, and 3) predict distribution and persistence in the next 100 years under scenarios incorporating potential threats and management activities. We discuss the challenges and provisional results associated with developing Bayesian species distribution and persistence models, incorporating expert opinion to mitigate data limitations and reduce uncertainty, and facilitating partner buy-in across federal, state, academic, and non-academic partners. Research products will identify priority areas based on species metrics, enable regional partners to implement effective conservation strategies, and inform listing decisions of the U.S. Fish & Wildlife Service.

0554 AES GRUBER AWARD IV, Friday 14 July 2017

Dan Crear[1], Rich Brill[2], Peter Bushnell[3], Kevin Weng[1]

[1]Virginia Institute of Marine Science, Gloucester Point, VA, USA, [2]National Marine Fisheries Service, NOAA, Gloucester Point, VA, USA, [3]Indiana University South Bend, South Bend, IN, USA

The Impact of Climate Change on the Physiology of Sandbar Sharks, *Carcharhinus plumbeus*

As a result of climate change, warm hypoxic waters have become more prevalent in coastal estuaries, where many species refuge from predation during growth and development. Newborn and juvenile life stages of sandbar sharks, *Carcharhinus plumbeus*, use these inshore habitats as nurseries during the summer. As the conditions of these habitats warm and become more hypoxic, it is unclear if sandbar shark distribution will shift as a result. To predict these shifts, it is important to understand the environmental thresholds of sandbar shark. Conditions that cause a lower aerobic scope (difference between maximum and minimum metabolic rates) and higher critical oxygen saturation (S_{crit}, O2 saturation in which minimum metabolic rate can no longer be sustained) suggest that the habitat quality is degraded. Therefore, the objectives of this study are to determine the aerobic scope and S_{crit} of sandbar sharks under future ocean conditions. The aerobic scope and S_{crit} were measured at multiple temperatures of individuals caught in an estuary along the eastern shore of Virginia. To date, the mean aerobic scope values at 24, 28, and 32°C for five sharks were 84 ± 6, 110 ± 25, and 119 ± 27 mg O2 kg-1 h-1, respectively. At the same three temperatures, mean S_{crit} was 60±3, 60±9, 67±7% O2 saturation, respectively. Despite the high variability in the preliminary data, it appears that aerobic scope still increases up to 32°C, but that at this warm temperature, sandbar sharks are less tolerant to hypoxic waters compared to a bottom-dwelling clearnose skates.

0598 AES Morphology, Sunday 16 July 2017

Stephanie Crofts, Brooke Flammang

New Jersey Institute of Technology, Newark, NJ, USA

Flexibility and Morphology of Shark Tails

An increase in stiffness coupled with the evolution of a lunate tail morphology are associated with increased swimming efficiency in actinopterygian fishes, sharks, and even extinct marine reptiles. In bony fishes, the lunate tail is symmetrical and formed by strong, rigid fin rays. In sharks, the lunate tail is slightly asymmetrical: the vertebral column runs through the dorsal lobe and the ventral lobe is formed by connective tissue and ceratotrichia. Extinct marine reptiles, ichthyosaurs, mosasaurs, and thalattosuchian crocodylomorphs, had inverted but similar tails. Sharks can actively stiffen their tails during swimming, but species with lunate tails have stiffer tails than those with more asymmetric tails. Our goal for this study is to understand how skeletal and soft tissues affect tail stiffness in both lobes, and how this varies between species. To do this we measured passive flexibility of 12 shark species, then dissected select representative archetypes from functional groups to compare morphology and estimate flexural stiffness. We found that tail flexibility varies between species, as do skeletal and soft tissue morphologies. Moreover we found that dorsal lobes are more passively flexible than the unsupported ventral lobes.

0786 Fish Reproduction & Development, Saturday 15 July 2017

Karen Crow

San Francisco State University, San Francisco, CA, USA

There may be more to the Hox Code than you thought. The "Distal Phase" HoxA/D expression pattern is an ancient module that is deployed in a variety of novel features in fishes.

Fins and limbs are homologous structures patterned by a shared genetic repertoire of HoxA/D expression, or "the Hox limb building toolkit". A unique inversion of the HoxD expression pattern is associated with the most well characterized example of a novel fin/limb modification to date-the tetrapod autopod, where an inverted collinear HoxD expression pattern specifies digit identity and the origin of the thumb. This pattern also occurs in paddlefish pectoral fins and catshark paired fins, indicating that it arose in the common ancestor of jawed vertebrates. This pattern is called 'distal phase' (DP) expression because it occurs in distal structures and is regulated independently. We argue that it may be deployed in a modular fashion, suggesting a greater role in the evolution of morphological diversity in vertebrates than previously recognized. We demonstrated the first evidence for HoxD DP expression in a body plan feature beyond fins and limbs- **the paddlefish barbel**, and the first evidence for HoxA DP expression in the developing **hindgut and vent of ray-finned fishes**, suggesting that the limb-building program may have an expanded repertoire. Interestingly, HoxA DP expression is predicted by similar conformational properties between the HoxA/D cis-regulatory

landscapes in zebrafish and mice, but has not been reported in vertebrate paired appendages. However, we found evidence suggesting that HoxA DP expression occurs in **claspers** of male cartilaginous fishes. Taken together, these data support the modularity of DP Hox expression pattern, and a greater role for the Hox code in evolution of novel body plan features.

0493 Lightning Talks II, Friday 14 July 2017

Jenna Crowe-Riddell[1], Coleman Sheehy III[2], Harvey Lillywhite[2], Kate Sanders[1]

[1]University of Adelaide, South Australia, Australia, [2]University of Florida, Gainesville, Florida, USA

Understanding the Population Structure in the Widest-Ranging Squamate Reptile

The yellow-bellied sea snake (*Hydrophis platurus*) is the only truly pelagic species that traverses the Indian and Pacific oceans. Despite this extensive distribution, very little is known about the interconnectivity between populations. Using a custom gene capture array we will sequence *H. platurus* tissues from museum and field collections in order to 1) resolve the population structure at a global scale, across oceans connecting Central America, Australia, Asia and Africa, and 2) reconstruct past demographic changes at a finer scale in two apparently separated populations of *H. platurus* in Costa Rica. To achieve these ambitious aims we are engaging collaborations with museum curators and field biologists who might contribute tissues.

0400 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Hayley Crowell, Emily Taylor

California Polytechnic State University, San Luis Obispo, CA, USA

Comparative Thermal Ecology of Coastal and Inland Populations of Southern Pacific Rattlesnakes (*Crotalus helleri*)

Understanding the effects of changing temperature regimes on a species is crucial if land managers and researchers are to make informed decisions about how to mitigate the predicted loss of diversity as a result of anthropogenic climate change. Field active body temperature data can be used to estimate metabolic rates using equations established in laboratory studies. The goal of this analysis is to use historical body temperature data from four distinct populations of *Crotalus helleri* from central California (two inland and two coastal) to compare body temperatures, estimated metabolic rates and annual energy budgets across varying habitat types. Snake body temperature data were collected via internal implantation of Thermochron iButton temperature loggers from 2006 to 2016. Snakes at inland sites experience higher body temperatures and therefore

greater energy expenditure than coastal populations. Operative temperature models will be used in combination with predicted increases in ambient temperature to extrapolate probable changes in body temperatures, activity times, and energy budgets at each site by 2100.

0001 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Martha Crump

Utah State University, Logan, UT, USA

Life Histories and Conservation of Anurans in the New World Tropics

The New World Tropics are home to well over 2000 species of anurans. The area has experienced widespread anuran population declines, caused primarily by the chytrid fungus *Batrachochytrium dendrobatidis* and habitat destruction, modification, and fragmentation. Fewer long-term field studies have been carried out on New World tropical anurans as compared to their temperate counterparts; for this reason we know much less about their population sizes and dynamics. Many anurans in the New World Tropics are terrestrial or arboreal and have specialized modes of reproduction that allow for independence of aquatic environments. Many other life history aspects, such as clutch size, number of clutches/year, and length of breeding season, differ between the faunas of the two regions. Most sampling techniques for surveying anuran populations have been developed in North America or Europe, where most species congregate at aquatic breeding sites and have a complex life cycle. We need to develop appropriate field survey methods for carrying out long-term population studies of species with terrestrial and other specialized modes of reproduction. Life histories must be considered in shaping conservation priorities of anurans in the tropics.

0053 Amphibian Biology, Ecology, & Conservation, Sunday 16 July 2017

Paul Crump, Jeff Houlahan

University of New Brunswick-Saint John, Saint John, New Brunswick, Canada

Using Out-of-Sample Predictions to Evaluate Performance of Automated Acoustic-Abundance Models

Statistical models created using hard-won ecological data on reptiles and amphibians are often insufficiently validated. Many projects treat the reporting of p-values or AIC scores as the final step in the process of model validation, but because of 1) sampling error, 2) measurement error, and 3) spatial and temporal variation in the process of interest, it is generally unknown how robust these inferences are. To investigate this, we assessed the transferability in time and space of acoustic-abundance models. We

developed an automated call recognizer from recordings of the wood frog (*Lithobates sylvaticus*) in New Brunswick, Canada using the bioacoustics software Song Scope. We used the recognizer to examine the relationship between wood frog egg mass abundance and acoustic activity at 43 sites in New Brunswick and 7 sites in eastern North America in 2015 and 2016. The models were parameterized using data from New Brunswick in 2015 or 2016 and used to make predictions in the other year in New Brunswick or the other sites in eastern North America. We used the root-mean-squared-error to assess model performance and found no agreement between what AIC determined was the best model and the model that gave the most accurate predictions to new data. This indicates the model selection approach could not identify the best predictive model and that without making predictions to new data not used to build the model, it was impossible to assess our understanding of the process.

0016 Herp Biogeography & Phylogeography II, Sunday 16 July 2017

Daniel Cueva, Jesus Rivas, Sarah Corey-Rivas

New Mexico Highlands University, Las Vegas, NM, USA

Assessing the Species Status & Distribution of *Eunectes beniensis* Utilizing a Molecular Comparative Approach

Eunectes beniensis (Dirksen, 2002) is a poorly studied and recently described anaconda species native to the Beni province, Bolivia. Originally thought to be a hybrid between *E. murinus* and *E. notaeus* due to range overlap between the species in the Beni province, Dirksen & Bohme (2005) disputed this notion and described it as a new species of anaconda utilizing solely morphological characteristics and scale counts from five individuals (four males and one female). Due to difficulty in acquiring samples and exporting tissue from South America, no one has validated this assumption using molecular techniques. I propose to sequence several nuclear and mitochondrial markers, and compare sequences of *E. murinus*, *E. notaeus*, & *E. beniensis* in order to create a phylogenetic analysis of the *Eunectes* genus and reevaluate *E. beniensis* species status. Phylogenetic analysis will be conducted using a maximum likelihood analysis in order to determine the relationship amongst species within the *Eunectes* group. We hypothesize that E. *beniensis* represents a population of anacondas residing within a hybridization zone, and does not merit valid species designation.

0327 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Joshua Cullen[1], Christopher Marshall[2]

[1]Texas A&M University, College Station, TX, USA, [2]Texas A&M University at Galveston, Galveston, TX, USA

Morphological Changes in Shark Teeth May Facilitate Ontogenetic Dietary Shifts

Form and function of the feeding apparatus are typically closely integrated since certain arrangements of the jaws, adducting musculature, and dentition are often closely tied to feeding behavior and dietary preferences. While jaw-closing biomechanics have been highly studied in a variety of fishes (including elasmobranchs), less work has been conducted on dentition. Sharks are known to undergo dietary shifts over their ontogeny, with some species exhibiting significant positive allometry of the feeding apparatus. It is currently unclear, however, whether there are any concurrent changes in tooth morphology of sharks. This study evaluated changes in tooth morphology at six locations along the jaw margin (anterior, middle, and posterior locations of upper and lower jaws) over the full ontogeny of bull (*Carcharhinus lecuas*), blacktip (*Carcharhinus limbatus*), and bonnethead sharks (*Sphyrna tiburo*). Elliptical Fourier analysis was used to capture the outline of each tooth while maintaining a 99.9% likeness to the original outline. Outlines were then evaluated by principal components analysis (PCA) for each species at each of the six tooth locations. PC scores for each tooth location of each species were used in a multivariate analysis of variance (MANOVA) to investigate changes in tooth morphology over ontogeny. From this analysis, it appears that changes in morphology occur in all three species at multiple locations along the jaw margin. Locations of significant changes in tooth shape occurred at different locations for each species, but exhibited some overlap. Differences in tooth morphology likely facilitate the processing of prey with different material properties.

0212 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Paul Cupp, Jr.

Eastern Kentucky University, Richmond, KY, USA

Polyandry and Polygyny in Green Salamanders, *Aneides aeneus*

Formation of male-female pairs leading to courtship and mating in *Aneides aeneus* may occur during spring and/or fall. Pairs occur in specific rock crevices or sometimes in adjacent crevices for periods of days or weeks. Pairing increases chances of courtship and mating, and allows for mate guarding thus reducing chances for polyandry and polygyny. But, not all *A. aeneus* pair for an extended time. Spontaneous pairing and mating may occur in rock crevices or on the surface. I released a gravid female into a rock crevice with a resident male, and mating ensued and was completed with spermatophore deposition and pickup within two hrs. Also, six instances of courtship and mating using unfamiliar males and gravid females were recorded on videos in the lab, and completed within 1-4 hrs. In addition, in five instances, single males were observed close to 2-3 breeding crevices, each containing a female with eggs, indicating that these males mated with multiple females. Females with eggs tend to aggressively reject unfamiliar or nonpaternal males from nest sites. Further, one specific male was monitored and located in the same position near 2-3 nest sites over seven years indicating that he is the paternal male. These observations indicate that some males may mate with more than one female and females more than one male during a breeding season. These behaviors are adaptive in that males may produce more young in a

breeding season, while females that mate with unfamiliar males will produce young with greater genetic variation.

0488 Lightning Talks II, Friday 14 July 2017

Tobey Curtis[1], Matthew Ajemian[2], Christopher Fischer[3], Michael McCallister[2], Gregory Metzger[4], Jessica Quinlan[5], Leann Winn[6]

[1]National Marine Fisheries Service, Gloucester, MA, USA, [2]Florida Atlantic University's Harbor Branch Oceanographic Institute, Fort Pierce, FL, USA, [3]OCEARCH, Park City, UT, USA, [4]Southampton High School, Southampton, NY, USA, [5]South Fork Natural History Museum, Bridgehampton, NY, USA, [6]New Jersey Institute of Technology, Newark, NJ, USA

First Observations of the Movements of Young-of-the-Year White Sharks (*Carcharodon carcharias*) in the Northwest Atlantic Ocean

In recent years, white sharks (*Carcharodon carcharias*) have become more accessible to researchers off the northeastern U.S. as coastal feeding aggregation sites have re-emerged and the overall population has increased. However, there has been very limited research focused on young-of-the-year (YOY) sharks relative to older age classes. Previous research indicated that the New York Bight is a region that has historically supported comparatively high concentrations of YOY and juvenile white sharks. In August 2015 and 2016, we deployed satellite tags on 10 YOY white sharks (119-145 cm fork length) caught on hook and line off Long Island, New York. The track data received to date indicate that these sharks remain mostly resident in New York Bight coastal waters through summer, supporting the notion that the region is a nursery area. Southward movements along the coast were observed during the fall, with potential evidence of overwintering habitat off the Outer Banks of North Carolina. These movement patterns are likely influenced by temperature (16-23 °C) and depth (<100 m) preferences, as well as prey (teleost and invertebrate) distribution and availability. YOY white sharks in this heavily-populated region are susceptible to anthropogenic impacts from recreational and commercial fishing, energy development, and coastal habitat degradation. As juvenile survival rates are important for long-term sustainability, further research is necessary to better quantify the potential impacts of these activities on the northwest Atlantic white shark population.

0396 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Paul D'Ortona, Grace Kocubinski, Rebecca Daub, Scott McRobert

Saint Joseph's University, Philadelphia, Pennsylvania, USA

The Effect of Gender on Shoaling Behavior in Guppies (*Poecilia reticulata*)

Shoaling behavior is thought to provide numerous benefits to individual fish, including reduction in the risk of predation (by blending into a group of phenotypically similar individuals), and increasing the opportunity to find mating partners. However, in highly dimorphic fish, like guppies, a trade-off exists with respect to shoaling. Males, with brightly colored tails, might be expected to shoal with other males to gain predation-related benefits, but may be expected to shoal with females to find mates. And the reverse situation is true for females. We examined the effect of gender on the shoaling behavior of captive adult male and female guppies by observing time spent swimming near same-sex and opposite-sex shoals, in dichotomous choice tanks. In the first set of tests, males spent significantly more time swimming near a shoal of males, or a shoal of females, vs. an empty chamber. However, when given a choice between same-sex and opposite-sex shoals, males showed no preference. This may indicate a balance between the predation-risk, and mating benefits of shoaling. We will also present tests (in progress) on the female choices.

0793 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Kristen A. Dahl[1], William F. Patterson, III[1], David S. Portnoy[2], J. Derek Hogan[2], Alison Robertson[3], Alice Ortmann[4]

[1]University of Florida, Gainesville, FL, USA, [2]Texas A&M University-Corpus Christi, Corpus Christi, TX, USA, [3]University of South Alabama, Dauphin Island, AL, USA, [4]Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada

DNA Barcoding and Microsatellite Genotyping Confirm Cannibalism in Northern Gulf of Mexico Invasive Lionfish, *Pterois volitans*

Invasive Red Lionfish (*Pterois volitans*) have become well-established within reef ecosystems across the western Atlantic where they pose substantial threats to native fish communities as generalist mesopredators. Species-specific identification of prey, which is necessary to elucidate invasive predator-prey interactions, is challenging with traditional visual identification given prey are often highly digested. In this study, we applied mitochondrial DNA barcoding to identify visually unidentifiable fish prey (n = 696) sampled from lionfish stomachs from the northern Gulf of Mexico. Barcoding nearly doubled the number of identifiable fish prey, leading to the highest prey diversity reported to date for invasive lionfish. Barcoding also identified potential cannibalism on juvenile lionfish, with the highest incidence corresponding to high adult lionfish densities. To test whether these samples constituted cannibalism, we performed genotyping of consumer and prey pairs (n = 80) across four nuclear DNA microsatellite loci. We confirmed 30.2% of prey samples as being cannibalized lionfish. This estimate should be considered conservative given rigorous assignment criteria, low allelic diversity in western Atlantic lionfish populations, and the greater difficulty in amplifying nuclear microsatellites versus mitochondrial barcodes from partially digested prey samples. These results indicate density-dependent cannibalism in invasive

lionfish. Furthermore, our results have important implications for other DNA barcoding diet studies in which potential cannibalism is observed.

0413 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Mindy Dang, Kevin W. Conway

Texas A&M University, College Station, TX, USA

An undescribed species of *Parachiloglanis* (Siluriformes; Sisoridae) from Nepal

The sisorid catfish *Parachiloglanis hodgarti* (Hora, 1923) is found in high altitude rivers and streams across the Himalayan region, including Bhutan, Nepal and India. The distribution of this species is highly fragmented with disjunct populations in central and eastern Nepal (type locality), northern India (Assam, Sikkim, West Bengal) and throughout Bhutan. A recent investigation of Bhutanese material of *P. hodgarti* concluded that multiple undescribed species are confused under the name *P. hodgarti* and it is likely that a similar situation exists in India and Nepal. We investigate material of *P. hodgarti* from eastern Nepal (type locality) and central Nepal to assess whether material from these different areas belongs to the same species. We document differences in standard counts and measurements, features of color pattern, and osteology between individuals of *P. hodgarti* from eastern Nepal (including material from the type locality) and central Nepal. We conclude that material of *P. hodgarti* from central Nepal represents an undescribed species.

0111 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Gonzalo Daudén Bengoa, Laura del Pilar Echeverri García, Sylvia Patricia Adelheid Jiménez Rosenberg, Sharon Zinah Herzka Llona

Centre of Scientific Investigation and Superior Studies of Ensenada (CICESE), Ensenada, Baja California, Mexico

Larval Fish Assemblages of Myctophidae Family Linked to Oceanographic Conditions in the Deepwater Region of the Southern Gulf of Mexico

Understanding the relationship between oceanographic processes and mesopelagic larval fish assemblages populations is challenging due to small larval size, limited development and the complexity of the physical and biological processes involved. Myctophids are one of the mesopelagic fish families with higher biomass and broader world-wide distribution, and they play an important role in the trophic structure of oceanic communities. However, studies focusing on the larval ecology of this family are scarce at a global level. The main goal of this study is to understand the relationship between oceanographic conditions and the larval fish assemblages of the Myctophidae family in the deep-water region (> 1000 m) of the southern Gulf of Mexico (19^{o}N a 25^{o}N).

During August-September 2015, 56 plankton samples were collected with oblique tows in the first 200 meters of the water column with a 333 μm mesh bongo net. On average, 30.75% of the standardized abundance of fish larvae was comprised of myctophids. Furthermore, an increasing larval abundance pattern was observed from the continental shelf boundary toward the deep-water areas. Through multivariate analyses (MANOVA, PCA and Cluster) we will establish the relationship between larval fish assemblages and specific oceanographic conditions, and evaluate whether larval fish assemblages feature a higher degree of similarity in regions with similar oceanographic conditions. Studying myctophid larval assemblages relative to oceanographic conditions will provide us detailed information about spawning areas and biogeographical patterns of pelagic fishes in the southern Gulf of Mexico region.

0340 ASIH Stoye Conservation, Friday 14 July 2017

Jon Davenport, Alex Riley, Peter Constantides

Southeast Missouri State University, Cape Girardeau, MO, USA

Plants Versus Salamanders: The Effects of Competition on Spotted Salamander and Bladderwort Life History

The coexistence of organisms in nature is more likely when phenotypic similarities of individuals are reduced. Despite the lack of similarity, distantly related taxa will compete intensely for shared resources. No larger difference between organisms that share a common prey could exist than between carnivorous plants and animals. However, few studies have considered inter-Kingdom competition among carnivorous plants and animals. In order to evaluate interactions between a carnivorous plant (greater bladderwort, *Utricularia vulgaris*) and a vertebrate (larval spotted salamanders, *Ambystoma maculatum*), we conducted a mesocosm experiment. We deployed two levels of spotted salamander density and the presence/absence of bladderwort. We measured salamander survival and growth along with bladderwort growth and flowering time. Mean spotted salamander survival and size at metamorphosis was not affected by the presence of bladderwort. However, mean time to metamorphosis was significantly increased in the presence of bladderwort. Mean bladderwort flowering time was delayed with an increase in spotted salamander density, but growth was not affected. Our data suggests that competitive interactions between carnivorous plants and larval spotted salamanders affect some key life history traits (time to metamorphosis and flowering date), but not others (growth or survival). Therefore, these interactions may be context dependent on resource availability with indirect costs survival or future fitness. Overall, our work illustrates that aquatic carnivorous plants may have unexpected impacts on other species in wetland food webs.

0155 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY II, Thursday 13 July 2017

Drew Davis, Jacob Kerby

University of South Dakota, Vermillion, SD, USA

Physiological Stress and Pathogen Infection in Larval Salamanders from Wetlands Influenced by Agriculture

Declines in amphibians are a global problem with complex local factors. While many factors contribute to these declines, much attention has been focused on the role of environmental contaminants and pathogens. Throughout eastern South Dakota, the use of tile drainage in agricultural fields has contributed to habitat degradation for many amphibian species, often through the increase in environmental contaminants in affected wetlands. These contaminants may represent additional stressors to amphibians, and prolonged exposure may affect immune function and influence pathogen dynamics. As part of a two-year study, we visited four wetlands (two reference, two tile drain) to measure water quality and both ranavirus infection and water-borne corticosterone (CORT) levels in larval Western Tiger Salamanders (*Ambystoma mavortium*). Although ranavirus infection prevalence among sites and between years was similar, we found that environmental contaminants were significantly greater and salamanders had significantly higher ranavirus infection loads at tile drain wetlands. Additionally, we found that water-borne CORT was greater from individuals at tile drain wetlands and that water-borne CORT is positively correlated with ranavirus infection load. While the causal relationships between environmental contaminants, ranavirus infection, and CORT are difficult to determine, chronically elevated CORT can be immunosuppressive and may result in high infection loads. This study adds to existing data describing the negative effects of agricultural tile drainage on wetland habitat quality and may suggest that additional stressors may trigger mass-mortality events in this system.

0549 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Drew Davis[1], Travis LaDuc[2], Gregory Pauly[3]

[1]University of South Dakota, Vermillion, SD, USA, [2]Biodiversity Collections, University of Texas at Austin, Austin, TX, USA, [3]Natural History Museum of Los Angeles County, Los Angeles, CA, USA

Morphological Variation Between Two Widely Distributed Populations of *Plethodon albagula* (Caudata: Plethodontidae)

The Western Slimy Salamander (*Plethodon albagula*) is a species of lungless plethodontid salamander with two broadly separated ranges: one is in the Edwards Plateau of Central Texas and the second is in the Interior Highlands of Arkansas, Missouri, and Oklahoma. Recent studies have demonstrated that Central Texas *P. albagula* includes multiple mtDNA clades, many of which are also morphologically distinct from one another. Given this unexpected diversity within the Edwards Plateau, even greater differences between the Edwards Plateau and Interior Highlands populations seem probable. We

examined 12 morphological characters, including both body shape and size characters, in 343 adult *P. albagula* from across both geographic ranges. Principal component analysis and discriminant function analysis suggest that there are strong morphological differences between these two populations, with both males and females from the Interior Highlands being larger in body size and shape characters than Edwards Plateau individuals. These results suggest that there are indeed morphological differences between these disjunct populations and additional molecular information is needed to detect potential cryptic species.

0378 Lightning Talks II, Friday 14 July 2017

Jonathan Davis[1], Philip Matich[2], Carey Gelpi[1]

[1]*Texas Parks and Wildlife Dept., Port Arthur, Texas, USA,* [2]*Sam Houston State University, Huntsville, Texas, USA*

Co-occurrence or Coexistence of two Estuarine Predators in Texas: Bull Sharks and Alligator Gars

The coexistence of species through their partitioning of preferred habitat and resources provide the structure for ecological communities. Bull Sharks (*Carcharhinus leucas*) and Alligator Gars (*Atractosteus spatula*) are two of the most abundant large-bodied predators found in Texas estuaries, especially in Sabine Lake. Texas Parks and Wildlife Department gillnet data from 1986-2016 were utilized to assess the spatial overlap of Bull Sharks and Alligator Gars. From 30 years of sampling, 9960 Alligator Gars and 633 Bull Sharks were collected in Sabine Lake. Among the Bull Sharks collected, 580 (~92%) co-occurred with Alligator Gar throughout the entire ecosystem. To better understand the breadth and overlap of the ecological niches of these species the diets of both predators will be analyzed and compared. Specimens from routine gillnet sampling will be utilized and given the high spatial overlap between these predators and high levels of productivity within Sabine Lake, trophic overlap is predicted. Initial observations suggest that Gafftopsail Catfish (*Bagre marinus*) are highly correlated with Bull Sharks occurrence, and we hypothesize that Gafftopsail Catfish abundances influence top predator distributions as a primary prey resource, and may be a link between Bull Shark and Alligator Gar coexistence.

0138 AES GRUBER AWARD III, Friday 14 July 2017

Matthew Davis[1], Pablo Suárez-Moo[2], Toby Daly-Engel[1]

[1]*University of West Florida, Pensacola, FL, USA,* [2]*Center for Research and Advanced Studies of the National Polytechnic Institute, Mexico City, Federal District, Mexico*

Population Structure and Phylogenetics of Atlantic and Caribbean Sharpnose Sharks (Genus: *Rhizoprionodon*)

Members of the genus *Rhizoprionodon* are small coastal requiem sharks that occur in high abundance throughout the coastal waters of the world. The Atlantic sharpnose shark *Rhizoprionodon terraenovae* is found throughout the Western Atlantic and Gulf of Mexico where it is often exploited by artisanal fisheries, though is considered of least concern to overfishing. Existing research has shown that the larger elasmobranch species display high vagility, or long range movements, whereas smaller sharks occupy small home ranges, with significant genetic heterogeneity between regions. Despite this trend, previous research on *R. terraenovae* has not supported significant genetic heterogeneity between regions on a large scale. We assessed the genetic population structure of *R. terraenovae* throughout its range using a highly polymorphic gene, the mitochondrial control region (CR), coupled with intensive sampling to determine if barriers to gene flow exist within this species' range. Our results indicate weak but significant population structure exists between the Gulf of Mexico and Atlantic Ocean, but found no evidence of genetic structure within basins. In the process of assessing *R. terraenovae* phylogeography, several samples from South Carolina, Virginia, and northern Florida were identified as the Caribbean sharpnose shark *Rhizoprionodon porosus*. *R. terraenovae* and *R. porosus* share a similar appearance, though their home ranges are non-overlapping north of the Bahamas. We sequenced the nuclear ribosomal Internal transcribed spacer-2 ITS2) gene to verify the species identification of these specimens, qualify the observed range expansion, and assess the possibility of hybridization.

0828 Herp Ecology II, Friday 14 July 2017

Graham Dawson, Stephen Mackessy

University of Northern Colorado, Greeley, CO, USA

Fourteen-year Demographic Analysis of *Crotalus viridis viridis* Hibernacula in Northern Colorado

Long-term mark-recapture studies are essential for understanding the ecology of long-lived species, but relatively few have been conducted on snakes. The Prairie Rattlesnake (*Crotalus viridis viridis*), an iconic species of the eastern plains, is a long-lived and important component of the Colorado shortgrass-steppe ecosystem that hibernates in large numbers at stable refugia. For 14 years, two hibernacula in Weld County, Colorado have been part of a mark-recapture study. The current study analyzes demographic characteristics of this population, including sex ratios, body mass and size, growth rates, size distribution, venom yield, capture rate, population size and den site fidelity. In addition, the effects of temperature and precipitation on growth rate were also explored. Overall 1786 unique individuals have been captured, and 1003 have been captured more than once. The adult sex ratio (F:M) is 0.78:1; males are generally larger than females and produce more venom. Individual snout-vent lengths ranged from 155 to 1160 mm, and the longest intercapture interval was 9 years. Neonates experience rapid initial growth, which then slows as they age. This population exhibits high levels of den site fidelity, with snakes returning to the site of their original capture over 99% of the time. Demographic studies such as this can be invaluable for future animal conservation of

snake species. These populations receive passive protection from the landowner, and all evidence suggests that this population is currently stable, but changes in land use and/or climate could adversely affect density and abundance, both locally and throughout their range.

0509 Herp Morphology & Development, Saturday 15 July 2017

Juan D. Daza[1], Aaron M. Bauer[2], J. Salvador Arias[3], Edward L. Stanley[4], David A. Grimaldi[5]

[1]Sam Houston State University, Huntsville, Texas, USA, [2]Villanova University, Villanova, Pennsylvania, USA, [3]UEL, CONICET-Fundación Miguel Lillo, San Miguel de Tucumán, Tucumán, Argentina, [4]Florida Museum of Natural History, Gainesville, Florida, USA, [5]American Museum of Natural History, New York, New York, USA

At the root of the Gekkota clade, who is the oldest?

A Mid-Cretaceous gecko skeleton (JCZ Bu1802, 99 mya) trapped in Burmite is the oldest non-ambiguous gekkotan. The fossil includes the axial skeleton, including the entire skull, 26 presacral vertebrae, sacrum, 5 caudal vertebrae, some ribs, the left pelvis and portions of the proximal parts of the limbs. Some apomorphic features distinguish JCZ Bu1802 from other gekkotans include two bones in the posterodorsal corner of the orbit (postorbital and postfrontal), and an anteromedial process of the pterygoid that excludes the entire medial border of the palatine from the pyriform recess. This fossil is a hatchling based on its size (22.5 mm SVL), and has features that are only seen in embryonic and hatchling gekkotans, such as unfused subolfactory processes of the frontal, a large parietal fontanel, and a parabasisphenoid-basioccipital (basicranial) fenestra. We test the phylogenetic position using morphology (632 characters) and a concatenated analysis with molecules (15,100 BP). We also added three other Cretaceous forms (*Gobekko, Hoburogekko*, *Norellius*). We scored the specimen for 58.8% of the morphological characters and ran multiple analysis using parsimony and implied weighting (k values from 20 to 200, increasing 10 points each time). We recovered the nodes Gekkota and (*Gobekko, Hoburogekko,* JCZ Bu1802) in all analyses and the subsequent nodes (*Eichstaettisaurus* + *Ardeosaurus*) and *Norellius* in 95% (morphology) and 85% (concateneated) of analyses. We conclude that *Gobekko, Hoburogekko* and JCZ Bu1802 seem to represent an early radiation of gekkonomorphs predating the origin of Gekkota and that *Norellius* documents the early appearance of gekkotan features among squamates.

0571 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Helena de Souza Brasil Barreto, Kathleen Cole, Jessica Maxfield

University of Hawaii at Manoa, Honolulu, HI, USA

Patterns of Oogonia and Spermatogonia Distribution in the Ovotestis of the Hawaiian Endemic Goby, *Eviota epiphanes*

Teleost fishes exhibit a dynamic range of sex determining systems and reproductive strategies. This diversity has been extensively explored in the literature, however, the vast majority of studies have focused on gonochoristic fishes (i.e. those with separate sexes). The precise mechanisms for sexual differentiation and maintenance remains poorly understood in hermaphroditic species. The aim of this research project is to identify the distributional pattern of gonial cells (i.e. oogonia and spermatogonia) in the non-partitioned ovotestis of the Hawaiian endemic hermaphroditic goby, *Eviota epiphanes*. In order to accomplish this goal, we propose to use immunohistochemical (IHC) techniques to identify proliferating cells expressing the *vasa* gene. This highly conserved gene is directly implicated in sexual determination and differentiation in many vertebrate taxa. Previous studies have shown that the *vasa* gene is expressed in the cytoplasm of both gonial cells and primordial germ cells (PGCs). We hypothesize that the number of appropriate gonial cells may increase through cell division during transition of sexual function. Alternatively, gonial cells may re-differentiate (i.e. oogonia become spermatogonia and spermatogonia become oogonia), and/or PGCs may be maintained in the ovotestis of adult hermaphroditic fishes and undergo differentiation during sexual transition. The results of this study will provide us with a clear/better understanding of how sexual differentiation, specifically the generation of new and different gametes, is regulated in hermaphroditic fishes.

0746 SSAR SEIBERT ECOLOGY III, Friday 14 July 2017

Samantha Dean[1], James Gibbs[1], Brian Underwood[2]

[1]State University of New York, Syracuse, NY, USA, [2]USGS Patuxent Wildlife Research Center, Laurel, MD, USA

Influence of Habitat Edges and Recreational Trails on the Distribution and Abundance of Amphibians in an Urban Protected Area

Recreational trails fragment habitat within protected areas set aside for amphibian conservation, potentially generating "edge effects" or changes in population and community structure at the boundary between two habitats. Little attention has been paid to the effects of trail edges on amphibians, which hinders conservation planning for protected areas. Amphibian populations and habitat covariates were compared among five disturbance types (0, 15, and 50 m from trail, habitat edge, edge + trail) and a control in a protected natural area at the Home of Franklin D. Roosevelt National Historic Site (Hyde Park, New York). Habitat edges exert a much stronger negative influence than trail edges, yet trail effects do occur and extend up to 50 m from trails, and are primarily driven by reduction in leaf litter and coarse woody debris whereas habitat edge effects are likely driven by changes in microclimate. Effects of recreational trails and habitat edges on amphibians is additive. Given effects of trails on amphibians, protected area managers should seek to limit unauthorized trails and trail

entrances/exits, as well as consider amphibian impacts in future trail design and planning.

0515 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Alison Deary, Annette Dougherty, Steve Porter, Janet Duffy-Anderson

NOAA/AFSC, Seattle, WA, USA

Development and phenotypic variation in first feeding larvae of sablefish (*Anoplopoma fimbria*)

In the Gulf of Alaska, sablefish (*Anoplopoma fimbria*) support a lucrative fishery with an ex-vessel value over $90 million, but their numbers have been declining even though the fishery is regulated. Numbers of age-0 juveniles during the first summer have been related to year class strength, but it is hypothesized that recruitment is determined earlier, during the larval/early juvenile stages. *Anoplopoma fimbria* is unique relative to many other fishes that spawn in deep water because their larvae and juveniles are neustonic. The protracted neustonic stages increase the exposure of individuals to biological and environmental stressors (e.g., prey availability, avian and fish predators, wind stress, light intensity, and variability in sea surface temperature and salinity) that reduce survival. We were particularly interested in examining factors related to feeding success in early stage *A. fimbria* so we examined laboratory reared individuals at the Alaska Fisheries Science Center to describe the pattern and timing of ossification in feeding and swimming structures. Due to the presence of a large yolk sac, we hypothesize that the skeletal elements required for swimming will ossify before feeding elements, but variability will exist in the onset of ossification among individuals. The data presented here are the first examination of the skeletal development of *A. fimbria* during the transition to first feeding, which improves our understanding of the mechanisms and ecological trade-offs that reduce mortality in individuals.

0772 Fish Ecology I, Sunday 16 July 2017

Raelynn Deaton Haynes, Kelly McNab, Caitlyn Higgins, Briana Sebastian, David Johnson

St. Edwards University, Austin, Texas, USA

Seagrass-Associated Fish Biodiversity in Texas Coastal Ecosystems

Seagrasses provide many ecosystem services and home to a plethora of aquatic organisms. As diversity begins to decline, these vulnerable ecosystems are becoming seriously threatened. Since Texas relies heavily on the coast for resources and industry and its coastline is an attractive destination for recreational activities, there is a great amount of stress on these seagrasses, as well as the aquatic organisms that depend on

their existence. Thus, we quantified fish, seagrass and adjacent terrestrial plant biodiversity along a 9km stretch of seagrass bed in Redfish Bay, Texas, an area susceptible to anthropogenic disturbance. We also quantified potential anthropogenic stressors to determine what factors predict biodiversity differences in seagrass habitats. We expected that species richness and abundance will vary among test sites, with more biodiversity identified in sites less accessible to humans. Results thus far do not support our predictions. Biodiversity of fishes and seagrasses was measured, anthropogenic impacts, such as boats and fishermen, were quantified, and water quality was assessed. Results suggest significant differences in seagrass biodiversity at one specific site, but no differences in fish biodiversity. To date, no "disturbance" measure quantified predicted biodiversity of seagrasses or fishes. Seagrasses are rapidly declining at a global scale, and, therefore an increased demand for scientific research on seagrass preservation is necessary, particularly in Texas where little is known about fish biodiversity in relation to seagrass habitats.

0748 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Friday 14 July 2017

Jonathan DeBoer, Aaron Bauer

Villanova University, Villanova, PA, USA

Non-adaptive Radiations in New Caledonian Geckos

The southwestern Pacific island of New Caledonia has one of the most highly endemic herpetofaunas in the world, including eight endemic genera of geckos and sixteen endemic genera of skinks. Representatives of different genera are typically morphologically and ecologically distinct from one another, but congeneric taxa may be very similar in both regards. Members of the diplodactylid genus *Bavayia* exhibit this pattern. Currently 12 species of *Bavayia* are described, but genetic data have revealed an even greater diversity of cryptic taxa (30 putative species), some of which are virtually indistinguishable from one another. It is presumed that such instances represent cases of "non-adaptive radiation," in which cladogenesis occurs through allopatric isolation, but species retain plesiomorphic ecological preferences. To evaluate this hypothesis, I generated predictive niche models using a Geographic Information Systems (GIS) approach to test for spatial niche similarity in described and putative species of *Bavayia*.

0274 AES GRUBER AWARD IV, Friday 14 July 2017

Simon Dedman[1], Rick Officer[1], Deirdre Brophy[1], Maurice Clarke[2], Dave Reid[2]

[1]Galway-Mayo Institute of Technology, Galway, Ireland, [2]Marine Institute, Oranmore, Ireland

Mapping Elasmobranchs with Gbm.auto - a Decision Support Tool automating Boosted Regression Tree modelling of data-poor species

abundance using environmental and human inputs, mapping essential habitats, and designing MSY-based MPAs considering stakeholder priorities

The gbm.auto R package suite automates and greatly simplifies delta log-normal Boosted Regression Tree spatial modelling, removing the high technical barrier that prevents many potential users from reaping the benefits of this powerful statistical modelling technique. The package and its documentation allow users with very little experience of R to generate maps of predicted abundance, representativeness maps for those abundance maps, bar plots of the relative influence of explanatory variables, dot and line plots of the relationships between explanatory variables and response variables, databases of the processed model objects, and a report explaining all the steps taken within the model. This process can be used to map essential habitats such as nursery grounds and spawning areas, to produce areas of key conservation importance for multiple species. Escapement biomass - the percentage of the stock which must be retained each year to conserve it - is then combined with the predicted abundance maps to create a Decision Support Tool that generates location and size options for MPAs to protect the target stocks, based on stakeholder priorities, especially the minimisation of fishing effort displacement. In bridging the gap between advanced statistical mathematics and conservation science/management/policy, these tools can allow improved spatial abundance predictions, and therefore better management and better conservation. Here we demonstrate how the package can be obtained and used for your project, with examples of the outputs it produces.

0544 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Breanna DeGroot[1], Kim Bassos-Hull[2], Michael McCallister[1], Matthew Ajemian[1]

[1]Florida Atlantic University, Harbor Branch Oceanographic Institute, Fort Pierce, FL, USA, [2]Mote Marine Laboratory, Sarasota, FL, USA

Movement and habitat use of Spotted Eagle Rays, *Aetobatus narinari*, throughout Florida

Worldwide declines in elasmobranchs have been well documented and continue to remain a major concern for marine ecosystems. The spotted eagle ray (*Aetobatus narinari*), is protected in Florida waters yet harvested in neighboring areas of the Gulf and Caribbean including Mexico, Cuba, and Venezuela. Despite a hypothesized capacity to undertake large-scale migrations, the movement ecology of spotted eagle rays remains largely understudied. This limits our ability to assess population connectivity and the potential impact of these conflicting management approaches. The objective of our study is to examine habitat use and multi-scale movement patterns in two major lagoon systems of Florida (Sarasota Bay Complex and the Indian River Lagoon). To study these movements, we are utilizing multiple acoustic biotelemetry methods, including active tracking and passive monitoring in our locations of interest. Additionally, we are taking advantage of major collaborative acoustic networks (FACT and iTAG) to understand large-scale movement patterns along the Florida coastline and

beyond. Preliminary data indicates that animals tagged off Sarasota in spring 2016 initially exhibited high fidelity, but have not returned to the region since September when a major red tide event encompassed the region. Individuals tagged in the Indian River Lagoon appear to exhibit similar fidelity, returning to the area after a short-term departure associated with Hurricane Matthew. Understanding how spotted eagle rays respond to major environmental events has conservation implications for this species and is pertinent to local bivalve fisheries that they may interact with.

0144 Herp Reproduction & Life History I, Thursday 13 July 2017

Jennifer Deitloff[1], Erin Myers[3], Stephen Spear[4], Dirk Stevenson[5], Craig Guyer[2]

[1]Lock Haven University, Lock Haven, PA, USA, [2]Auburn University, Auburn, AL, USA, [3]University of Houston, Houston, TX, USA, [4]The Wilds, Cumberland, OH, USA, [5]The Orianne Society, Tiger, GA, USA

Multiple paternity and heritability of color in *Drymarchon couperi* (Eastern Indigo Snake)

Multiple paternity is common in many vertebrates, including snakes, and understanding how frequently it occurs within a species is important for determining the role it might play in conserving that species. One such species, the Eastern Indigo Snake (*Drymarchon couperi*), is the subject of an ongoing captive-breeding program and repatriation project in the southeast United States. Many characteristics of the reproductive biology of this species are poorly understood, including whether clutches are sired by more than one male, and which characteristics, if any, are selected in potential mates. One characteristic that might play a role in sexual selection is color, as several studies have described variation of color in this species. Our first objective was to determine if multiple paternity occurs in source and repatriated populations of *D. couperi*. Second, we examined whether color may play a role in sexual selection. Therefore, we also tested several hypotheses examining associations between color, heritability, and multiple paternity. We found that multiple paternity likely occurred in four of the 13 clutches (~31%). Furthermore, heritability of color was relatively high; but single-sired and multi-sired clutches were not different in color nor in the variability of color within a clutch. We conclude that management of *D. couperi* could benefit by exposing captive-bred females to multiple males within a mating. This will allow for use of stored sperm to inseminate eggs or for females to seek new mates among the repatriated population, thus increasing effective population size when the population is most vulnerable.

0329 Lightning Talks II, Friday 14 July 2017

Zackary Delisle, Johanna Delgado-Acevedo, Lani Lyman-Henley, Dean Ransom

Texas A&M University, Commerce, Texas, USA

Cottonmouth and Diamond-backed Water Snake Spatial Ecology within Constructed and Natural Wetlands

Wetlands are critical habitats for a plethora of biodiversity, including mammals, fish, avifauna, and herpetofauna. In Texas, precolonial wetlands have declined by at least 52%. Because of this decline, wetland restoration and conservation efforts are of pivotal concern. Our preliminary research shows that cottonmouths (*Agkistrodon piscivorus leucostoma*) and diamond-backed water snakes (*Nerodia rhombifer*) are some of the most common serpents in Texas' Hunt County wetlands. Their abundance, omni-carnivorous diet, and role as prey suggest these serpents are important trophic links within wetland ecosystems. These commonalities are also evocative of broad interspecific competition. Our first objective is to quantify the microhabitat selection and home range sizes of each species, and certain subgroups (*e.g*. sex, gravid status), within constructed and natural wetlands. The study sites will be the constructed wetland owned by Texas A&M University-Commerce, and the natural wetland at Cooper Lake WMA, Cooper, TX. Home range comparisons could imply the suitability of constructed wetlands, and microhabitat comparisons may reveal how these two species partition their habitat. Our second objective is to quantify the herpetofauna community in these same wetlands. Communities will be evaluated using Shannon's Index, species richness, and equitability. Community comparisons may again help suggest the suitability of constructed wetlands for herpetofauna. Preliminary surveys showed that the constructed wetland's species equitability is continually increasing. Therefore, more surveying could show that as constructed wetlands age herpetofauna equitability may increase.

0211 ASIH STOYE GENERAL ICHTHYOLOGY III, Friday 14 July 2017

Naomi Delventhal[1], Randall Mooi[2]

[1]University of Manitoba, Winnipeg, MB, Canada, [2]Manitoba Museum, Winnipeg, MB, Canada

Intra-relationships of *Callogobius* (Teleostei:Gobiidae) - A Morphological Approach

Callogobius Bleeker comprises more than 40 nominal species, and numerous undescribed species. The monophyly of *Callogobius* is supported by the shared presence of a unique arrangement of raised sensory papillae rows. McKinney's (1980) unpublished Master's thesis recognized two species groups using osteology and external morphology - a stout-bodied (*maculipinnis*) and a slender-bodied (*hasseltii*) group. Our study sampled a larger number of characters in the external anatomy (fin shape, scale distribution and morphology, sensory pores and papillae patterns, urogenital papilla morphology, color pattern) and osteology (including characters in the suspensorium, gill arches, cranium, axial skeleton and paired fins). We identify three monophyletic species groups, two containing stout-bodied species (*maculipinnis*, and *sclateri* groups) and one containing species that have an elongate caudal fin and often slender body (*hasseltii* group).

Members of these groups are distinguished from each other both by external anatomy and osteology; however the composition of our *maculipinnis* and *hasseltii* groups, as well as our interpretation of some characters, differ from McKinney's work. Several remaining species of *Callogobius* do not fit clearly into these monophyletic groupings; we temporarily place them in an undefined and likely nonmonophyletic assemblage, the *tutuilae* group. Preliminary molecular phylogenetic analysis supports the monophyly of our *maculipinnis*, *sclateri* and *hasseltii* groups but the *tutuilae* group remains unresolved. We confirm that morphological variation (including that in some seemingly superficial characters) contains meaningful phylogenetic signal and should not be dismissed as a data source even in large, unwieldy genera.

0812 LFC Physiological Performance III, Sunday 16 July 2017

Nancy Denslow[1], Erchao Li[2], Derek Bolser[1], Kevin Kroll[1], David Dreier[1], Erica Brockmeier[3], Francesco Falciani[3]

[1]University of Florida, Gainesville, FL, USA, [2]East China Normal University, Shanghai, China, [3]University of Liverpool, Liverpool, UK

Exposure of Fathead Minnows (*Pimephales promelas*) to Narcotic Chemicals Alters Energy Metabolism and Growth

Chemicals that cause acute toxicity to fish may do so by interfering with mitochondrial function. We have investigated chemicals classified as polar and nonpolar narcotics on developing fathead minnow embryos. Chlorophenols and dinitrophenol, which are classified as polar narcotics, are commonly found in the environment from low ng/L concentrations up to mg/L and are released as degradation byproducts from chlorination of sewage and drinking water and from industrial sources. Phenols with increasing substitution on the phenol ring (phenol, 2,4-dinitrophenol, 2,4-dichloro-phenol and pentachlorophenol) show adverse effects on developing fathead minnow embryos including on development, heartbeat, and mitochondrial function. The observed effects were dose dependent and more severe for the more highly substituted phenols. Basal mitochondrial respiration and ATP production were decreased in a dose-responsive manner for the chlorinated phenols, and this was linked to adverse effects in development and heart rate. There was growth retardation in embryos exposed to 2,4-dinitrophenol. Pentachlorophenol and 2,4 dinitrophenol are recognized uncouplers of mitochondrial oxidative phosphorylation. Changes in gene expression were also investigated, highlighting their molecular effects.

0331 General Ichthyology II, Sunday 16 July 2017

John Denton[1], John Maisey[1], Mark Grace[3], Michael Doosey[2], Alan Pradel[6], Henry Bart[2], Gavin Naylor[5], Paul Tafforeau[4]

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Unusual Cranial Morphology of the Pocket Shark *Mollisquama sp.* (Squaliformes; Dalatiidae) Suggests Potentially Novel Feeding Mechanics

The midwater dalatiid sharks consist of nine described species, in seven genera, and are notable for adaptations related to both bioluminescence emission and feeding. Among the best-known examples of dalatiid ecomorphology is the heterodonty of the cookiecutter sharks (*Isistius sp.*), which exhibit a 'cartridge' of enlarged teeth in tooth rows along the Meckel's cartilage. These teeth are used for extracting characteristic tissue plugs from prey animals and are notorious for their diagnostic wound. Here, we examine the cranial morphology of a related and unknown species, the pocket shark (*Mollisquama sp.*), using propagation phase-contrast X-ray synchrotron microtomography. The pocket shark exhibits a heterodont dentition similar to that of the cookiecutter shark. However, the unusual, bulbous rostral profile of the pocket shark is explained by a massively enlarged suborbitalis muscle that extends ventrally to form an enlarged vertical wall of tissue anterodorsal to the palatoquadrate. This muscle is nearly the size of the Meckel's cartilage and is far larger than in the cookiecutter shark. The suborbitalis infiltrates a novel subethmoid fontanelle, not seen in the cookiecutter, that may serve as a reinforcing structure for muscle action. The *Mollisquama* labial cartilages each exhibit a plate-like morphology, and the configuration of the upper and lower labials together is planar, not angular. This cranial configuration suggests the pocket shark may exhibit a novel slicing mechanism for feeding.

0096 Amphibian Conservation II, Sunday 16 July 2017

Anne Devan-Song, Justine M. Fox, Haley A. Moniz, Nancy E. Karraker

University of Rhode Island, Rhode Island, USA

Can Upland Clustering of Eastern Spadefoot Toads (*Scaphiopus holbrookii*) Predict Breeding Pool Locations?

Breeding pools of the explosive breeder *Scaphiopus holbrookii* are highly ephemeral and often difficult to locate. There is no established method used to find them and researchers rely on prior knowledge of locations or by detection on breeding nights when males are calling, which range from zero to a few nights a year. It is likely that many breeding pools remain undetected, which can interfere with protection of breeding habitats. In a study conducted in Yorktown VA, we observed upland clustering of larger, sexually mature *S. holbrookii* near known breeding pools. We hypothesized that larger toads cluster near breeding pools outside of breeding periods, and that these clusters can be used to predict locations of dried-up breeding pools. In 2016, we surveyed forest adjacent to 10 km of roads for *S. holbrookii* on non-breeding

nights and obtained GPS location and snout-vent length for >1000 toads. We interpolated average toad length within 14 m^2 pixels across a 35 m buffer around surveyed roads and determined the relationship between average toad length and distance to nearest known breeding pool. Clusters of large adults and small juveniles were more likely to be found within 100 m of breeding pools than medium-sized toads, while the vast majority of medium-sized toads were found 100 to 1200 m away from breeding pools. Upland clustering of both large adult and small juvenile *S. holbrookii* may be useful in predicting locations of ephemeral breeding pools, which has important implications for monitoring and conserving populations of this species.

0623 Herp Biogeography & Phylogeography I, Sunday 16 July 2017

Tom Devitt[2], David Cannatella[1], David Hillis[1]

[1]University of Texas, Austin, TX, USA, [2]City of Austin, Austin, TX, USA

Species Formation in *Eurycea* Salamanders of the Edwards-Trinity Aquifer System, West-Central Texas

The karstic Edwards-Trinity Aquifer system of west-central Texas is one of the most species-rich groundwater ecosystems in the world, represented by dozens of endemic groundwater-obligate species with narrow, naturally fragmented distributions. Here, we examine how geomorphological and hydrogeological processes have driven population divergence and speciation in a radiation of plethodontid salamanders (genus *Eurycea*) endemic to the Edwards-Trinity system. Species in this clade show convergence among subterranean populations alongside morphological conservatism of surface-dwelling forms with cryptic species boundaries. Coalescent analysis of genome-wide genetic data show complex patterns of isolation and reconnection driven by surface and subsurface hydrology, resulting in both adaptive and non-adaptive population divergence and speciation. Our results uncover new cryptic species and refine the boundaries of named species, several of which have been classified as threatened or endangered with extinction under the Endangered Species Act due to groundwater abstraction. Regional climate and hydrologic models that predict increased air temperature and decreased springflow forecast the Edwards-Trinity salamanders and codistributed groundwater-obligate species in the region to be highly vulnerable to extinction.

0563 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Wendy Diaz, Kevin W. Conway

Texas A&M University, College Station, TX, USA

An Investigation of Substrate Scraping Behavior in Three Species of Sicydiine Gobies Inhabiting Freshwater Streams on Dominica, West Indies

Gobies of the genus *Sicydium* are freshwater fishes present throughout the western Central Atlantic and eastern Central Pacific. They feed by scraping algae from hard surfaces in fast flowing rivers and streams and have highly modified teeth used for scraping. An investigation and analyses was conducted specifically on the frequency of substrate scraping during feeding in three different species of *Sicydium* found on Dominica (*S. buscki*, *S. plumieri* and *S. punctatum*). A total of 20 video recordings of scraping events were obtained using a waterproof digital camera and analyzed using appropriate software. Forty individual sicydiine gobies were documented: *S. punctatum* (n=14), *S. plumieri* (n=5), *S. buscki* (n=18). The total length range for *S. punctatum* was 22.0-71.2 mm, 32.3-117.0 mm for *S. plumieri*, and 34.0-82.0 mm for *S. buscki*. The head length range for *S. punctatum* was 3.9-13.5 mm, 8.0-25.3 mm for *S. plumieri*, and 6.8-18.1 mm for *S. buscki*. The range of scrapes per second for *S. punctatum* was 8-11, 2-6 for *S. plumieri*, and 3.5-6.5 for *S. buscki*. *Sicydium punctatum* had an average of 9.6 scrapes per second. *Sicydium plumieri* had an average of 3.9 scrapes per second. *Sicydium buscki* had an average of 4.8 scrapes per second. Results show that there are significant differences in the frequency of scraping in the different species of *Sicydium*. Thus, individuals can be identified as one of the three species documented based on their scraping frequencies.

0140 ASIH STOYE ECOLOGY & ETHOLOGY IV, Friday 14 July 2017

Amanda DiBella, Scott L. Parker

Coastal Carolina University, Conway, SC, USA

Dietary Composition and Prey Selectivity of the Diamondback Terrapin (*Malaclemys terrapin*) in North Inlet, SC

Diamondback terrapins (*Malaclemys terrapin)* are physiologically and ecologically specialized turtles endemic to estuaries of the Gulf and eastern coasts of the U.S. Diamondback terrapins may play an important role in maintaining salt marsh biodiversity and ecosystem function through the consumption of herbivorous periwinkle snails *(Littorina littorea)* and crabs (*Uca pugilator, Sesarma reticulatum*). However, relatively little is known about terrapin feeding ecology and predator-prey relationships. The purpose of this study was twofold: The first objective was to determine whether terrapins preferentially select periwinkle snails over other available prey items in the field. Our second objective was to determine whether prey selection under laboratory conditions, when terrapins are given a choice of prey items, parallels that observed in the field. Analysis of prey abundance in fecal samples indicates that terrapins show a preference for periwinkle snails (92%) compared to other available prey such as crabs (5%) or fish (<1%). In contrast, in laboratory feeding trials, terrapins showed a preference for fiddler and marsh crabs (80%), with periwinkles being the least preferred prey (0% consumed). Frequent predation attempts on fish (*Fundulus heteroclitus*) were also made. Preference for crabs and fish in the laboratory may be due to increased nutritional benefit of these prey species compared to the less digestible, but more easily accessible periwinkles. Our results indicate that prey selection by terrapins in the field may be constrained by a tradeoff between availability of periwinkles, an

abundant prey item with relatively low digestibility, compared to less available but more digestible crabs and fish.

0216 AES GRUBER AWARD III, Friday 14 July 2017

Pavel Dimens[2], David Portnoy[0]

[1]Texas A&M University - Corpus Christi, Corpus Christi, TX, USA, [2]University of Southern Mississippi, Hattiesburg, MS, USA

Population structure of a migratory small coastal shark, *Carcharhinus acronotus*, across cryptic barriers to gene flow

Patterns of population structure in the blacknose shark (*Carcharhinus acronotus*) were assessed using 2,178 nuclear encoded single nucleotide polymorphism loci scored for 249 individual sharks sampled from the U.S. South Atlantic (Atlantic), eastern and western Gulf of Mexico (Gulf). Results concurred with findings from a previous study that utilized microsatellites and mtDNA, supporting divergence between the Gulf and Atlantic and weak structure between the eastern and western Gulf. Individuals from the Florida Keys, an area which could potentially be a seasonal mixing zone for Atlantic and eastern Gulf populations, largely assigned to the eastern Gulf population. Of 79 Keys individuals analyzed, 50 were assigned to the Gulf, and four to the Atlantic with greater than 80% membership probability. Seven potential Gulf migrants were identified in the Atlantic and three potential Atlantic migrants were identified in the Gulf using the whole data set. When a reduced data set consisting only of markers that were significantly divergent between the eastern Gulf and Atlantic was used for assignment only five migrants were detected (four in the Atlantic and one in the Gulf). The results indicate that the Straits of Florida do not act as a hard barrier preventing movement between the western Atlantic and eastern Gulf. Despite the number of migrants detected exceeding that which is theoretically required to cause gene pools to homogenize, the western Atlantic and Gulf remain distinct; this suggests differences in potential and realized dispersal over generational scales.

0490 ASIH STOYE GENERAL ICHTHYOLOGY II, Thursday 13 July 2017

Kyle Dineen, Brook Fluker

Arkansas State University, Jonesboro, AR, USA

Genetic Structure and Diversity of Disjunct Populations of Rainbow Darters (*Etheostoma caeruleum*) and Southern Redbelly Dace (*Chrosomus erythrogaster*) Throughout the Mississippi Corridor

Conservation studies of North America's freshwater fish fauna frequently focus on recently fragmented species or species with naturally small ranges. Our grasp of how

recent, natural isolation affects the migration and genetic diversity of common and widespread freshwater fishes is limited. *Etheostoma caeruleum* and *Chrosomus erythrogaster* are widespread, abundant, and have overlapping distributions with comparable patterns of naturally disjunct populations on their range margins. Both species have potentially isolated populations in tributaries on Crowley's Ridge, Arkansas and the Bluff Hills, Mississippi. These regions are recent geological formations that would have been colonized by these species within the last 10,000 years making these species excellent subjects for studying the impacts of recent, natural genetic isolation. In this study, we analyze microsatellite DNA loci from both species to evaluate genetic diversity and connectivity among populations on Crowley's Ridge, the Bluff Hills, and larger core populations. Using DNA sequence data, we also test hypotheses about the pattern and timing of colonization of Crowley's Ridge and the Bluff Hills. The results of this study will provide useful information about the biogeographic history and conservation status of these potentially disjunct populations of *E. caeruleum* and *C. erythrogaster*.

0097 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Chris Distel

Schreiner University, Kerrville, TX, USA

Exotic armored catfish may reduce survival and growth of native amphibians

Invasive species threaten biodiversity worldwide. Armored catfish, which are benthic grazers, have been introduced globally and damage ecosystems in numerous ways. However, their competitive interactions with native benthic grazers have not been tested. This study tested for the effects of an invasive armored catfish (*Hypostomus plecostomus*) on performance in native Rio Grande leopard frog (*Rana berlandieri*) tadpoles. Aquarium tests showed that armored catfish can negatively affect native amphibian survival and growth even when food is abundant. However, mesocosm tests showed no effects of competition. While the mechanisms of effect remain unclear this is the first study to demonstrate exotic armored catfish as a potential threat to native amphibians, which are declining globally.

0427 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Blake Dixon, James Watling

John Carroll University, Ohio, USA

Thermal tolerances of Red-backed salamanders, *Plethodon cinereus*, with differing temperature exposure histories

Twenty-first century climate change is predicted to push many ectothermic vertebrates to and past their critical thermal maxima (CT_{max}), resulting in negative fitness and local extinctions. These predictions have fueled interest in using CT_{max} to understand which organisms and habitats face the greatest threats from increasing temperatures. However, few studies of ectothermic vertebrates have considered how an individual's CT_{max} can change depending on the thermal environment it is acclimated to, and the rate of temperature increase it experiences during CT_{max} trials. This experiment tested the CT_{max} of *Plethodon cinereus* acclimated to 20°C or 15°C, and described how thermal tolerance shifted using different rates of temperature increase (1°C/min or 0.5°C/min) during trials. Preliminary results suggest that animals acclimated to 20°C and those experiencing faster thermal ramping had the highest CT_{max}, indicating at least some potential for acclimation to reduce negative impacts of climate change on vulnerable ectotherm populations.

0151 Lightning Talks II, Friday 14 July 2017

Tiffany Doan

New College of Florida, Sarasota, FL, USA

Can Exotic Reptile Invasion Be Facilitated by Disease?

The state of Florida has become a haven for invasive reptile species, with exotics making up over 40% of its current reptile fauna. Invasive species have often displaced the native species, causing reductions in their populations. In some cases, invasive species are superior competitors with a higher tolerance for urbanized habitats. One particular example of this phenomenon is the abundant invasive *Anolis sagrei* and the now uncommon native *A. carolinensis*. One facet of the invasion of *A. sagrei* that has not received attention is susceptibility to disease. A recent study examined the relative infection rates of the malaria parasite *Plasmodium floridense* in Central Florida where *A. sagrei* is dominant but *A. carolinensis* still persists in some habitats. In that study, we found that *A. carolinensis* were infected at over twice the rate of *A. sagrei*. Because we also found that leukocytes were elevated in infected lizards, *Plasmodium* infection may harm the fitness of these species, though few studies have examined what effects malaria has on lizard health. Reduced infection by blood parasites may be one of the many factors allowing *A. sagrei* to successfully invade Florida and to become the superior competitor throughout its introduced range. Although few studies have examined the effects of parasitic infection on native versus invasive species, infection status could be a new piece to the puzzle of what determines invasion success. Knowledge of the interactions of infection, invasion, and competitive ability will be valuable for combatting the damage that invasive species may wreak on ecosystems.

0448 Fish Behavior, Saturday 15 July 2017

Terry J. Donaldson

University of Guam Marine Laboratory, Mangilao, Guam, USA

Mating Systems of *Hemigymnus melapterus* and *Cheilio inermis* (Labridae) on a Spawning Aggregation Site: Weird!

Species of fishes reproducing on resident spawning aggregation sites use different mating systems, and there is intraspecific variation in their use. A number of species utilize a lek-like system in which males secure and defend temporary territories for the purpose of attracting females. They defend these territories against rival males, often vigorously, and in some cases territorial males will also engage in streaking or sneaking while attempting to mate with a rival male's females. The territories they hold may be favorable if found in a location that is attractive to females. Attraction isn't everything, however. Some males forego establishing mating territories and instead mimic females in coloration, body size and even behavior, and reproduce using multiple episodes of group spawning. The relatively large tropical wrasse *Hemigymnus melapterus* engages in lek-like behavior but may be reduced to pair-spawning if site densities are low. In contrast, *Cheilio inermis* engages in group spawning but occasionally larger, single males also pair-spawn if site densities are low. Site density of either species on the site at any given time is a common factor for both species. What is not clear is the role of timing, given that moon phase, tidal state and time of day do not appear to influence local population densities at the site let alone the reproductive behavior observed there.

0240 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Friday 14 July 2017

Caroline Dong[1], Claire McLean[1], Adnan Moussalli[2], Devi Stuart-Fox[1]

[1]*The University of Melbourne, Melbourne, Victoria, Australia,* [2]*Museum Victoria, Melbourne, Victoria, Australia*

Asymmetrical Introgression of Throat Coloration Across a Contact Zone of Australian Agamids

Natural contact zones between lineages in the early stages of speciation offer a unique opportunity to directly measure the progress of speciation. Furthermore, speciation is facilitated when traits under divergent selection are linked to reproductive isolation, such as coloration. The Australian tawny dragon lizard, *Ctenophorus decresii*, is a compelling study system of incipient speciation with a candidate reproductive isolating trait. The species comprises two genetically and phenotypically distinct lineages that that are geographically structured into a 'northern' and 'southern' lineage, and interact in a narrow contact zone. The lineages exhibit striking differences in male throat coloration. An examination of genetic and phenotypic data from across the contact zone reveals strong patterns of asymmetrical introgression. We characterized hybrid throat coloration using segmentation analysis and reflectance spectrophotometry and found evidence that selection favors the northern phenotype in the contact zone. However, analysis of transcriptome sequences reveals that hybrid individuals are genetically more similar to the southern lineage. Further investigation into the complex contact zone

dynamics between these two divergent lineages will contribute to our understanding of the role of coloration in speciation.

0187 Plenary, Thursday 13 July 2017

Maureen Donnelly

Florida International University, Miami, FL, USA

ASIH has been Very, Very, Good to Me: How Service to the ASIH Enhanced my Academic Career

I began my career in herpetology as a member of all three societies, but started doing "heavy lifting" while I was a postdoctoral fellow. That involvement in society business helped me make connections that advanced my career, and those connections help advance the careers of my students, and now my academic grand-students. Service to a professional society can not only help a scientist advance their career, but it can pave the way for friendships that enhance academic life.

0893 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

María A. Doria-González[1], Andrea M. Espitia-Galvis[1], Angel L. Martínez-González[1], Glenys Tordecilla-Petro[2], Charles W. Olaya-Nieto[1], Fredys F. Segura-Guevara[1]

[1]Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences. University of Cordoba., Lorica, Córdoba, Colombia, [2]Institución Educativa Lácides C. Bersal. Alcaldía municipal., Lorica, Córdoba, Colombia

Reproductive Ecology of Bocachico *Prochilodus magdalenae* in the San Jorge River Basin, Colombia

Reproductive ecology of Bocachico *Prochilodus magdalenae* in the San Jorge River basin, Colombia, was studied. Individuals with total length (TL) ranged between 19.9 and 42.7 cm and total weight (TW) ranged between 103.0 and 1105.0 grams were collected. The gonads were placed in Gilson solution, the Vazzoler scale was applicated and sexual proportion, maturity index, spawning season, length at first maturity, ovocites's diameter and fecundity were estimated. 210 females, 171 males and 15 undifferentiated were found, with sexual proportion female: male 1.2:1, differently than expected, and sexual dimorphism in size, since females reach larger sizes than males. Length at first maturity was estimated in 30.2 cm TL for both sexes, oocites's diameter were 951 µm and average fecundity estimated was 109972 oocites. The results achieved suggest that Bocachico is a fish whose spawning season extends from May to October, with annual spawning in the rainy season and synchronous gonadal development in two groups, large oocytes and high fecundity associated to the ovaries´s weight.

0215 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Dana Drake[1], Britt Ousterhout[2], Jarrett Johnson[3], Thomas Anderson[4], Chris Shulse[5], Kenton Lohraff[6], William Peterman[7], Tracy Rittenhouse[1], Betsie Rothermel[8]

[1]University of Connecticut, Storrs, CT, USA, [2]University of Arkansas, Fayetteville, AR, USA, [3]Western Kentucky University, Bowling Green, KY, USA, [4]University of Kansas, Lawrence, KS, USA, [5]Missouri Department of Transportation, Jefferson City, MO, USA, [6]DPW Natural Resources, Fort Leonard Wood, MO, USA, [7]Ohio State University, Columbus, OH, USA, [8]Archbold Biological Station, Venus, FL, USA

Amphibian Community Composition in Missouri Ponds

We examined community composition of pond-breeding amphibians at over 200 ponds in Missouri between 2002 and 2012 using drift fence and dipnet and funnel trap data. We encountered a total of 20 pond-breeding amphibian species in the combined surveys. We also examined whether the presence of fish and Bullfrogs, *Rana* (*Lithobates) catesbeiana*, influenced observed patterns of diversity. Our results indicate that the presence of fish, Bullfrogs, and their interaction influenced the community composition of amphibians at these sites, but in opposite patterns. Fish presence was negatively associated overall with species diversity, while Bullfrogs often had a positive relationship with the total number of species, total caudate species, and total anuran species, and the presence of both fish and Bullfrogs was negatively associated with anuran species diversity. It is important to have baseline community species composition data from wide geographical ranges so spatiotemporal changes in community structure can be noted and assessed.

0640 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Michael Dreslik[1], Christopher Petersen[2], Scott Goetz[3], John Kleopfer[4], Alan Savitzky[5]

[1]Illinois Natural History Survey, Champaign, Illinois, USA, [2]Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, USA, [3]Auburn University, Auburn, Alabama, USA, [4]Virginia Department of Game and Inland Fisheries, Richmond, Virginia, USA, [5]Utah State University, Logan, Utah, USA

Spatial Ecology of the Timber Rattlesnake (*Crotalus horridus*) from the Mid-Atlantic Coastal Plain

Studies of the spatial ecology of organisms provide insights into movement rates, area used, and habitat use. Spatial studies answer such conservation-related questions as how much and when an organism moves, how much area it requires, and what factors affect both movements and activity areas. Our study aimed to determine what factors affect movement patterns and activity area sizes of Timber Rattlesnakes (*Crotalus horridus*) in the mid-Atlantic using data collected over a 17 year-period, which afforded us the ability to examine the effects of individual and inter-annual variation. There have been few long-term studies of the spatial ecology of this species on the Coastal Plain. We used mixed-effects general linear regression, coupled with AIC methods, to determine which predictive models best explained the variation observed in movement and activity areas. For movement, we found that the daily and annual total distances moved by male snakes were approximately two times those of females and males moved greater distances from hibernacula than females. In most cases, half of the variation was explained by differences among individuals. Similarly, activity area sizes for males were more than twice those of females, with the individual variation being a less important component. Our study suggests one aspect of snake size (mass) may play a role in the spatial ecology of this species. Importantly, we observed a positive relationship between increasing mass and size of activity areas in males, however, this trend was not seen in females.

0648 Snake Biology I, Sunday 16 July 2017

Michael Dreslik[1], Christopher Petersen[2], Scott Goetz[3], John Kleopfer[4], Alan Savitzky[5]

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Factors affecting the movements of Timber Rattlesnakes (*Crotalus horridus*) from the Mid-Atlantic Coastal Plain

Factors governing why or how far an organism moves can reflect local conditions, such as weather and habitat structure, as well as intrinsic biological variables such as age, sex, and reproductive condition. These variables may act synergistically to influence the frequency and distance of movements. We sought to determine whether climatic, behavioral, and/or biological factors drive movements in a mid-Atlantic population of Timber Rattlesnakes (*Crotalus horridus*), using a 17-year radio-telemetric data set. We used mixed-effects binary logistic regression to determine the probability of movement, and general linear mixed-effects regression, coupled with an AIC approach, to determine the best predictive models for distance per movement. Our results indicate that movements are influenced by numerous climatic, behavioral, and biological variables. For example, as mean three-day maximum temperature increased, so did the probability of movement, but the greatest distances moved were at the lower (egress and ingress) and higher temperatures (main activity season). Additionally, the probability of

movement was approximately the same throughout the year, whereas the greatest movement distances occurred during the summer months. As the number of days increased since last feeding, the probability of movement decreased, but the distances moved increased. Movements decreased before shedding and increased slightly after shedding. Together, our data suggest that numerous factors affect movements in *C. horridus*, notably the impact of weather patterns.

0645 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kandria Driskill, Kyle Dineen, Brook Fluker

Arkansas State University, Jonesboro, AR, USA

Body shape variation within and among lineages of the Rainbow Darter, *Etheostoma caeruleum*

The Rainbow Darter (*Etheostoma caeruleum*) is distributed widely throughout the eastern United States, with several disjunct populations in the lower Mississippi River drainage. An unpublished morphological study of *E. caeruleum* suggested several potentially distinct species in the White River drainage and in tributaries of the lower Mississippi River drainage. However, published phylogeographic studies are not concordant with morphological data. This study used geometric morphometrics to evaluate body shape differences of *E. caeruleum* across its range. Specifically, we asked whether differences in body shape corresponded to previously identified lineages or putative species based on meristic data. Preliminary results based on populations from loess habitats of Crowley's Ridge in Arkansas (St. Francis River drainage) and upland habitats of the Ozark Highlands (White River drainage) revealed some overlap in body shape between distinct lineages. However, disjunct populations from Crowley's Ridge were somewhat differentiated from other populations based on the distinction of the nuchal hump. Results from this study will provide valuable information about the distinctiveness of potentially unrecognized diversity within *E. caeruleum*.

0848 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; LFC BLAXTER BEST STUDENT POSTER

Melissa Drown[1], Delan J. Boyce[2], Ehren A. Habeck[2], Matthew Poach[2], R. Christopher Chambers[2]

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Plasticity of Responses to High CO_2 in Early Life Stages of Atlantic Silverside, *Menidia menidia*

Absorption of atmospheric CO_2, elevated from hydrocarbon combustion, by ocean surface waters has led to an acidification of coastal and ocean water (OA). OA is expected to affect the future mineralogy and biota of these ecosystems in ways ranging from minimal and subtle to strong and pervasive. Marine scientists lack a predictive understanding of the patterns of responses and downstream consequences of these effects. To date, experimental CO_2 effects studies on early life stages of fishes and other marine fauna typically use a small number of elevated CO_2 environments into which experimental subjects are placed then evaluated for responses. While effective for determining whether CO_2 has an effect on the responses measured, little is revealed about the scope and shape of the biological responses. Here we describe a new experimental apparatus for achieving a large number of different CO_2 concentrations among experimental tanks, report its performance, and use a forage fish (Atlantic Silverside, *Menidia menidia*) to demonstrate the extent and shape of various early life-stage biological responses to a wide range of CO_2 concentrations. This high-frequency CO_2 system (HFCO2) uses gas diffusion across distance to generate up to 12 unique and stable CO_2 concentrations. The HFCO2 system can also be used to mimic high-frequency (e.g., daily) oscillations in CO_2 concentrations as would be expected in nearshore and estuarine environments in summer. Such knowledge of full phenotypic plasticity of fish to CO_2 is needed to establish a quantitative understanding of CO_2 effects on our living marine resources in future CO_2-impacted environments.

0121 AES Conservation & Management I, Saturday 15 July 2017

Marcus Drymon[1], Steven Scyphers[0]

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Attitudes and Perceptions Influence Recreational Angler Support for Shark Conservation and Fisheries Sustainability

Despite the perilous status of many shark populations, rallying support for their conservation has been challenging, due in part to both long held negative perceptions and desire for shark fisheries. Recreational anglers are often advocates of conservation and can act as valuable partners with resource managers in developing fisheries management and conservation strategies. However, understanding their attitudes and perceptions, particularly towards resources status and management, is essential to developing successful management strategies and predicting outcomes. As a case study for assessing the complex challenges of sustainable shark fisheries, Florida recreational anglers were surveyed to understand how attitudes and perceptions influenced their willingness-to-donate for shark 1) conservation and protection or 2) fisheries sustainability. Overall, recreational angler willingness to donate was 25.5%, but attitudes and perceptions helped explain dramatic divides. For instance, willingness-to-donate was only 6% among the subset of anglers that perceived a growing large coastal shark population as a threat to recreational fishing opportunities. Highest support for shark conservation was shown by anglers who value seeing sharks in the wild (41.4%), and

even more so among individuals who occasionally target sharks while fishing recreationally (65.8%). Pervasive among anglers unwilling to donate was a perception that shark populations were increasing, and thus not in need of further protection. These findings illustrate attitudes and perceptions that challenge shark conservation and fisheries management, as well as the critical importance of engaging anglers when developing strategies that rely on the recreational angling community for support.

0913 LFC Physiological Performance I, Saturday 15 July 2017

Benjamin Dubansky, Warren Burggren

University of North Texas, Denton, Texas, USA

Growth, Development, and the Measure of Cardiovascular Physiology in Embryonic and Larval Teleost Fish

The use of developmental models in environmental science enhances understanding of the ecosystem response to stressors, and teleosts are often convenient subjects. In developing fish, cardiovascular structure and function are predictably and profoundly altered by both natural and anthropogenic stressors. As such, cardiovascular effects have become benchmarks in developmental teleost studies where observational and optical techniques enable rapid data collection. However, defects of the developing heart and vasculature can also be subtle, and are thought to result from a complex interaction of both environmental and heritable factors whereby developing organisms may be physiologically primed for increased plasticity and resilience, or sensitivity to stressors. Further, alteration in the timing of developmental processes may be reflective of an adaptive strategy. Complicating this, we note that development occurs across multiple trajectories and is neither linear nor saltatorial. In this vein, we illustrate here that synchronicity of growth and development can be variable, thus resulting in perceived alterations in cardiovascular physiology that are perhaps indirect effects, rather than direct effects of environmental stress. However, there is a poor understanding of the development of cardiovascular regulation in early life stage fish and much work is still needed that may be explanatory of effects seen in previous and ongoing work. Drawing upon a few examples and emerging model systems, we illustrate how growth, development, experimental timelines, and measurement can inform on and guide the acquisition of physiological data.

0238 Turtle Conservation, Saturday 15 July 2017

Thomas Duchak, Russell Burke

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Habitat and Species-specific Factors could be causing Maternally-linked Hatching Failure in a Threatened Turtle Population

We collected four years (2013-2016) of wood turtle nesting data at a site in northern New Jersey (NNJ) and found the overall hatch rates of this population to be unusually low (≈30%). Intra-individual hatch rates and comparisons between in-situ and artificial incubation revealed that many females consistently produced clutches with low (<50%) hatch rates, regardless of incubation conditions. In contrast, the annual hatch rates of other females were either consistently high (>50%) or highly variable, ranging from 0-100%. Thus, some females routinely made much larger contributions to the next generation than others. We obtained hatch rate data from a similar study in northern Virginia (NVA) and compared hatch rate repeatability between the NNJ and NVA populations to determine whether maternally-linked hatching failure (MLHF) is uncharacteristic of wood turtles. Additionally, we collected preliminary hatch rate data on NNJ painted and snapping turtles at the same site to determine if they also experience low hatch rates. Repeatability estimates revealed that maternal identity accounted for 58% of hatch rate variation in NNJ and only 5.6% in NVA. In 2016, the overall painted (58.82%; n = 5) and snapping (76.28%; n = 7) turtle hatch rates were not as low as the overall wood turtle hatch rate (31.71%; n = 16); however, larger sample sizes are needed for robust statistical comparisons. Our current results suggest that an unknown and, possibly, wood turtle-specific factor could be responsible for the elevated proportions of MLHF in NNJ. Inbreeding, deficient maternal diets, or environmental contamination are potential causes.

0916 AES Morphology, Sunday 16 July 2017

Laurent Duchatelet[1], Nicolas Pinte[1], Taketeru Tomita[2], Jérôme Mallefet[1]

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Species-specific dorsal luminous pattern in Etmopterids with an emphasis on the dorsal spine associated photophores

In the darkness of the ocean an impressive number of taxa have evolved the capability to emit bioluminescence. Most mesopelagic organisms emit a ventral dim glow that matches with the environmental residual light in order to camouflage themselves (countershading hypothesis), as for Etmopteridae. Dorsal luminescence pattern, conversely, is rare within these deep-sea organisms. Nevertheless, new evidences show that *Etmopterus spinax, Etmopterus molleri* and *Etmopterus splendidus* have a luminescence pattern spread all over the dorsal surface of the body. When we visualize the dorsal luminescent pattern in these three lanternshark species, we were able to observe specific lines of luminous organs, called photophores, on the dorsal area as well as more light coming up from the spines boundary. This dorsal light seems to be conflicting with the ventral photophores counterilluminating camouflage role. Moreover, skin photophores surrounding the defensive dorsal spines show a precise pattern supporting an aposematism function for this bioluminescence. Highlighting the defensive spine with bioluminescence seems to deter predators after a first learning bite on an Etmopteridae species. Thanks to in vivo digital camera pictures, *in situ video recording*, morphological

and histological analysis, we reconstruct these species dorsal light emission pattern, with an emphasis on the photogenic skin associated with the spine. Video footage analysis validated, for the first time, the defensive effect of the dorsal spines. Finally, we validate that Etmopterid, by opposition of Squalid and Heterondontid, do not have any spine-associated gland via CT scan analysis.

0733 Texas and Mexican Blindcats/Desert Fishes, Saturday 15 July 2017

Laura E. Dugan[1], Dean A. Hendrickson[2], Antonio Hernández-Espriú[3], Gary P. Garrett[2], Adam E. Cohen[2], Brad Wolaver[4], Ryan Smith[5]

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Conservation status assessment of the endangered Mexican blindcat, *Prietella phreatophila*

Discovery of the Mexican blindcat, *Prietella phreatophila*, in Texas in 2016 generated interest in the species, which had previously only been known from Mexico but is listed as a foreign endangered species in the US. Consequently, an effort was undertaken to conduct a conservation status assessment of the fish using standardized methods developed by NatureServe. These assessments aim to determine the extinction risk of species and produce conservation ranks, which can be used to inform listing statuses and policy decisions and to determine conservation priorities. The rank is determined by assessing factors in three main categories: rarity, threats, and trends. Here we used three rarity and one threat factor in the NatureServe rank calculator to determine the global conservation rank of *P. phreatophila*. Known occurrences were compiled, and the online tool GeoCAT (geospatial conservation assessment tool) was used to determine range extent and area of occupancy. Number of occurrences (e.g., populations) was estimated based on the spatial distribution of observations and their proximity to one another. Threat comprised scope, which was assessed in ArcGIS by intersecting the total area covered by a given threat with the known occurrence area of *P. phreatophila*, and severity, which was estimated based on expert opinion. The resulting conservation rank was G2 (globally imperiled; roughly equivalent to IUCN's Vulnerable rank); however, complete data were not available for any factor thus motivating the need for further study. When new data are available, the rank can be easily updated with this new information using the rank calculator.

0394 AES Conservation & Management II, Saturday 15 July 2017

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Bright spots of sustainable shark fishing

Sustainability is not on the menu according to the movies 'Sharkwater' and 'Racing Extinction'. We evaluate the null hypothesis that there are no sustainable shark fisheries. Fisheries stock assessments were available for a total of 65 populations of 47 species. We estimate that ~9% of the global catch of sharks is biologically sustainable, taken from 39 populations of 33 species that exhibit a wide range of life histories. Stocks that met some or all of the sustainability criteria mostly occur in the waters of developed countries that have well-developed fisheries management systems. Sustainable shark fisheries yield about 4,406 t of dried fins, suggesting 8.7% of the global trade is from sustainable sources. Sustainable shark fishing is not only possible, transitioning toward sustainable fishing is a viable for a wide range of the world's shark and ray fisheries.

0185 Turtle Conservation, Saturday 15 July 2017

Kirsten Dutcher[1], Amy Vandergast[2], Ken Nussear[1], Todd Esque[3], Anna Mitelberg[2], Jill Heaton[1]

[1]*University of Nevada, Reno, Reno, Nevada, USA,* [2]*USGS-Western Ecological Research Center, San Diego, California, USA,* [3]*USGS, Henderson, Nevada, USA*

A Recent History of Mojave Desert Tortoise (*Gopherus agassizii*) Genetic Connectivity in Relation to Utility-Scale Solar Development

Large-scale development of utility solar facilities on public lands in the Mojave Desert has recently increased due to initiatives for renewable energy in the United States. This has decreased available habitat for the Mojave desert tortoise (*Gopherus agassizii*), which is a federally threatened species. Although faced with multiple threats to its persistence, major contributors include habitat loss and fragmentation. In 2015 we began studies of tortoises inhabiting six 1-km^2 plots bridging the California-Nevada border. The plots are located in habitat adjacent to solar facilities in designated connectivity corridors, relatively open habitat, and adjoining mountain passes in an effort to determine genetic connectivity in this rapidly changing landscape. Blood samples were collected and genotyped at 21 microsatellite loci. We find no evidence of inbreeding and heterozygosity conformed to Hardy-Weinberg expectations (F_{IS} = -0.023 ± 0.004, F_{IT} = 0.012 ± 0.012) and little genetic differentiation among plots (F_{ST} = 0.034 ± 0.012), which falls within range-wide estimates (F_{ST} = 0.012 – 0.132) for the species. Weak population substructure exists (k = 2) with shared alleles from each cluster in all plots, indicating a near panmictic population. Full-pedigree likelihood analysis identified second order relatives distributed among plots. Our results indicate a recent history of genetic connectivity across the landscape and provide a reference point from which to compare current and future measures of connectivity required to understand the maintenance of current genetic population structure for Mojave desert tortoises.

0518 AES Reproduction, Sunday 16 July 2017

Jessica Dutton[1], Kaitlyn Gioia[2], Nicholas Fisher[3], Daniel Madigan[4]

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Mercury Bioaccumulation and Maternal Transfer in Spiny Dogfish (*Squalus acanthias*)

Mercury (Hg) is a global pollutant that biomagnifies up marine food webs. The spiny dogfish (*Squalus acanthias*) is a small, commercially valuable shark species with an ovoviviparous reproductive strategy and a gestation period lasting approximately 24 months. Using a Direct Mercury Analyzer, this study 1) determined the concentration of Hg in muscle, liver, brain, heart, blood, and fins, in relation to body length, in 49 female spiny dogfish caught off Long Island, NY, and 2) investigated the maternal transfer of Hg from the female into the eggs, and then the transfer of Hg from the external yolk sacs into the muscle and liver of the developing embryos. The Hg concentration was highest in the heart (0.67 to 3.22 µg/g dry weight), followed by the muscle, brain and blood, and lowest in the liver (0.02 to 0.26 µg/g) and fins (0.007 to 0.16 µg/g). There was a positive relationship between body length and Hg concentration in the muscle, liver, heart, brain and blood ($p < 0.01$), and dorsal and caudal fins ($p < 0.05$). Forty-nine females contained 200 eggs and 200 embryos (average = 4.1 eggs and 4.1 embryos per female), all of which accumulated Hg. There was no relationship between Hg concentration in the eggs and egg diameter, whereas Hg concentration in the embryos increased in the liver and decreased in the muscle with an increase in embryo body length ($p < 0.01$). This study showed that maternal transfer should not be overlooked as a source of Hg in sharks.

0353 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jessica Dutton[1], Brian Jackson[2], Diego Cardeñosa[3], Andrew Fields[3], Demian Chapman[4]

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Trace Element Concentrations in Shark Fin Soup and Dried Shark Fins

Prior studies have estimated that approximately 100 million sharks are killed each year for their meat and fins. Shark fins are used in shark fin soup and dietary supplements. This study investigated the concentration of eight essential trace elements (Co, Cr, Cu, Fe, Mn, Ni, Se, Zn) and five nonessential trace elements (Ag, As, Cd, Hg, Pb) in shark fin soup (n = 18) and dried shark fins (n = 17) purchased from Chinese restaurants and stores in New York and Texas using ICP-MS. Samples were also genetically identified to

determine the species. Blue shark (*Prionace glauca*) was the predominant species identified in the soup (n = 7) and the dried fins were mainly scalloped hammerhead (*Sphyrna lewini*; n = 6) or a *Carcharhinus* sp. (n = 10). For the essential elements, Zn, Fe, and Mn was found at highest concentration (38.1, 28.3 and 15.1 µg/g dry weight, respectively) and for the nonessential elements, As was found at highest concentration (0.649 µg/g dry weight). The average concentration of Hg in the fins (0.066 µg/g dry weight) is significantly lower than concentrations reported in shark muscle and well below the FDA 1 µg/g wet weight guideline for human consumption. Fins extracted from the soup were also speciated for methylmercury; there was large intra- and interspecies variability in the data, e.g., between 10 and 100% of the total Hg concentration was methylmercury in blue shark. This study is the first in-depth investigation into the concentrations of trace elements in shark fins.

0028 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Julia E. Earl

Oklahoma State University, Stillwater, OK, USA

Effects of Global Change on Amphibian Biomass Export from Ponds: a Meta-analysis of Mesocosm Studies

Information on the role of amphibians in ecosystems is important for informing conservation, understanding what may happen if species decline, and supporting policy decisions. Some of these roles will likely be altered with increased global change, but it is unclear what these effects will be and which types of global change will have the largest impact. One role that pond-breeding amphibians play is transporting nutrients and energy from aquatic to terrestrial ecosystems as recently metamorphosed individuals. Mesocosm experiments have played a key role in helping scientists understand the effects of different types of global change on tadpoles and emerging metamorphs, and these results can be used to estimate effects on amphibian biomass export from ponds to the surrounding terrestrial ecosystem. I used this approach to estimate effect sizes for different types of global change on amphibian biomass export and then performed a meta-analysis to compare the effects of different types of global change. Preliminary analyses have been completed for the following types of global change: land use change, climate change, contaminants, and emerging pathogens. I found that land use resulting in input of plant material to ponds increased amphibian biomass export. Increased canopy cover, shortened hydroperiods possible with climate change, and low pH all decreased amphibian biomass export, but decreases were most severe with high levels of heavy metal contamination. No effects were found for increased temperatures and emerging pathogens, but sample sizes were low. Future work will focus on adding studies on pesticides and invasive species to this analysis.

0788 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Laura Echeverri-García[1], Sharon Herzka[1], Patricia Jiménez-Rosenberg[2], Paula Pérez-Brunius[1], Vicente Ferreira-Bartrina[1], Jesús Cano-Compairé[1]

[1]Center for Scientific Research and Higher Education of Ensenada (CICESE), Ensenada, Baja California, Mexico, [2]Interdisciplinary Center of Marine Sciences (CICIMAR-IPN), La Paz, Mexico

Influence of oceanographic processes in the spatial distribution of fish larvae in the deepwater region of the Gulf of Mexico

The spatial distribution of ichthyoplankton is related to zones and seasons of spawning and to ocean circulation processes. These factors influence the ichthyoplankton assemblages, in which eggs and larvae from different zones converge. Upwelling filaments, frontal zones, currents and eddies are oceanographic processes that can influence larval transport, affecting the distribution, abundance and mortality of larvae. Few ichthyoplankton studies have been conducted in the deepwater region (depths >1000m) within Mexico's Exclusive Economic Zone (south of 25 °N). We are currently working on the characterization of larval fish assemblages in this region, obtaining information on taxonomic composition and abundances during different times of the year. This study presents data obtained during XIXIMI cruises carried out in November 2010, July 2011 and August-September 2015. Plankton samples were collected with bongo nets by oblique hauls; oceanographic data were obtained from CTD casts and satellite images (chl-a concentration and sea surface height anomalies). The abundance gradients of some families are analyzed. We evaluate the relationship between their distribution and mesoscale oceanographic processes, such as the confluence of coastal currents and upwelling events in the southeastern gulf, and anticyclonic and cyclonic eddies. The results show the occurrence of massive transport of coastal taxa from the continental shelf to the deepwater region, as well as the dominance of larvae of oceanic families in anticyclonic circulation structures and in the oligotrophic central Gulf of Mexico. These analyses highlight the importance of studying larval fish assemblages as indicators of oceanographic processes and transport patterns at regional scales.

0347 Turtle Conservation, Saturday 15 July 2017

Tomo Eguchi[1], Sam McClatchie[1], Cara Wilson[2], Scott Benson[3], Jeffrey Seminoff[1], Robin LeRoux[1]

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Density, abundance, and distribution of loggerhead turtles off southern California during an extremely warm period

North Pacific loggerhead turtles (*Caretta caretta*) nest on Japanese beaches and mature adults distribute in the western Pacific. Juveniles, however, disperse throughout the

North Pacific, some reaching the west coast of the Baja California peninsula, Mexico, while others remain in the high seas of the central North Pacific. Occasional sightings, strandings, and fishery bycatch have indicated that loggerheads are present along the west coast of the US, where the majority of sightings occur off southern California. El Niño conditions brought warm waters along southern California in late 2014 through 2015 and aggregations of loggerheads were reported. An aerial survey was conducted during fall 2015 to determine density, abundance, and distribution of loggerheads off southern California. Approximately 5,000 km of track lines were surveyed during 11 days and more than 200 loggerheads were sighted. Using line-transect analysis, we estimated approximately 15,000 loggerheads at the sea surface (CV=21%). Accounting for those that were submerged and not available for detection, there were more than 70,000 loggerheads in the area. A similar survey during fall 2011 found no loggerheads. We speculate that the unusual warm waters created favorable conditions for loggerheads. Since 2003, management measures have been in place to reduce loggerhead interactions in the California-based drift gillnet (CADGN) fishery, which close the fishery from June to August when El Niño conditions are expected or present. The observed temporal and spatial distribution of loggerheads did not match with the current CADGN fishery management rules, indicating that the management rule may need to be reconsidered.

0293 AES GRUBER AWARD IV, Friday 14 July 2017

Samantha Ehnert, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Mercury Accumulation and Effects in the Brain of Atlantic Sharpnose Sharks (*Rhizoprionodon terraenovae*)

Sharks often bioaccumulate mercury in their muscle to levels that threaten the health of human consumers. However, data is lacking on how mercury in the brain affects shark neurophysiology. Therefore, this study examined if shark brains accumulate significant levels of mercury, if mercury accumulation occurs in certain subcomponents of the brain, and if mercury accumulation is associated with effects on the shark central nervous system, with special focus on the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*). Sharks were collected throughout the U.S. Southeastern coast, along most of the shark's geographical range. Results indicate that there is an exponential relationship between muscle mercury and the length of the shark and between the muscle and brain mercury levels. However, brain mercury levels were significantly lower than muscle and did not exceed most known thresholds for neurological effects, suggesting limited potential for such responses. The lack of correlations between brain mercury concentrations and biomarker levels of mercury-induced neurological effects (markers of oxidative stress and cell damage) in shark cerebrospinal fluid support this premise. Higher mercury levels were measured in the forebrain of shark in comparison with the midbrain and hindbrain, but these levels were below threshold levels for effects. The percent methylmercury in the brain is lower than previous studies in the shark brain,

suggesting mercury demethylation occurs in the shark brain. This extensive study is one of the first to demonstrate the correlation of mercury in the shark brain and muscle, as well as to identify significantly higher mercury levels in the forebrain.

0380 LFC Multi-Stressor Effects, Friday 14 July 2017

Werner Ekau[1], Simon Geist[2]

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Climate change impacting recruitment in upwelling areas: Can we save the small pelagics' stocks from extinction?

The northern Benguela ecosystem (nBUS) has been facing increasing temperatures and decreasing dissolved oxygen (DO) levels over the last decades. This had implications for key processes and trophic interactions within the system including shifts in community ranges and trophic levels, changes in energy flows and migration patterns. A feedback into biogeochemical processes can be expected. As confirmed for other upwelling systems, oxygen is a major factor structuring and limiting the "living space" of pelagic organisms. Adaptations to oxygen deficits happen at the community level; species may either cope with lower oxygen levels and migrate into or through the oxygen minimum zone (OMZ) or leave/avoid the area/OMZ. Spatial and temporal distribution patterns of key species of zooplankton and fish larvae and their observed latitudinal shifts imply an overall change of biomass distribution and impact on the vertical (carbon) transport pattern. Changes in depth distribution of key taxa show their differences in hypoxia tolerance, hence different strategies to cope with the OMZ. Shrinkage of the oxygenated surface layer is constraining sensitive species and will lead to further adjustments of daily and/or seasonal vertical migrations. Simulated oxygen consumption rates and experimental data show mass specific rates between 10 and 50 ml O_2 g^{-1} d^{-1} imposing that elevated zooplankton densities contribute significantly to a further oxygen decline in the OMZ. Focussing on results from the Benguela Current Ecosystem the question is raised whether systems like the nBUS or Humboldt Current have the chance to flip back into "original" conditions under expected climate change forecasts.

0546 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Diego Elias, Fernando Alda, Alexandria Adams, Prosanta Chakrabarty

Louisiana State University, Baton Rouge, LA, USA

Comparative Phylogeography of the Green Swordtail (*Xiphophorus helleri*) and the Common Platy (*Xiphophorus maculatus*) across Middle America

The genus *Xiphophorus* (subfamily: Poeciliinae) is distributed across Middle America and is comprised of 26 recognized species, that are divided into four groups according to their distribution: the northern swordtails and the northern platyfish which are distributed from Northern Mexico to the northern portion of the Trans-Mexican volcanic belt in Veracruz, Mexico, and the southern swordtails and the southern platyfish which are distributed from the Southern portion of the Trans-Mexican volcanic belt towards Northern Guatemala, Belize and the Caribbean slope of Guatemala and Honduras. The southern swordtails and southern platyfish are the most species rich, representing about 52% of the species diversity of the genus. Notably, both groups are composed of several geographically restricted species, and one single widespread species, *Xiphophorus helleri* (swordtails) and *X. maculatus* (platyfish), which overlap in their distribution. The objective of this work was to evaluate the genetic structure across the range of *X. helleri* and *X. maculatus* and to test if there is congruence among the phylogeographic patterns recovered for both species, using mitochondrial and nuclear markers. Our results shed light on the roles of previous hypothesized barriers (e.g., Isthmus of Tehuantepec) and of past climatic events shaping the genetic structure and demographic history of the widespread Common Platy (*X. maculatus*) and the green swordtail (*X. helleri*) in the geographically complex region of Middle America.

0537 ASIH STOYE GENERAL ICHTHYOLOGY I, Thursday 13 July 2017

Diego Elias[1], Elyse Parker[2], Caleb McMahan[3], Christian Barrientos[4], Kimberly Foster[5], Kyle Piller[2]

[1]Louisiana State University, Baton Rouge, LA, USA, [2]Southeastern Louisiana University, Hammond, LA, USA, [3]The Field Museum of Natural History, Chicago, IL, USA, [4]Wildlife Conservation Society, Bata, Equatorial Guinea, [5]Western Michigan University, Kalamazoo, MI, USA

Multi-locus phylogeny of *Pseudoxiphophorus* (Poeciliidae): Re-evaluation of relationships and geographic distribution

The subfamily Poeciliinae (Poeciliidae: Cyprinodontiformes) represents one of the dominant groups of freshwater fishes in Middle America, including 276 viviparous species distributed from the southeastern United States to northeastern Argentina and the Caribbean. Within this subfamily, the genus *Pseudoxiphophorus* is represented by nine species (*P. jonesii, P. tuxtlaensis, P. bimaculatus, P. cataractae, P. obliquus, P. diremptus, P. attenuatus, P. litoperas* and *P. anzuetoi*) distributed from northern Mexico to northern Nicaragua. A previous molecular phylogenetic study of the group suggests that the genus *Pseudoxiphophorus* harbors cryptic diversity, particularly in the most widespread species of the genus, *P. bimaculatus,* which is not recovered as monophyletic across its range of distribution. The objective of this study was to re-evaluate the phylogenetic relationships of the genus using a novel molecular dataset including both mitochondrial (one locus) and nuclear (six loci) markers. Our analysis recovered novel relationships among species of the genus and provides evidence to suggest that some species within *Pseudoxiphophorus* possess a more widespread distribution across Middle America than

previously hypothesized. This work provides a robust historical framework that will allow an exhaustive examination of diagnostic morphological characters for the independent lineages recovered and will shed light on the evolutionary history of the genus *Pseudoxiphophorus* and the complex history of freshwater fishes of Middle America.

0191 AES Reproduction, Sunday 16 July 2017

Mariano Elisio[1], Jorge, H. Colonello[1], Cynthia, A. Awruch[2], Gustavo, M. Somoza[3], Gustavo, J. Macchi[1]

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Inter-annual Changes in the Narrownose Smooth-hound Shark (*Mustelus schmitti*) reproductive timing in Relation to Temperature Patterns in Coastal Waters of the South-western Atlantic Ocean (34-42 °S)

As chondrichthyans have a relatively low reproductive potential, intensive protection of their reproductive events is critical for its sustainable management. This study assessed the inter-annual changes in reproductive events of a commercially important shark in southern Brazil, Uruguay and Argentina, *Mustelus schmitti*, in relation to environmental variability in two coastal areas of the south-western Atlantic Ocean (*El Rincón* and *Río de La Plata*). Data were collected from 612 sample sites during six spring surveys. The reproductive scenarios were defined by the presence of vitellogenic and ovulated females. Plasma sex steroids levels were assessed in females at similar reproductive stage captured at different temperatures to gather physiological evidences of reproductive thermal influences. Progression of reproduction (increase in proportion of ovulated females) showed significant inter-annual variability associated with bottom temperature conditions. Sites associated with reproductive aggregations (co-occurrence of ovulated and vitellogenic females) were significantly warmer than those where only vitellogenic females were found. Depth and salinity were not related with ovulation. The mean ovulation temperature estimated (temperature encompassing 50% of ovulated females) was 17.8 ± 0.98 °C. Change in sex steroid levels was consistent with the ovulation temperature. Inter-annual differences of more than one month were predicted in the reproductive timing of *M. schmitti* by using historical bottom temperature variability models together with the estimated ovulation temperature. In sum, this study showed significant inter-annual changes in *M. schmitti* reproductive timing in response to thermal variability. Thus, present results should be considered for management strategies seeking reproductive protection of this species.

0459 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Mariano Elisio[1], Yan Zhang[2], Leandro, A. Miranda[3], Yoji Yamamoto[2], Carlos, A. Strüssmann[2]

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Potential Application of an *In Vitro* Gonadal Culture Assay to Determine Fish Reproductive Response to Environmental Temperature

Temperature is a key environmental cue controlling gonadal development and spawning in fish. This control appears to be associated with the influence that this physical variable exerts on gonadal steroidogenesis. This study assessed if profiling of steroid synthesis on *in vitro* gonadal cultures at different temperatures accurately reflects the fish reproductive response to environmental temperature. The pejerrey *Odontesthes bonariensis* was selected as model because of its well characterized *in vivo* reproductive response to temperature changes. Ovarian *in vitro* cultures of three females were performed at 6 different temperatures between 12 and 27 °C, using Leivovitz L-15 medium containing 17-hydroxy-progesterone (100 ng/ml). Testosterone (T), estradiol (E_2), and relative gene expression of gonadal aromatase (*cyp19a1a*) were measured after 12 hours culture. *Cyp19a1a* relative expression showed an almost linear decrease with temperature increase, while both T and E_2 levels in culture medium showed a Gaussian relationship with temperature. On average, the highest level of E_2 was obtained between 19 and 20 °C, while for T it was between 20.5 and 21.5 °C. The optimal temperature range estimated in this study for production of E_2 (hormone promoting ovarian development) coincided with the optimal temperature previously reported for ovarian maturation in this species (19-20 °C). The optimal temperature estimated for T production, which was approximately 1.5 °C higher than for E_2, could indicate the best temperature for inducing spawning. In conclusion, this study provides promising evidences for the development of a relatively easy *in vitro* assay to determine fish reproductive response to environmental temperature.

0061 ASIH STOYE ECOLOGY & ETHOLOGY I, Thursday 13 July 2017

James Erdmann

Southeastern Louisiana University, Hammond, Louisiana, USA

This Little Piggy: Why do Amphibians Vibrate Their Feet While Hunting?

Toe vibrations while foraging have been observed across nearly two-dozen amphibian taxa, in species exhibiting highly disparate ecology, geography, and evolutionary history. To date, no theory satisfactorily explains the general occurrence of these behaviors. I explore the theoretical views and empirical consequences of toe vibrating in

amphibians using the Gulf Coast Toad (*Incilius nebulifer*; Girard, 1854) and their dominant diet item, woodlice (Isopoda, Oniscidea) as a study system. Using novel laboratory methods and application of a little-used statistic, I describe the correlates of toe vibrations, both in relation to the feeding and movement patterns between predator and prey. Overall, the presence of toe vibration is associated with increased feeding success in toads, but the conditions involved are inconsistent with current theory on the subject. Toe vibration as a biotremological adaptation remains equivocal pending further experimentation.

0291 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Janelle Espinoza, Jaime Alvarado-Bremer

Texas A&M University at Galveston, Galveston, TX, USA

Population Structure of Gulf Killifish (*Fundulus grandis*) Along the Northern Gulf of Mexico Coast Using Mitochondrial DNA Sequencing

Gulf killifish are among the most abundant nekton in *Spartina alterniflora* salt marsh habitat along the Gulf of Mexico coast, and are important prey items for shorebirds and many fish species. Their low dispersal potential and high site fidelity within the marsh make them an excellent indicator species for habitat health, and they have been used as such in studies on the impacts of recent oil spills in the Gulf. Despite their ecological importance, Gulf killifish are not considered a model species, and therefore little data exists regarding levels of genetic diversity and population connectivity. This study seeks to characterize genetic differentiation among Northern Gulf of Mexico populations using mitochondrial DNA sequence data. Specimens (n=176) were obtained from locations in Texas, Louisiana, and Mississippi. DNA was extracted, and segments of mitochondrial genes ND2, ND5, and the Control Region were PCR amplified and sequenced. The analysis of a total of 1,088 bp shows strong phylogeographic association with significant differences between locations. Accordingly, the null hypothesis of panmixia was rejected and confirmed with AMOVA ($p<0.05$). The data also shows the Atlantic sister-species, *Fundulus heteroclitus,* to be more closely related to populations from the Southern Texas coast than to populations from Louisiana and Mississippi, as hypothesized by the vicariant refugia hypothesis associated with the last glacial maxima. Future studies should focus on resolving this relationship by including samples from the Mexico coast and farther east along the U.S. coast.

0548 ASIH STOYE GENERAL ICHTHYOLOGY I, Thursday 13 July 2017

Kory Evans, Brian Schubert, James Albert

University of Louisiana at Lafayette, Lafayette, LA, USA

Developmental bias facilitates trophic diversification in Amazonian electric fishes

The Neo-Darwinian view of adaptation by natural selection assumes that phenotypic variation is produced randomly with respect to function. However, developmental pathways are often buffered against the effects of mutations such that small changes in the timing of gene expression may generate non-random, functionally viable phenotypes. Phenotypes produced as a result of these developmental biases should exhibit a wide range of adaptability in order to persist at higher frequencies than alternative phenotypes. Here we explore the role of developmental biases in the production of ontogenetic variation and phylogenetic diversity in the neurocrania of Neotropical electric fishes (Gymnotiformes: Teleostei). We examine the role of developmental biases on the evolution of convergent phenotypes and use stable isotope analyses to examine the ecological and functional implications of convergent evolution via developmental biases in seven species of brachycephalic gymnotiform fishes. We find multiple trophic ecologies associated with very similar brachycephalic skull shapes and a diversity of lower jaw morphologies. These findings suggest that the brachycephalic skull is widely adaptable for a variety of trophic functions, due in part to the diverse array of lower jaw structures within which it can be adorned.

0650 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Elizabeth Everman, Luke Lockhart, Jacob Marlay, Daniel Bittel, Paul Klawinski

William Jewell College, Liberty, Missouri, USA

Seasonal and geographic variation in physiological and behavioral thermoregulation in *Hemidactylus turcicus*

The physiological and behavioral thermoregulation of ectothermic organisms is strongly influenced by environmental temperature, and previous research has shown that the ability to tolerate challenging temperatures is a function of both basal tolerance and the capacity for acclimation. The Mediterranean gecko (*Hemidactylus turcicus*) was introduced to Florida in 1910 and underwent subsequent range expansion, reaching Texas by 1950 and extending as far north as Kansas by 2006. *H. turcicus* populations in south Texas experience climate that is most similar to that of their native range, while northern *H. turcicus* populations experience climate with greater seasonal variability and frequency of cold temperatures. This suggests that northern invasive populations are at the edge of their thermal limits. We addressed the influence of climate and seasonal acclimation on physiological thermotolerance and behavioral thermoregulation in geckos collected in January from Galveston, TX and Oklahoma City, OK. Sprint speed of individuals collected from Texas and Oklahoma across horizontal and vertical surfaces at 10 degrees C indicates the critical thermal minimum (previously reported as 10 degrees C) is plastic and that cold tolerance of this species is dependent on seasonal thermal regime. The relatively recent establishment of *H. turcicus* across a variable climatic gradient makes this species ideal for understanding how physiological limits,

behavioral thermoregulation, and phenotypic plasticity contribute to the persistence of species in novel and thermally challenging environments.

0758 Reptile Conservation, Sunday 16 July 2017

Cord Eversole[1], Scott Henke[1], Selma Glasscock[2], Bart Ballard[1], Randy Powell[1], David Wester[1]

[1]Texas A&M University- Kingsville, Kingsville, Texas, USA, [2]Welder Wildlife Foundation, Sinton, Texas, USA

A theoretical harvest model for American alligators (*Alligator mississippiensis*) in Texas

The American alligator (*Alligator mississippiensis*) is a crocodilian species that was once listed as endangered in the United States but is now harvested both recreationally and commercially throughout its range in the southeastern United States. Harvest of alligators typically includes egg collection and hunting. However, the effects of harvest on alligator populations have received little to no scientific scrutiny. A theoretical simulation model was built to evaluate the impact of several harvest strategies on long-term (i.e., 100 years) alligator population trends. System dynamics software was used to develop the model and data for the model was acquired through literature and anecdotal information on alligator ecology. Results of model simulations showed that current harvest (50% egg harvest, 2% subadult harvest, 2% adult harvest) in Texas is sustainable, but alligator populations will stabilize at levels below population potential. The best harvest scenario for a sustainable harvest that maintains alligator populations at a relatively unchanging level is a 38% egg harvest, 2% subadult harvest, and 2% adult harvest. An elevated egg harvest (80%) can be sustained if no hunting harvest occurs. Contrarily, an increased hunting harvest (4% subadult, 4% adult) can be sustained with no egg harvest. This model verifies the function of current alligator harvest within populations and provides a tool for future use in determining the effect of changes in harvest or life history characteristics on alligator population dynamics.

0767 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Cord Eversole[1], Scott Henke[1], Randy Powell[1], Selma Glasscock[2], Bart Ballard[1], David Wester[1]

[1]Texas A&M University- Kingsville, Kingsville, Texas, USA, [2]Welder Wildlife Foundation, Sinton, Texas, USA

The influence of nest patch on nest site selection and success of American alligators (*Alligator mississippiensis*)

Selection of particular nest patches or sites results in nonrandom patterns of nest distribution and is said to be driven by natural selection. These nonrandom patterns

result from selection of habitat characteristics, such as patches in a habitat mosaic or specific microhabitats by nesting females. No studies to our knowledge have attempted to directly quantify or elaborate on this idea for American alligators (*Alligator mississippiensis*). In this study, we evaluated the influence of nest patch on nest site selection and preference of female American alligators in order to demonstrate the role of "nursery" habitat in alligator life history and ecology. We also examined the effect of nest patch and nest site characteristics on alligator nest success. Our data demonstrates that nest site selection of alligators is influenced by nest patch characteristics. It is probable that natural selection has selected for these behaviors associated with nest patch and site selection because they are directly related to increased nest success, due to a primarily lower probability of nest depredation, and an increased probability of hatchling survival. Patch characteristics of nursery habitats such as presence of islands, shallow water, and adequate vegetation coverage are what contributes to increased nest and hatchling survival and therefore selection by nesting female alligators. Conservation and management practices should consider this information when implementing management strategies.

0801 Fish Genetics, Saturday 15 July 2017

Ron Eytan[1], Eva Paulus[2], Max Weber[1], Tracey Sutton[3]

[1]Texas A&M University at Galveston, Galveston, Texas, USA, [2]Barry University, Miami, Florida, USA, [3]Nova Southeastern University, Dania Beach, USA

Once bitten, twice shy: a cryptic species of Sloane's Viperfish (*Chauliodus sloani*) discovered in the mesopelagic waters of the Gulf of Mexico

The deep-oceanic Gulf of Mexico (GoM) is one the highest diversity pelagic ecosystems in the world. While some species of deep-sea fishes appear to be exclusively found in the GoM, a large portion of the deep-sea fish fauna is represented by species found in other basins. However, genetic methods have begun to unravel some of this traditional taxonomy, and have revealed unanticipated diversity and endemism in the deep-pelagic of the GoM. This is in the form of cryptic, undescribed species. One example is *Chauliodus sloani* or Sloane's viperfish, a mesopelagic predatory fish found throughout the earth's deep-pelagic waters. Our genomic surveys of viperfish samples have revealed two deeply divergent viperfish linages co-existing in the GoM, one apparently endemic to the GoM. These fishes live in sympatry, with no obvious ecological or morphological differences separating them. Nonetheless, they have not interbred for millions of years and species delimitation methods have identified them as two independently evolving lineages. Here we use comparative genomics to understand divergence, gene flow, and the historical demography of these two species, with the ultimate goal of elucidating speciation mechanisms.

0897 LFC Contributed III, Saturday 15 July 2017

Marianne Falardeau[1], Caroline Bouchard[2], Dominique Robert[3], Louis Fortier[4]

[1]McGill University, Montréal, QC, Canada, [2]Greenland Institute of Natural Resources, Nuuk, Greenland, [3]Université du Québec à Rimouski, Rimouski, QC, Canada, [4]Université Laval, Québec, QC, Canada

Invasion of the Canadian Arctic Archipelago by Pacific Sand Lance Detected by an Ichthyoplankton Survey

Northward invasions into rapidly warming Arctic marine ecosystems by southern species are occurring at a higher rate than the global average. In the Barents Sea, fish communities, once dominated by species endemic to the Arctic, are undergoing a "borealization" process as subarctic species rapidly expand their distribution northward, outcompeting Arctic fish assemblages. The same trend is observed in the Chukchi and Beaufort Seas, where North Pacific demersal and pelagic species are increasingly reported north of the Bering Strait, including commercially-important gadids and salmonids. Niche-based models run under climate change scenarios predict a drastic shift in the range of several Pacific species, which will eventually lead to an Atlantic-Pacific interchange. Among these range shifts, an expansion of Pacific sand lance (*Ammodytes hexapterus*) into the Northwest Passage and the Northwest Atlantic Ocean is projected by 2100. Relying on an annual ichthyoplankton survey in the Western Canadian Arctic, we report the occurrence and reproduction of Pacific sand lance for the first time in the Canadian Arctic Archipelago, a region far outside the species traditional range south of the Bering Strait. We observed an increasing density of larval Pacific sand lance with time over the 2011-2016 period, suggesting that environmental conditions are becoming increasingly favorable for the species to reproduce in the Central Canadian Arctic. Invasion of Arctic coastal ecosystems by sand lance could be facilitated by flexible habitat requirements, fast larval growth and the capacity of burying themselves into sediments to survive through harsh winter conditions.

0698 Lizard Conservation, Saturday 15 July 2017

Bryan Falk[1], Emma Hanslowe[1], Amy Yackel Adams[2], Robert Reed[2]

[1]U.S. Geological Survey, Homestead, FL, USA, [2]U.S. Geological Survey, Fort Collins, CO, USA

Working Towards Improved Management of Invasive Black and White Tegus (*Salvator merianae*)

Land managers need control and monitoring tools for populations of invasive species, but many of these tools are species-specific and undeveloped for newly established populations. Researchers developing these tools may have to build them in several steps over multiple years, and here we describe one year's progress in developing control and monitoring tools for invasive black and white tegus (*Salvator merianae*) in South Florida. Despite intensive trapping efforts by several agencies and private individuals over the last few years, the tegu population continues to expand, and it is unclear what control

methods and intensities are necessary for containment. In 2016 we conducted several experiments with the ultimate goal of facilitating containment of the tegu population, including: 1) a trap trial for juvenile lizards; 2) a bait trial; and 3) a radio-transmitter-attachment trial for growing, juvenile lizards. We discuss how these results will inform future research and control efforts and illustrate the effectiveness of a multi-year strategy in invasive-species research.

0562 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Patricia Faulkner, David Hala, Lene Petersen

Texas A&M University at Galveston, Galveston, Texas, USA

Physiological Effects of Salt Stress on Juvenile American Alligators (*Alligator mississippiensis*)

Gulf of Mexico coastal habitats constitute vulnerable ecosystems susceptible to the impacts of storm surges which can cause saltwater intrusions into freshwater habitats. These intrusions can be both persistent (~1 year) and severe (~24 ‰) and have significant negative effects on freshwater organisms. The Gulf of Mexico region is habitat for American alligators (*Alligator mississippiensis*) which have a low tolerance to saline environments as they are unable to excrete high sodium (Na^+) concentrations. Indeed, studies have shown high salinity to cause hyperosmotic stress (electrolyte imbalance) and mortalities of juvenile alligators. Changes in electrolyte balance stimulate the Renin-Angiotensin-Aldosterone System (RAAS) which is an endocrine system responsible for regulating blood pressure and cardiac function. Adverse effects of salt stress in juvenile alligators include high aldosterone and stress hormone levels (corticosterone, catecholamines). It is, however, unknown if saline environments affect cardiac function in alligators via RAAS stimulation. This project aims to determine the physiological effects of salinity stress on juvenile alligators. To this end, juvenile alligators were exposed to either 0 or 12 ‰ salinity for five weeks. Chronic effects of brackish water on cardiac physiology will be determined by assessing plasma electrolyte levels (Na^+, K^+, Cl^-), gene expression of cardiac RAAS hormone receptors (angiotensin II type 1, mineralocorticoid, glucocorticoid), plasma hormone levels (angiotensin II, aldosterone, and corticosterone), and in vivo cardiac performance using electrocardiography (ECG). This study will increase our understanding of alligator physiological responses to salt stress, and inform decision-makers regarding management of wild alligators.

0580 Fish Reproduction & Development, Saturday 15 July 2017

Richard Feeney[1], Milton Love[2], Taylor Sakmar[3], William Steinriede[4], Kaia Joye Moyer[3]

[1]*Natural History Museum of Los Angeles County, Los Angeles, CA, USA,* [2]*Marine Science Institute, University of California, Santa Barbara, CA, USA,* [3]*Catalina Island Marine Institute, Avalon, CA, USA,* [4]*Catalina Island Camps, Howlands Landing, CA, USA*

Unusual occurrence of King-of-the-Salmon (*Trachipterus altivelis*) juveniles near Santa Catalina Island, California, during the winter of 2013

Dozens of fragile King-of-the Salmon juveniles appeared nearshore at Santa Catalina Island and were observed and photographed in situ at three separate localities during the winter and spring of 2013. Usually this species is confined to the mesopelagic zones off the coast. The oceanographic conditions of the Southern California Bight were not unusual except for strong winter upwelling. A northwestern gale came through a week before the first observed fish. Numerous other pelagic organisms such as ctenophores, pelagic mollusks, siphonophores, and a manefish, were also observed. The young King-of-the-Salmon juveniles (50-150 mm) display fantastic elongations of the dorsal, caudal and pectoral fin rays not seen in preserved specimens. The function of these elongations, and curious color changes, is not known. The elongations are mostly gone by 300 mm and in larger juveniles (500-600 mm) completely lost. Like many lampriforms they undulate their dorsal fin to move and position themselves, sometimes with a vertical posture with the pectoral and dorsal fins extended out. Mitochondrial DNA from a few specimens submitted to BOLD show high similarity to adult *Trachipterus altivelis* and *T. trachypterus*, supporting growing evidence that these two ribbonfish species are synonyms.

0444 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Friday 14 July 2017

Logan Fehrenbach, Christopher R. Tracy

California State University - Fullerton, Fullerton, CA, USA

Physiological differences of two closely related skink species, *Plestiodon skiltonianus* and *Plestiodon gilberti*, that differ in habitat aridity

Plestiodon skiltonianus and *Plestiodon gilberti* are two closely related skink species located in Western North and South America. *P. gilberti* is thought to have evolved a larger body size from *P. skiltonianus* to deal with heat flux across the skin as it moved into warmer and more water restricting habitats. *P. skiltonianus* is usually found in cooler and higher elevation habitats while *P. gilberti* can be found in warmer and lower elevation habitats. Both species can be found in areas of sympatry, however these areas are patchy and intermixed between areas of allopatry. This experiment was done to test inter/intraspecific physiological differences in sympatric and allopatric populations of both species. It was hypothesized that there would be significant physiological differences between all populations tested. To test physiological differences, burst sprint speed, critical maximum and minimum temperatures, and preferred temperature was taken. Respirometry analysis including oxygen consumption rates, carbon dioxide production rates, and evaporative water loss rates were taken at a range of temperatures

both species experience in the field. Preliminary results show interspecific differences in optimal temperature, preferred temperature, and critical maximum and minimum temperatures. These results suggest that *P. gilberti* moving into a more xeric habitat resulted in a physiological shift along with the change in body size. Also, each species retains a physiological plasticity when compared between sympatric and allopatric populations of the same species.

0902 Herp Biogeography & Phylogeography I, Sunday 16 July 2017

Martin Femenías[1], Luciano J. Avila[2], Jack W. Sites, Jr.[3], Mariana Morando[2]

[1]Univ. Nacional Patagonico, Trelew, Chubut, Argentina, [2]Centro Nacional Patagonico, Puerto Madryn, Chubut, Argentina, [3]Brigham Young University, Provo, Utah, USA

The Leiosaurae "matuastos" lizard clade endemic to southern South America: phylogeography, species limits, biogeographic history and new candidate species

The Leiosaurae is one of the most enigmatic lizard clades from the Southern Cone of South America. The species of this clade are poorly represented in herpetological collections and almost nothing is known of their natural history. These limitations make this clade one of the least known of the herpetofauna of South America. Although a recent molecular phylogeny with most of the 18 described species has been published, no within-species studies have been completed, and here we present a phylogeographic study of the four species of the genus *Diplolaemus*, as well as for *Leiosaurus bellii* in a paleogeographic context. We implemented a species delimitation study on this clade, using a multilocus coalescent approach, and a sample of 342 individuals from 235 localities, the most extensive to date for this clade. We present molecular diversity indexes and infer historical demographic patterns based on the cyt-b gene, and we update the phylogeny of the group based on two mitochondrial and eight nuclear genes. We generate hypotheses for the historical biogeography and evolutionary history of this clade.

0351 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Steven Ferguson[1], Shannon Smith[2], Ronald Lowe[1], Robert Colombo[2], Devon Keeney[1]

[1]Le Moyne College, Syracuse, NY, USA, [2]Eastern Illinois University, Charleston, IL, USA

Impact of Low-Head Dams on the Genetic Structure of Fish Populations in Two Illinois Rivers

Low-head dams are prevalent throughout the United States and can influence the genetic structure of riverine fish populations in multiple ways. We used microsatellites to assess how two low-head dams affect genetic diversity and differentiation in longear sunfish (*Lepomis megalotis*), bluntnose minnow (*Pimephales notatus*), black redhorse (*Moxostoma duquesnei*), and golden redhorse (*Moxostoma erythrurum*) in two Illinois rivers. We also examined if hybridization is occurring between the two redhorse species throughout the study area. Initial results suggest the dams are not reducing genetic diversity along rivers, but are influencing genetic differentiation in at least one species, bluntnose minnow. Genetic differentiation is potentially the result of poor quality habitat created by a dam serving as a deterrent to fish movement. Hybridization is not common between the redhorse species analyzed in our study region. Our data reveal that even small dams can impact the genetic structure of fish populations and that the influence of dams depends on the focal species, river system, and the individual dam itself.

0081 Lightning Talks I, Friday 14 July 2017

Miranda Figueras[1], Brian Bastarache[2], Russell Burke[1]

[1]Hofstra University, Hempstead, New York, USA, [2]Bristol County Agricultural High School, Dighton, Massachusetts, USA

Water exchange relationships and overwintering behavior in hatchling turtles

Neonate ectotherms face a wide range of environmental hazards because of the diverse habitats they inhabit and their small sizes. This is especially true amongst high latitude turtles which experience cold winter conditions after hatching; such hatchlings must balance challenges involving desiccation, freezing, and predation, among other threats. Four behavioral patterns are known; turtle hatchlings either overwinter in water (OIW), terrestrially overwinter shallowly in the nest and likely freeze (TIN), terrestrially overwinter deep in the nest and perhaps avoid freezing (TBN), or terrestrially overwinter outside the nest entirely and likely freeze (TON). Previous investigations found that TIN and TBN species were generally able to supercool and resist freezing at lower temperatures, as well as being better at resisting desiccation. We measured desiccation tolerance of three additional turtle species, two that use the TON strategy (Diamondback Terrapins, *Malaclemys terrapin*, and Common Box Turtles, *Terrapene carolina*) and Wood Turtles (*Glyptemys insculpta*), which are probably OIW strategists. As predicted, hatchlings of the two TON species had high desiccation resistance. In fact, Diamondback Terrapins had extraordinarily high desiccation resistance, which may be due not only to their habit of overwintering on land, but also their exposure to saline environments. As predicted, the OIW strategist had the lowest desiccation tolerance. We therefore found additional support for the hypothesis that desiccation tolerance is associated with overwintering strategies in hatchling turtles.

0088 SSAR SEIBERT ECOLOGY II, Thursday 13 July 2017

Miranda Figueras[1], Kent Hatch[2], Timothy Green[3], Russell Burke[1]

[1]Hofstra University, New York, USA, [2]LIU Post, New York, USA, [3]Brookhaven National Laboratory, New York, USA

Consumption and Assimilation Patterns of the Eastern Box Turtle, Diet Generalists

Eastern Box Turtles (*Terrapene carolina*, EBT) are generalist omnivores and important seed and fungal spore dispersers throughout the eastern United States. Studies have shown that EBT feed opportunistically on seasonally available fruit, plants, invertebrates, and occasionally carrion. We radio-located EBT in the Pine Barrens of Long Island, New York and collected fecal and blood samples. We identified prey items to the highest possible taxonomic level, and quantified seeds in the fecal samples. Plasma was analyzed for C and N isotopes ratios (δ C and δ N). We found highly seasonal patterns in fruit seed abundances in fecal samples correlating with availability. Vaccinium fruit were in 50% (June), 50% (July), and 20% (August) of samples, showing consumption of Vaccinium before they ripened and after they fell to the ground. Unidentifiable plant material was in 90-100% of samples in all periods. Coleopterans were in 70% (June), 85% (July), 80% (August), and 80% (October) of samples. Snails were in 10% of samples from June, August, and October, and 28% of July samples. Mushrooms were in 10% of June samples, 45% (July), 10% (August), and none in October. Surprisingly, stable isotope analysis indicated no significant differences in the δ C and δ N from EBT plasma sampled throughout their active season despite seasonal consumption patterns. Low plant digestibility reducing nutrient assimilation, diet items with similar δ C and δ N contributions, and a short study period may have affected EBT nutrient assimilation patterns.

0091 Fish Biogeography & Morphology, Saturday 15 July 2017

Daniel E. Figueroa[1], Mauro Belleggia[2], Santiago Barbini[1], David Sabadín[1], Lorena Scenna[1], Melisa Chierichetti[1], Martin Roman[1]

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The Young Argentine Sea, Its Ichthyofaunistic Colonization and Its Traumatic Evolution

At the beginning of the Mesozoic Era (140mA), the Argentine Sea did not exist, the Gondwana was probably a set of united plates with shallow water. In the middle of that Era (112Ma) the plates separate with each other allowing shallow marine intrusions, where an endemic fish fauna develops, as some coelacanths. At the end of the Mesozoic Era, in the Cretaceous period (66 Ma), the south Protoatlantic joins with the North Atlantic (Tethys Sea in part), and allows the fish fauna of Tethyan origin to colonize the south, reaching Antarctica. The opening of the Drake Passage in the Oligocene period

(33 Ma), in the Cenozoic Era, enables the cold waters of the Pacific Ocean to penetrate in the south Atlantic, causing drastic effects on the thermophilic fauna. Successive glaciations in the Quaternary Period (2 Ma-10,000A), allowed the polar front to advance several times to lower latitudes, leaving the Argentine Sea within it. This traumatic development in the constitution of the southwest Atlantic is reflected in the heterogeneous composition of the Argentine marine ichthyofauna, with cosmopolitan, Tethyan, Pacific, Antarctic, Gondwanic and own lineages.

0499 Herp Physiology, Saturday 15 July 2017

Michael Finkler, Jessica Filer

Indiana University Kokomo, Kokomo, Indiana, USA

Physiological Consequences of Delayed Nest Emergence for Hatchling Snapping Turtles *(Chelydra serpentina)*

Snapping Turtle *(Chelydra serpentina)* hatchlings typically emerge from their nests soon after hatching and overwinter in aquatic habitats. Overwintering in nests is rare, even in areas where freezing risks are low. Herein we explored how remaining an additional three weeks (Day 7 to Day 28 post-hatching) in a simulated nest environment influences body size, metabolic rate, and blood plasma chemistry (osmolality and urea concentration) compared to animals held in water for the same time interval. Both live mass and carapace lengths of hatchlings held in water increased during from Day 7 to Day 28 post-hatching, whereas neither measure changed in hatchlings held in moist sand. Metabolic rates of hatchlings held in water were lower than those of hatchlings held in sand. Plasma osmolality tended to increase in Day 28 hatchlings held in sand, and decrease in Day 28 hatchlings held in water, compared to Day 7 hatchlings. Plasma urea concentrations were higher in Day 28 hatchlings held in sand than in Day 7 hatchlings, but Day 28 hatchlings held in water had similar urea concentrations to those of Day 7 hatchlings. As mass did not change over 21 days in hatchlings held in sand, elevated concentrations of total plasma solutes may represent a response by the hatching to maintain fluid volume and blood pressure. Nevertheless, sustained continuous elevation of urea and other potential toxic substances in the blood, coupled with increased energetic expenditure may, in part, account for why Snapping Turtle hatchlings rarely overwinter in the nest.

0853 AES GRUBER AWARD III, Friday 14 July 2017

Cristín Keelin Fitzpatrick[1], Kimberly Finnegan[1], Andrea Bernard[1], Filip Osaer[2], Krupskaya Narváez[2], Mahmood Shivji[1]

[1]Save Our Seas Shark Research Center and Guy Harvey Research Institute, Nova Southeastern University, Dania Beach, FL, USA, [2]ElasmoCan, Asociación Canaria para

la Investigación y Conservación de los Elasmobranchquios, Las Palmas, Gran Canaria, Spain

Almost Angels? The Critically Endangered Angelshark (*Squatina squatina*) in its Last Refuge, the Canary Islands

Once so abundant as to be called the 'common' angelshark, *Squatina squatina* has been extirpated from nearly the entirety of its historical range, from the eastern North Atlantic, to the Mediterranean (IUCN Red List Critically Endangered). The angelshark now seems to occur in any abundance only in the waters surrounding the Canary Islands. We present the first genetic assessment of the angelshark's population dynamics and diversity. Tissue samples were collected between 2007-2016 from three islands within the archipelago: Gran Canaria, Tenerife, and Lanzarote. To investigate the genetic population dynamics, a three part approach was adopted: (i) DNA sequencing four mitochondrial regions commonly used in vertebrate population analysis [control region, COI, ND4, and ND2] of 300 angelsharks, (ii) Whole mitochondrial genome sequencing of nine individuals to identify and examine the comparative sequence variability in other gene regions, and (iii) assessment of nuclear diversity with 40 species-specific microsatellites. Results reveal exceptionally low genetic diversity across all individual mitochondrial regions sequenced, with single haplotypes in each region found across nearly all individuals. Mitogenome analysis follows this trend with only 11 single nucleotide polymorphisms seen across all Canary Island individuals in a genome of 16,689 bp. Furthermore, screening of 40 microsatellite markers across 32 individuals has shown all but two loci to be monomorphic. Such low levels of genetic diversity may have implications for the evolutionary persistence of this species and ultimately underscore the angelsharks' highly vulnerable state.

0346 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Adania Flemming, Lawrence Page

University of Florida, Florida Museum of Natural History, Gainesville, Florida, USA

North versus South; a comparative life history study of the Swamp Darter, *Etheostoma fusiforme*

Do we expect the life histories of subspecies of fishes to differ from one another? The Swamp Darter, *Etheostoma fusiforme,* has had a complex taxonomic history, with two subspecies, based on morphological data, now recognized. The life history for the Swamp Darter is well documented for the northern subspecies, but little information exists for the southern subspecies despite the opportunity for differentiation. An ecological study of the southern population is essential for a comprehensive understanding of this taxonomically complex species. Over a period of 18 months, at Hatchet Creek in the Suwanee River drainage of Florida, an ecological and behavioral study of the Swamp Darter has revealed differences between the northern and southern populations in several life history characteristics. Our findings confirm that in the

southern population, the Swamp Darter can live for at least fifteen months, spawns from February to April, and consumes a variety of invertebrates not found in the diet of the northern population. By better characterizing the differences in life history between the northern and southern populations of *E. fusiformе*, we can better inform policy makers about strategies to protect or otherwise manage this species and the aquatic ecosystems it inhabits. Looking at why or when differences in life histories of subspecies arose may also help in our understanding of evolutionary processes.

0725 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brian Folt

Auburn University, Auburn, Alabama, USA

Knives for a Pro? Prepollical Spines of the Glassfrog *Teratohyla spinosa* as a Sexually Dimorphic Weapon

Sexually dimorphic weapons are morphological traits used in combat between rival males for resources. In Neotropical forests, glassfrogs (Centrolenidae) occur along stream habitats, where males defend and advertise from territories which provide access to females and oviposition sites. While all centrolenid species possess an ossified prepollex, the prepollex is exposed to form a spine at the base of the thumb for one species, *Teratohyla spinosa*. This exposed prepollical spine has been suggested to play a role in male combat, but natural history of *T. spinosa* is undescribed. Here, I used mark-recapture methods and focal observations of *T. spinosa* from three populations at La Selva, Costa Rica, to better understand the species' life history and the function of prepollical spines. Mark-recapture models for two populations of males described similar apparent survival (0.43 ± 0.12 SE; 0.42 ± 0.09) but varying population size (29 individuals, 27-37 CI; 49, 45-57). I observed male combat behavior where one male used a prepollical spine to jab his opponent; this male "won" the dispute and resumed advertising for females, while the loser vacated the site. Males exhibited scarring in populations, potentially as a consequence of male combat with spines; the proportion of scarred individuals increased with population density. These observations suggest that exposed prepollical spines of male *T. spinosa* are consistent with criteria for sexually dimorphic weaponry. Spine use in combat may influence fitness by inflicting wounds and reducing access to females, and male-male interactions appear to be density dependent.

0712 SSAR SEIBERT ECOLOGY I, Thursday 13 July 2017

Brian Folt, Craig Guyer

Auburn University, Auburn, Alabama, USA

Effects of Invertebrate Predators on Vertebrate Prey are Strong but Inconsistent with the Mainland-island Model of Anole Population Regulation

For the species-rich radiation of anoles, literature has supported a dichotomy between population regulation in Caribbean islands and Central-South America ecosystems, where island populations are regulated by competition for resources and mainland populations are regulated by predation. A recent experiment on island anoles supported predictions of the mainland-island model, but comparable tests are needed to reconcile the role of predation in mainland populations. Here, I used multi-species occupancy models to test the mainland-island model with a frog and anole assemblage in Costa Rica that is depredated by spiders (Ctenidae). I modeled the relative contribution of food, microhabitat, and predators toward frog (*Craugastor bransfordii*, *Oophaga pumilio*) and anole (*Norops humilis*) occupancy and detection to test the predictions that (1) occupancy is more strongly influenced by predators than resources (food, leaf-litter), and (2) detection decreases when predators are present. Frog occupancy was most strongly influenced by predators and secondarily by leaf litter; predator effects on frogs increased as litter decreased. Anole occupancy was also influenced by leaf litter, but not by predators. Detection probability of all species was elevated when predators were present. Results described strong effects of predators on a prey vertebrate assemblage in a Central American forest. However, patterns of anole occupancy and detection were inconsistent with predictions of the mainland-island model, and oppose literature invoking predation as the dominant force shaping ecology and evolution of mainland anoles. A novel interaction between leaf litter and predation pressure of frogs has significant implications for models of patch dynamics and amphibian declines.

0228 NIA BEST STUDENT PAPER, Friday 14 July 2017

João Pedro Fontenelle[1], Fernando Marques[2], Matthew Kolmann[3], Nathan Lovejoy[1]

[1]University of Toronto Scarborough, Toronto, ON, Canada, [2]Universidade de São Paulo, São Paulo, SP, Brazil, [3]University of Washington, Friday Harbor, WA, USA

Molecular Phylogeny of the Neotropical Freshwater Stingrays (Chondrichthyes: Myliobatiformes: Potamotrygonidae), with Biogeographical Inferences

Neotropical freshwater stingrays of the family Potamotrygonidae, which includes ~40 described species in 4 genera within Potamotrygoninae, form a very diverse and geographically widespread group, found in almost every major river basin in South America. This freshwater clade is sister to the marine Styracurinae, composed of two amphi-American species of *Styracura* – *S. pacifica* and *S. schmardae*. Diversity and biogeography of freshwater stingrays are still poorly understood and we address both population- and species-level relationships among potamotrygonid lineages using four molecular markers, both nuclear and mitochondrial, for over 350 terminal taxa. Our dataset includes almost all presently described species of this family and an unprecedent

biogeographical representation. We time-calibrated our tree using well-documented vicariant events and fossil priors, informed by literature documenting the paleogeography of South America. The phylogeography of each genus and species were evaluated, to test whether observed patterns are congruent with other Neotropical freshwater fishes. The phylogeny corroborates the monophyly of the family and its two subfamilies. Within Potamotrygoninae, we provide molecular evidence for the paraphyletic status of *Potamotrygon*, which includes members of *Plesiotrygon*. This clade is sister to *Heliotrygon*+*Paratrygon*. Time estimates and paleogeographical events suggest the evolution of potamotrygonids is intimately correlated with geological processes of the continent, marine intrusions, river captures and changes in river drainage patterns. Finally, we discuss rates of diversification within freshwater lineages and possible events of hybridization and introgression, a phenomenon rarely observed in elasmobranchs, which might explain the lack of reciprocal monophyly for many nominal species of *Potamotrygon*.

0570 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Clifford Fontenot, Jr[1], John Pojman[2]

[1]*Southeastern Louisiana University, Hammond, LA, USA,* [2]*Louisiana State University, Baton Rouge, LA, USA*

Self and Conspecific Dermatophagy in the Aquatic Salamander *Amphiuma tridactylum*

Dermatophagy, the practice of eating shed skin, in amphibians and reptiles has been reported anecdotally in the literature, but the process and purpose remains poorly understood. We document a fortuitous observation of whole-skin shedding and conspecific dermatophagy in *Amphiuma tridactylum* (Three-toed Amphiuma), and report on 2 additional observations of self-dermatophagy. Shed skins are potential protein and nutrient sources, and we suggest that dermatophagy may be a much more common occurrence than originally thought.

0690 Fish Biogeography & Morphology, Saturday 15 July 2017

Kassandra Ford, James Albert

University of Louisiana at Lafayette, Lafayette, LA, USA

The long and short of it: Patterns of snout differentiation in four species of mormyrid electric fishes (Osteoglossiformes: Mormyridae)

In the weakly electric group of fishes, Mormyridae, there is diversity in the head shape and snout length among the c. 221 species; however, the evolutionary and allometric patterns within this diversity are largely unstudied. Some species have elongate tubular snouts with a small terminal mouth used for benthic feeding, while others use

brachycephalic snouts to feed throughout the pelagic zone. Previous work examined processes leading to snout differentiation in South American electric fishes (Gymnotiformes), but studies have yet to investigate head shape diversity in Mormyridae. This research analyzed patterns in snout elongation and head shape diversity in four mormyrid species using two-dimensional geometric morphometrics. Species included in this study have varying snout lengths, and include *Brienomyrus brachyistius* (n=30), *Marcusenius mento* (n=30), *Mormyrops anguilloides* (n=14), and *Mormyrus rume* (n=10). Homologous landmarks and intervallic semi-landmarks were placed to capture the head shape, angle of snout depression, and snout length of the specimens. Through the Geomorph program, Principal Component Analyses of statistically significant variables were generated to perform multivariate regressions between the three measurements of head shape diversity. Further, evolutionary allometry was analyzed to determine the covariation between shape and allometric patterns of growth among these species. These results showed significant covariation between head shape, snout length, and angle of snout depression among the adult males of the four mormyrid species. This preliminary study provides further opportunities to evaluate the underlying diversity of head shape among additional mormyrid species and examine the covariation between snout elongation and ontogenetic patterns of diversification.

0886 AES Conservation & Management II, Saturday 15 July 2017

Sonja Fordham

Shark Advocates International, Washington, DC, USA

Wait, what? That's legal? An examination of under-appreciated inadequacies and imbalances in elasmobranch conservation policy

Recent decades have brought great advances in shark and ray conservation around the world. Myriad U.S. domestic actions, listings under the Convention on International Trade in Endangered Species (CITES) and the Convention on Migratory Species (CMS), and Regional Fishery Management Organizations' (RFMOs) retention bans have been well-publicized. Nevertheless, significant gaps remain and often go unnoticed. For example, thirty giant devil rays were landed legally in Turkey this year despite protections agreed under CMS, CITES, the Barcelona Convention, and the Mediterranean RFMO. Implementation of CITES controls for commercially valuable elasmobranchs is highlighting countries' latitude for determining sustainability. Many CMS parties have yet to strictly protect Appendix I-listed sawfishes and mobulids as pledged. Greenland sharks' exceptional vulnerability has gained much attention, but commonly recommended protections are not feasible. There are still no international limits for the most valuable and vulnerable shark species taken in tuna fisheries (makos). In the US, retention of ~20 Atlantic shark species is prohibited, yet less fecund cownose rays are almost completely unregulated. While Congress debates a national shark fin ban, smoothhounds remains exempt from best practice finning bans and the legal "winging" of skates is commonplace. Fourteen years after smalltooth sawfish were listed

under the Endangered Species Act, no areas have yet been closed to fishing to protect sawfish, and observer coverage in the fleet most lethal to sawfish is exceptionally low. Heralding conservation achievements is important, but recognizing and addressing policy shortcomings is critical to achieving effective, balanced conservation programs. Specific recommendations will be offered.

0740 NIA BEST STUDENT PAPER, Friday 14 July 2017

Kimberly Foster, Devin D. Bloom

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Molecular Phylogenetics and Diversification of South American Darters (Characiformes: Crenuchidae)

Characiformes comprise >2,000 species that are largely pelagic, such as tetras and piranhas. The characiform family Crenuchidae, known as South American darters, is intriguing because the 86 described species include a radiation of benthic and pelagic lineages. Previous morphology based phylogenetic studies of crenuchids indicate multiple transitions between pelagic and benthic habitats. Benthic crenuchids are more speciose (>70 species) and morphologically diverse than pelagic crenuchids, a pattern that suggests this clade may have undergone an adaptive radiation. Our study aims to determine evolutionary relationships, determine the number and frequency of benthic/pelagic habitat transitions and explore diversification patterns of crenuchids using molecular phylogenetics and comparative analyses. We generated a multi-locus phylogeny using Bayesian and maximum-likelihood inference. Preliminary results show widespread discordance with the current taxonomy of the group and instances of undescribed diversity. Using ancestral character reconstruction, we found crenuchids are ancestrally pelagic with multiple transitions into the benthos. These results provide the first comprehensive molecular phylogeny of Crenuchids and indicate a re-evaluation of current systematics of Crenuchidae is needed. Moreover, we suggest South American darters may have undergone an adaptive radiation facilitated by a transition to the benthos.

0710 Lightning Talks II, Friday 14 July 2017

Austin Francis

Armstrong State University, Savannah, GA, USA

Experimental Hydrodynamics of Hammerhead Shark Cephalofoils

Hammerhead sharks (Family Sphyrnidae) are an unusual group of fishes that are characterized by a distinctive lateral expansion of the rostrum known as a cephalofoil. Among species of hammerhead sharks, there is considerable variation in the shape of the cephalofoil. To examine the hydrodynamics of different cephalofoil shapes, digital

particle image velocimetry (DPIV) was used to visualize fluid flow around, and in the wake of, cephalofoils for three species of hammerhead shark (*Eusphyra blochii Sphyrna mokarran*, and *Sphyrna tudes*). In *E. blochii*, the cephalofoil is broad and wing shaped. In *S. mokarran*, the cephalofoil is nearly straight, while in *S. tudes* it is more angular with sagittal and parasagittal notches. Computed tomography (CT) scans of each species were used to 3D print scale models for testing. These models were fixed in a recirculating flow tank seeded with polyethylene microspheres. The microspheres were illuminated by a green (532 nm) laser sheet oriented in either a horizontal or vertical (parasagittal) plane. Models were tested at two velocities, 6.35 cm/s and 12.4 cm/s. Fluid flow was recorded by a high-speed video camera at 120 fps with video analyzed using PIVlab for cross-correlation analysis. The resulting velocity vectors; fluid vorticity and momentum; as well as lift and drag forces were compared among the different species. Different cephalofoil shapes were observed to exhibited differences in wake that may indicate differences in locomotor performance.

0309 AES Ecology I, Sunday 16 July 2017

Bryan Frazier[1], William Driggers III[2], Camilla McCandless[3], Ashley Shaw[1], Elizabeth Vinyard[1]

[1]South Carolina Department of Natural Resources, Charleston, SC, USA, [2]National Marine Fisheries Service, Pascagoula, MS, USA, [3]National Marine Fisheries Service, Naragansett, RI, USA

On the importance of sampling gear: Relative abundance and habitat utilization of sharks in South Carolina revisited

Scientists deploy sampling gear for a multitude of reasons, such as when collecting biological data for studies examining species abundance, length composition, life history, habitat preferences, and movement patterns. However, if careful consideration of sampling gear, including bias and selectivity, is not incorporated into survey design, an incomplete picture of community structure and species-specific distribution and length composition will likely emerge. Sampling for coastal sharks has been ongoing since 1994 in the nearshore and estuarine waters of South Carolina. Resulting data have been used to identify nursery areas, designate essential fish habitat, generate indices of abundance and determine seasonality and habitat utilization of coastal sharks in the region. In 2014, we introduced additional sampling gear to existing survey methods, yielding surprising new information about species composition and relative abundance of juvenile and large coastal sharks in the nursery areas and nearshore waters of South Carolina.

0055 ASIH STOYE GENERAL HERPETOLOGY, Thursday 13 July 2017

Connor French, Jason Brown

Southern Illinois University, Carbondale, Illinois, USA

Climate Fluctuation as a Driver of Diversification in Peruvian Poison Frogs

The Amazonian rainforest at the foothills of the Andes is one of the most diverse ecosystems in the world. Despite considerable research quantifying the biodiversity it contains, the key factors driving contemporary distribution patterns of its biota remain poorly understood. While these factors are certainly diverse and not limited to a single overarching mechanism, biogeography and climatic instability are widely considered to be fundamental in maintaining Amazonian rainforest biodiversity. To better understand the explicit role of these factors in the maintenance of biodiversity since the Pliocene, we assessed the phylogeographic history of a small clade of poison frogs (*Ameerega petersi* group). We constructed a phylogeny with divergence time estimates and measured key demographic parameters to quantify lineage diversification in this group. We integrated these metrics with species distribution models that utilize climate data spanning four million years ago to present day to evaluate the climatic conditions that gave rise to the *A. petersi* group's current distributions and relationships. We found that different stages of their estimated dispersal patterns correlated with lineage divergence time estimates. We therefore conclude that historical climate fluctuations contributed significantly to the dispersal and diversification of this group of anurans.

0697 AES Ecology III, Sunday 16 July 2017

Michael Frisk[1], Keith Dunton[2], Chris Martinez[3], Catherine Ziegler[1], Josh Zacharias[1]

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Passive acoustic telemetry reveals seasonal long distance migrations in the winter skate (*Leucoraja ocellata*)

The movement ecology of western Atlantic skates is poorly understood and existing information has been derived from short-term seasonal surveys and a limited number of traditional tagging studies. It has been hypothesized that large changes in the abundance of winter skate in the western Atlantic were the result of periodic migration events and not tied to a closed-population level response. However, no direct observations of winter skate movement have been published supporting long distance migration. We tracked the movements of 61 winter skates, *Leucoraja ocellata*, along coastal New York between 2012 and 2014 using passive acoustic telemetry. Individuals were monitored with the coastal New York receiver network from Montauk to the Hudson River, and the ACT Network receiver arrays provided extended coverage between Cape Hatteras and Massachusetts. Days at liberty averaged 138, and ranged from 3 to 490. Preliminary results indicated that some individuals performed considerable north-south migrations between coastal Massachusetts and North Carolina, with the total distance traveled ranging from 27 to 1376 km, and averaging 330 km. The daily rate of movement averaged 7 km per day; however, spring and fall movements

were considerably higher, and often exceeded 20 km per day. These observations provide new insights into the seasonal movements of north Atlantic winter skates, which add complexity to our understanding of stock structure and broader management concerns. Importantly, the observations support the hypothesis that winter skate regularly undertake large coastal migrations.

0642 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Shelby L. Frizzell[1], Dalton B. Neuharth[1], Connor Adams[1], Timothy Johnson[1], Wade A. Ryberg[1], Toby J. Hibbitts[2], Travis J. LaDuc[3], Brad D. Wolaver[4], Jon Paul Pierre[4], Benjamin J. Labay[5], C. Mike Duran[6]

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Comparative Analysis of Photo Identification for Mark-Recapture Data in the Spot Tailed Earless Lizard (*Holbrookia lacerata*)

The Spot-tailed Earless Lizard (*Holbrookia lacerata*) was historically found in open grassland habitats across central and southern Texas and northern Mexico. Distribution surveys conducted in 2008-2009 found that this species was in only 5% of historic localities, motivating a petition to list *H. lacerata* in 2010. U.S. Fish and Wildlife Service (FWS) declared listing may be warranted in 2010 and requested data on current and future threats to *H. lacerata* populations and habitat. A collaborative research program was developed to characterize *H. lacerata* viability within the FWS's Species Status Assessment (SSA) framework. Surveys were conducted in different areas of historical and known habitat for estimation of population size using mark-recapture techniques. *Holbrookia lacerata* have unique blotches on their backs in different shapes and sizes that provide unique identifiers for individuals. Encounter histories were constructed from side-by-side comparisons of photos taken of individual lizards for each site. Upon review of the photos, no similarities were found between blotching patterns of any individuals indicating they were all unique. These results indicate that, while no recaptures were found, this method can still be used to distinguish between individuals for mark-recapture studies on this species.

0465 Fish Conservation II, Sunday 16 July 2017

Bridgette Froeschke[1], John Froeschke[0]

[1]The University of Tampa, Tampa, Florida, USA, [2]Gulf of Mexico Fishery Management Council, Tampa, Florida, USA

Does Size Matter?

Distribution and abundance of estuarine fishes are influenced by temporal, physical, and spatial variables. Spatially, the distance to the nearest inlet into the Gulf of Mexico has shown to be an important predictor variable for the occurrence of a variety of species (southern flounder, spotted seatrout, sheepshead etc.) in estuaries. Many estuarine species increase in abundance near inlets suggesting these areas are potential essential fish habitat. However, does size matter and if so what does that mean for secondary bays? This project examined the size distribution of multiple fish species (bonnethead, black drum, red drum, gulf flounder, sheepshead, gray snapper, striped mullet, pinfish, and Atlantic croaker), that range in a variety of life history traits in Tampa Bay in Tampa, Florida and Aransas-Bay Complex in Port Aransas, Texas. Overall, we found that size does matter and you can use size to follow movement and potentially identify breeding grounds.

0002 LFC Nutrition, Friday 14 July 2017

Lee A. Fuiman

University of Texas Marine Science Institute, Port Aransas, TX, USA

Nutritional Programming in Red Drum: The Ecological Context

Nutritional or metabolic programming occurs when variations in nutrition during a specific developmental window result in long-term metabolic effects. Nutritional programming has been demonstrated in captive fishes under laboratory conditions, but could it be operating in nature and does it have important consequences? Fatty acid composition of red drum (*Sciaenops ocellatus*) eggs, especially docosahexaenoic acid (DHA), was experimentally manipulated by altering the proportions of natural products fed to adults. This produced variations in embryonic nutrition. Larvae reared from these eggs for 21 days under common garden conditions contained significantly different levels of DHA in their tissues, indicating changes in lipid metabolism associated with embryonic nutrition. Ecological performance of larvae (foraging and escape behavior) was significantly correlated with DHA content of larval tissues. Does egg fatty acid composition of eggs vary in nature? Red drum eggs were sampled at Port Aransas, Texas, for 8 years (2009-2016). There was significant interannual variation in fatty acid composition of those eggs, with a 71% increase in DHA from the lowest to highest annual mean. These findings demonstrate that variation in embryonic nutrition of red drum is a natural occurrence and that nutritional programming could have consequences for larval survival, thereby linking maternal diet to success of offspring.

0116 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Yuki Fujinami, Ko Shiozaki, Hirotaka Ijima, Mikihiko Kai, Yasuko Semba

National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, Shizuoka, Japan

Movements of the Adult Female Blue shark (*Prionace glauca*) in the Northwestern Pacific

Blue shark (*Prionace glauca*) is a highly migratory pelagic species with circum-global distribution in the tropical and temperate waters. Generally, knowledge of migration is important for the management and conservation of exploited species. However, there is little information about the movement patterns of blue shark in the North Pacific. We used pop-up satellite tags to explore the movement of blue sharks in the Northwestern Pacific. We released 19 sharks and obtained the datasets with deployment periods longer than one month (86-242 days) from five adult females. Four of five females were judged to be pregnant by visual inspection and palpation at time of release. All females were released at southern waters off Japan (17-29°N and 129-133°E) in October 2015. Pregnant females tended to travel in a northeastward direction from warmer to colder water regions (experienced SST: 14.1-30.0 °C) from autumn to next spring. One female further travelled offshore along the Kuroshio-Oyashio transition zone from January to March, and moved in to the transition zone (around 35°N and 166°E) in April. The female showed unique movement such as vertical distribution in shallow water (< 200 m) for one week compared to the period before or after that and then returned in a southwest direction to the warmer region. Given that the location and date of this event was in the pupping ground and parturition period and that neonates were reported in the vicinity, it was suggested that migration of this adult female blue shark was related to parturition.

0369 AES Trophic Ecology/Physiology, Friday 14 July 2017

Austin Gallagher[1], Rachel Skubel[2], Heidi Pethybridge[3], Neil Hammerschlag[4]

[1]Beneath the Waves, Miami, FL, USA, [2]Leonard and Jayne Abess Center for Ecosystem Science and Policy, University of Miami, Miami, FL, USA, [3]CSIRO Oceans and Atmosphere Research, Hobart, Australia, [4]Rosensteil School of Marine and Atmospheric Science, Miami, FL, USA

Measuring the Energetic and Nutritional Status of Large, Migratory Sharks: Implications for Studies on Movement, Diet, and Reproduction

Evaluating how sharks metabolize energy is increasingly useful for conservation physiology, as it can provide information on their current nutritional condition. However, obtaining metabolic information from these species is inherently challenging owing to their relative rarity, cryptic nature and often wide-ranging underwater movements. Here, we investigate aspects of energy metabolism in four free-ranging shark species (n = 281; blacktip, bull, nurse, and tiger) by measuring three metabolic parameters [plasma triglycerides (TAG), free fatty acids (FFA) and cholesterol (CHOL)]

via non-lethal biopsy sampling. Plasma TAG, FFA and total CHOL concentrations (in millimoles per litre) varied inter-specifically and with season, year, and shark length varied within a species. The TAG were highest in the plasma of less active species (nurse and tiger sharks), whereas FFA were highest among species with relatively high energetic demands (blacktip and bull sharks), and CHOL concentrations were highest in bull sharks. Although temporal patterns in all metabolites were varied among species, there appeared to be peaks in the spring and summer, with ratios of TAG/CHOL (a proxy for condition) in all species displaying a notable peak in summer. These results provide baseline information of energy metabolism in large sharks and are an important step in understanding how the metabolic parameters can be assessed through non-lethal sampling in the future. In particular, this study emphasizes the importance of accounting for intra-specific and temporal variability in sampling designs seeking to monitor the nutritional condition and metabolic responses of shark populations.

0175 Fish Conservation II, Sunday 16 July 2017

Grantly Galland[1], Shana Miller[2]

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Harvest Strategies - the Next Phase of Fisheries Management for Tuna and Beyond

In recent years, fisheries management has started to shift from a highly political process, where managers repeatedly negotiate quotas, to a system where harvest control rules are triggered at pre-determined reference points to meet pre-agreed management objectives (such as maintaining stability in catch from year to year). The combination of these tools, along with the models designed to test their effectiveness, is called a harvest strategy or a management procedure. Through an iterative process, managers and scientists work together to develop a harvest strategy for each fishery under their jurisdiction, including by incorporating the advice and feedback of stakeholders. This positive shift in management leads to more profitable fisheries, with more consistent catch and market value, while simultaneously protecting stocks from reaching unsustainable levels. Harvest strategies also take some of the politics out of fisheries management and reduce the likelihood of "horse trading" or other practices that may not be in line with the best available scientific information. Here, we detail the steps necessary to produce an effective harvest strategy and highlight case studies where this new management tool has been successful.

0532 LFC Physiological Performance I, Saturday 15 July 2017

Fernando Galvez

Louisiana State University, Baton Rouge, Louisiana, USA

The Integrative Physiology and Comparative Genomics of Osmotic Diversification in *Fundulus* Species

Killifish from the genus *Fundulus* are capable of much physiological plasticity to environmental salinity, however the extent of this plasticity varies amongst species. Although some *Fundulus* species are extremely euryhaline and can alter the phenotype of their ion-transporting epithelia to compensate for broad changes in environmental salinity, other species have narrow salinity tolerance ranges and are only capable of making limited physiological alterations. This presentation will describe results from a series of osmotic challenge experiments comparing species, and populations among species, to discover the integrated physiological and genomic basis of derived freshwater- and seawater-tolerance at micro- and macro-evolutionary scales. I will also briefly discuss comparative experiments among three sister species pairs of *Fundulus* to discover the genomic and physiological basis of repeated and parallel losses of hyper-osmotic tolerance. Finally, this presentation will investigate the ontogeny of osmoregulatory organs and the hyperosmotic tolerance limits of *Fundulus* larvae reared at different salinities ranging from fresh water to sea water. I will present how differences in rearing salinity influences the ontogeny of osmoregulatory tissues in larvae and the expression of ion transport proteins in transporting epithelia, and how these effects influence hyperosmotic tolerance in the euryhaline killifish species, *Fundulus grandis*.

0535 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Tony Gamble

Marquette University, Milwaukee, WI, USA

Sex chromosome evolution in House Geckos (*Hemidactylus*)

Much of our knowledge about sex chromosome evolution comes from studying clades with ancient, relatively stable sex chromosome systems such as mammals, birds, and *Drosophila*. However, clades with multiple, independently derived sex chromosome systems can provide important insight into mechanisms that drive these transitions and illuminate the earliest steps in sex chromosome evolution [2]. Thus identifying transitions between sex chromosome systems in a phylogenetic context should be a high research priority. Squamates (lizards and snakes) have long been of interest for studying sex determination and sex chromosome evolution because they have a variety of sex-determining systems, including male (XY) and female (ZW) heterogamety, and temperature-dependent sex determination (TSD), with numerous transitions among them. Here, I identify the sex chromosome systems of five house gecko (*Hemidactylus*) species and identify a transition between male (XY) and female (ZW) heterogamety in the genus. These results illustrate that squamates, and geckos in particular, offer an excellent set of replicate evolutionary "experiments" to examine the origin and evolution of sex chromosomes. The RAD-seq method used here can significantly accelerate the

pace of sex chromosome discovery, facilitating the study of sex chromosome origins and evolution.

0333 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Marissa Ganzfried[1], Carl Anthony[1], Cari-Ann Hickerson[1], Jennifer Deitloff[2]

[1]John Carroll University, University Heights, Ohio, USA, [2]Lock Haven University, Lock Haven, Pennsylvania, USA

Comparison of Cranial Morphology in a Color Polymorphic Salamander

Differences in cranial morphology within and among species of plethodontid salamanders have been linked to variation in diet and behavior. A slower, stronger jaw (i.e. large squamosal:dentary ratio) has been related to consumption of small prey such as springtails. Elongation of the jaw, coupled with expansion of the posterior of both the cranium and the jaw (defined as robustness) are positively associated with increased levels of aggression. We used a polymorphic species of salamander (*Plethodon cinereus*) that is known to vary in both diet and aggressive behavior to examine differences in head shape between striped and unstriped morphs. At one field site in Northeastern Ohio the striped morph is more aggressive, and maintains more consistent access to cover objects on the forest floor. As a result, the striped morph is found in prey rich territories containing an abundance of small prey. We hypothesized that striped salamanders would either exhibit cranial shape consistent with increased aggression, or morphology consistent with a diet of small prey items. We examined head shape differences between morphs (n=1146 specimens) from 9 polymorphic sites using geometric morphometrics. Differences in head shape were significant among localities, however, only one locality showed significant differences by morph. At this locality, the cranial morphology of striped morphs was significantly more robust which is consistent with elevated aggressive and territorial behavior by this morph. These results indicate that in at least one polymorphic population, differential selection on morphs may have resulted in distinct head shapes of striped and unstriped morphs.

0869 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Steven Gardner, Scott Goetz, Mary Mendonca

Auburn University, Auburn, AL, USA

Assessing Immunocompetence in Anurans: Validation of a modified in Vitro Assay Measuring Innate and Cell-Mediated Responses

Global amphibian declines and other conservation concerns relating to animal health have fueled an increase in the application of ecoimmunologically based investigations. As the field of ecoimmunology matures there is a growing need for assays providing more detailed immunological assessments of non-model organisms. Previous studies have addressed cell-mediated immunity, which could induce inflammation and be energetically demanding, in the form of T-cell proliferation, measuring radioactivity of incubated anuran cells exposed to radio-labeled thymidine, as well as measuring skin swelling after injection of PHA between toe webbing of toads. We are developing a modified in Vitro cytometric assay to measure anuran splenocyte proliferation, which involves culturing T cells stimulated with a mitogen, and measuring the total numbers of proliferated cells using flow cytometry. We have successfully distinguished living proliferated anuran T cells in culture using Alexa Fluor 647, a fluorescently labeled CD3+ antibody that has a high affinity and specificity for T cells, and with Ghost Dye Red 780, which has a strong affinity for amine groups, binding more strongly to dead cells, allowing for distinction between living and dead cells. In addition to cell mediated responses, we have also assessed innate immune responses by measuring nitric oxide production in splenocyte culture supernatants using Griess reagents. These assays are improvements over commonly used in vivo assays that provide limited information that is highly variable, and will enable comparison of anuran cell mediated and innate immune responses among populations, allowing investigation into population declines.

0837 LFC Physiological Performance III, Sunday 16 July 2017

Monica Vanessa Garduño Paz

Universidad Autonoma del Estado de Mexico, Toluca, Estado de Mexico, Mexico

Physiological and Morphological Phenotypic Plasticity of Larval Fish

Phenotypic responses to environmental factors and mixed effects of these have driven species to increase their fitness. For more than thirty years the study of phenotypic plasticity has allowed researchers to understand deeply how organisms phenotypes are originated as interactions of ecology and genetics. Fish are known for their high phenotypic plasticity in several aspects and due to their great diversity lots of studies have been developed to elucidate the origin of this. The present study is an exhaustive review, about the role of phenotypic plasticity in morphological and physiological aspects throughout fishes, including freshwater, marine and brackish. Here we pretend to distinguish the effect of genetic variation from phenotypic plasticity and identify the factors that promote plasticity in fishes in their early lives and how they lead to changes in shape, growth and metabolism. We are eager to considerate experimental data as well as descriptive ones in order to compare methodologies to measure the plasticity and conclusions. Finally, elucidating the costs and limits of phenotypic plasticity in larval fish.

0491 Texas and Mexican Blindcats/Desert Fishes, Saturday 15 July 2017

Gary Garrett[1], Megan Bean[2], Robert Edwards[3], Dean Hendrickson[1]

[1]University of Texas at Austin, Austin, TX, USA, [2]Texas Parks and Wildlife Department, Austin, TX, USA, [3]University of Texas Rio Grande Valley, Edinburg, TX, USA

Declines and losses of spring/ciénega ecosystems in the Chihuahuan Desert of Texas

Desert ecosystems are particularly susceptible to anthropogenic influences. This is especially true for desert aquatic systems where limited water resources can be easily impaired by excessive water mining depleting the underlying aquifers. Although the aquatic environments and their associated native fishes are declining throughout the Chihuahuan Desert, we will focus on examples from the Big Bend region, the Balmorhea Springs Complex, the Pecos River region, and the Devils River region. Ongoing and impending land use and water consumption patterns suggest even further reductions in the near future. Even though numerous conservation activities are underway, archaic Texas water laws must be revisited and reformulated if the desert aquatic systems are to be truly conserved for more than the immediate future.

0013 ASIH STOYE ECOLOGY & ETHOLOGY IV, Friday 14 July 2017

John Gatto, Joel Trexler

Florida International University, North Miami, Florida, USA

Using Agent Based Modeling to Describe Dispersal Potential in the Florida Everglades

Immigration into newly inundated habitats is well documented, but the mechanisms that influence a species' ability to recolonize successfully are poorly understood. Several studies have focused on the behavioral changes and directionality of fish movement caused by changing hydrology. Furthermore, a recent study investigating speed has attempted to explain recolonization patterns; however, speed alone does not describe this phenomenon. Agent Based Modeling (ABM) has become a popular method for modeling ecological processes by using computer simulated "agents". In this study, we used ABM to model species dispersal by combing directional field data with laboratory swimming speed estimates. Our simulations used six hypothetical species, each with increasing levels of directedness, to demonstrate how the combination of directionality and speed influences arrival time. Virtual fish were tasked with swimming for 12 hours to reach a refuge habitat located 1 km away. Six speeds were investigated and replicated 10 times for a total of 466,560 simulations. Arrival time and distance from habitat were collected at the end of each run, and we compared simulated results to those collected in the field. This study revealed that both speed and directedness are indicative of species which inhabits a recently disturbed habitat quickly. Fast, directed individuals are more likely to reach a habitat first compared to slow, undirected ones. Lacking just one of

these characteristics can greatly inhibit a species' ability to disperse and recolonize a recently disturbed habitat. Furthermore, our simulated results generated information consistent with field data collected in a long term dataset.

0361 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Aaron Geheber[1], McKenzie Russell[1], Caleb McMahan[2]

[1]University of Central Missouri, Warrensburg, MO, USA, [2]The Field Museum of Natural History, Chicago, IL, USA

Inferring Evolutionary Niche Conservatism in Neotropical Cichlid Assemblages using Functional Morphological Traits

Systematic research focuses on evolutionary relationships among species groups based on morphological and molecular data; however, ecological relationships among closely related species are often overlooked. Assessment of species environmental function is a basic goal in ecology, and recently, placing functionality in an evolutionary context has become an area of interest among ecologists attempting to understand the role that lineage plays in community dynamics. By examining how species traits have evolved, and are distributed within communities, we can better recognize how interspecific interactions have influenced present-day community composition (e.g., if co-occurring close relatives share similar traits, does this lead to competitive exclusion locally?). We examined functional traits, including body shape and trophic morphological features (representative of niche use), among co-occurring cichlids (Cichlidae) in the Usumacinta/Grijalva drainage in Mexico and Guatemala. This study system harbors > 20 species of cichlid, and many occur in sympatry at local scales where interactions are plausible. By incorporating functionally relevant traits with a molecular based phylogeny, we tested for evolutionary niche conservatism within cichlid assemblages. We found evidence of evolutionary niche conservatism in functionally relevant traits among the assemblage members. Furthermore, our findings suggest variable levels of conservatism among cichlid functional traits within the assemblage. Future applications of these findings for examining cichlid assembly processes will be discussed.

0437 AES Reproduction, Sunday 16 July 2017

Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Preliminary Observations on the Search for a Shark Early Pregnancy Test

Information on the reproductive biology of sharks and rays, including as size- or age-at-maturity, reproductive periodicity, reproductive cyclicity, and the location of breeding events is critical for the management and conservation of exploited elasmobranch populations. However, the lethal approaches often used to obtain these data have become increasingly rejected in recent years as they are often viewed as being inconsistent with a conservation ethic and unsuitable for use with threatened or endangered species. This has led to growing use of nonlethal approaches for characterizing shark reproduction, such as the analysis of circulating gonadal steroid concentrations as indicators of reproductive maturity and stage and field-based ultrasonography. Notwithstanding the utility of these methods, there remains a need for the development of a reliable test for shark pregnancy as none of the gonadal steroids typically assayed in shark reproduction studies exhibit correlations with the gestation period and the use of ultrasonography has limitations that preclude widespread application. Because of this, we have devoted great effort towards the identification of a shark early pregnancy marker, first by examining the usefulness of blood-borne markers shown to be useful for identifying pregnancy in other vertebrates and more recently, by conducting more specific observations on differences in the circulation of pregnant versus non-pregnant elasmobranchs. In this presentation, I provide an overview on these efforts, highlighting more recent use of proteomics and metabolomics as methods for pregnancy biomarker discovery in elasmobranchs.

0271 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Amy George[1], Tatiana Garcia[2], Benjamin Stahlschmidt[1], Duane Chapman[1]

[1]U.S. Geological Survey - Columbia Environmental Research Center, Columbia, Missouri, USA, [2]U.S. Geological Survey - Illinois Water Science Center, Champaign, Illinois, USA

Comparison of swimming speeds in larval bighead, silver, and grass carp

Asian carp are invasive in the waterways of central North America, and are being found in the Great Lakes and their tributaries. Questions about recruitment potential motivate a need for accurate models of egg and larval dispersal. In order to improve these dispersal models, swimming behaviors and capabilities during early ontogeny are needed. We measured ontogenetic changes in routine and maximum swimming speeds of bighead, grass, and silver carp larvae after hatching. Daily measurements of routine swimming speed were taken for two weeks using a still camera and the LARVEL program, a custom image-analysis software. Larval swimming speed was calculated using larval location between pairs of subsequent image frames and their time frame.

Using an endurance chamber, we found the maximum speed of larvae (post-gasbladder inflation) for 4-8 weeks post-fertilization. For all species, larval swimming speeds showed similar trends with respect to ontogeny - increases in maximum speed, and decreases in routine speed. Maximum speeds of bighead and grass carp larvae were similar and generally faster than silver carp larvae. Routine swimming speeds of all larvae were highest before gas bladder inflation, most likely because gas bladder inflation allowed the fish to maintain position without swimming. Downward vertical velocities of pre-gasbladder inflation fish were fastest. Grass carp larvae had the highest speeds in the pre-gasbladder inflation period, and the lowest speeds in the post-gasbladder inflation period. Knowledge of swimming capability of these species, along with hydraulic characteristics of a river, enables further refinement of models of embryonic and larval drift.

0139 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Michael Ghedotti[1], Josephine Gruber[1], Ryan Barton[1], W. Leo Smith[3], Matthew Davis[2]

[1]Regis University, Denver, Colorado, USA, [2]St. Cloud State University, St. Cloud, Minnesota, USA, [3]University of Kansas, Lawrence, Kansas, USA

Morphology of the glowbelly (*Acropoma*) bioluminescent organ (Teleostei: Acropomatidae)

Bioluminescence, the generation of light by living organisms, is widespread in fishes but organs that generate light or that generate light by housing bioluminescent bacteria are often poorly known. The largely deep-sea glow bellies (genus *Acropoma*) have a pronounced bilaterally paired light organ that houses bacteria in the genus *Photobacterium.* In this study we seek to determine the anatomic structure of the bioluminescent organ and shed light on its likely evolution. We used histological sectioning and gross dissection to explore the anatomy of the bioluminescent organs in *Acropoma japonicum* and *A. hanedai;* and we used a DNA sequence dataset to generate a phylogeny for the group. The bacterial bioluminescent organs in *Acropoma* are derived from the posterior intestine, internally compartmentalized, lined by a simple epithelium (columnar peripherally and cuboidal more centrally), and connected across the midline. This anatomy in the context of the phylogeny suggests that the bioluminescent organs of *Acropoma* likely originated independently of those in the related pempherids despite the presence or a posterior intestinal bioluminescent organ in *Parapriacanthus.* Continuing work is needed to have a reasonably complete understanding of bioluminescence evolution in this group.

0133 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Sam Ghods[1], James Orr[2], Ingrid Spies[2], Duane Stevenson[2]

[1]*University of Washington, School of Aquatic and Fishery Sciences, Seattle, WA, USA,* [2]*NOAA/National Marine Fisheries Service, Alaska Fisheries Science Center, Resource Assessment and Conservation Engineering Division, Seattle, WA, USA*

Next-Generation RAD Sequencing of 22 Species among 10 genera of Snailfishes (Liparidae)

Snailfishes (Family Liparidae) are difficult to identify and present a challenging phylogenetic problem using traditional morphological methods. This study aims to provide support for an earlier mitochondrial DNA gene cytochrome oxidase (CO1) molecular phylogeny of species of the family Liparidae, produced primarily using eastern North Pacific species and augmented with BOLD data for a global analysis. In that analysis, 490 bp of DNA sequence data obtained by Sanger sequencing clarified the taxonomy and phylogenetics of 79 species and 29 genera of liparids. Using next generation sequencing of restriction-site associated DNA tags (RAD sequencing) we will identify single nucleotide polymorphisms (SNPs) from 22 eastern North Pacific snailfish species across 10 genera, many of the same species used in the COI analysis, in order to hypothesize interspecific relationships. We expect that this approach will provide hundreds to thousands of SNPs, primarily from nuclear DNA, that will complement the phylogenetics based on CO1 data.

0241 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Whit Gibbons

University of Georgia, SREL, Aiken, SC, USA

Ray Semlitsch: A Brief History of a Visionary in Amphibian Ecology

Ray Semlitsch was the paragon of the outstanding field biologist and consummate scientist that many herpetologists and conservation biologists strive to be. His contributions to amphibian conservation and mentoring of students to become natural historians are legion. His productivity as a scientist and his effectiveness as a mentor were underpinnings of his legacy to his students, colleagues, and future amphibian ecologists and wetland conservation biologists. His ultimate dedication to conserving wetland habitats and amphibian biodiversity rests on a foundation of childhood experiences spent exploring forests, streams, and beaver ponds in the Adirondack Mountains. Details of the personal back story of Ray Semlitsch's journey from fur trapper to combat Marine to student/technician to professor of biology will focus on key crossroads that led to his becoming a visionary in amphibian and wetland conservation.

0029 Herp Physiology, Saturday 15 July 2017

Anthony Gilbert, Donald Miles

Ohio University, Athens, OH, USA

Natural Selection on Thermal Preference and Performance Over a Rapid Timescale

Climate change is radically transforming the thermal quality of global habitats. Changes in ambient temperature due to anthropogenic climate change portend to alter species activity patterns, raise field-active body temperatures, and modify their performance capacities. Whereas species have already altered their distributions or phenology to cope with changing environments, the evidence for physiological traits evolving in response to rising temperatures is limited. When organisms specialized to narrow thermal niches prefer and are active at body temperatures close to their upper thresholds for activity and function, shifts in the operative temperature distribution of thermal environments may result in a severe reduction in performance capacity. As a result, natural selection in altered thermal environments should be strong. However, many models have suggested the likelihood of thermal adaptation is low, because of limited variation among individuals. Here, we estimated the strength and form of natural selection on major thermal traits linked with the ability of organisms to exploit environments exceeding their physiological limits. We detected significant directional selection favoring tree lizards with warmer thermal preferences and greater sprint performance at their optimal temperature. Our analyses also revealed convex correlational selection between thermal preference and critical thermal maxima. Assuming thermal traits are heritable, we conclude evolutionary adaptation may be a viable mechanism of long-term persistence in altered thermal environments.

0457 ASIH STOYE GENERAL ICHTHYOLOGY II, Thursday 13 July 2017

Matthew Girard, Leo Smith

University of Kansas, Lawrence, KS, USA

Relationships of carangiform fishes: a total evidence approach

Carangiformes is a clade of 26 families, 1,088 species, which includes the traditional Pleuronectiformes and representatives of the traditional Percoidei and Scombroidei. These fishes are found in a diversity of habitats that range from freshwater rivers to the deep sea. This variation in habitat is mirrored by tremendous morphological variation, particularly modifications to their cranial and axial skeletons. Preliminary investigations and prior work on the carangiform subgroups have shown phylogenetic discrepancies across the clade, with the placement and monophyly of numerous carangiform subgroups being contentious. As these fishes are highly diverse morphologically and this variation has been shown to be a valuable source of phylogenetically informative characters, an expanded survey of variation in carangiform skeletal systems will be conducted. This data will be combined and analyzed with DNA sequence data to work toward a well-supported phylogeny of the Carangiformes.

0588 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Donna Glinski[1], Robin Van Meter[2], W. Matthew Henderson[3], S. Thomas Purucker[3]

[1]Oak Ridge Institute of Science and Education, Athens, GA, USA, [2]Washington College, Chestertown, MD, USA, [3]U.S. EPA, Athens, GA, USA

Agricultural Spray Drift Concentrations in Rainwater, Stemflow, and Amphibians in Southern Georgia

In order to study spray drift contribution to non-targeted habitats, pesticide concentrations were measured in stemflow (water flowing down the trunk of a tree during a rain event), rainfall, and amphibians in an agriculturally impacted wetland area near Tifton, Georgia, USA. Agricultural fields and sampling locations were located on the University of Georgia's Gibbs research farm. Samples were analyzed for >150 pesticides and over 20 different pesticides were detected in these matrices. Data indicated that herbicides (metolachlor and atrazine) and fungicides (tebuconazole) were present with the highest concentrations in stemflow, followed by those in rainfall and amphibian tissue samples. Metolachlor had the highest frequency of detection and highest concentration in rainfall and stemflow samples. Higher concentrations of pesticides were observed in stemflow for a longer period than rainfall. Furthermore, rainfall and stemflow concentrations were compared against aquatic life benchmarks and environmental water screening values to determine if adverse effects would potentially occur for non-targeted organisms. Of the pesticides detected, several had concentrations that exceeded the aquatic life benchmark value. The majority of the time mixtures were present in the different matrices, making it difficult to determine the potential adverse effects that these compounds will have on non-target species, due to unknown potentiating effects. These data help assess the importance of indirect spray drift exposures to non-targeted habitats and species.

0128 Herp Ecology I, Friday 14 July 2017

Brad M. Glorioso[1], J. Hardin Waddle[1], Lindy J. Muse[2], Jeffrey M. Lorch[3]

[1]U.S. Geological Survey, Wetland and Aquatic Research Center, Lafayette, LA, USA, [2]Cherokee Nation Businesses, Wetland and Aquatic Research Center, Lafayette, LA, USA, [3]U.S. Geological Survey, National Wildlife Health Center, Madison, WI, USA

Snake Fungal Disease in a Louisiana Snake Assemblage

Snake fungal disease (SFD) is an emerging infection in snakes caused by the fungus *Ophidiomyces ophiodiicola* (*Oo*). The disease gained prominence after being linked to high mortality rates in two protected species of pit viper. SFD has been documented in wild snakes throughout much of eastern North America. However, there are little data for most species concerning baseline prevalence rates and disease effects on populations.

Therefore, we initiated a capture-mark-recapture study of the nonvenomous snake assemblage in southwest Louisiana to determine prevalence rates and compare survival probabilities of infected and uninfected snakes. We swabbed all captured snakes regardless of gross signs of the disease and used real-time PCR to detect *Oo* on the swabs. Eight species of nonvenomous snakes were captured, with Western Ribbonsnakes (*Thamnophis proximus*) and Southern Watersnakes (*Nerodia fasciata*) accounting for most captures. Return rates were over 25% and 50% for Western Ribbonsnakes and Southern Watersnakes, respectively, with some individuals captured many times allowing for possible changes in disease state. We found clear differences by season in disease prevalence in these two species. Snakes can be captured year round at this location, which may have implications for disease progression and ultimately survival compared to snakes in northern populations. The mechanisms that have allowed *Oo*, which is thought to be native, to emerge are unknown, but weather and long-term climatic factors are hypothesized as potential causes. Our future research direction is to examine some of these weather and climatic factors that may have facilitated the emergence of *Oo*.

0127 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brad M. Glorioso[1], J. Hardin Waddle[1], Lindy J. Muse[2], Beau B. Gregory[3], Charles D. Battaglia[3]

[1]U.S. Geological Survey, Wetland and Aquatic Research Center, Lafayette, LA, USA, [2]Cherokee Nation Businessess, Wetland and Aquatic Research Center, Lafayette, LA, USA, [3]Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Lake Charles, LA, USA

Occupancy of Gulf Coast Waterdogs (*Necturus beyeri*) in Southwest Louisiana

The Gulf Coast Waterdog, *Necturus beyeri*, is a permanently aquatic neotenic salamander that inhabits sandy, spring-fed streams along the Gulf Coastal Plain. In Louisiana, there are few known localities for this species, with most records being more than 40 years old. Thus, the Gulf Coast Waterdog is a tracked species of greatest conservation need by the Louisiana Natural Heritage Program. Siltation and other forms of habitat degradation have been posited to negatively affect their distribution but empirical data are lacking. We undertook a two-season study from late 2015–early 2017 using an occupancy framework to determine what site characteristics best predict occupancy of waterdogs in southwest Louisiana. We trapped waterdogs using unbaited minnow traps at 100 (50 each season) randomly selected bridge crossings of streams for two weeks within the suspected range in southwestern Louisiana. Stream characteristics such as width, depth, substrate, pH, turbidity, and flow rate were measured at the study sites. Drainage area upstream of the site was gathered from GIS information. A hierarchical occupancy model will indicate the relative importance of these factors for occurrence of Gulf Coast Waterdogs. Lesser Siren (*Siren intermedia*), and less commonly Three-toed Amphiuma (*Amphiuma tridactylum*), were also captured during this study, and similar

analyses may reveal apparent differences in stream characteristics among these permanently aquatic salamanders.

0507 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Elizabeth Glynne[1], Juan D. Daza[1], Aaron M. Bauer[2]

[1]Sam Houston State University, Huntsville, Texas, USA, [2]Villanova University, Villanova, PA, USA

Alternative configurations of the lacrimal foramen in geckos

In most lizards, the lacrimal foramen is the path for the lacrimal duct. In geckos, the lacrimal foramen can be enclosed by the prefrontal and the maxilla, prefrontal, maxilla and lacrimal or by the prefrontal, maxilla and jugal. The generalized condition in gekkotans is that the ventral border of the orbitonasal flange is concave creating two small processes (here termed as the ventrolateral and ventromedial maxillary processes of the prefrontal). Using high-resolution computed topographies (HRCT) we sampled all genera within Gekkota. We found that this character is not universal across the families. We observed that in some species, only one process is present, while in other species the presence of a third process occurs just medial to the lateromedial maxillary process. Two ventral processes of the prefrontal are present in all pygopodidaens, eublepharids, the majority of sphaerodactylids and phyllodactylids, while this character seems to be highly variable in Gekkonidae. When only one process is present, the ventrolateral process is consistently lost (e.g. *Afrogecko porphyreus* [Gekkonidae], *Asaccus elisae* [Phyllodactylidae], *Pseudogonatodes barbouri*, and some *Sphaerodactylus* [Sphaerodactylidae]). A third process of the prefrontal originates independently in four families: Pygopodidae *(Pygopus lepidopodus*), Sphaerodactylidae (*Euleptes europaea* and *Coleodactylus brachystoma*), Phyllodactylidae (*Tarentola mauritanica)*, and in several gekkonids (*Cyrtopodion rohtasfortai*, *Stenodactylus doriae*, *Chondrodactylus angulifer*, *Cryptactites peringueyi*, and more). The variation of the prefrontal processes will be added later to a morphological dataset to see if it is phylogenetically informative.

0270 HL GRADUATE RESEARCH AWARD, Friday 14 July 2017

Cody Godwin, Jeremiah Doody, Brian Crother

Southeastern Louisiana University, Hammond Louisiana, USA

Assessment of ATV Impacts on Softshell Turtle Nests

Recreational vehicle use (e.g., all terrain vehicles or ATVs) has become increasingly popular in recent years, and is particularly prevalent in the southeastern U.S.. Numerous studies have indicated negative effects of ATVs on the environment,

especially in and around wetlands, including wetland degradation, soil erosion, destruction of vegetative communities, and direct animal mortality via impact. However, the impact of ATVs on nest success of fresh water turtles has not been documented. The beaches of the Comite River in southeastern Louisiana bring into close contact ATVs and the nesting sites for two species of softshell turtles (*Apalone mutica* and *Apalone spinifera)*. The present study aims to understand the impacts of the ATVs on softshell turtle nests and thus the turtle populations. A study performed in 1993-1994, when ATVs were absent, provides a baseline for assessing the current impacts. Analyses from the 2015 and 2016 field season show that ATVs impacted 35% and 31% of nests respectively, and is the highest source of nest mortality on the Comite River.

0105 Herp Physiology, Saturday 15 July 2017

Jeffrey Goessling, Mary Mendonca

Auburn University, Auburn, Alabama, USA

Effects of trapping on markers of acute stress in Gopher Tortoises, *Gopherus polyphemus*

Threatened and endangered species are often the focus of intensive research and management programs, yet these programs may represent significant stressors to the taxa of conservation interest. As part of a broad study assessing disease in Gopher Tortoises (*Gopherus polyphemus*), we assessed markers of acute stress (plasma glucocorticoid concentration [cort], heterophil: lymphocyte ratios, and plasma lactate concentration) in *G. polyphemus* to determine if trapping caused a significant stress response. We analyzed animals based on how they were captured in the field. Individuals were either hand captured or trapped. In trapped animals, we evaluated whether individuals showed signs of stress in the trap (e.g. panting, pacing) or if they were behaviorally calm. When analyzed by capture condition (e.g. hand captured, trapped-stressed, or trapped-calm), we found that both [cort] and lactate concentration were significantly elevated above hand captured and trapped-calm animals ($P < 0.05$ for both). Heterophil: lymphocyte ratios were not significantly different between capture conditions. There was however a positive significant relationship between [cort] and heterophil: lymphocyte ratios ($P < 0.0001$; $R^2 = 0.574$). Our data both shed light on best practices for research and management of threatened and endangered species, as well as basic understanding of the complex interplay between physiological responses stress in wild populations.

0653 SSAR SEIBERT ECOLOGY II, Thursday 13 July 2017

Scott Goetz[1], James Godwin[1], Fred Antonio[2], Michelle Hoffman[2], David Steen[1]

[1]Auburn University, Auburn, Alabama, USA, [2]Central Florida Zoo, Sanford, Florida, USA

Indigo Snakes Prefer Pit Vipers When Neonates But Not After A Year in Captivity

The federally-threatened Eastern Indigo Snake is considered a dietary generalist; however, we know little about the prey preferences of this imperiled species. In this study, we investigated dietary preferences using a multi-year sample of hatchling Eastern Indigo Snakes (2015, N = 55; 2016, N = 34) by assaying responses to chemical cues from several potential prey species. In 2015, we explored predatory response to cues from a mammal, representatives of two subfamilies of snakes (Colubrinae and Crotalinae), as well as an unscented control (DI water) and observed a significant preference for Copperheads. Following a year in captivity, we re-assayed a proportion of these snakes to assess how preferences may have changed over time and found that their preference for mammal scent increased significantly. In 2016, we conducted a follow-up experiment on a new cohort of hatchling Indigo Snakes to determine if the preference for Copperheads we previously documented was actually indicative of a preference for pit vipers in general. We presented snakes with cues from three species of pit vipers (Copperheads, Cottonmouths, and Pygmy Rattlesnakes) and did not observe a significant difference among pit viper scents. Our results suggest Eastern Indigo Snakes prefer pit viper prey and also that these preferences may change over time. Future research will examine whether the dietary shifts we documented are due to natural ontogenetic shifts or were a result of captive conditions; we also intend to investigate potential co-evolutionary relationships between ophiophagous snakes and pit vipers.

0634 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Scott Goetz[1], Christina Romagosa[2], Arthur Appel[1], Craig Guyer[1], Mary Mendonca[1]

[1]Auburn University, Auburn, Alabama, USA, [2]University of Florida, Gainesville, Florida, USA

Cuban Treefrog Innate Immunity Covaries with Time since Colonization

Immunological trade-offs provide the basis of many ideas that seek to explain the success of biological invasions. It has been suggested that invasive species at the leading-edge of expanding distributions should allocate resources away from costly immune functions to benefit life-history traits associated with dispersal. We investigated differences in innate immunity of invasive Cuban Treefrogs in relation to time since colonization. We used two techniques to compare immune responses between a long colonized region (core) and a recently colonized region (leading-edge). We compared metabolic responses of frogs injected with an endotoxin that induces an inflammatory response, lipopolysaccharide (LPS), to sham-injected controls. We detected a sex-related difference in the mass-independent metabolism of sham-injected frogs, with males exhibiting a significantly greater metabolic rate ($F_{1, 21} = 29.02$, $P < 0.001$) than females. We observed significantly greater metabolism in both males ($P < 0.041$) and females ($P < 0.007$) from the core region compared with control frogs. Conversely, metabolism of LPS

injected frogs did not differ significantly from control frogs in males (P = 0.195) or females (P = 0.132) from the leading edge region. We also measured the bacterial killing ability of frog blood plasma and observed a significant increase of bactericidal ability of frogs from the core compared with the leading-edge (F1, 26 = 28.67, P < 0.001). Our results suggest that Cuban Treefrogs at the leading-edge of their expanding invasive distribution have reduced innate immunocompetence and support hypotheses predicting a relationship between invasion success and immunological trade-offs.

0304 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Cory Goff[1], Caitlin Gabor[1], Susan Walls[2]

[1]Texas State University, Texas, USA, [2]USGS Wetland and Aquatic Research Center, Gainesville, Florida, USA

Core vs. Periphery: Linking Amphibian Declines to Habitat Quality and Increased Stress

Climate change has become a significant driver of ecological systems, and is associated with changes in environmental factors like temperature, humidity, precipitation, and sea level rise. In addition, anthropogenic disturbances also alter habitat and reduce habitat quality. These factors can limit population ranges with optimum habitat in the core of the range and lower quality habitat along the range periphery. One mechanism to assess how individuals and populations respond to changing conditions is to assess their physiological health. We obtained baseline and stress-induced water-borne corticosterone (CORT) release rates for *Pseudacris ornata* (Ornate Chorus Frog) tadpoles from multiple sites in seven locations throughout the species' range. We hypothesized that locations in the range periphery where populations have been declining would not show a stress response (indicating chronic stress) and that baseline CORT release rates from these peripheral populations would be higher than more stable populations in the range core. Baseline CORT release rates were lower in core versus peripheral locations and CORT release rates increased with lower water quality (higher water temp, tds, and conductivity). Higher baseline CORT release rates in sites with lower water quality may partially mediate the observed population declines in peripheral populations.

0389 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Harrison Goldspiel

SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

Spatial and Historical Drivers of Pool-Breeding Amphibian Abundances in a Central New York Forest

Pool-breeding amphibians of the forested northeastern United States have complex life cycles, requiring connected terrestrial adult and aquatic larval habitats. Habitat augmentation (e.g., vernal pool construction) is an increasingly common conservation strategy in this region, especially in areas where there have been substantial wetland losses, yet there is no consensus regarding how these projects should best be designed. This research examined how different spatial arrangements of larval (wetland) and adult (upland) habitat regulate terrestrial amphibian populations by sampling amphibian abundances and upland microhabitat characteristics in an experimental array of 39 vernal pools constructed in 2010 at Heiberg Memorial Forest (Tully, NY). Time and area-constrained visual encounter surveys and forest habitat assessments were conducted in uplands varying in vernal pool densities (0 – 9 pools) and stand age (primary versus post-agricultural secondary forest) to test whether greater wetland or upland habitat availability is associated with larger populations of Wood Frogs (*Lithobates sylvatica*) and Spotted Salamanders (*Ambystoma maculatum*). Previous work suggests that older forests with higher quality of adult habitat and/or sites with greater pool densities may support larger populations of pool-breeding anurans and salamanders. This research aims to estimate these relationships to obtain a more complete understanding of the ecological and historical drivers of amphibian communities and inform guidelines for conservation and land management.

0178 ASIH STOYE GENERAL HERPETOLOGY, Thursday 13 July 2017

Jeronimo Gomes Da Silva Neto[1], William Sutton[1], Stephen Spear[2], Michael Freake[3]

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The Use of Species Distribution Models (SDMs) and Environmental DNA to Evaluate the Distribution of the Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) in Tennessee, U.S.A.

The Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) is a long-lived, fully-aquatic salamander that inhabits cool, well-oxygenated streams and rivers in the eastern United States. Although once abundant, *C. a. alleganiensis* populations have experienced major declines across the historical range due to habitat degradation, siltation, aquatic contaminants, and infectious diseases. Tennessee provides some of the best remaining habitat for *C. a. alleganiensis* throughout the known geographic range. However, standardized state-wide distribution assessments have been limited to known populations, and status of other *C. a. alleganiensis* populations remains unknown. We used current and historical occurrence data, in combination with landscape and environmental covariates, to create a species-specific predictive habitat model using species distribution modeling (SDMs) techniques and environmental DNA samples. The overarching goals of this project are to use the resulting model to identify remaining functional populations of *C. a. alleganiensis* and areas of special concern, and encourage

efficient use of time and resources to effectively manage and conserve the few remaining secure, yet declining, hellbender populations throughout the state of Tennessee.

0888 Fish Ecology II, Sunday 16 July 2017

Jania M. Gómez-Romero[1], Ruth T. Chacón-Polo[1], Ángel L. Martínez-González[1], Glenys Tordecilla-Petro[2], Charles W. Olaya-Nieto1[1], Fredys F. Segura-Guevara[1]

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Trophic ecology of Cachegua *Trachelyopterus insignis* in the Cienaga de Ayapel

To study the feeding ecology of Cachegua *Trachelyopterus insignis* in the Cienaga de Ayapel, Colombia, we analyzed 403 stomachs of individuals collected between January and December 2013, with sizes between 11.8-27.1 cm total length (TL) and total weight (WT) between 17.0-250.0 grams. The stomach content was analyzed using the Proportion of empty stomachs, Grade of digestion, Frequency of occurrence, numerical Frequency, Gravimetry and relative importance Index. The Proportion of empty stomachs was low and most of the foods were half digested, identifying five food groups: Fishes, vegetable Rests, Detritus, Insects, and Others. Fishes were the most common group (61.6%), the most abundant group (39.5%) and the greatest group composition in weight (45.1%), respectively. The relative importance Index indicates that Fishes (IIR =27.8) and vegetable Rests (IIR =12.6%) are food groups of secondary relative importance in the species´s diet, while other food groups are classified as occasional food groups with low relative importance. The results suggest that Cachegua is an omnivorous fish with a carnivorous tendency, which maintains its food preferences as it grows throughout the year, correlated with the hydrological cycle of the Cienaga de Ayapel.

0742 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Alany Pedrosa Gonçalves, Victória Judith Isaac

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Seasonal and Spatial Changes in the Abundance of an Endemic Tropical Fish, Before a Big Dam

Hypancistrus zebra (Siluriformes: Loricariidae) is a small endemic fish of the Volta Grande of the Xingu River. It is very appreciated in international ornamental fish trade and strongly threatened because of the construction of Belo Monte Dam, that changed the natural course of the river. The aim of this study was to determinate the variation in

the abundance of *H. zebra* in Volta Grande, before Belo Monte Dam, considering the effects seasonal and spatial. *H. zebra* was collected by diving, in four sites (Gorgulho da Rita - 03º20'S 52º10'W; Ilha da Fazenda - 03º36'S 51º50'W; Jericoá - 03º23'S 51º44'W; Belo Monte - 03º06'S 51º43'W), monthly, from March 2009 to February 2010. In each site, were realized four replicates of one hour. Were considered four hydrologic periods: rising (December, January, February), wet (March, April and May), lowing (June, July and August), dry (September, October and November). 250 specimens were captured, with 35% in Jericoá site, 31% in Belo Monte site and 25% in Ilha da Fazenda and 9% Gorgulho da Rita. Considering the hydrologic period, 38% of the specimens of *H. zebra* were captured in the dry, 24% in lowing, and 19% in rising and wet, each. Significant differences in the abundance were found between Gorgulho da Rita and the other sites, with lowest abundances in Gorgulho da Rita, while, lowing and dry the greatest abundances. The construction of Belo Monte Dam, generated severe changes in the hydrological cycle, which can cause the extinction of *H. zebra* in its natural habitat.

0093 Herp Genetics, Saturday 15 July 2017

Breanna Gould, Sarah Corey-Rivas

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Immune Gene Toll-like Receptor-2 and Amphibian Tolerance to Emerging Fungal Disease

Emergence of fungal chytridiomycosis caused by the pathogen *Batrachochytrium dendrobatidis* (Bd) is undeniably linked to drastic declines in amphibian biodiversity. Most Bd naïve populations experience acute mortality, dramatic decline, and/or extinction when an outbreak occurs. Some amphibian populations, however, remain either unaffected or persist at low frequencies where Bd is prevalent. Why certain populations exhibit differential survivorship during infection remains a source of question, and provides an impetus for further investigation of amphibian immunogenetics. Toll-like receptor-2 (TLR-2) is a primary candidate gene for host tolerance to Bd because it is involved in the recognition of fungal ligands in other vertebrates. Boreal toads (*Anaxyrus boreas boreas*) are ideal models for understanding the relationship between TLR-2 genotypic variation and amphibian immune response, given that geographically separate populations (study sites = CO & UT) of the same species exhibit observable survivorship differences to Bd fungal infection. Captive reared individuals (n=72) originating from each population (CO=36; UT=36) will be challenged with Bd, TLR-2 genotyped and compared to genotypes from wild populations (n=50). Individual TLR-2 genotypes will be examined for polymorphisms to observe potential pattern-process relationships between genetic variation and differential survivorship exhibited by infected boreal toad populations. Our findings will provide useful data for future amphibian immunogenetics studies by characterizing the first TLR marker in *Anaxyrus sp.*, and will expose potential population-level processes of contemporary immunogenetic evolution as a result of selection pressure by emerging fungal disease.

0707 ASIH STOYE GENERAL ICHTHYOLOGY II, Thursday 13 July 2017

Jessica Grady, C.M. Gienger, Rebecca E. Blanton

Austin Peay State University, Clarksville, TN, USA

Factors Affecting Scale Shape Variation in Etheostomatinae Darters

The species-rich darter clade (Percidae: Etheostomatinae) has a vast research history. However, studies of variation in scale microstructure have been limited to a small number of species and variation in scale shape has not been previously studied. A pilot study conducted on a subset of darters revealed discernable variation in scale shape among genera, species, and clades. Given this result and the documented role of environment on other aspects of darter phenotypic diversity, our goal was to evaluate the relative impact of phylogeny, environment, and behavior on darter scale shape. We generated scale shape data using geometric morphometrics. TPSDIG2 was used to digitize 7 homologous landmarks for 30 individuals from 97 species of darters representing all genera, subgenera, and terminal clades. Variables documenting species habitat use (e.g., flow, mesohabitat), spawning mode, food acquisition mode, burying behavior, and phylogeny were summarized from the literature. Procrustes superimposition and ordination methods were carried out in MORPHOJ 1.05f and tps software (Sunybrook). Scale shape variation was noted within and among genera and clades of darters. Analyses testing the relationship between scale shape variation and the identified environmental and behavioral variables and phylogeny are ongoing. Because scales aid in reducing drag and facilitating movement, understanding the relative impact these factors have on darter phenotypes will enhance knowledge of the response of this group of fishes to environmental changes and provide insights to factors promoting phenotypic diversification.

0186 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jasmin Graham, Gavin Naylor

College of Charleston, Charleston, SC, USA

Evolutionary Relationships of Hammerhead Sharks (Sphyrnidae): Reconciling Signals Across Anatomical and Molecular Data

In the current study we reassessed the conflicting hypotheses that have been forwarded to account for the evolution of hammerhead sharks. First, skeletal anatomical features of seven species of hammerhead sharks (Sphyrnidae) and two species of requiem shark (Carcharhinidae) were used to estimate a phylogenetic hypothesis for the group. Specimens were CT scanned and segmented to create virtual 3-D models of the sharks. A character matrix was derived from the segmented CT scans and subjected to phylogenetic analysis. The phylogenies created using the anatomical data gathered from the CT scans were consistent with the former phylogeny derived from anatomical data.

They showed that the hammerhead shark most closely related to the outgroup sharks from the Carcharhinidae family was *Sphyrna tiburo*, the "bonnethead" shark, which has one of the least developed cephalofoils among all of the hammerhead family. The data suggests that cephalofoil size has increased over the course of evolution and may confer some evolutionary advantage. However, an analysis of both nuclear and mitochondrial DNA sequence data using a newly developed cross species gene capture approach was conducted and yielded a tree that was concordant with previous hypotheses based on molecular data, but strongly discordant with the tree created based on the anatomical data. We attempted to reconcile these two conflicting hypotheses and pinpoint the causes underlying the conflict between the analyses. Initial indications suggest that the way the trees are rooted may account for the apparent conflict.

0141 Amphibian Conservation III, Sunday 16 July 2017

Sean Graham[1], Donald Walker[2], Crystal Kelehear[1]

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Conservation Status of Dwarf Salamanders (*Eurycea quadridigitata* complex) in Georgia

Conservation priorities are hampered by our inability to determine species boundaries and from lack of basic natural history and distribution information. An example is the Chamberlain's Dwarf Salamander, *Eurycea chamberlaini*. A recent phylogeography determined the formerly recognized, widespread species *Eurycea quadridigitata* is a species complex of at least four species. *Eurycea chamberlaini* was the first new species of this complex described (from populations in the Carolinas) and was recently petitioned for listing under the U.S. Endangered Species Act. To assess the conservation status of this species I conducted 236 surveys at 218 localities in 37 Georgia counties totaling 356 person hours of search effort. The goal of the study was to determine the county level distribution of the salamander in Georgia and resolve the taxonomy of this species. 115 salamanders tentatively identified as *E. chamberlaini* were found at 43 sites in 25 counties. This salamander was located in 14 new counties, and most major distribution gaps in Georgia were filled by this study. However, our genetic analysis confirms these specimens do not form a monophyletic clade with *E. chamberlaini* collected from the Carolinas. No specimens assignable to *E. chamberlaini* (in the strict sense) were located in Georgia, indicating *E. chamberlaini* probably has a distribution restricted to South and North Carolina and can be removed from Georgia's list of species. Instead, we confirm Georgia specimens referable to *E. chamberlaini* are an undescribed species corresponding to the "central clade" identified previously by Lamb and Beamer (2012).

0008 Amphibian Behavior, Friday 14 July 2017

David Green

McGill University, Montreal, Quebec, Canada

Size-Assortative Mating in Anuran Amphibians: Assessing the Evidence

Assortative mating and sexual selection are central to the processes of speciation. Their occurrence within populations implies both competition for, and choice of, mates based on some heritable attribute. Size-assortative mating among anuran amphibians has been reported many times, although its significance has been unclear. I performed a comprehensive meta-analysis of 284 studies in 67 species reported in 96 publications dating back to 1976. Data pooled over 2 or more years were significantly more likely (Chi-square = 7.75, p = 0.005) to yield a positive relationship between male and female body size (53% of 51 data sets) than single season data (30% of 125 data sets). Findings of positive assortative mating in the literature were always accompanied by statistics but there were 31 instances of non-significant results without any statistical information at all. Using weighted, Z-transformed, r-values as the effect sizes, the evidence for size-assortative mating among anurans is very weak. Where it does appear to occur, it is largely in populations characterized by scramble competition among males, rather than sexual selection by females.

0763 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brian Greene

Missouri State University, Springfield, MO, USA

Survival estimates of cottonmouths (*Agkistrodon piscivorus*) derived from a 16-year mark-recapture study

Demographic data are essential for understanding population dynamics and life history strategies. However, obtaining such data is sometimes problematic for cryptic and secretive organisms like snakes. I used mark-recapture data in a modeling framework to estimate apparent survival and recapture probability for a stream-associated population of cottonmouths in southwest Missouri. Although estimates of annual survival were high for all adult snakes (0.91 ± 0.020), the best supported models indicated that survival varied by sex and year, with survival of females being more variable than for males. Capture probability differed annually due to differences in sampling effort and was suggested to be higher for females than males (range for sexes combined: 0.05-0.26 per year). Higher encounter rates for females are biologically realistic because of their tendency to bask when gravid. Annual survival estimates for juveniles averaged 52% (± 0.044 SE) with a single best supported model indicating no sexual differences. Recapture intervals for juveniles were extremely variable with many neonates being recaptured only once in their first year of life and others escaping detection for 7-9 years following their initial capture. Such lengthy recapture intervals may cause underestimation of juvenile survival in short-term studies, possibly contributing to the appearance of low juvenile survival in reptiles. The combination of long recapture intervals and relatively long lifespan highlight the importance of long-term studies in

deriving robust estimates of demographic parameters for viperids with similar life histories.

0202 Herp Reproduction & Life History I, Thursday 13 July 2017

Katherine Greenwald, Marisa Hildebrandt, Kelsey Mitchell

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Context-dependent Use of "Stolen Sperm" by Unisexual *Ambystoma* Salamanders

Unisexual (all female) *Ambystoma* salamanders reproduce using a "leaky" form of gynogenesis requiring the uptake of a spermatophore from a sympatric sexual male. This may trigger gynogenetic egg development, or the sperm genome may be incorporated into the zygote, typically resulting in ploidy-elevated offspring. Sperm genome incorporation varies with temperature, but it is unknown if it may be influenced by other factors. We conducted breeding trials pairing unisexual females with either an *A. laterale* male from their own pond ("local male"), or an *A. laterale* male from a more distant pond ("foreign male"). We tested two mutually exclusive hypotheses: (1) offspring benefit from locally adapted genes, which predicts that local male genomes will be incorporated more frequently than foreign male genomes; (2) offspring benefit from genetic diversity, which predicts the opposite. Adults and eggs were genotyped using a panel of microsatellite loci to determine ploidy and paternity (or lack thereof). Females paired with foreign males produced fewer clutches overall, and a lower proportion of the eggs were viable. Genotyping revealed that a significantly lower proportion of these eggs included the paternal genome, supporting the local adaptation hypothesis. The ability to flexibly adjust between sexual and asexual reproduction in a context-dependent manner might help explain the evolutionary success of this lineage.

0798 Fish Life History, Saturday 15 July 2017

Rachel Grey[1], Virginia Shervette[1], Joseph Ballenger[2], David Wyanski[2]

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Life History of Lionfish (*Pterois* spp) in Invaded Range

Lionfish (*Pterois volitans* and *Pterois miles*) recently invaded the western Atlantic Ocean, with the first sighting occurring in 1985. These two species are originally native to the Indo-Pacific region and were thought to be introduced into waters near Florida via aquarium releases, although multiple introductions are probable. The two species are morphologically indistinguishable so genetic markers are required to determine the species of an individual. Previous research has demonstrated that invasive lionfish can significantly impact coral reef ecosystems through the reduction of reef fish recruitment

and out-competing native species for prey and refuge. The goal of this study is to determine and compare population attributes (aspects of age structure, growth rates, and reproductive cycle) of *Pterois* sp. across their invaded range within the Atlantic Ocean. Currently, we have samples from four main areas: 1) Honduras, 2) Puerto Rico, 3) Florida, and 4) South Carolina. To-date, we have collected otoliths and gonads from 1,580 individuals ranging in size from 84-430 mm total length (TL). Of those, 1,119 are from Honduras (95-430 mm TL), 24 are from PR (158-390 TL), 32 are from FL (96-340 mm TL), and 405 are from SC (84-415 mm TL). Over the total study period (2015-2016) samples were collected from each population to determine periodicity in gonad development and spawning, spawning frequency, reproductive output, and size- and age-at-reproduction. This study will examine the life history of lionfish populations and how density of fish may affect growth and sexual maturity rates.

0193 Lizard Conservation, Saturday 15 July 2017

Ashley Grimsley, Daniel Leavitt, Michael Ingraldi

Arizona Game and Fish Department, Phoenix, Arizona, USA

Flat-tailed Horned Lizard (*Phrynosoma mcallii*) Population Viability Analysis in the Yuma Desert of Arizona

The Flat-tailed Horned Lizard (*Phrynosoma mcallii*) is distributed within a limited range, including extreme southwestern Arizona, southern California, and Sonora and Baja California, Mexico. Human expansion from both agricultural and urban development has caused significant habitat and range reduction. To determine the vulnerability of populations and relative risk of extinction of *P. mcallii* in Arizona, we carried out a structured population viability analysis (PVA) using demographic and occupancy data collected in the Yuma Desert from 2008 to 2015. Results suggested a low risk of population extinction (0.07 ± 0.01) over the next 100 years. Deterministic results showed a positive annual rate of change ($\lambda = 1.08$) and a positive exponential rate of increase ($r = 0.08$). The exponential rate of increase for the stochastic results was also positive ($r_s = 0.02 \pm 0.001$), and the mean time to first extinction was 56 ± 3 years. Sensitivity analyses revealed potential drivers of population growth are related to reproduction and mortality. Specifically, results showed future monitoring and research should be focused on evaluating the age at first offspring, reproductive success, clutch size, percent of females breeding, percent of females producing multiple broods, and drivers of mortality dynamics to enhance our understanding of these factors on population persistence. Finally, we determined that management should be considered at the Yuma Desert when the population size is near 122,309 or lower, based on a 30% decline in current population numbers. Future efforts will be focused on conducting a meta-population PVA of *P. mcallii* populations range-wide.

0149 SSAR SEIBERT ECOLOGY II, Thursday 13 July 2017

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Tracking dispersal and habitat use of neonatal copperheads (Crotalinae; *Agkistrodon*) using harmonic radar technology

Studies evaluating the effect of forest management on the habitat preferences of nesting snakes and their dispersing offspring are limited, despite the importance of these age cohorts to population viability and genetic diversity. Recent studies have identified the neonatal snake cohort as an important dispersal vector in several species. Unfortunately, the comprehensive examination of early-life characteristics in snakes is logistically challenging because of ineffective tracking techniques and low detection probabilities in situ. During the 2015-2016 activity seasons, we examined the activity patterns and microhabitat use of newborn copperheads (*Agkistrodon contortrix*) in Bankhead National Forest in northern Alabama. Gravid female copperheads were implanted with VHF radiotransmitters and tracked periodically until mid-August when they were placed in hardware cloth exclosures at their parturition sites to give birth. Neonates were implanted with harmonic direction finder (HDF) tags after their initial ecdysis and tracked daily. Case-control microhabitat surveys were conducted alongside natal tracking efforts. Microhabitat use was analyzed using conditional logistic regression within an information-theoretic framework. Our analysis revealed that neonates chose locations in closer proximity to course woody debris and woody undergrowth than what was available. Neonates exhibited a characteristic "beads-on-a-string" dispersal, punctuating step-wise movements with stops at woody shelters. Our findings indicate that recently managed areas provide neonatal copperheads with a patchy distribution of suitable thermal conditions and physical retreat sites reminiscent of naturally occurring early-successional habitat. We will also give an assessment of the HDF system as a telemetry tool, and recommend potential applications for HDF technology in vertebrate spatial analysis.

0638 AES Conservation & Management II, Saturday 15 July 2017

Dean Grubbs[1], John Carlson[3], Andrea Kroetz[3], Mark Bond[4], Bianca Prohaska[2], Bryan Keller[2]

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First observation of the birth of wild smalltooth sawfish, *Pristis pectinata*, and the use of varied telemetry approaches to assess sawfish habitat use and residency in Andros, the Bahamas

The smalltooth sawfish (*Pristis pectinata*) is listed as *Critically Endangered* in the IUCN Red List of Threatened Species and *Endangered* under the United States' Endangered

Species Act. The species is restricted to the Atlantic Ocean and populations declined throughout the range due to overfishing and habitat loss. Southwest Florida (U.S.) and the west side of Andros Island (Bahamas) harbor perhaps the only known viable populations of smalltooth sawfish and mixing between these populations is unknown. Parturition for smalltooth sawfish has only been known to occur in Florida whereas the birth origin of Bahamas sawfish was unknown. We used passive acoustic (implanted coded transmitters) and satellite (archival PSAT, towed and fin-mounted SPOT) telemetry to assess movements and residence time of large juvenile and adult sawfish in Andros. For all animals tagged, we documented heavy use of mangrove creeks along the northwest coast of Andros as well as the shallow back-country region connected to these creeks. The data suggest year-round residency in a relatively small area of Andros (~300 km^2) for some animals. During our surveys we verified the use of the Andros back-country by small juvenile sawfish and in December 2016 we captured a large mature female sawfish that was in the process of giving birth in one of core area tidal creeks. Five term pups 69-71 cm total length were born rostrum first. Samples for genetic analyses and to assess physiological stress were collected from the pups. This is the first time the wild birth of sawfish has been documented.

0364 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Anna Gruszkiewicz, Kyle Piller

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Analysis of Body Size Evolution and Diversification Rates in the Subfamily Poeciliinae

Body size can play a vital role in the ecology, life history, and distribution of a species. Previous studies have found that many fish species exhibit a phyletic shift toward smaller body size over evolutionary time, especially in freshwater systems. This body size trend raises interesting questions about the potential correlation between diversification rates and the rate of body size evolution. This study examines this potential correlation within the subfamily Poeciliinae (family Poeciliidae). Poeciliinae is a highly speciose (> 250 species) group of live bearing New World fishes found in the Americas ranging from the southern US to southern regions of South America and the Antilles. Poeciliids typically inhabit small freshwater and brackish streams that can isolate populations and limit dispersal and gene flow which readily promotes speciation and small body size. For this study, diversification rates and body size evolution will be inferred using BAMM (Bayesian Analysis of Macroevolutionary Mixtures), using a multilocus phylogeny for the subfamily. Divergence dates will be estimated using multiple fossil calibrations and BEAST (Bayesian Evolutionary Analysis Sampling Trees). Specimens for body size measurements (SL) will include at least 30 individuals from those species included in the final phylogeny. We predict that poeciliid species have shifted toward smaller body size and faster diversification rates over evolutionary

time which would be consistent with patterns found in other freshwater Actinopterygian fishes.

0899 Fish Ecology I, Sunday 16 July 2017

George Guillen, Jenny Oakley, Mandi Gordon, Cory Scanes

University of Houston Clear Lake Environmental Institute of Houston, Houston, Texas, USA

Influence of Freshwater Inflow on Larval and Juvenile Fishes of the Lower Brazos River Estuary, Texas

The State of Texas is conducting validation studies to determine whether existing environmental flow standards adopted and implemented under the Senate Bill 3 process should be modified. Many of these standards were adopted using limited data and best available science. Unlike most Gulf coast estuaries the Brazos River discharges directly into the Gulf of Mexico instead of an enclosed bay. The ichthyoplankton and post-larval juvenile fish community of the lower Brazos River estuary has been rarely monitored during the last 50 years. The primary objectives of our study were to characterize and determine the influence of river discharge on physicochemistry and immature fish community in the Brazos River estuary. We conducted multiple collections of ichthyoplankton and early post-larval juvenile fish during 2012 through 2016 at five sites extending from the mouth of the river to a point located 42 kilometers upstream. These data were compared to limited historical data to characterize the response of larval and early post-larval juvenile fish communities over a broad range of freshwater inflow. Based on statistical analysis of these data we detected distinct lateral and vertical gradients in salinity, dissolved oxygen, and ichthyoplankton and immature fish composition related to freshwater discharge. We found that high and sustained freshwater discharges significantly altered the seasonal community composition of the lower river. Further research is needed over a range of flow regimes to better characterize the response of estuarine biota to varying freshwater inflow in order to provide better advice to agencies responsible for water allocation.

0721 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Joe C. Gunn[1], Leah K. Berkman[2], Lori S. Eggert[1]

[1]*University of Missouri, Columbia, MO, USA,* [2]*Missouri Department of Conservation, Columbia, MO, USA*

Validating the Taxonomic and Distributional Status of the Neosho Smallmouth Bass (*Micropterus dolomieu velox*)

Since Lacepède's original classification of the black basses in 1802, the nomenclature, number of unique species, and methods for identifying novel taxa for *Micropterus* have

varied repeatedly. Currently, biologists recognize nine species and a number of subspecies based primarily on morphology; however, we lack strong genetic evidence to support the present taxonomy. One area of debate involves the relationship between two designated subspecies of Smallmouth Bass. The subspecies status of the Northern Smallmouth Bass (*M. d. dolomieu*), which inhabits a significant portion of central North America, and the Neosho Smallmouth Bass (*M. d. velox*), whose native range is geographically restricted to the lower Ozark highlands, has not been adequately studied since their descriptions by Hubbs and Bailey in 1940. The subspecies are identified predominately by the number of soft dorsal fin rays, predorsal contour, and the presence or absence of teeth along the tongue. With the prevalence of stocking programs that focus on sportfish, and with the potential for hybridization and genetic introgression in mixed populations, it is vital that we understand the impacts of interspecific stocking on local biodiversity. We investigated the taxonomic and distributional status of *M. d. velox* in Missouri, Arkansas, and northeastern Oklahoma. Using 10 microsatellite loci, we assessed levels of genetic diversity among samples collected from tributaries of the Arkansas River Basin and evaluated the taxonomic distinction between these variants. Our results lay the groundwork for an investigation of hybridization between Smallmouth subspecies using genomic methods and for delimiting the ranges of the diverged forms.

0348 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Theresa Gunn, Christine Bedore

Georgia Southern University, Statesboro, Georgia, USA

Environmental and physiological regulation of stingray color change

Many reef fishes exhibit dynamic coloration and body patterns that can change under nervous control. Lowe et al (1996) showed that hammerheads in high UV environments have higher skin melanin concentrations, which likely functions as a protective mechanism against UV damage. However, several species of benthic sharks and rays likely alter melanin concentrations in the skin to provide background matching for camouflage. The yellow stingray (*Urobatis jamaicensis*) is a small, reef-dwelling elasmobranch with elaborate spot patterns that provides effective camouflage against their rock-reef background. Because yellow stingrays likely use this camouflage as a predator avoidance strategy, melanin responses to UV light may be supplanted by responses to other environmental mechanisms such as habitat color/brightness. To investigate this hypothesis, we housed rays in either black or white tanks for one week and photographed the rays daily. Stingrays in black tanks significantly darkened skin color over the seven-day period whereas rays in white tanks significantly lightened their skin color during the same period. To investigate the role of UV light on changes in camouflage, rays were housed individually in black and white tanks and were held in either UV present or UV absent light environments. Preliminary results indicate that rays adjust to their tank conditions independent of the presence of UV. We plan to

further examine the underlying physiological mechanisms that control color change in the yellow stingray, including the extent to which color change is visually mediated.

0815 AES Behavior, Sunday 16 July 2017

Tristan Guttridge[1], Samuel Gruber[1], David Jacoby[2]

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Validating Animal Social Structure Inference Methods: Acoustic Tracking vs. Direct Observations of Lemon Sharks, *Negaprion brevirostris*

Tools such as biotelemetry (radio and acoustic telemetry) and biologging (archival logger) devices offer a sophisticated means of evaluating the behaviour, spatial ecology, energetics, and physiology of free-living animals in their natural environment. However, the extent to which these can be used to investigate interactions between large aquatic animals, such as sharks that range over wide areas, remains relatively unexplored. One promising recent approach uses GMMs (Gaussian mixture models) to identify spatio-temporal clustering events (bursts of detections) in acoustic tracking data, from which co-occurrences can be inferred to map the underlying social structure of animals moving through arrays of passive receivers. By recording the number of times individuals co-occur and the duration of these co-occurrences at different locations, it was possible to make inferences about the leadership patterns within a population of wild sharks. However, despite these tantalizing results, how well this inference method captures true social structure remains unmeasured, leaving the model as yet unvalidated. Here we provide a validation of this method by comparing the social structure of juvenile lemon sharks, *Negaprion brevirostris*, derived from acoustic telemetry data via the GMM technique, to those collected from direct wild observations of social behaviors. This dual dataset is rare for free-ranging sharks and provides an important testing ground for this novel approach, which could prove a crucial tool for elucidating the ecological role and conservation implications of sociality in marine ecosystems.

0371 Amphibian Biology, Ecology, & Conservation, Sunday 16 July 2017

Jacquelyn Guzy[1], Kelly Halloran[1], Jessica Homyack[2], John D. Willson[2]

[1]University of Arkansas, Fayetteville, AR, USA, [2]Weyerhaeuser Company, Centralia, WA, USA

Influence of Streamside Management Zones on Salamander Species Richness within Managed Forests of the Ouachita Mountains of Arkansas

A primary tool for maintaining ecological integrity in managed forest landscapes are streamside management zones (SMZs), buffers of mature forest retained along streams.

Our study examined the importance of SMZs surrounding headwater streams for maintenance of salamander biodiversity in the Ouachita Mountains of Arkansas, USA. During the spring and summers of 2014-2016 we conducted four surveys at each of 102 headwater streams across a gradient of SMZ widths and adjacent stand ages. We used a hierarchical Bayesian species-richness model to estimate salamander species richness and species-specific occupancy responses to SMZ and stand characteristics, while accounting for variation attributable to other site and sampling covariates. Additionally, we used binomial mixture models with Bayesian inference to examine the influence of SMZs on abundance of two stream-associated salamanders, the Ouachita dusky salamander (*Desmognathus brimleyorum*) and many-ribbed salamander (*Eurycea multiplicata*). Our results indicate a strongly positive occupancy response across the salamander community to increasing SMZ width, with estimated richness increasing relatively linearly across the range of SMZ widths of 0 - 100 m but varying across species. Similarly, we found that abundance of both focal stream salamander species increased with increasing SMZ width. We found that our focal stream salamanders are relatively resilient to the effects of intensive forestry, provided some SMZ buffer is maintained along streams. Conversely, woodland and pond-breeding salamanders exhibited low occupancy probability at sites with small SMZs. Collectively, our results provide important insights into the contributions of SMZs to the conservation of salamander biodiversity in managed forests.

0260 Fish Morphology, Saturday 15 July 2017

M. Laura Habegger[1], Philip Motta[2], Dave Johnson[3]

[1]Florida Southern College, Lakeland, USA, [2]University of South Florida, Tampa, USA, [3]Smithsonian Institution, Washington, DC, USA

An osteological description of the rostrum in billfishes (Xiphiidae and Istiophoridae)

Although the rostrum of billfishes is the major structure characterizing this group, its anatomical components have been in debate and a thorough description of the major osteological differences among species is still lacking. The goal of this study was to describe the osteological elements of the rostrum in two billfish representatives, an istiophorid and a xiphiid. Comparisons were made from a developmental standpoint using cleared and stained billfish larvae along with histological and CT scan images from adult specimens. Preliminary results showed the rostrum of each family to have different osteological components that vary through development resulting in major morphological differences found in the adults. The rostrum in xiphiids comprises mostly the premaxilla and its ascending process, but in istiophorids, the prenasals, an additional bone absent in xiphiids, is also present. Despite these differences both rostra have a common developmental pathway, an early, horizontally oriented rostral cartilage that acts as the major supportive structure. Overall differences in osteology and morphology of the feeding apparatus in billfishes will be further discussed in a form-functional context.

0094 Herp Morphology & Development, Saturday 15 July 2017

Travis Hagey[1], Jordan Garcia[2], Oacia Fair[1], Nikki Cavalieri[1], Barb Lundrigan[1]

[1]Michigan State University, East Lansing, MI, USA, [2]Beloit College, Beloit, WI, USA

Variation in Lizard Adhesive Toe Pad Shape

Adaptation is an important phenomenon in evolution, having generated much of the biodiversity we see today in extant species and the fossil record. The evolution of gecko lizard toe pads provides an excellent opportunity to investigate how divergent and convergent adaptive morphological evolution can both occur during the generation of diversity. The shape and organization of gecko pads vary extensively across the Gekkota infraorder, likely dictating how geckos cling to textured surfaces in the wild. Although there has been much investigation of the biomechanics of gecko adhesive performance, little attention has been paid to the diversity of toe pad shape. Very few studies have explicitly quantified toe pad shape or considered its evolutionary history. In addition to the apparent morphological diversity across gecko toe pads, there are multiple cases of assumed morphological convergence in pad shape among very distantly related genera. This pattern in variation suggests that gecko toe pads have had a complicated evolutionary past, likely with episodes of convergent evolution followed by divergent adaptation. We quantified toe pad shape across padded Gekkota and *Anolis* lizard and found repeated examples of convergent evolution in toe pad shape. Investigating the interplay between ancient convergence and recent adaptation will give us insight into how different processes of adaptation work together to generate biodiversity.

0701 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; LFC BLAXTER BEST STUDENT POSTER

Polly Hajovsky, Michelle Bromschwig, Simon Geist

Texas A&M University-Corpus Christi, Corpus Christi, TX, USA

Evaluation of Microplastic Pollution in Texas' Coastal Bays and Influence on Larval Food Web

Microplastic pollution and the negative consequences of microplastics entering the food web has come into the focus of research in recent years. The uptake of microplastic particles that are mistaken for food can lead to emaciation despite having a full stomach. Here we show baseline information on microplastic pollution in Texas coastal bays, which are important nursery areas for fin- and shellfish. To account for potential differences in pollution related to population density two bays are compared. Corpus Christi Bay (CCB) will act as our affected area due to it being surrounded by cities, inflow from wastewater treatment plant, two shipping channels, as well as one river providing freshwater inflow all the way from Uvalde County. In contrast, Upper Laguna Madre (ULM) will act as our less affected area due to it being a rural area

further away from shipping channels, with very little freshwater inflow from local creeks. This study addresses the three following research questions: 1) How severe is the microplastic pollution in size classes relevant for the larval food web in CCB and the ULM? 2) To what amount do microplastics enter the larval food web by ingestion? 3) Is there a spatio-temporal pattern in the ingestion frequency and does this influence the nutritional condition of larvae and early juveniles from sites with different microplastic exposure?

0428 General Herpetology, Sunday 16 July 2017

Amber Hale, Mark Merchant

McNeese State University, Lake Charles, LA, USA

Autophagy pathway in the American alligator

American alligators fast in response to cooler temperatures, which is accomplished by decreasing metabolism and body temperature depression. Nutrient scarcity, at the cellular or organismal level, may promote autophagy. Autophagy is a well-conserved sub-cellular catabolic process that cells activate to maintain energy homeostasis during periods of cellular stress. It is our working hypothesis that alligators upregulate the autophagy pathway during their winter anorexia. We have used published genomic data to perform an analysis of the autophagy pathway and related regulators, as well as, adapted molecular methods to this non-traditional animal model. We have compared nucleotide sequences, protein sequences, domain conservation, and regulatory data to the human homologues. The autophagy pathway is highly conserved and alligator amino acid sequences exhibit high identity with human homologues. Several autophagy proteins, including autophagic flux marker LC3, have been detected in multiple tissue types by western blot analysis. As we move forward, we plan to utilize these detectable proteins to identify differences among tissues and seasonally driven regulatory changes.

0641 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES SYMPOSIUM – APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Brianna Hall[1], Nick Wegner[2], Christine Bedore[1]

[1]Georgia Southern University, Statesboro, GA, USA, [2]Southwest Fisheries Science Center, National Marine Fisheries Service, La Jolla, CA, USA

Quantifying the potential for cranial endothermy in batoid fishes: A comparative study

Cranial endothermy, or "brain warming," has independently evolved in tunas, billfishes, and lamnid sharks. Brain warming is thought to have evolved to maintain fast

visual and brain function across a wide range of temperatures, thereby allowing for niche expansion. Preliminary brain morphological and histological analyses suggest the presence of a rete mirable around the brain of cownose rays, *Rhinoptera bonasus*. In species identified as cranial endotherms, retia can be used as countercurrent heat exchangers to facilitate brain warming. Likewise, preliminary results reveal *R. bonasus* body temperatures can reach 3^{o}C above ambient and their visual physiology demonstrates a smaller reduction in temporal resolution than strictly ectothermic fishes. These results suggest that cownose rays may possess mechanisms that either enable heat retention or heat production, allowing them to maintain body temperatures different than ambient. Cownose rays are relatively small in size compared to other cranial endotherms and are easily collected and maintained in a laboratory setting. If found to be cranially endothermic, cownose rays will be a model organism to study current hypotheses regarding the sensory-driven evolution of cranial endothermy. Future work will use behavioral and physiological assays to evaluate the true potential for heat retention and production.

0425 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kayla Hall[1], Peter Hundt[2], Karen Crow[1], John Swenson[1]

[1]San Francisco State University, San Francisco, California, USA, [2]University of Minnesota, Minneapolis, Minnesota, USA

Diamonds are a ray's best friend: a redistribution of fin rays is associated with a shift to the pelagic environment in myliobatids.

Batoids (skates and rays), exhibit swimming modes that may be characterized on a spectrum from undulation (>1 wave present along the fin) to oscillation (<0.5 wave present along the fin). The latter represents a derived modification in a group of pelagic rays (Myliobatidae) that have shifted to the pelagic environment. Oscillatory swimming appears to be associated with changes in pectoral fin morphology that result in a diamond shaped body plan, and a redistribution of pectoral fin ray elements. However, variation in the number of fin rays in batoid pectoral fins has not been characterized in a comparative or phylogenetic context. To better understand how the batoid body plan was modified in association with a shift in swimming and feeding modes, we quantified fin ray elements that articulate with the three primary cartilages of pectoral fins and cephalic lobes in myliobatids and their relatives. We found no evidence that additional anterior fin rays evolved in association with the origin of cephalic lobes. Rather, we found that variation in the distribution of pectoral fin ray elements is associated with the evolution of the oscillatory swimming mode. This research will help us better understand how the myliobatid pectoral fins were reorganized in conjunction with cephalic lobe evolution, separation of feeding and locomotion appendages, and invasion of the pelagic environment.

0328 Poster Session I, Rio Grande Exhibit Hall, Saturday 15 July 2017

Yvette Halley, Eric Merriam, Amy Welsh, J. Todd Petty, James Anderson

West Virginia University, Morgantown, WV, USA

Using Environmental DNA to Assess Species Composition in Appalachian Headwater Streams

Historically, wildlife and fisheries management depended on visual detection methodology to analyze species distribution. However, some species proved to be more problematic to detect and monitor because of their location, behavioral characteristics, and low population densities. Recently, advances in the processing and analysis of environmental DNA (eDNA) have enabled researchers to detect aquatic macroorganisms that might previously have been challenging to observe. Organisms constantly shed cellular material into the environment, facilitating detection of the organism's DNA. We utilized an aqueous environmental DNA filtering approach in conjunction with chloroform-isoamyl extractions, PCR and next-generation sequencing (NGS) methods to examine the species composition of amphibians and fish in West Virginia streams. Since aquatic eDNA becomes highly degraded in a short period of time, this method results in a relatively short detection window. This provided our group the ability to detect recent inhabitants of Appalachian streams.

0533 Herp Ecology II, Friday 14 July 2017

Brian Halstead[1], Patrick Kleeman[2], Gary Fellers[2]

[1]U.S. Geological Survey, Dixon, CA, USA, [2]U.S. Geological Survey, Point Reyes, CA, USA

Effects of Drought on the Demography of a Meadow Population of Sierra Nevada Yellow-legged Frogs (*Rana sierrae*)

Amphibians are declining worldwide, and amphibian populations face diverse stressors ranging from habitat loss to introduced species to a changing climate. We examined the effects of drought on a meadow population of federally Endangered Sierra Nevada Yellow-legged Frogs (*Rana sierrae*) in Yosemite National Park using 16 years of capture-mark-recapture data. Both recruitment and survival were positively related to water availability, resulting in lagged correlation of abundance with water availability. In severe drought years, recruitment into the adult population from *in situ* reproduction was nonexistent, and adult abundance decreased markedly. The effects of drought on Sierra Nevada Yellow-legged Frogs are likely context-dependent, however, as deeper alpine lakes are likely better buffered against drought than shallower meadow systems. Discovering under which circumstances different stressors become important drivers of amphibian population dynamics will inform conservation of these imperiled animals

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0685 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Emma Hanslowe[1], Michelle Collier[2], Bryan Falk[1], Amy Yackel Adams[3], Robert Reed[3]

[1]United States Geological Survey, Homestead, Florida, USA, [2]National Park Service, Homestead, Florida, USA, [3]United States Geological Survey, Fort Collins, Colorado, USA

Non-target Captures Incidental to Live Trapping for Invasive Argentine Black-and-white Tegus (*Salvator merianae*) in Florida

Live trapping is a major component of invasive-species research and management, but stress and/or mortality of incidentally captured native species is of concern to permitting agencies and natural resource managers. Between 2011 and 2016, we deployed live traps of several sizes targeting an expanding population of invasive Argentine black-and-white tegus (*Salvator merianae*) south of Homestead, Florida, USA. We deployed between 22 and 150 traps per year and used the resulting dataset to: 1) assess non-target capture species and frequency; 2) analyze differences in non-target captures among different bait types and trap models/sizes; and 3) summarize non-target species deaths. Over 70,000 trap nights have yielded 615 tegus and more than 600 captures of 31 non-target species. Only 11 non-target individuals were found dead in the trap. Enclosing bait within a commercially available metal bait basket reduced non-target captures, and fewer non-target captures were observed in smaller traps. Our results are important for understanding the effects of invasive-species management on native species and can be used to improve trap efficiency by reducing non-target captures. Furthermore, the mortality rate of non-target captures was low enough that managers may consider less-than-daily trap checks so as to reduce costs of trapping programs for invasive species in Florida.

0443 Amphibian Conservation II, Sunday 16 July 2017

Takashi Haramura

Kyoto University, Shirahama, Wakayama, Japan

Acoustic cues can be used to attract invasive cane toads in Japan.

Cane toads (*Rhinella marina*) are invasive pests in many parts of the world, including the Japanese island of Ishigaki. However, there are few methods available for their control. Vocalization such as an advertisement call by males dominates the reproductive behaviour of many species of toads. Thus, we may potentially use vocalization for controlling cane toad populations. In this study, I conducted experimental trials to evaluate the potential use of acoustic cues (conspecific male calls) to attract adult cane toads by making artificial sounds. These results demonstrate that I could selectively attract each sex of toad using artificial toad sounds. Optimal stimulus differed between sexes (males were attracted to the chorus call and to a lesser extent the call of an individual male, while females were attracted to the low-frequency call). Playback

systems are relatively inexpensive and easy to construct, and require little maintenance effort. Our results demonstrate that include artificial acoustic sounds may be effective in capturing invasive cane toads in Japan.

0556 Lightning Talks I, Friday 14 July 2017

Rebecca Hardman[1], William Sutton[2], Dale McGinnity[3], Sheri Reinsch[3], Marcy Souza[1], Phil Colclough[4], Michael Freake[5], Kelly Irwin[6], Matt Gray[1], Debra Miller[1]

[1]University of Tennessee, Knoxville, TN, USA, [2]Tennessee State University, Nashville, TN, USA, [3]Nashville Zoo at Grassmere, Nashville, TN, USA, [4]Knoxville Zoo, Knoxville, TN, USA, [5]Lee University, Cleveland, TN, USA, [6]Arkansas Game and Fish Commission, Arkansas, USA

Prevalence of Ranavirus and Bd in Hellbender Populations of Tennessee and Arkansas

The Hellbender (*Cryptobranchus alleganiensis*) is a large aquatic salamander containing two subspecies, Ozark Hellbender, *C. a. bishopi*, and Eastern Hellbender, *C. a. alleganiensis*, from the Ozark mountains and eastern U.S., respectively. Both subspecies have seen population declines over the past 25 years, especially in *C. a. bishopi* which is federally endangered. Habitat degradation alongside other factors may facilitate disease caused by amphibian pathogens such as Ranavirus and chytrid fungus (*Batrachochytrium dendrobatidis*) or Bd. Other pathogens such as the emerging salamander chytrid (*Batrachochytrium salamandrivorans* or Bsal) are also of concern as potential primary or secondary causes of disease. Our objective was to determine prevalence of these agents to understand the role of emerging amphibian pathogens in *C. alleganiensis* declines. We collected tissue and swabs from *C. a. bishopi* and *C. a. alleganiensis* individuals from Arkansas and Tennessee respectively during the summers of 2011-2015. We used qPCR analysis to determine presence of Ranavirus and Bd from tail samples and skin swabs, respectively. In the latter two years we collected samples of microbiome and secretion analyses. Overall, for *C. a. bishopi*, we detected 32% prevalence of Bd and 8.6% ranaviral infections; for *C. a. alleganiensis*, we detected 15% prevalence of Bd and 3% prevalence of Ranavirus. We have not found any Bsal positive individuals but have discovered Bd consistently present in these populations. We are currently in our second phase of investigating morbidity and mortality in hellbenders by comparing host skin microbiomes with changes in clinical disease and host peptide production.

0885 Herp Physiology, Saturday 15 July 2017

Daniel Haro[1], Katherine Holst[1], Gregory Pauly[2], Russell Burke[3], Heather Liwanag[1]

[1]*California Polytechnic State University, San Luis Obispo, CA, USA,* [2]*Natural History Museum of Los Angeles County, Los Angeles, CA, USA,* [3]*Hofstra University, Hempstead, NY, USA*

Comparing thermal physiology between introduced, urban populations of the Italian Wall Lizard (*Podarcis siculus*) in New York and California

Nonnative species must be pre-adapted, or quickly adapt to novel environmental conditions in order to establish a population. The Italian Wall Lizard (*Podarcis siculus*) has been introduced to several urban and suburban sites since the 1960s. Of these populations, New York and California lizards have been geographically separated from source populations for 50 and 23 years, respectively. Magnitude of seasonal temperature change is greatest in the Long Island, New York population, with summer to winter differences of 20.4°C. In contrast, a San Pedro, California population experiences summer to winter changes of only 9 °C. The extent to which these introduced populations have adapted to novel abiotic conditions since their arrival is unknown. Potential explanations for their success include pre-adaptation, rapid genetic adaptation, physiological plasticity, or behavioral avoidance of novel temperatures. To begin examining the role of each, we measured thermal preferences and thermal tolerances (CT_{min} and CT_{max}) of lab acclimated lizards from each population (NY n=25, CA n=29). Our goal is to determine if there are differences in thermal physiology traits that persist after long term lab acclimation (28 weeks). Differences in thermal preference will demonstrate the relative importance of behavior. Differences in thermal tolerance may indicate the influence of genetic adaptation, whereas similarities would suggest that pre-adaptation or plasticity could be more important. Future work will determine how these traits change in response to cold acclimation, which may help ascertain the role of plasticity. Ultimately, this study will provide insight into the physiological capabilities of a successful introduced species.

0658 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Antony Harold, Dana Norton, Dana Warheit, Miranda Brooker

College of Charleston, Charleston, South Carolina, USA

Relative growth of jaw and pharyngobranchial teeth in the Naked Goby, *Gobiosoma bosc* (Teleostei: Gobiidae)

We continue our study of the ontogeny of dentition in *Gobiosoma bosc*, a western North Atlantic estuarine goby species. A series of about 40 specimens collected from Charleston Harbor, South Carolina, ranging in size from 17 to 52 mm SL were cleared and counter-stained using standard methods. The lower jaw and the branchial arches were removed and oriented for measurement using an eye-piece reticle. Measurements were made of the length and basal diameter of anteromedial premaxillary and dentary teeth and lateral teeth of the posteriormost pharyngobranchial tooth plate. Pharyngobranchial teeth are elongate, less curved and shorter than the enlarged jaw teeth along the outer jaw margin in the same individual. These enlarged jaw teeth

become more broad-based with growth. The basal diameter of pharyngobranchial teeth also undergoes a relative increase with body size but to a lesser degree compared with the jaw teeth. The relative growth of pharyngobranchial dentition, in terms of both tooth length and diameter, lags behind that of the jaw teeth. The implications for functional anatomy and trophic ecology are that there is greater reliance on food processing by pharyngobranchial teeth at relatively small body sizes and as development proceeds the jaw teeth become longer and have a greater area of attachment, hence more functional in manipulating the larger prey handled by large individuals. This interpretation is consistent with published observations that show that as *G. bosc* reach larger body sizes the diet shifts from mainly microcrustaceans to macroinvertebrates such as amphipods and polychaetes.

0307 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Elizabeth Harper[1], David Patrick[3], James Gibbs[2]

[1]New England College, Henniker, NH, USA, [2]SUNY-ESF, Syracuse, NY, USA, [3]The Nature Conservancy, Concord, NH, USA

Forestry Practices and the Dynamics of Amphibian Populations at the Landscape Scale: Modeling the LEAP Datasets

Numerous studies have documented substantial reductions in amphibian densities related to timber harvest in the United States, however, subsequent extinctions are rare. To better understand the population dynamics that have allowed so many amphibian species to persist in the face of widespread forest disturbance, we developed spatially explicit metapopulation models for four forest-dependent amphibian species (*Lithobates sylvaticus, Ambystoma opacum, A. talpoideum, and A. maculatum*) that incorporated demographic and habitat selection data derived from experiments conducted as part of the Land Use Effects on Amphibian Populations Project (LEAP). We projected local and landscape-scale population persistence under 108 different forestry practice scenarios, varying treatment (partial cut, clear-cut with coarse woody debris removed, and clear-cut with CWD retained), cut patch size, total area cut, and initial amphibian population size. Under these scenarios, landscape-scale extinction was highly unlikely, occurring in <1% of model runs and for only 2 of the 4 species. Yet for all species, population sizes were reduced by approximately 50% in all clear-cut scenarios, regardless of the size of harvested patches. These findings suggest that debate over timber harvesting effects on pool-breeding amphibian populations in the United States should focus not on questions of landscape-scale extinction, but on the ecological consequences of dramatic reductions in amphibian biomass. Additionally, we conclude that amphibian declines and extinctions are far more likely to occur as a result of permanent habitat loss resulting from development than from the temporary degradation of habitat caused by current forestry practices.

0521 Lightning Talks I, Friday 14 July 2017

Pamela Hart, Prosanta Chakrabarty

Louisiana State University, Baton Rouge, LA, USA

Phylogenomic hypothesis of the relationships among Southern Cavefish populations using UCEs

The evolutionary and biogeographic histories of widespread subterranean organisms remains a poorly understood facet of biology. The Southern Cavefish, *Typhlichthys subterraneus*, occurs throughout the eastern United States and spans myriad isolated cave systems as well as numerous aquifers and river basins. Previous research using a few mitochondrial and nuclear loci suggest that there may be several distinct lineages dispersed within and across these geographic barriers; however, the number of lineages and the relationships among these lineages as well as how these lineages correspond with geographic features such as river basins and aquifer networks remains unclear. To assess the complex evolutionary and biogeographic history of *T. subterraneus*, we collected genomic data from nearly 500 ultraconserved element (UCEs) loci. We sampled six of the nine hypothesized *T. subterraneus* lineages that are distributed across their range, newly discovered populations, and several closely related taxa (i.e., *Amblyopsis* and *Forbesichthys*). This work will provide insight into the patterns and modes of diversification among subterranean organism as well as inform further phylogenomic analyses on *T. subterraneus*.

0214 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Michael Harvey[1], James Scrivani[1], Kyle Shaney[2], Eric Smith[2], Amir Hamidy[3], Nia Kurniawan[4]

[1]Broward College, Davie, FL, USA, [2]University of Texas at Arlington, Arlington, TX, USA, [3]Museum Zoologicum Bogoriense, Cibinong, West Java, Indonesia, [4]Universitas Brawijaya, Malang, East Java, Indonesia

Sumatra's Endemic Crested Dragons (Agamidae: *Lophocalotes*): Species Delineation, Sexual Dimorphism, Ecology, and Parasites

Using concordance and a mitochondrial tree-morphological character approach, we show that recently discovered populations of *Lophocalotes* represent a new species. Like its only known congener, the new species occurs only on Sumatra in montane forests above 1000 m. These agamids are slow moving, arboreal, generalist predators and lay 2–6 eggs, multiple times per year. Compared to females of the same SVL, male *Lophocalotes* have more nuchal crest scales, larger heads, longer shanks, and higher and longer tails. Interestingly, coloration of the buccal epithelium is sexually dichromatic in the new species. An undescribed species of the nematode *Spinicauda* infected most hosts, and parasite load increased with SVL. These parasites had an aggregated population

structure as indicated by a relatively high coefficient of dispersion and close fit to a negative binomial distribution.

0719 Herp Physiology, Saturday 15 July 2017

Tanner Harvey, Stephen Mackessy

University of Northern Colorado, Greeley, Colorado, USA

Prey specificity of *Boiga irregularis* venom toxins

The Brown Treesnake (*Boiga irregularis*) is an arboreal species native to insular southeast Asia and is a well-known problematic invasive species on Guam. A potent three-finger neurotoxin (3FTx), irditoxin, is a prominent component of the venom and is highly toxic to lizards and birds but not mammals. Irditoxin is composed of two subunits linked by a single disulfide bond, and prey specificity of irditoxin may result from the heterodimeric nature of the protein. Evaluation of the toxicity of the individual irditoxin monomers has the potential to demonstrate importance of the dimer structure to prey-selective toxicity, as monomers could show lower toxicity to lizards and higher toxicity to mammals. Irditoxin isolated from Brown Treesnake (Guam) venom was reduced and the individual monomers were separated using reversed phase HPLC. Both Irditoxin subunit A and subunit B were assayed for toxicity (LD_{50}) using *Hemidactylus* geckos and NSA mice. This toxicity data is compared to the established LD_{50} values for the intact heterodimeric irditoxin. The broader implications of this research are to evaluate and understand the differential effects observed between the subunits and intact toxin toward reptiles and birds, as compared to mammals. This species utilizes constriction for dispatching mammalian prey, while lizards are simply grasped and held until immobilized; venom and toxin effects are thus reflected in differential utilization of the two main modes of prey capture seen in advanced snakes (mechanical and chemical). Other species of colubrid rear-fanged snakes show taxon-specific toxins, but only *Boiga* appear to possess heterodimeric 3FTxs.

0204 Lizard Life History, Saturday 15 July 2017

Jill Heaton, Kirsten Dutcher

University of Nevada, Reno, Reno, Nevada, USA

Natural History and Ecology of Two Endemic Namibian Girdled Lizards: *Namazonurus pustulatus* and *Karusasaurus jordani*

Namibia is home to four endemic girdled lizards, three *Namazonurus sp*. and one *Karusasaurus sp*. These species have poorly understood geographically restricted ranges and have been the subject of few studies. Presented here is information on the habitat, diet, morphology, and sexual dimorphism of *Namazonurus pustulatus* (Herero Nama

Lizard) and *Karusasaurus jordani* (Northern Karusa lizard). *Namazonurus pustulatus* is restricted to rocky habitat (largely quartzite and quartz) with suitable narrow crevices, while *K. jordani* is found in a wider range of rock types and crevice morphologies. The ambiguity of Peters (1862) type locality of Neu-Barmen (present day Gross-Barmen) versus Otjimbingwe for *N. pustulatus* may never be resolved. However, there is very little in the way of suitable habitat in and immediately around (10 - 20 km) Otjimbingwe proper. They were easily found at present day Gross-Barmen. Updated distribution maps will be presented for both species. Both species feed primarily on Coleoptera, but also a wide variety of other insects. In *N. pustulatus*, adult females are larger and reach maximum SVLs greater than males. There is no difference in size between the sexes in *K. jordani*. Relative to SVL, males have larger heads than females in both species. Male *N. pustulatus* and *K. jordani* have generation glands and wax filled femoral pores; females in both species lack generation glands, but *N. pustulatus* has non-wax filled femoral pores while female *K. jordani* has wax-filled femoral pores.

0587 Lightning Talks I, Friday 14 July 2017

Brandon Hedrick[1], Samantha Cordero[2], Patrick O'Roark[2], Edward Watt[2]

[1]University of Massachusetts–Amherst, Amherst, MA, USA, [2]Hitchcock Center for the Environment, Amherst, MA, USA

Assessment of the First Amphibian Road Crossing Structure in North America 30 Years After Installation

Roads and highways cause substantial complications to wildlife migrations, including habitat segmentation and road mortality. Road mortality is especially high for amphibians, which move slowly across roads and often in large numbers. In order to curb the effects of road mortality, the use of barrier fences and culverts is becoming widespread. The first sets of amphibian culverts developed in the United States were built in 1987 in Amherst, Massachusetts in order to protect the spotted salamander, *Ambystoma maculatum*. Upon installation, surveys on the culvert's effectiveness suggested that 76% of salamanders were successfully using the culverts with the remaining salamanders displaying hesitation and eventual balking. However, anecdotal accounts have suggested that these culverts have become less effective in recent years. While initial surveys of amphibian tunnel use within several years are common in the literature, much less is known about the long-term effectiveness of amphibian road crossing structures. In order to better understand culvert degradation, we are performing a three-year study measuring the efficacy of the Amherst culverts (2016–2018). Last year, of 177 salamanders recorded, 45% scaled the barrier fences in spite of fence maintenance. Of the salamanders reaching the tunnels, only 16% successfully used the tunnels. In Spring 2017–2018, we will continue monitoring and will change tunnel configurations in order to attempt to isolate factors causing decreased tunnel use. The ultimate goal of this study is to determine if it is possible to retrofit older amphibian tunnels cheaply to increase use without having to perform costly full-scale renovations.

0397 AES Ecology III, Sunday 16 July 2017

Vital Heim[1], Dieter Ebert[1], Samuel H. Gruber[2], Tristan L. Guttridge[2]

[1]Department of Environmental Sciences, University of Basel, Basel, Switzerland, [2]Bimini Biological Field Station Foundation, Bimini, Bahamas

Behaviour at a provisioning site and the effects on the habitat and space use of the great hammerhead shark, *Sphyrna mokarran*, in Bimini, Bahamas

The global shark-diving industry generates millions of dollars annually worldwide. Food attraction and provisioning are becoming increasingly popular as established techniques to attract and feed charismatic megafauna. These techniques although successful are controversial with local and national stakeholders concerned about the ecological and behavioural impacts of such practices on the target species and possible resulting ecosystem implications. There is growing interest about possible impacts of provisioning on the behavioural ecology of large-bodied marine apex predators and the effects of shark provisioning are poorly documented. Here, we examine how provisioning site measures recorded for individual sharks impacts horizontal, vertical and thermal habitat use and the behaviour of the great hammerhead shark, *Sphyrna mokarran*. This species is known to be predominately a seasonal winter resident of Bimini, but the impacts of provisioning on local movements are unknown. A total of n=29 individuals were identified during more than 90 provisioning days. Provisioning indexes ranged from 0.01 to 0.76 with daily food intake per individual up to 16 kg*event-1. The provisioning measures were compared to detections on a Vemco acoustic receiver array (n=62 receivers) throughout the Bimini environs and provide us with the first insights into how daily provisioning influences shark movements.

0337 Herp Systematics II, Sunday 16 July 2017

Matthew Heinicke[1], James Titus-McQuillan[2], Edward Stanley[3], Aaron Bauer[4]

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Evolutionary Insights from the Phylogeny of Southern African Shovel-nosed Snakes (*Prosymna*)

The lamprophiid snake genus *Prosymna* includes 16 named species of small, semi-fossorial snakes distributed across sub-Saharan Africa, with two centers of endemism and diversity: one in southern Africa and another in eastern Africa. *Prosymna* is notable among African snake genera in that dietary data indicate that some species are specialist squamate egg predators, including hard-shelled gecko eggs in at least some species. However, understanding of both biogeography and character evolution in the genus is hindered by a lack of a phylogeny for the group as a whole. We have assembled a

dataset including six nuclear and mitochondrial genes for exemplars of 11 of 16 species of *Prosymna*, including all southern African species. Phylogenetic analyses show that southern African *Prosymna* form a well-supported monophyletic grouping, and that within the southern African radiation species found farther north (for example, in Angola) tend to occupy more basal positions in the phylogeny. Relatively deep divergences in some species suggest that additional cryptic taxa may be present. Analyses of skull morphology for a subset of species show extensive differences in patterns of bone fusion, shape, and dental specialization. At least two different strategies for facilitating egg ingestion are suggested by cranial osteology. Implications for dietary evolution are discussed.

0301 Texas and Mexican Blindcats/Desert Fishes, Saturday 15 July 2017

Dean A. Hendrickson[1], Antonio Hernández-Espriú[2], Laura Dugan[3], Peter Sprouse[4], José Antonio Dávila Paulín[5], Jean Krejca[4], Andrew Gluesenkamp[6], James Reddell[1], Ryan Smith[7], Sarah Howard[8], Jack Johnson[8], Gary P. Garrett[1], Adam E. Cohen[1], Francisco J. García De León[9], Brad Wolaver[10], Dante B. Fenolio[6]

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Discovery of Endangered Mexican Blindcat, *Prietella phreatophila*, in Texas: Implications for International Groundwater Management and Evolution of the Regional Karst Aquifer Biota

Mexican blindcat, *Prietella phreatophila*, described in 1954 from a cave system near the town of Múzquiz in central Coahuila state, and considered a Mexican endemic, was listed by the U.S. Fish and Wildlife Service as a foreign endangered species (protected "wherever found") in 1970. Explorations in the 1990s discovered many new localities extending nearly to the international border, and in 2016 the species was discovered in Amistad National Recreation Area (ANRA) in Texas, just north of the international border near Del Rio. Not only does the discovery support the aquifer of this fish being an internationally shared resource, but the stygobitic invertebrate biota found with the fish indicates a potentially large extent of the aquifer, and thus possibly the fish, in Texas. Invertebrate faunal connections (historic or current) extend from the Amistad Lake area of the new occurrence west into the Trans-Pecos region and east into the Edwards Aquifer of central Texas. We explore implications of this for both water management and evolutionary history of this and other blind ictalurids, and suggest that population genetic studies of both stygobitic fishes and invertebrates could help hydrogeologists better define often difficult to map aquifer extents and inter-

connections. While NPS is continuing to support the cave explorations of ANRA that produced the Texas discovery, we propose a broader bi-national sampling effort for both the fish and invertebrates. We also report establishment of a small captive population of the fish at San Antonio Zoo for research and possibly eventual conservation applications.

0417 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kodiak Hengstebeck[1], Christina Romagosa[1], Paul Andreadis[2], Ian Bartoszek[3]

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Trapping Large Constrictors from Underground Refugia

Burmese pythons are well established and highly invasive throughout southern Florida. In parts of southwest Florida, where dry upland habitats are more common, pythons have been documented using burrows constructed by gopher tortoises and armadillos. We are currently performing intensive burrow-scoping surveys to examine burrow use by Burmese pythons. Removal of pythons from burrows has proven to be extremely difficult, as some of these burrows can extend up to 10 meters under ground. We have designed specialized traps to capture pythons as they exit the burrow, and are placing these traps over any burrow where a python is detected. To date, 3 wild pythons have been detected and successfully trapped. The use of these traps to remove pythons, rather than burrow excavation, helps preserve the essential features and integrity of the burrow for future use by native species.

0883 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY II, Thursday 13 July 2017

Michelle Herrera, Joseph Heras, Donovan German

University of California, Irvine, Irvine, CA, USA

Digestive Specialization in the Family Stichaeidae: Molecular Underpinnings and Potential for Plasticity

Dietary specialization is best studied from the molecular to the whole organism level. Prickleback fishes (family Stichaeidae) are an excellent study system in which to study dietary specialization because they exhibit dietary variation in sympatric species, sister taxa with different diets, and feature convergent evolution of herbivory. The objective of this study was to determine the plasticity of prickleback gut length in response to dietary shifts and the genetic underpinnings of dietary specialization. We studied four species that naturally vary in diets: *Xiphister mucosus* (herbivore), *Xiphister atropurpureus* (omnivore), *Phytichthys chirus* (omnivore), and *Anoplarchus purpurescens* (carnivore). We assigned individuals of *X. mucosus* and *A. purpurescens* to omnivore or carnivore diets in

the laboratory, whereas *X. atropurpureus* and *P. chirus* individuals were fed the carnivore diet. In wild fish, we observed the longest guts in herbivores, followed by omnivores and then carnivores. Similar effects of diet on gut length were observed in the laboratory-fed fish (omnivore>carnivore within a species). The transcriptomic profiles of pancreatic and mid intestinal tissues of wild-caught and captive fishes were examined using Illumina platforms. We performed genome-driven transcriptomic assemblies with the genome of the prickleback *Cebidichthys violaceus* as the reference. Coverages of 16-20 million reads per tissue were achieved and analyses of differential expression and enrichment of genes involved in digestion and absorption of nutrients are underway. Overall, this study will provide crucial insight into how vertebrates specialize to use specific resources, and how plastic the digestive system can be.

0861 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jeremy Higgs[1], Jill Hendon[1], Eric Hoffmayer[2], Chris Butler[1]

[1]The University of Southern Mississippi, School of Science and Technology, Gulf Coast Research Laboratory, Center for Fisheries Research and Development, Ocean Springs, MS, USA, [2]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA

Offshore Diet of the Atlantic Sharpnose Shark, *Rhizoprionodon terraenovae*, from the northern Gulf of Mexico

Sharks are frequently considered important predators in coastal waters and their trophic role within these ecosystems have been well documented. Although the habitat range of many coastal shark species extends out to waters near the shelf break, most of the trophic ecology research conducted on these species has focused within nearshore habitats. Similarly, the diet of the Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*), the most abundant shark species in the northern Gulf of Mexico, has been limited to geographically isolated, nearshore regions. This data gap presents a unique opportunity for further investigation of the feeding ecology of this ubiquitous species from the offshore waters of the northern Gulf of Mexico, where prey assemblages can change dramatically. In 2011, 325 Atlantic Sharpnose Sharks (female = 197, male = 97, unknown = 31), ranging in size from 450 to 905 mm fork length, were collected between Port Isabel, Texas and the Florida Keys. Of these, 162 individuals (49.8%) contained prey items in their stomach. Prey were identified to the lowest taxonomic level and quantitatively analyzed using frequency of occurrence, weight, number, proportional weight, proportional number, and index of relative importance. In addition to prior studies, results from the current study will better define the trophic role and overall diet of the Atlantic Sharpnose Shark throughout their distribution in the northern Gulf of Mexico.

0264 Fish Systematics, Saturday 15 July 2017

Eric Hilton[1], Ann Matarese[2], Duane Stevenson[2]

[1]*Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA,* [2]*NOAA-Fisheries, Alaska Fisheries Science Center, Seattle, WA, USA*

Osteology of the Northern Ronquil, *Ronquilus jordani*, and the Comparative Development of the Skeleton of Bathymasteridae (Zoarcoidei): Insights into Systematic Relationships

Bathymasteridae is a relatively basal family of Zoarcoidei and comprises seven species in three genera (*Rathbunella*, *Ronquilus*, and *Bathymaster*) from the North Pacific Ocean. We described the skeleton of *Ronquilus jordani* based on examination of a broad ontogenetic series (8.2-115 mm SL) and use this as a backdrop to discuss two ontogenetic characters that show variation across Bathymasteridae. The adult caudal skeleton of *Ronquilus* and *Bathymaster* comprises three distinct hypural elements: a single large element ventral to the diastema, which includes the parhypural (based on presence of a canal for the caudal vasculature; no ontogenetic fusion was observed), and two elements dorsal to the diastema (a large element formed by an ontogenetic fusion of two hypural elements, and a smaller dorsal element). In contrast, there are three elements dorsal to the diastema at all stages of ontogeny in *Rathbunella* (there is a similar element ventral to the hypural in all three genera). The vertebral column of *Rathbunella* develops in an anterior to posterior direction from a point immediately behind the skull. In *Ronquilus* and *Bathymaster*, the vertebral column (including the neural and haemal elements and centra) begin development in the mid-body region, and progresses both anteriorly and posteriorly. Both of these characters suggest that *Ronquilus* and *Bathymaster* are more closely related to each other than either is to *Rathbunella*, supporting past systematic analyses of the family based on morphological data. Recent molecular analyses suggesting paraphyly of Bathymasteridae will be discussed in the context of available morphological data.

0102 Herp Genetics, Saturday 15 July 2017

Kristin Hinkson[1], Stephen Richter[0]

[1]*Memphis Zoo, Memphis, TN, USA,* [2]*Eastern Kentucky University, Richmond, KY, USA*

Success of Management Practices: Genetic Diversity and Effective Size in the Endangered Dusky Gopher Frog (*Lithobates sevosus*)

Monitoring temporal changes in genetic diversity and effective population size can provide vital information on future viability of small populations. The dusky gopher frog, *Lithobates sevosus*, is a critically endangered species found only in coastal Mississippi, with low genetic variability as a consequence of isolation and population size reduction. Conservation management practices have been implemented, but their efficacy has not been addressed. We genotyped egg samples collected 1997-2014 to determine temporal trends in population genetic variation and structure using nine

microsatellite loci. Effective population size was estimated using both temporal and single-sample estimators. Observed and expected heterozygosity and allelic richness revealed temporally stable, but low, levels of genetic variation, with evidence of inbreeding in each year. There was weak genetic structure among years, which can be attributed to increased effects of genetic drift and inbreeding in small populations. *L. sevosus* exhibited an increase in effective population size, and currently has an estimated effective size of 33.0-58.6 individuals, which is approximately half the census size. This large ratio could possibly be explained by genetic compensation--a phenomenon where, at low population sizes, most individuals participate in breeding activities. We found that management practices have been effective at maintaining and improving effective size and genetic diversity, but that additional strategies need to be implemented to enhance viability of the species. Future research will investigate the captive population's role in preserving genetic variation.

0865 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Natasha Hinojosa[2], Matthew Gilg[1]

[1]*University of North Florida, Jacksonville, FL, USA,* [2]*University of North Carolina at Wilmington, Wilmington, NC, USA*

Genetic Assessment of the Hybrid Zone Between the Mummichog and Gulf Killifish

Hybrid zones provide excellent opportunities to study evolutionary processes such as speciation, competition, gene flow and selection. A hybrid zone between *Fundulus heteroclitus* and *Fundulus grandis* is located across an ~38 km stretch of coast near Flagler Beach, FL. Using this hybrid zone, we decided to look at the strength of the reproductive barriers, the survivorship of the hybrids and their reproductive abilities. Two different age cohorts of *Fundulus* spp., juveniles and adults, were collected in the summers 2015 and 2016. Using restriction fragment length polymorphisms (RFLP) in 4 different loci, 3 nuclear and 1 mitochondrial, we determined the genetic composition of the Flagler Beach population. Results showed that the juveniles of 2015 were mostly composed of *F. grandis*-like individuals and the adults were mostly composed of *F. heteroclitus*-like individuals. Further collections in 2016 showed a similar pattern as seen in the previous year. The hybrid indices showed strong reproductive barriers are present between the two species, yet hybrids are fertile since the majority of hybrids have genotypes typical of F2 or backcrosses. There is also evidence for low survivorship in hybrids since recombinant genotypes are lacking in the adults but not the juveniles. Future studies will focus on determining why different genotypes differ in fitness, and whether the hybrid zone is shifting or changing in width.

0843 Herp Biogeography & Phylogeography I, Sunday 16 July 2017

Eric Hoffman[1], Steve Johnson[2], Sarah May[1], Anna Farmer[3], Stacey Lance[4]

[1]University of Central Florida, Orlando, Florida, USA, [2]University of Florida, Gainesville, Florida, USA, [3]Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA, [4]University of Georgia, Savannah River Ecology Laboratory, Aiken, South Carolina, USA

Connectivity vs Isolation: a case study of gene flow in an imperiled salamander

The striped newt (*Notophthalmus perstriatus*) is an imperiled species of salamander endemic to north-central Florida and southern Georgia, USA. Individuals inhabit upland pine, scrub, and scrubby flatwoods communities and breed exclusively in isolated wetlands that lack predatory fishes. The species has declined throughout most of its range due to habitat loss and degradation (e.g., fire suppression), which appears to have reduced landscape-scale habitat connectivity. During the past 20 or so years the species has primarily been detected at "stronghold" sites that consist of multiple breeding ponds embedded within fire-maintained uplands. We used 10 polymorphic microsatellite markers to evaluate how contemporary patterns of gene flow and genetic diversity influence population dynamics and effective population size within and among 18 populations found throughout the species range. We sought to answer two main questions: A) were the patterns of genetic differentiation identified in on our previous work (May et al. 2011) due to contemporary or historical connectivity of populations; and B) would geographically isolated populations be re-founded if a population became extirpated? Our data indicated that little gene flow occurs between populations. Indeed, STRUCTURE indicated that all 18 populations represented unique genetic units (i.e. k=18), that global FST=0.13, and that there was a strong pattern of isolation-by-distance. Our results provide unique insight into the mechanisms influencing patterns of gene flow among populations of *N. perstriatus*. Understanding the cause of patterns observed for striped newts is important for conservation and effective management of this and other species with similar life history characteristics.

0839 LFC Contributed IV, Saturday 15 July 2017

Joel Hoffman[1], Christy Meredith[1], Anett Trebitz[1], Greg Peterson[1], Julie Lietz[1], Chelsea Hatzenbuhler[1], Erik Pilgrim[2], Sara Okum[2], John Martinson[2]

[1]US EPA Office of Research and Development, Duluth, MN, USA, [2]US EPA Office of Research and Development, Cincinnati, OH, USA

DNA Metabarcoding of Fish Larvae for Detection of Non-Native Fishes

Our objective was to evaluate the use of fish larvae for early detection of non-native fishes, comparing traditional and molecular taxonomy approaches to investigate potential efficiencies. Fish larvae present an interesting opportunity for non-native fish early detection because they are abundant and can be readily transported in ballast water. Our approach was to intensively sample a Great Lakes non-native species

introduction hotspot and then compare the success and efficiency of fish larvae taxonomic characterization between traditional taxonomy and community-level DNA metabarcoding. We intensively sampled the Duluth-Superior harbor, the Great Lakes largest freshwater port, using a spatially balanced design to equally allocate catch effort across the harbor. To maximize the number of species encountered, we sampled at different time periods throughout the spring spawning period and used multiple types of sampling equipment. Overall, there was strong agreement between the two approaches at the port- and taxonomic family-level, but less so at the sample level. The DNA-based identification required low levels of biomass to detect a species presence, detected taxa not identifiable using morphology (including eggs and non-native species), and revealed limitations in morphological identification. However, DNA-based identification could not fully resolve all the species present and did result in some potential false positives. We conclude with a few notable reservations that DNA metabarcoding presents an important advance for measuring the species richness of larval fish assemblages.

0170 AES GRUBER AWARD II, Thursday 13 July 2017

Sarah Hoffmann[1], Samantha Leigh[2], Cassandra Donatelli[3], Elizabeth Brainerd[4], Marianne Porter[1]

[1]Florida Atlantic University, Boca Raton, FL, USA, [2]University of California, Irvine, Irvine, CA, USA, [3]Tufts University, Medford, MA, USA, [4]Brown University, Providence, RI, USA

Three-Dimensional Movements of the Pectoral Fin During Routine Turns in the Pacific Spiny Dogfish, *Squalus suckleyi*

Early models treated shark pectoral fins as semi-rigid foils, generating lift and adjusting vertical position in the water column; however, flow visualization analyses demonstrated that pectoral fins for at least one benthic species generated negligible lift during swimming. Although the role of pectoral fins in lift generation remains unknown, the above studies agree that fins act to reposition the body during swimming. Furthermore, bonnethead and thresher sharks use pectoral fins during maneuvering: turning and braking, respectively. The goal of this study was to describe pectoral fin rotation of Pacific spiny dogfish, *Squalus suckleyi*, during volitional turning behaviors. We hypothesized that pectoral fins rotate with three degrees of freedom about the pectoral girdle articulation. We used Video Reconstruction of Moving Morphology (VROMM) to track rigid body points in 3D and quantify the movement of the pectoral fin in relation to the body. Volitional swimming data were paired with electrical stimulation of pectoral girdle muscles to infer how specific kinematic outcomes are produced. We found that during volitional turning, the pectoral fin on the inside of the turn is depressed, protracted, and supinated. Similar depression and supination of the pectoral fin occurred with electrical stimulation of the ventral pterygoideus muscle, and stimulation of the cranial pterygoideus was solely responsible for protraction. Based on these data, we infer that the cranial and ventral pterygoideus muscles produce the

pectoral fin movements recorded during volitional swimming. This study demonstrates the use of underwater cameras in a large volume for VROMM analyses.

0470 Herp Genetics, Saturday 15 July 2017

Iris Holmes, Maggie Grundler, Alison Davis Rabosky

University of Michigan, Ann Arbor, MI, USA

Color Mosaics in Frogs and Snakes: What Drives Geographic Variation in Color Polymorphism?

Color polymorphism in natural populations can manifest as a striking patchwork of phenotypes in space, with neighboring populations characterized by dramatic differences in morph composition. These "geographic mosaics" can be challenging to explain in the absence of localized selection because they are unlikely to result from simple isolation-by-distance or clinal variation in selective regimes. Using case studies in *Oophaga* poison frogs and *Sonora* ground snakes to identify processes that can lead to the formation of geographic mosaics, we developed a simulation-based model to explore the influence of predator perspective, selection, migration, and genetic linkage of color loci on allele frequencies in polymorphic populations over space and time. We found that the relative sizes of predator and prey home ranges can produce large differences in morph composition between neighboring populations under both positive and negative frequency-dependent selection. We also demonstrated the importance of the interaction of predator perspective with the type of frequency-dependence (positive vs. negative) across migration and selection intensities. Our results show that regional-scale predation can promote the formation of phenotypic mosaics in prey species, without the need to invoke spatial variation in selective regimes. We suggest that predator behavior can play an important and underappreciated role in the formation and maintenance of geographic mosaics in polymorphic species.

0726 LFC Contributed I, Friday 14 July 2017; LFC SALLY L. RICHARDSON BEST STUDENT PAPER

Angie Hoover[1], Luciano Chiaverano[1], Alison Deary[2], Frank Hernandez[1]

[1]University of Southern Mississippi, Ocean Springs, MS, USA, [2]National Oceanographic and Atmospheric Administration, Seattle, WA, USA

Spatial Variation in Larval Gulf Menhaden (*Brevoortia patronus*) Growth and Condition During a High Freshwater Discharge Event

The Gulf Menhaden commercial fishery is the largest by weight in the northern Gulf of Mexico. Efforts to manage stocks of fisheries importance have recently evolved toward ecosystem management approaches, which consider multiple biotic and abiotic environmental influences. In January 2016, historic levels of rainfall within the Upper

Mississippi River Basin prompted the earliest opening of the Bonnet Carré Spillway, a water control structure north of New Orleans, LA, that diverts water from the Mississippi River through Lake Pontchartrain, and into the northern Gulf. This unprecedented winter opening of the spillway coincided with the spawning season and larval ingress period for Gulf Menhaden. The Consortium for Coastal River Dominated Ecosystems (CONCORDE), along with several other research consortia, collected physical and biological data aboard the *RV Point Sur* from February 10-12, 2016 in order to assess the biophysical impacts of this atypical discharge event in the Mississippi Bight. Distinct water masses were identified during the cruise using a suite of physical and chemical observations, and subsurface plankton samples were collected in each water mass using a 60-cm bongo net fitted with a 202-µm and a 333-µm mesh net. Our specific objectives for this study are to utilize physical (e.g., temperature, salinity) and biological data to examine zooplankton (prey) assemblage structure, and larval Gulf Menhaden body condition (weight-length ratios), growth (otolith increment analysis), and diet in relation to the discharge event. Overall, we hope to better understand how biophysical factors influence larval menhaden survivorship and recruitment dynamics in the Gulf of Mexico.

0820 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Friday 14 July 2017

Ariel Horner, Emily Karwacki, Cassandra Sarria, Anna Savage

University of Central Florida, Orlando, Florida, USA

Ribbiting results: emergent pathogen dynamics vary spatially and temporally in subtropical wetland communities

Emerging infectious diseases in amphibians have contributed to their population declines worldwide. We collected over 900 tissue samples from amphibians in wetland communities over two years to monitor and assess pathogen dynamics in an amphibian biodiversity hotspot, Florida, USA. Three amphibian pathogens, *Batrachochytrium dendrobatidis, Ranavirus* and *Dermomycoides* sp., were targeted. We examined monthly prevalence and intensity of each pathogen for multiple species (7 hylids, 4 ranids, 1 bufonid and 1 microhylid) across three sites along a latitudinal gradient using quantitative (q)PCR with custom primers and probes for each pathogen. We analyzed seasonal pathogen dynamics and identified temperature and precipitation as important drivers of prevalence and intensity and extensive co-infection in some sites and seasons. Our research is the first continuous monitoring effort of multiple pathogens in the state, and our results provide a better understanding of infectious disease dynamics in an understudied region. Our data are important for helping inform conservation practices of vulnerable amphibian species, as well as informing managers of best practices for disease monitoring.

0773 Amphibian Conservation IV, Sunday 16 July 2017

Jillian S. Howard, Kira D. McEntire, John C. Maerz

University of Georgia, Athens, GA, USA

Generating robust estimates of salamander vital rates to model population responses to climate change

Population models are important for understanding how animals respond to environmental change. Informative demographic models must contain robust estimates of vital rates, which often requires long-term data. Consequently, demographic models are lacking for even well studied taxa. For example, salamanders within the *Plethodon* genus are abundant and influential in eastern deciduous forests, yet few estimates of vital rates exist. From 2010 ongoing, we conducted a robust design, capture-recapture study of *Plethodon* at the Coweeta Hydrologic Lab in North Carolina to (1) estimate size-class-specific survival and fecundity, (2) determine how survival varies with weather, and (3) create a population projection model for *Plethodon*. Annual survival estimates ranged from 0.798 for adults to 0.350 for hatchlings. Adult female fecundity was estimated at 2.60 offspring per year, based on our estimates of oviposition frequency (0.422) and clutch size (15 eggs), and on literature estimates of hatch rate (mean 0.554, range: 0.00 to 1.00). Model estimated 28-day survival increased with increasing temperature. We predicted 28-day survival for the real-time temperature trends preceding each sampling occasion, and observed consistently high survival from late spring to fall, but a steep drop in survival for winter and early spring. We found year-specific annual survival was higher in years with fewer total nights below 3°C, further indicating the presence of a punctuated overwinter mortality event in *Plethodon*. Annual rainfall had an inverse relationship with annual survival; this counterintuitive result may be related to increased dispersal in wet conditions as our model did not account for permanent emigration.

0790 Reptile Conservation, Sunday 16 July 2017

Christopher Howey

Pennsylvania State University, University Park, PA, USA

Restoration of Timber Rattlesnake Rookeries: Efficacy of Daylighting Management

The range of Timber Rattlesnakes (*Crotalus horridus*) extends further north than most other rattlesnakes. In these colder, northern latitudes, gravid female *C. horridus* must use rare, open habitats (rookery sites) in order to elevate body temperatures necessary for successful embryonic development. Unfortunately, many of these rookery sites are becoming overgrown with vegetation and it is believed females occupying these sites will no longer be able to maintain preferred body temperatures and reproductive fitness will suffer. For the past two summers (2016 and 2017) we have radio-located gravid females at six rookery sites; four of which have become overgrown with vegetation. At

each site, we monitored available operative temperatures, canopy cover, and presence of potential predators. We determined the body temperature of females throughout the entire summer, behaviors, date of parturition, and estimated litter size. Between the two summers, we removed trees surrounding three of the six rookery sites using a targeted disturbance called "Daylighting". Operative temperatures increased as canopies became more open. During the first summer, gravid females occupying more enclosed rookery sites dropped litters at a slightly later date, abandoned rookery sites, aborted their litters, and mothers suffered increased mortality. We will further discuss body temperatures maintained by females at rookery sites, and the efficacy of Daylighting management. Dependent on the success of this restoration technique, these management techniques can be applied throughout the species northern range to increase female reproductive success.

0692 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Steven J. Hromada[1], C. A. F. Howey[2], C. M. Gienger[2]

[1]Austin Peay State University, Clarksville, TN, USA, [2]Pennsylvania State University, University Park, PA, USA

Response of Reptile and Amphibian Communities to Prescribed Fire in Oak/Hickory Forests

Prescribed fire can have important impacts on ecosystems, including direct effects in the form of injury and mortality to individuals, or indirect, in the form of changes to preferred resources available within the environment. Most research has focused on the direct impacts of the initial burn, and not on the long-term impacts of a fire. Changes in habitat structure (such as a decrease in canopy cover or an increase in herbaceous cover) from prescribed fire can increase availability of preferred microhabitats for some species while reducing the availability of preferred microhabitats for others. We examined the responses of herpetofaunal communities to a prescribed fire regime in an Oak/Hickory forest at Land Between the Lakes National Recreation Area, KY. Four plots were established in an area that received large-scale prescribed burns in 2007 and 2010, and four were established in a similar area that has not received any recent fire treatment. Herpetofaunal communities were sampled using drift fences and artificial cover object arrays, and habitat attributes were sampled via transects. Sampling was performed 2011 through 2016. Although species richness and community structure did not differ between treatments, differences in reptile diversity and relative abundances reflected differences in habitat structure between treatments. These results suggest that the habitat changes caused by prescribed fire can have indirect impacts on reptile abundances and diversity even when prescribed fire is not consistently applied.

0063 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Hua Hsun Hsu, Zahid M. Nazeer, Yu Jia Lin, Premlal Panickan

King Fahd University of Petroleum & Minerals, Dhahran, Eastern Province, Saudi Arabia

Elasmobranch diversity in Saudi Arabian waters of the Arabian Gulf

Elasmobranchs have existed in the world's oceans for hundreds of million years. Most are top predators and important regulators that help to manage healthy marine ecosystems. There have been some studies about elasmobranchs in the Arabian Gulf, but few investigations have focused on Saudi Arabian waters, which has the longest coastline of the Arabian Gulf with diverse habitats. In this study, elasmobranchs were observed and recorded by: a) 240 fisheries-independent bottom trawl surveys operated in 175 stations in offshore waters conducted between 2013 and 2016; b) a monthly investigation of three main landing sites and fish markets (Jubail, Qatif and Darin) since March 2016; and c) monthly interviews of fishermen for observations and documentation of large elasmobranchs during 2016. From the bottom trawl surveys, 106 stations (60.6%) collected elasmobranchs. At landing sites and markets, species richness increased beginning in October and peaked on February. Photos and videos of the largest elasmobranch, the whale shark, *Rhincodon typus*, were obtained from fishermen's interviews. A total of 41 elasmobranchs, including 22 sharks in 2 orders and 7 families, and 19 batoid fishes in 3 orders and 9 families, were recorded in Saudi waters of the Arabian Gulf. The trend of species richness showed a continuous increase each month. This study provides the first comprehensive survey of elasmobranch diversity in Saudi Arabian waters of the Arabian Gulf.

0824 AES GRUBER AWARD III, Friday 14 July 2017

Jeanette Huber, Gavin Naylor

College of Charleston, Charleston, SC, USA

Global Population Structure and Historical Demography of the Endangered Sawfish (Family Pristidae)

The iconic sawfish (Family Pristidae) is endangered mainly due to over harvesting within the last century, and little is known about the global connectivity of these large marine fishes. This study aims to compare the genetic variation of all five species of sawfish and their populations throughout their current and historic ranges. The evolutionary history of the family and each species will be explored in further analysis. The study will take advantage of DNA hybridization gene capture and next generation sequencing techniques in order to sequence whole mitochondrial genomes for 200+ individuals. Findings may be used to gain insight into the levels of gene flow and movement patterns of sawfish populations globally and help identify evolutionary significant units important for consideration in conservation strategies in the future.

0867 Herp Physiology, Saturday 15 July 2017

Spencer Hudson, Geoff Smith, Edmund Brodie Jr., Susannah French

Utah State University, Logan, UT, USA

Trade-offs Between Locomotor Performance and Immunocompetence in Side-Blotched Lizards (*Uta stansburiana*)

Life history theory predicts that resource allocation into one particular trait reduces the amount of available energy that can be invested into a competing trait, resulting in life history trade-offs. Immunity and performance fit within this framework of trade-offs as key factors to survival, and thus fitness. Performance traits such as locomotion are energetically expensive, but are rarely integrated into life-history studies, especially in relation to immunity. During various types of immune challenges, locomotor behavior in the form of reduced movement may offset the associated energetic costs. Here, we examined energetic trade-offs between performance and immune function in side-blotched lizards by determining differences in immunocompetence, sprint speed, and endurance capacity in response to various immune challenges. We subjected groups to primary and secondary immune challenges with lipopolysaccharides (B cell mitogen), as well as cutaneous biopsies (integrated immune responses). In doing so, we compared changes in sprint speed and endurance capacity with respect to wound healing ability and febrile responses to lipopolysaccharides. Our results may suggest that locomotion is an important part of energy allocation decisions when subject to immune challenges and thus a key component of life history trade-offs.

0557 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Klaus B. Huebert[1], R. Christopher Chambers[2], Kenneth A. Rose[3]

[1]UMCES Horn Point Laboratory, Cambridge, MD, USA, [2]NOAA / Northeast Fisheries Science Center, Highlands, NJ, USA, [3]Louisiana State University, Baton Rouge, LA, USA

Modeling Cumulative Effects of Ocean Acidification and Warming on Winter Flounder Populations

We are developing an individual-based fish population model to synthesize data from CO2 and temperature experiments conducted with winter flounder (*Pseudopleuronectes americanus*) early life-history stages. Additional environmental factors (e.g., hypoxia or pollution) will be included as a third, generic, co-stressor. Since early life-history stages can be particularly sensitive to environmental stressors, the first year of life is modeled in much greater detail than subsequent ages. For example, larval growth is simulated in hourly time-steps based on bioenergetics and optimal foraging, whereas age-1 to age-10 growth is simulated in annual time-steps from von Bertalanffy growth curves. A super-individual approach is used to follow individuals from eggs until senescence. Model predictions include young-of-the-year stage abundances and durations, total annual spawning population abundance, age-structure, and recruitment. The model allows for

quantifying CO2 and temperature effects on annual dynamics and cumulatively over multiple generations.

0475 AES Morphology, Sunday 16 July 2017

Benjamin Hughes[1], Tilo Burghardt[2], Michael Scholl[1]

[1]Save Our Seas Foundation, Geneva, Switzerland, [2]The University of Bristol, Bristol, UK

Large-scale Automated Photo-identification of Individual Great White Sharks

We present a fully automated, contour-based photo-identification system for recognising the fins of individual great white sharks. Together with the Wildbook data-management platform, the system forms a cornerstone of the International White Shark Fin-printing Database project. The core objective of this project is to promote a better understanding of white shark biology at regional and global scales, by providing a collaborative platform for collecting, storing and sharing photographic white shark mark-recapture data. In this context, the purpose of the fin-printing software is to assist human efforts to visually recognise individual sharks within large-scale image corpora, representing regional and global shark populations. To recognise individuals, robust fin contour detection is combined with combinatorial representations of fin shape. Unidentified query fin representations are compared against a database of previously identified individuals to return a ranked list of candidate identities. The system demonstrates promising individual recognition performance with no need for manual labelling and with an average compute time of one minute per image. On a test-bed dataset comprising 26000 images and representing 1500 individuals, 72 per cent of fins are correctly classified, with a further ten per cent of correct matches occurring within the top ten identities returned. The system is fully integrated within the mark-recapture database environment and is accessible via an easy-to-use web interface. As such, the system is ready to assist in the identification of individual sharks within regional and global populations. Furthermore, we expect the framework to generalise to other Elasmobranch species exhibiting individually distinctive biometric contours.

0229 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Friday 14 July 2017

Daniel F. Hughes[1], Paul M. Gignac[2], Eli Greenbaum[1], Arshad M. Khan[1]

[1]University of Texas at El Paso, El Paso, Texas, USA, [2]Oklahoma State University Center for Health Sciences, Tulsa, Oklahoma, USA

Elucidating the Cranial Diversity of Chamaeleonidae by Incorporating Validated Field-Based Brain Tissue Preservation Methods into Multi-Scale Structural Analyses

Species extinctions beget losses to our understanding of trait variation, and sampling such rare taxa demands extraordinary care in accelerating data-rescue efforts before poorly understood species are lost. However, traditional specimen preservation does not permit researchers to consistently retrieve neuroanatomical data at high resolution. We experimentally developed a protocol using novel field-based procedures for brain preservation while collecting specimens of Chamaeleonidae in Central and East Africa. We found that delicate brain tissues—preserved under remote field conditions—were comparable to laboratory preserved tissues. Further, immunostaining for small neurotransmitter and neuropeptide biomarkers were similar between our comparisons. Concordantly, our field-preservation approach was found to be tractable with diffusible iodine-based contrast-enhanced computed tomography (diceCT), allowing for the detailed documentation of whole neural structures (i.e., by differentiating myelinated from unmyelinated components) alongside nearly all other soft tissues. We integrated our validated field-based protocol into a pipeline that aims to examine the cranial diversity (e.g., osteological and nervous tissues) of Chamaeleonidae as a model for comprehensive data rescue of inaccessible taxa. This pipeline involves first CT-scanning field-collected specimens in their native state (un-stained) to reconstruct high-density tissues. The same specimens are next stained with Lugol's iodine (I_2KI) and re-scanned to also visualize soft-tissue structures. Finally, brain tissues are then de-stained and used for subsequent histological preparations to examine cytoarchitectural features at the microscopic level. Our results set up the potential for comprehensive, comparative approaches to elucidating the cranial diversity of poorly known and often inaccessible reptile species across micro- to macroscopic scales of analysis.

0231 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Daniel F. Hughes[1], Lukwago Wilber[2], Mathias Behangana[2], Michele Menegon[3], J. Maximilian Dehling[4], Jan Stipala[5], Colin R. Tilbury[7], Krystal A. Tolley[8], Chifundera Kusamba[6], Eli Greenbaum[1]

[1]University of Texas at El Paso, El Paso, Texas, USA, [2]Department of Environmental Sciences, Kampala, Uganda, [3]Museo Tridentino di Scienze Naturali, Trento, Italy, [4]Universität Koblenz-Landau, Koblenz, Germany, [5]University of Exeter, Cornwall, UK, [6]Centre de Recherche en Sciences Naturelles, Lwiro, Congo, [7]University of Stellenbosch, Stellenbosch, South Africa, [8]South African National Biodiversity Institute, Cape Town, South Africa

From the Floor, to the Canopy: Comparative Phylogeography of Two Sympatric Chameleon Species in Central Africa's Albertine Rift

The Albertine Rift is the most diverse highland region in continental Africa, and thus an ideal region to test hypotheses of squamate evolution. Nevertheless, it is not well known whether sympatric taxa share diversification patterns in relation to the historical biogeographic events of this region. We set out to investigate the relative roles of

environmental and taxon-specific factors in influencing spatiotemporal patterns of genetic diversity in two sympatric chameleon species. The Ituri Forest Chameleon (*Kinyongia adolfifriderici*) and Boulenger's Pygmy Chameleon (*Rhampholeon boulengeri*) share distributions and habitats, yet differ in microhabitat use and foraging behavior. *Rhampholeon boulengeri* is considered terrestrial and forages on the forest floor, whereas *K. adolfifriderici* is considered arboreal and forages high in the forest canopy. Our combined results from gene-tree and species-tree reconstruction methods of two mitochondrial (16S, ND2) and one nuclear gene (RAG-1) indicated that these two species were not widespread in the rift, but rather composed of genetically distinct, cryptic populations. Phylogeographic patterns demonstrated that similar geographic areas for both species harbored distinct clades with restricted distributions, yet *R. boulengeri* had several more widely distributed clades. Diversification dates identified the Miocene as the most important time for lineage formation, which was likely triggered by isolation in forest refugia. The divergence dates for clades of both species suggest that historical biogeographic events affected speciation dynamically, such that congruent and taxon-specific patterns emerged. The distribution of genetic diversity we found support several putative biogeographic barriers in the region that were identified in previous studies.

0198 AES Behavior, Sunday 16 July 2017

Ruth Hughes[1], Kristen Pedersen[2], Steve Huskey[2]

[1]Carol Martin Gatton Academy, Bowling Green, Kentucky, USA, [2]Western Kentucky University, Bowling Green, Kentucky, USA

The Kinematics of Envenomation by the Yellow Stingray, *Urobatis jamaicensis*

Venom has evolved in numerous taxa with delivery mechanisms varying from fangs and modified ovipositors to spurs, spines, and barbs. Each is either a means of offense to subdue prey or defense to protect against predators. One such group, the stingrays, has a spine located on their tail that can be used to stab threats, and approximately 1500 people are stung by rays along US coasts annually. Their venomous spine, with rearward-facing, barbed edges, often requires surgical removal. While much is known about stingrays, no detailed explanations of the behavior and mechanism of spine deployment exist. Yellow stingrays, *Urobatis jamaicensis*, were maintained in the laboratory and were induced to vertically strike a foot-like apparatus under high-speed (500fr/s) videography. Strikes averaged 0.1784s to make contact with the apparatus and reached a mean maximum velocity of 225.60cm/s at approximately 60% of the strike duration. Maximum average acceleration of the strikes was 3686.85cm/s2. As the tail reached approximately 65% of its total excursion, the tip of the tail was depressed to an average of 31.78 degrees exposing the spine. Morphological analysis revealed significant reduction in the dorso-ventral height of the tail vertebrae at the point of spine attachment creating a "hinge" to accomplish tail-tip flexion and spine exposure. Yellow stingrays use tail-strikes to protect themselves from threats, and a better understanding

of the behavior and mechanism used to deploy the spine may help reduce the number of human envenomations annually.

0890 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Megan Human, Noelle Bowlin, Andrew Thompson, William Watson, Ed Weber

NOAA Southwest Fisheries Science Center, USA

New Developments in Temperature-Dependent Incubation in Pacific Sardine Eggs Compared with Historical Estimates

The Daily Egg Production Method (DEPM) is a useful tool in assessing the spawning biomass of Pacific Sardine. This method uses an exponential mortality model derived from the temperature-dependent rates of egg development established 20 years ago using eggs collected from net tow samples with an estimated time of fertilization. To determine if this relationship is still current we collected ripe male and female sardines during trawl surveys and fertilized the eggs at sea. The eggs were reared in constant temperature baths between 12°C and 21°C, collected at regular time intervals, preserved, and later staged in the laboratory. Preliminary results from the temperature-dependent egg-development model suggest eggs in our experiment developed more quickly at comparable temperatures than in previous experiments. These results may be due to differences in experimental design; we were able to begin recording developmental stages upon fertilization instead of using estimates of peak spawning times. However, further experimentation is needed. This research can be used to update the temperature-dependent egg development curve used in the parameter estimation for the DEPM.

0744 Lightning Talks II, Friday 14 July 2017

Peter Hundt

St. Cloud State University, St. Cloud, MN, USA

An Open Access Online Database for the Diets of Fishes

Ichthyologists studying ecology, evolutionary biology, fisheries management, etc. often require descriptions of fish diets to conduct a wide array of research. Since there is currently no repository for diet information, researchers are often reduced to using categorical descriptions of trophic guild such as carnivore, herbivore, etc. or face the task of conducting stomach content analysis. I am seeking collaborators to help me create an open access online relational database of fish diets that can store raw diet data to be sorted by a wide range of users. The database will serve as a place to store all future diet data moving forward, but also include data gathered from all past studies using new technologies capable of reading tables from PDF files. The main goal of this talk is to find collaborators and provide evidence that using generic trophic guilds, rather than actual diet data, can result in misleading findings. I will compare the results of a trophic

morphologies study of blennies using actual diet data to results using trophic guilds from the literature.

0764 LFC Nutrition, Friday 14 July 2017

Ione Hunt von Herbing, Wren Busby, Mike Anderson

University of North Texas, Denton, Texas, USA

Our Inner Oceans: Understanding the origins of the gut microbiome and how probiotics may help maintain health in early stages of fishes under chronic stress

Human and animal health are linked to natural microbial populations of the intestines, but until recently little was understood about the possible origins of the gut microbiome. Recent results from a three-year plankton sampling cruise revealed that >73% of the diversity of our ocean's microbes is shared with the human gut microbiome, despite physicochemical differences between these two ecosystems**.** Microbes in the human, as well as the fish gut maintain intestinal cell tight-junction integrity, produce vitamins and fight pathogens, among other functions. But "chronic stress" changes gut microflora, resulting in homeostatic imbalance, and increased susceptibility to disease. In agriculture and more recently aquaculture, antibiotics was used to treat disease brought on by stress due to overcrowding and handling. While strength is in diversity, the use of antibiotics reduces gut microfloral communities and disrupts development of the gut. In our studies we tested an alternative biological control agent to antibiotics, probiotics (live microorganisms beneficial to host health), which is thought to improve gut health through increasing microbial diversity. While treatment of antibiotics (ampicillin) in early stages of zebrafish (*Danio rerio*) retarded intestinal development (serotonin receptors and enteric innervation), treatment with probiotics (single strain and multiple strain) in juvenile Mozambique Tilapia (*Oreochromis mozambicus*) and Red Drum (*Sciaenops ocellatus*), showed enhanced growth, immune and endocrine health and reduced mortality, resulting in a general improvement of condition. Deep sequencing work will determine if improved health stems from increased microbial diversity in the gut during development due to probiotics.

0668 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jordan Hunziker[1], Juan D. Daza[1], Emma Sherratt[2], Aaron M. Bauer[3], Wolfgang Böhme[4], Philip Wagner[4]

[1]Sam Houston State, Huntsville, Texas, USA, [2]Australian National University, Canberra, ACT, Australia, [3]Villanova University, Villanova, PA, USA, [4]Zoological Research Museum Alexander Koenig, Bonn, Germany

A copal gecko from Madagascar

A specimen from the Alexander Koenig Research Museum, classified as an *Sphaerodactylus* gecko from the Dominican Republic turns out to be a Madagascan gekkonid. The specimen preserved in a teardrop shaped resin was CT scanned, revealing a very complete anterior half of the body, including the skull, vertebral column, pectoral girdle and forelimbs. Comparative analysis of the skeleton using a large data base of living species indicate that the lizard is a member of the genus *Ebenavia*. This genus today includes two recognized species, *E. inunguis* and *E. maintimainty*. The most widespread species is *E. inunguis*, which occurs in the Mauritius, the east coast of Madagascar including Ile aux Prunes, Nosy Boraha, and Nossi Mangabe, the northwestern tip of Madagascar, including Nosy Komba and Nosy Be, Comoros, and Pemba Island. *E. maintimainty* has a more restricted range in the South Western portion of Madagascar Toliara Province. The distribution of major copal localities in Madagascar match the distribution of *E. inunguis* (Cap D'Ambre), and this together with morphological similarities, support the identity of this specimen.

0075 Herp Morphology & Development, Saturday 15 July 2017

Steve Huskey[1], Michael Smith[1], Christopher Anderson[2], Kenny Barnett[3]

[1]Western Kentucky University, Bowling Green, KY, USA, [2]University of South Dakota, Vermillion, SD, USA, [3]New York State Dept. of Env. Conservation, New York, NY, USA

Functional Diversity of the Gular Pouch in Chameleons: Who Gives a Hoot!

Chameleons represent one of the most enigmatic groups of vertebrates on the planet with numerous functional morphological specializations, from ballistic tongues and turreted eyes to ornate skull adornments and feet with two opposable digits. Descriptions dating back over 150 years also describe chameleon internal anatomy with features whose functions have yet to be determined, such as complex lung diverticula and gular pouches. The gular pouch is an out-pocketing of the trachea that can be inflated postero-ventrally into a space above the hyoid mechanism and rostral to the pectoral girdle. A survey of fresh carcasses from 38 species revealed gular pouches in 9 taxa. Pouch length, width, and volume were analyzed for 74 carcasses. Relative to body size, veiled chameleons (*Chamaeleo calyptratus*) possess a gular pouch significantly larger than any other taxa. Further examination revealed that the gular pouch in some species is formed from significant expansion of the tissue between two hyaline cartilage rings of the trachea. This tissue develops into a large, overlying sac that extends posteriorly. Others develop as regions of soft tissue between multiple tracheal rings expand and fuse together. Numerous chameleon taxa are known to generate “buzzing” from their throat region, with some creating a perceptible “hoot”. It is our hypothesis that specialized hyoid retractor muscles are contracting at a high-frequency to create the buzz and, when lying against an inflated gular pouch, generate the hoot. Preliminary evidence suggests that these biotremors are used for conspecific communication during territoriality displays, courtship, and mating.

0281 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Mike Iacchetta, C. M. Gienger

Austin Peay State University, Clarksville, TN, USA

Endocrine Stress Response of Eastern Fence Lizards to Fire-altered Landscapes

Quantifying the endocrine stress response through measurement of glucocorticoids has become an increasingly common method for determining how organisms respond physiologically to challenges imposed by the external environment. Habitat alterations, such as fire, change the landscape's habitat structure and resource availability, necessitating physiological responses to cope with the environmental change. We tested the hypothesis that Eastern Fence lizards cope with fire effects on the environment by modulating their endocrine stress response. We measured the baseline and stress-induced plasma corticosterone (CORT) concentration of male Eastern Fence Lizards in a chronosequence of fire-altered habitats. Although vegetative canopy cover, leaf litter depth, and vegetation composition differed among habitat types (recently burned, recovering, and unburned), there was not a significant effect of habitat type on plasma CORT concentration or on body condition. Using a general linear model, we found no cumulative effect of habitat type, type of blood draw (baseline or stress-induced), body temperature, body condition, or the time taken to collect blood samples on concentration of plasma CORT. Also, no single factor in the model was a significant predictor of CORT concentration while controlling for all other factors within the model. Low intensity burns may not produce a challenging stressor necessary to elicit adjustments to the endocrine stress response in Eastern Fence Lizards. Instead, lizards may respond behaviorally to avoid prolonged periods of allostatic overload by locating microsites within their environment which allow individuals to maintain longer periods of optimal performance.

0067 AES Conservation & Management I, Saturday 15 July 2017

Pedro Ibañez[1], Mauro Belleggia[2], Daniel E. Figueroa[3]

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Biological Aspects of the Broadnose Skate *Bathyraja brachyurops* from the Argentinean Continental Shelf

The purpose of this study was to investigate the diet, the reproduction and the dynamics of the broadnose skate *Bathyraja brachyurops* from the southwestern Atlantic Ocean,

based on a comprehensive dataset obtained from 1999 to 2012. A total of 1.757 skates were caught, measured to the nearest mm, weighed, sexed and maturity stage determined. Food habits were studied based on analysis of stomach contents from a subsample of 344 specimens, from which 290 (84.3%) contained food. The diet consisted on fish in the north and crustaceans in the south region. We found that the length at which 50% of skates are mature (LT_{50}) differed between sexes, region and periods. The LT_{50} were estimated to be 707 mm for females, and 683 mm for males. The LT_{50} for males decreased from 697 mm to 673 mm from 1999-2006 to 2007-2012 in the northern region, whereas the LT_{50} for females decreased from 750 mm to 688 mm from 1999-2006 to 2007-2012. In the southern region, the LT_{50} for males decreased from 675 mm to 623 mm from 1999-2006 to 2007-2012, whereas the LT_{50} for females decreased from 711 mm to 636 mm from 1999-2006 to 2007-2012. Females with egg capsules were found between 70 and 208 m depth. Skates catch data from research vessels were interpolated and plotted to show the dynamics of this species in the Southwestern Atlantic from 1999 to 2012 and the effects of a permanent closed area for fisheries.

0683 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017; AES GRUBER AWARD

Johanna Imhoff[1], Dean Grubbs[0]

[1]*Florida State University Department of Biological Science, Tallahassee, FL, USA,*
[2]*Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA*

Trophic Relationships and Mercury Contamination of Deep Sea Sharks in the Gulf of Mexico

As long-lived mid to upper trophic level predators, elasmobranchs are susceptible to carrying high loads of bioaccumulating toxicants and may facilitate the long-term persistence of these contaminants in marine food webs. Methylmercury (MeHg) is a particularly concerning contaminant in fishes because high levels of contamination can put humans at risk for reproductive and neurological problems via fish consumption. There is special interest in MeHg in northern Gulf of Mexico food webs because of the hypothesis that the 2010 Deepwater Horizon Oil Spill created ecological conditions ideal for increased methylation of ambient mercury. Preliminary data show that deep sea sharks can carry relatively high concentrations of MeHg in their tissues (up to 7 ppm wet weight in muscle) and the typical bioaccumulation pattern of increasing MeHg contamination with fish size. However, the slopes of these relationships and the amount of individual variation in MeHg contamination differ between species. MeHg bioaccumulation patterns can be influenced by multiple factors, such as size, sex, taxon, trophic ecology, ontogeny and depth habitat. Trophic relationships and MeHg contamination will be analyzed in six shark species that range from the continental shelf edge to the mid-slope and include both Carcarhiniformes (*Mustelus canis*, *M. sinusmexicanus*) and Squaliformes (*Squalus cubensis*, *S. clarkae*, *Centrophorus uyato*, *C. granulosus*). Trophic ecology will be described using stable isotopes (δ13C and δ15N) and stomach contents. Differences in MeHg bioaccumulation patterns for sharks feeding

in different food webs (benthic, mesopelagic) and on different dominant prey categories will be investigated.

0478 AES Trophic Ecology/Physiology, Friday 14 July 2017

Danielle Ingle[1], Lisa Natanson[2], Marianne Porter[1]

[1]Florida Atlantic University, Boca Raton, FL, USA, [2]National Marine Fisheries Service, Narragansett Laboratory, Narragansett, RI, USA

Mechanical properties of vertebral cartilage at biologically relevant strains

Recently, the *ex vivo* mechanical behavior of cartilaginous vertebral columns found in elasmobranchs (sharks, skates, and rays) has been described to operate as a break or a spring, depending on the tail beat frequency and curvature imposed during testing. The vertebrae themselves have been shown to operate as a spring *in vivo*, and they are able to deform as much as intervertebral joints. At the vertebra level, studies have examined the ability of cartilage to maximally withstand loads and the magnitude of loads accommodated before failure, but not mechanical behavior under biologically relevant loading conditions. Here, we examine stiffness (a material's ability to resist deformation) and resilience (a material's ability to absorb energy during elastic deformation) of cartilaginous centra at a biologically relevant strain using animal total length, species, strain rate, and anatomical location as statistical main effects. Based on previous work on in vivo strains during swimming, we chose to test at 4% strain. We examined two species from the order Carcharhiniformes and four species from the order Lamniformes. We found that resilience and stiffness both varied significantly with all the main effects. Resilience decreased with total length, and it increased with strain rate and from anterior to posterior anatomical position along the vertebral column. Stiffness also decreased with animal total length while increasing posteriorly toward the caudal fin. These data detail elastic mechanical behavior in cartilaginous vertebral centra at biologically relevant strains observed during *in vivo* swimming.

0876 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES SYMPOSIUM – APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Callie Ingram, Jim Gelsleichter

University of North Florida, Jacksonville, Florida, USA

Effects of the Deepwater Horizon Oil Spill on Reproduction of Deep Sea Sharks

Deepwater Horizon (DWH) oil spill was the largest in history, an estimated 5 million barrels of crude was released at a depth of 1500m into the northern Gulf of Mexico (Gom). The most toxic constituents of crude oil are polycyclic aromatic hydrocarbons

(PAHs). PAHs are organic compounds that can easily infiltrate the cells of organisms. One studied effect occurs in the reproduction of fish. These effects result in alterations in estrogen cycling and estrogen-regulated effects such as declines in egg yolk production and possibly the reduction of fertility. The goal of this study was to examine possible effects of the DWH oil spill on alterations in estrogen cycling. This was executed using plasma estrogen profiles of three deepwater shark species found in abundance in DWH impacted areas of the Gulf. The chosen species are the gulper shark (*Centrophorus granulosus*), the short spine spurdog (*Squalus mitsukurii*) and the Cuban dogfish (*Squalus cubensis*). Complications rose due to the lack of studies on circulating estrogen profiles in deepwater sharks; therefore, a preliminary goal was to examine changes in estradiol in relation to size and maturity status. Correlations between estradiol and follicle growth were then examined. This study resulted in clear associations between total length and maturity along with estradiol in all species. A strong correlation between estradiol and follicle size was suggested in *C. granulousus* and *S. mitsukurii*. There was little evidence for reduced levels of estradiol during periods of reproduction of elevated oil exposure in *S. cubensis*, but further study is required.

0762 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Michael Izumiyama[1], Liam O'Malley[1], Karen Crow[1], Michael Westphal[2], Ken Oda[3], Kristine Lesyna[3], Steve Morey[4]

[1]San Francisco State University, San Francisco, CA, USA, [2]Bureau of Land Management, Hollister, CA, USA, [3]California Department of Fish and Wildlife, Belmont, CA, USA, [4]Florida State University, Tallahassee, FL, USA

Reproductive Isolation in two Sympatric Surfperches

Barred and calico surfperch are sister taxa that live in sandy, near shore environments. These species are sympatric throughout most of their ranges and their northern distribution overlaps with the southern range of the redtail surfperch. In this region, individuals that appear to be hybrids between redtails and barred or calico surfperches have been observed, but none that appear to be hybrids between barred and calico surfperches. We investigated the possibility that temporal divergence in mating season may contribute to reproductive isolation between sympatric calico and barred surfperches. We constructed the reproductive calendar for barred surfperch using gonadostomatic index (gsi) data from specimens caught by hook and line between 2014 and 2017. Females have long gestation periods and give birth to live young, and therefore are reproductively active all year. However, mating season is clearly defined by peak gsi in males. We compared aspects of mating, birthing, clutch size and larval development between barred and calico surfperches. There was some overlap in peak mating season between barred and calico surfperches, however the window for mating in barred surfperch is more protracted than calico. This study contributes to our understanding of surfperch life history and reproductive isolation in sister species.

0242 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Silvina Izzo[1], Gabriela Andreoli[1], Daniel E. Figueroa[2], Marcela Costagliola[1]

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Molecular Characterization of Sympatric Skates *Dipturus* and *Zearaja* from Argentine Sea Based on DNA Barcode

Skates *Dipturus argentinensis* and *Zearaja chilensis* present a particular challenge for fishery management and conservation, since they are sympatric species and they have been the subject of intense exploitation in the last years. In the Argentinean Sea, their behavioral habits and the morphological similarity in juvenile stages, make these species difficult to identify. Here we report a molecular characterization of *D. argentinensis* and *Z. chilensis* in base of DNA barcode sequence data (Cytochrome C Oxidase I). Twenty three specimens, classified by morphology as *D. argentinesis*, *Z. chilensis* and others as *Z.* sp with different thorny patterns, were identified at species level by comparing their DNA barcode with reference sequence data. We described that *Z. chilensis* have at least three morphotypes for the thorny pattern because all the *Z.* sp individuals were identified as *Z. chilensis* with more than 99% of similarity, and had a low K2P distance with the reference sequences. Data from phylogenetic analysis showed a unique clade for *D. argentinensis* and *Z. chilensis*, so we conclude that both species belong to the genus *Zearaja*. We found that the reference sequences of *Z. chilensis* from the Pacific had a high divergence (3.46%) from the *Z. chilensis* of the Argentinean Sea, which would indicate two different species. We suggest that the Argentinean form should be called *Z. flavirostris* (Philippi, 1892). The obtained results contribute to the characterization of these sympatric species from the Argentinean Sea and are useful as a reference parameter for the differentiation of the species.

0664 LFC Contributed III, Saturday 15 July 2017

Nate Jacobson[1], Kathy Koch[1], Chris Cieciek[1], Doug Bradley[1], Doug Dixon[2]

[1]LimnoTech, Ann Arbor, MI, USA, [2]Electric Power Research Institute, Palo Alto, CA, USA

Internet-Based Larval Fish and Egg Taxonomic Keys for North American Freshwater and Marine Fishes

The utility of traditional taxonomic fish keys is sometimes limited by availability, new species introductions/discoveries, characteristic corrections, publication errors, and/or costs, which forces scientists to rely on multiple, sometimes outdated keys. Contemporary web-based key platforms can provide greater access to these important resources and allow flexibility for updates/corrections, high-resolution images, and greater identification precision. With funding support from the Electric Power Research

Institute (EPRI), a collaborative effort was undertaken to develop free, open-access, web-based versions of seminal taxonomic keys used for freshwater and marine environments. The key platform (http://www.eprilarvalfishid.com/) includes diagnostic information and images from prominent guides from the Great Lakes Region, Ohio River Basin, and Atlantic and Pacific Oceans. The information from these sources is used to help identify a specimen of interest to the family, genus, or species level. To date, the user-friendly, diagnostic keys contain 161 freshwater species, 1,029 Atlantic species, and 1,034 Pacific species, with updated species information and images being added as available. This presentation will describe and demonstrate the resources and discuss their value for supporting early life stage taxonomic activities. This will also provide an opportunity to solicit feedback on the utility of the keys, additional species information and images, and other suggestions from experts in the field to improve on the usefulness and coverage of the resource.

0906 Fish Reproduction & Development, Saturday 15 July 2017

Robert Jacobson

Roger Williams University, Bristol, RI, USA

Stop Counting Eggs!: Using Computer Vision To Gather Data

Computer vision and image processing software has long been applied to problems in biology, but the complexity of many of the algorithms has historically required a computer scientist or specialized programmer to implement, and many sophisticated techniques have had significant computer hardware requirements. Advances in the fields of computer vision and machine learning, the increased availability of inexpensive powerful parallel computing hardware, and the maturation of easy to use software packages have recently brought sophisticated computer vision and image processing techniques within the grasp of the typical life scientist. Measuring tasks that take days, weeks, or months to do by hand can now be done in hours by a computer. We survey several computer technologies in the context of counting and measuring eggs of marine organisms and propose a way to make it even easier for non-programmer scientists to apply these technologies to their own work.

0275 AES GRUBER AWARD I, Thursday 13 July 2017

Kelsey James[1], Lisa Natanson[2]

[1]*University of Rhode Island, Kingston, RI, USA,* [2]*National Marine Fisheries Service, Northeast Fisheries Science Center, NOAA, Narragansett, RI, USA*

Does sex change everything? The relationship between band pair deposition and maturity in the Little Skate, *Leucoraja erinacea*

Band pair deposition in elasmobranchs is generally assumed to be annual. However, several examples to the contrary and the difficulty of confirming annual periodicity warrant further study into the underlying physiological controls of band pair deposition. Age validation of elasmobranchs has only been successful up to a certain age, generally the age at maturity. This suggests that reproductive development may affect band pair deposition. Little Skate, *Leucoraja erinacea*, was used as a model organism to investigate the role of sexual maturity in vertebral growth. Forty-one mature Little Skates (22 females and 21 males) were injected with oxytetracycline (OTC) and maintained in captivity for 13 months. Individual food consumption, temperature, and female egg deposition were monitored daily throughout the experiment. Vertebral growth distal to the OTC mark was measured and the band type(s) identified as opaque and/or translucent. The characterization of adult vertebral growth is critical to assess the validity of using band pair counts as accurate age estimates.

0610 Fish Behavior, Saturday 15 July 2017

Paul James[1], Gerard Closs[2]

[1]Central Washington University, Ellensburg, WA, USA, [2]University of Otago, Dunedin, Otago, New Zealand

Spatial Segregation and Site Fidelity of the Canterbury Galaxias (*Galaxias vulgaris*) in a Small New Zealand Stream

The Canterbury galaxias (*Galaxias vulgaris*) is a small, non-diadromous gaxaliid inhabiting streams on the east side of New Zealand's South Island. Adults of this species are rarely seen during daylight hours as they hide under cobble-sized rocks in riffles, but can be found feeding in shallow, open water areas at night. Our objective was to investigate the diel pattern of movements of *G. vulgaris* and to determine their resting site fidelity for specific rocks. We tagged adult *G. vulgaris* with PIT tags and used a hand-held antenna to track fish on four riffles within a 2 km study reach in Trotters Creek, Otago, NZ. Surveys using the antenna were conducted over a six-week period to scan for tags within permanently established 5 x 5 m grids where individuals were tagged and released. An X-Y coordinate system was used to determine the exact location of tagged individuals during detection scans within the grid at each site. Most fish were detected within their original 25 m^2 capture grid during daytime surveys, but significantly fewer were detected during nighttime surveys. Although individuals appeared to move away from their resting shelters at night, most returned to their previous shelter on the following day. Coordinate maps of individual detection locations showed that fish appeared to have specific resting site territories of less than 0.5 m^2 that rarely over-lapped with other individuals. Results suggest that individual *G. vulgaris* exhibit resting site fidelity and have established territories.

0912 Snake Biology I, Sunday 16 July 2017

Eric Januszkiewicz, Nicole Chinicci

East Stroudsburg University, East Stroudsburg, PA, USA

Optimization of a Multiplex PCR Analysis for *Crotalus horridus*

Multiplex PCR analysis allows for the amplification of multiple loci at one time and is highly useful for genetic studies, particularly for monitoring species populations such as for the timber rattlesnake. Timber Rattlesnakes (*Crotalis horridus*) have experienced habitat loss, population fragmentation, and extirpation throughout their range in the Northeastern United States. Information regarding the genetic variation of this species can be used for conservation management efforts. A multiplex of nine primers was designed for genotyping populations of *C. horridus* to evaluate genetic variation. DNA was extracted from shed skins, tissue samples, blood, and scale clippings. From thirty-two samples, 93% of the loci were amplified with a mean of 8.7 alleles per locus. The mean polymorphic information content was 0.67, indicating this multiplex can be used for future analysis of *C. horridus* populations.

0092 AES Ecology I, Sunday 16 July 2017

Matthew Jargowsky, Marcus Drymon

University of South Alabama, Mobile, Alabama, USA

Spatial Ecology of Rays in Mobile Bay

Overexploitation and habitat loss threaten marine fauna on a global scale, particularly those that inhabit coastal and estuarine systems. The fourth largest estuary in the United States, Mobile Bay is a dynamic watershed home to a diverse aquatic assemblage, including several species of ray that coexist throughout its expanse. Rays represent an understudied group of aquatic vertebrates; nearly half of the known species are listed as data deficient according to the IUCN. To better understand the distribution of the ray assemblage in Mobile Bay, we examined a series of fishery-independent trawl surveys. 792 individuals representing six species of ray and one species of skate have been sampled, with smooth butterfly ray (*Gymnura micrura*), Atlantic stingray (*Hypanus sabinus*), lesser numbfish (*Narcine bancroftii*), and southern stingray (*Hypanus americanus*) being the most common. Immature and mature individuals of both sexes have been caught for all species encountered, although the sex ratio is male biased (58.7% males, $p<0.001$). Smooth butterfly rays have the highest catch by abundance and weight (61.12 individuals/km^2, 70.75 kg/km^2). Mature male butterfly rays were caught in early February, when water temperatures were as cold as 15°C, where large gravid females did not appear in the trawls until water temperatures reached 25°C in early May. Lesser numbfish were caught intermittently and their catch was male dominated (73.1% males, $p=0.001$), suggesting some degree of sexual segregation. Mobile Bay clearly serves as important habitat for this assemblage of rays, and further studies examining the mechanisms by which they partition resources are needed.

0429 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Friday 14 July 2017

Rebecca Jasulevicz, Aaron Bauer

Villanova University, Villanova, PA, USA

Morphological Diversification of the Pectoral Girdle and Associated Structures within Gekkota

Geckos occupy a diverse array of habitats and substrates. They have developed unique morphological adaptations to facilitate effective locomotion across various substrates; in particular, there have been shifts in the morphology of the pectoral girdle. The pectoral girdle articulates the forelimbs with the axial skeleton and provides attachment points for musculature associated with locomotion, ventilation, and feeding. There is extensive phylogenetic and functional variation in the coracoid, clavicles, and interclavicle, but less in the scapulae. Although individual elements of the girdle are relatively simple, their geometries are quite complex. High resolution x-ray computed tomography (HRXCT) and diffusible iodine-based contrast-enhanced computed tomography (diceCT) are appropriate tools to qualitatively and quantitatively assess morphological differences in the pectoral girdles of arboreal, terrestrial, and rock-dwelling gecko species. Cleared and stained specimens were used to supplement the CT dataset. Both symplesiomorphy and convergence across the six families of gekkotan lizards are responsible for similarities in the pectoral girdle among geckos utilizing comparable substrates.

0222 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kyle Javenes[1], James Spotila[2], Laurie Mauger[1]

[1]*Southern Utah University, Cedar City, UT, USA,* [2]*Drexel University, Philadelphia, PA, USA*

Sequence Variation of the CytB Gene in American crocodile, *Crocodylus acutus*, Populations in Pacific Costa Rica

Sequences of mitochondrial genes are useful in studying phylogeography and genetic differentiation in populations of threatened and endangered species. We determined the genetic structure of American Crocodile (*Crocodylus acutus*) populations in Pacific Costa Rica for the CytB mitochondrial gene using the primer pair L14849, and H15453. Crocodile samples were collected from 11 localities (Las Baulas National Park, Santa Rosa National Park, Palo Verde National Park, and several rivers and lagoons on the Osa Peninsula). Sequences were edited on BioEdit 7.0.9.0 and aligned with ClustalW on Mega 7.0.18. We sequenced 547 base pairs for 119 individuals. Gene sequences were collapsed into 5 haplotypes on FaBox 1.41. Haplotype CytB2 was unique to crocodiles in Las Baulas National Park. We constructed maximum likelihood (ML) trees for the mitochondrial region and estimated the mitochondrial divergence and substitution

model across geographical locations for crocodiles in Pacific Costa Rica. Preliminary data support minimal divergence and independent evolution in the sampled populations.

0423 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kortney Jaworski[1], Madelyn Messener[2], Cari-Ann Hickerson[2], Carl Anthony[2]

[1]Christopher Newport University, Newport News, Virginia, USA, [2]John Carroll University, University Heights, Ohio, USA

Differences in Territory Quality between Striped and Unstriped Eastern Red-backed Salamanders

The color polymorphic Eastern Red-backed Salamander (*Plethodon cinereus*) provides an emerging model system to understand how divergence may occur in sympatry. At our field site in northeastern Ohio, color morphs of this species (striped and unstriped) differ in their investment in territorial behavior. In this population, the striped morph exhibits relatively high levels of aggressive behavior and maintains more consistent access to refugia (territorial foci) on the forest floor. These differences in behavior among morphs influence surface activity, access to prey, and may result in assortative pairings by color, a critical first step in the process of sympatric divergence. In this study, we were interested in whether prey availability, a key component of territorial quality, differed between morphs. Prey availability within territories likely influences fitness of territorial holders via direct effects of nutritional intake and through perceived mate quality, so we expected the striped morph to maintain territories with higher-quality and more abundant prey items than the unstriped morph because of its heightened aggression. Analysis of similarity revealed significant variation in available prey between striped and unstriped salamanders. We found that the territories of striped salamanders contained 32% more prey, including groups important to the diet of this species, but that the numbers of quality (soft-bodied) prey did not differ between territories. Our results add to a growing body of evidence suggesting that striped Eastern Red-backed Salamanders maintain a territorial advantage over their unstriped counterparts.

0637 Reptile Behavior, Friday 14 July 2017

Andrew Jesper, Scott Eckert

Principia College, Elsah, Illinois, USA

A 3D Approach to the Analysis of Movement Patterns and Homerange Estimation for the Timber Rattlesnake (*Crotalus horridus*) in Central Illinois

Movement distances (daily, weekly, monthly or yearly) and home ranges of animals can vary greatly due to environmental and biological factors. Sometimes such variation can be attributed to dissimilar research or analytical methodology and sometimes it is the

combination of data collection methodology, analytical approaches and environment that leads to conflicting results between studies. One environmental factor that can significantly influence spatial statistics for terrestrial animals is topographical complexity, which is often disregarded in movement studies that use 2-dimensional (planimetric) analysis. In this study we analyze data from a 1 year radio-telemetry study of timber rattlesnake (*Crotalus horridus*) movements and home range in a mature mid-western Oak-Hickory forest using 3-dimensional distance analysis. We then compare our 3-dimensional results with a planimetric analysis and with published studies on movements and home range of timber rattlesnakes, as we attempt to explain the high levels of variance exhibited across these published studies.

0680 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Jarrett Johnson

Western Kentucky University, Bowling Green, KY, USA

The Management Implications of Gene Flow Across Species Boundaries

The naming and describing of species is a phenomenon that has preoccupied biologists for centuries. This is a worthwhile endeavor, as it improves our ability to comprehend patterns in nature and communicate effectively regarding ecological and evolutionary observations. However, modern biologists recognize that species are not uniform entities, but rather collections of populations and individuals that are more or less discontinuous from other such groups. Except when they aren't. Conservation Biology is predicated on protecting biodiversity, and for the most part, this means preventing the extinction of species. However, as anthropogenic influences on biodiversity continue to grow, conservation practitioners will increasingly need to implement management plans for taxa that do not fit nicely into categories. Here, we present hybridization of threatened and endangered taxa as a case study for the importance of conservation approaches with enough flexibility to accommodate non-species-based perspectives of biodiversity. When hybridization occurs as a direct result of anthropogenic activity, as it has for the California tiger salamander, management to mitigate the loss of indigenous genetic diversity is generally perceived as imperative. The legal protection of California tiger salamanders under the US Endangered Species Act has been clouded by the presence of admixed populations encompassing large variation in the proportion of indigenous and non-indigenous genetic material. Effective conservation initiatives for hybridized taxa requires the development of best practices for evaluating the status of admixed populations and a comprehensive understanding of the ethical concerns, scientific difficulties, and practical limitations involved in determining such a status under myriad circumstances.

0495 Herp Behavior, Thursday 13 July 2017

Michele A. Johnson[1], Daisy M. Horr[1], Ellee G. Cook[2], Bonnie K. Kircher[3]

[1]Trinity University, Texas, USA, [2]University of Missouri, Columbia, Missouri, USA, [3]University of Florida, Gainesville, Florida, USA

The Phylogeny of Lizard Display: An Analysis of Color, Motion, and Sound in Communication

Lizard display behaviors include a remarkable diversity of color, motion, and vocal components. To examine this diversity, we performed a survey of the scientific literature, searching for descriptions of behavioral displays of the 453 lizard genera in 43 families. We recorded whether species within each genus vocalized or performed displays that made their body size appear larger or included movements of the limbs, head, tail, throat, or mouth. We then determined the proportion of genera in each family that exhibited each component of display, and the number of distinct motions performed within each family. We also estimated the number of display colors for each family, the number of locations on the body in which colorful patches were used in display, and whether members of each family were known to change their body color during social interactions or across seasons. We found significant phylogenetic signal in the proportion of families that exhibit head movements, extension of the gular region, and vocalization, suggesting that these traits evolve more slowly than the other components of lizard displays. We also found that the different types of movement displays (excluding tail motions) evolved together in lizard families, and that families evolved complexity in motion and color components of display together. Finally, families that evolved seasonal (breeding) color changes had more complex displays than families that did not change color seasonally. Together, these results indicate that the components of lizard display evolve in association, and suggest areas for further work on the adaptive value of display.

0776 Amphibian Conservation II, Sunday 16 July 2017

Steve Johnson, Suzanne Simpson, Emily Leary

University of Florida, Gainesville, FL, USA

Critical thermal minima of Cuban Treefrogs in Florida

Quantifying thermal tolerance for introduced ectotherms is essential to understand potential range limits, which can inform management strategies. Cuban Treefrogs (*Osteopilus septentrionalis*), native to numerous Caribbean islands, are an invasive species in Florida with established populations throughout the peninsula. Cuban Treefrogs are known to negatively impact populations of native treefrogs via predation, and possibly competition. Accurate estimates of potential range expansion of Cuban Treefrogs are needed to better predict their ultimate distribution limits in Florida and the southeastern USA. The temperature niche of a species, driven by its thermal tolerance, is one important factor that affects a species' ability to expand its distribution. Understanding

the thermal limits of Cuban Treefrogs, in particular their critical thermal minimum (CTmin), should aid in predicting their ultimate range limits in North America. We used a common garden experiment to determine the CTmin of Cuban Treefrogs from three areas in Florida (n = 60 per site) that spanned a latitudinal gradient. Results indicate that Cuban Treefrogs are much more resistant to short-term cold exposure than previously reported. Frogs from northern Florida displayed marginally lower CTmins than frogs from our central and southern sites, in both cold-acclimated and control frogs. There is potential for Cuban Treefrogs to adapt to cooler temperatures, which would facilitate their continued expansion north and west in the Southeast.

0693 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Timothy Johnson[1], Connor Adams[1], Toby Hibbitts[2], Wade Ryberg[1], Tyler Campbell[3]

[1]Texas A&M Institute of Renewable Natural Resources, College Station, TX, USA, [2]Biodiversity Research and Teaching Collections, Department of Wildlife and Fisheries Sciences, College Station, TX, USA, [3]East Foundation, TX, USA

Herpetofaunal Utilization of Texas Pocket Gopher (*Geomys personatus*) Mounds under Varying Grazing Regimes in the South Texas Sand Sheet

The South Texas Sand Sheet is a unique ecosystem characterized by thornscrub woodlands and open grasslands on deep, sandy soils. These rangelands are known to support a vast array of herpetofaunal diversity. Previous research has shown that fossorial rodents can act as ecosystem engineers by facilitating soil turnover, contributing to rangeland plant production, and providing refuge for other vertebrate species. The Texas Pocket Gopher, *Geomys personatus*, is found throughout the South Texas Sandsheet and can occur in high densities across the landscape, creating thousands of sand mounds on the surface as they excavate burrows. To determine the extent of herpetofaunal use of *G. personatus* mounds, we conducted sampling within two different grazing regimes on the Las Coloraditas Grazing Research Area located on the East Foundation's San Antonio Viejo Ranch. Sampling was conducted over the course of several weeks in May on 1-hectare sites that were randomly selected in both heavy and exclusionary grazing regimes. All sand mounds within each site were sampled by filtering the collected sand through a large sieve. We recorded the density of mounds at each site, as well as the snout-to-vent length (SVL), sex, and reproductive condition of each herptile observed. Here we present the results of our study to determine if different grazing regimes have an effect on herpetofaunal utilization of *G. personatus* mounds within the South Texas Sandsheet.

0862 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Yanesha Johnson, Michael Sandel

The University of West Alabama, Livingston, Alabama, USA

Post-mortem Dynamics of the Guppy Dermal Microbiome at Varying Temperatures

Fishes represent a major contribution to freshwater biomass, yet the microbial dynamics responsible for recycling this biomass remain poorly understood. Recent and ongoing changes in global climate impart a need to understand and ultimately predict microbial dynamics during freshwater fish decomposition. We examined the relationship between temperature and decompositional microbiome dynamics in a small-bodied stream fish. The Guppy is a globally-distributed livebearing freshwater fish renowned as a classic model in evolutionary ecology. We monitored microbial diversity in the dermal microbiome of 48 deceased Guppies at two temperature regimes. Decomposing fish were removed as biological replicates and processed at regular intervals. Microbial DNA was isolated with acetone precipitation and extracted using a commercial kit. The 16s rRNA gene was amplified using universal PCR primers, and amplicons were sequenced on an illumina 2500. Sequence reads were mapped to a microbial database using Qiime, and relative diversity metrics were calculated for each sample. We compared microbiomes across treatments and across timepoints using statistical packages in R. Results indicate a trend of varying diversity during fish decomposition, where fish microbiomes at higher temperatures change more rapidly than those at lower temperature. Metabolic differences were noted between the two communities, where higher microbiomes appear supported a greater diversity of anaerobic microbes. This study highlights the importance of a general understanding of microbial population dynamics during freshwater fish decomposition, as influenced by global climate change. We also discuss the role of potential confounding influences on decompositional microbial activity, including salinity, hardness, and pH.

0042 Fish Conservation II, Sunday 16 July 2017

Leslie Jones, Bridgette Froeschke, Brian Garman

University of Tampa, Tampa, FL, USA

Factors influencing the population of Sheepshead, *Archosargus probatocephalus*, in Tampa Bay

Sheepshead, *Archosargus probatocephalus*, is an important recreational species, with developing commercial appeal. We present time series analysis of sheepshead populations in Tampa Bay, Florida, from 1996 to 2014. In particular, we discuss the impact of environmental factors in the Bay such as temperature, rainfall, dissolved oxygen and salinity, and their influence on population levels in years 2008, 2009, and 2014, which are approximately two standard deviations above the mean. Tampa Bay is the largest estuary in Florida, and our study provides a window into some of its unique properties, as well as preliminary data for our examination of sheepshead populations in the state.

0206 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jillian Josimovich[1], Monica Matthews[1], Jessica Hinson[1], Michael Ravesi[2], Sasha Tetzlaff[3], Bruce Kingsbury[1]

[1]Indiana University - Purdue University Fort Wayne, Fort Wayne, IN, USA, [2]Michigan Department of Military and Veterans Affairs, Lansing, MI, USA, [3]University of Illinois Urbana-Champaign, Champaign, IL, USA

First Assessment of Soft-release Translocation of Wild-caught Snakes

Wildlife translocations are often unsuccessful in that relocated animals may exhibit different behavior or higher mortality than controls. Soft-release translocation entails keeping animals in an outdoor enclosure at the release site temporarily in the hopes that they will acclimate to the new environment more readily than animals that are immediately released. Here, we report on the status of an ongoing study investigating the utility of soft-releasing the massasauga (*Sistrurus catenatus*), a small, federally threatened rattlesnake. Venomous snakes are often translocated or killed due to potentially negative interactions with humans, but little research has been done assessing what methods are best for relocating them. To our knowledge, past experiments have only soft-released captive-reared snakes; we are the first to explore whether this technique is effective when translocating wild-caught snakes. Since 2013, we have radio-tracked over 50 translocated and control massasaugas: 12 soft-released (i.e. held in enclosures for approximately two weeks prior to release), 10 hard-released (i.e. released immediately upon relocation), and 29 residents (i.e. released at site of capture). We are comparing measures of behavior and survival to evaluate the "success" of each translocation effort, and preliminary analyses indicate that there are not significant differences between translocation treatments. This work is continuing until at least the spring of 2019 and constitutes some of the earliest research of the pros and cons of using soft-release to translocate wild-caught snakes.

0045 Amphibian Biology, Ecology, & Conservation, Sunday 16 July 2017

Bryan Juarez[1], Daniel Moen[2], Dean Adams[1]

[1]Iowa State University, Ames, Iowa, USA, [2]Oklahoma State University, Stillwater, Oklahoma, USA

Morphology predicts jumping performance in frogs

Ecological and evolutionary processes depend on individual fitness. Oftentimes, organismal performance is a more accurate predictor of individual fitness than

morphology. Furthermore, studies of organismal performance often require live animals, prohibiting the use of museum specimens and limiting such studies to those species for which field collecting and manipulation is permitted. Recent work has shown that organismal performance, such as feeding performance in fishes, can sometimes be precisely estimated from morphology. Here we test whether morphological proxies can predict jumping performance in frogs. First, we used biological and physical principles to mathematically derive three morphological proxies for three types of performance measures: jumping velocity, energy, and power. These morphological proxies use non-invasive anatomical measurements such as the tibiofibula length, leg length, body size, and mass of frogs to estimate jumping performance. Second, we used simple regression methods to assess the precision with which these morphological proxies allow us to predict jumping performance in frogs of different sizes and different microhabitats. Preliminary analyses indicate that we are reasonably able to estimate all three types of performance measures: jumping velocity, energy, and power. The ability to predict jumping performance from morphology (using live animals or museum specimens) allows the rapid sampling of many individuals. Therefore, relative to traditional laboratory methods, this new method enables us to more easily collect the large sample sizes necessary to test different population- and macroevolutionary-level hypotheses regarding the jumping performance of frogs.

0017 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Ingrid Kaatz, Donald Stewart

SUNY College of Environmental Science & Forestry, Syracuse, NY, USA

Social Behavior Context Sounds and Call Type Differences in Driftwood Catfishes (Family Auchenipteridae) Support the Acoustic Communication Hypothesis.

Sounds were recorded in aquarium groups in a sound-proof room with passive acoustics in *Liosomadoras oncinus* (n = 2-3 fishes) and *L. morrowi* (n = 4-6 fishes) using 1-hr hydrophone recordings (n = 15). Calls were analyzed for duration (ms; mean+SD, 95% CI, range). Direct behavioral observations (n = 43 1-hr samples) determined contexts. "Boops" occurred predominantly during coversite competition. "Boops" were continuous pulse series swimbladder sounds: *L.o.* 190+118, n = 82, CI 26, 28 - 712; *L.m.* 187+98, n = 191, CI 15, 76 - 569). Pulse number correlated positively with duration (n = 17). Intersound intervals for "boops" were variable: *L.o.* 556+359, n = 53, CI 80, 124 - 2405; *L.m.* 412+348, n = 72, CI 97, 24 - 2485. Reproduction contexts were accompanied predominantly by silence or a swimbladder "trumpet" call (series of short "toot" sounds). "Trumpet" call (n = 24) subunit durations were: *L.o.* 46+13, n = 158, CI 2, 24 - 103; *L.m.* 70+31, n = 5, CI 27, 32 - 110. Intra-call intersound duration between "toots" was regularly patterned: *L.o.* 46+12, n = 158, CI 2, 24 - 103. "Boops" are longer in duration than "trumpet" components. Diel patterns (# sounds/1-hr, n=72) indicated significantly more acoustic activity during nocturnal and dawn light treatments. Field disturbance context "boops" differed from aquarium sounds. Pectoral stridulation sounds were rare in

aquaria (n = 4 call events, 18 sweeps). Abundant patterned swimbladder sounds in specific behavioral contexts and differences between call types and contexts supports the communication hypothesis.

0806 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Dovi Kacev[1], Lisa M Komoroske[1], Shannon Corrigan[2], Christine N Bedore[3], Kady Lyons[4], Andrew R Thompson[1]

[1]Southwest Fisheries Science Center, La Jolla, California, USA, [2]Hollings Marine Laboratory, Charleston, South Carolina, USA, [3]Georgia Southern University, Statesboro, Georgia, USA, [4]The University of Calgary, Calgary, Alberta, Canada

Advances in molecular tools and applications to understanding the ecology and physiology of elasmobranchs

Collecting data to study the ecology and physiology of elasmobranchs can be difficult due to their cryptic life histories or low population abundances. Over the past decade, there have been tremendous advances in molecular technologies, allowing for the rapid collection of genomic scale data and increases in analytical power. These novel tools can open the door to addressing new questions such as examining population structure at a finer scale, the biological extent of human impacts, local adaptations, and molecular pathways of physiological processes. In this presentation, we review some of the new genetic tools available to ecologists and discuss their application to better understanding the ecology and physiology of elasmobranch fishes and the potential implications for conservation and management.

0197 AES Behavior, Sunday 16 July 2017

Stephen Kajiura, Jordan Waldron

Florida Atlantic University, Boca Raton, FL, USA

Seasonal Abundance and Spatial Distribution of Blacktip Sharks (*Carcharhinus limbatus*) in Southeast Florida

Southeast Florida experiences an enormous seasonal influx of upper trophic level marine predators each year as blacktip sharks (*Carcharhinus limbatus*) migrate south to overwinter in nearshore waters. These sharks form aggregations ranging from a few individuals to thousands. The sharks are often found in very shallow water, only a few meters from popular swimming beaches, which raises concerns about potential negative interactions. To quantify shark abundance and distribution, an aerial survey was conducted during peak season (December - April) from 2011-2017. A low altitude (150m) survey flight was flown from Government Cut (South Beach, Miami) to Jupiter

Inlet at approximately biweekly (2011-2014) or weekly (2015-2017) intervals. A high definition video camera recorded a transect from the beach to approximately 200m offshore. Segments of the survey transect were demarcated by inlets, and the number of sharks found within each segment was counted to calculate shark density. During the seven year study, the greatest shark density was consistently found in February and March. Although sharks were seen throughout the entire 132km length of the survey transect, significantly greater numbers of sharks were found at the northernmost third of the transect in Palm Beach County (Boynton Beach Inlet to Jupiter Inlet) where densities exceeded 1,000 sharks km^{-2}. The habitat throughout the transect is largely consistent, so it remains unclear why the sharks are not distributed farther south. Southward migrating sharks might simply stop once they reach appropriate conditions and warming oceans might eventually restrict their migration to increasingly higher latitudes.

0299 Herp Genetics, Saturday 15 July 2017

Benjamin Karin[1], Tony Gamble[2], Todd Jackman[3]

[1]University of California, Berkeley, Berkeley, CA, USA, [2]Marquette University, Milwaukee, WI, USA, [3]Villanova University, Villanova, PA, USA

Rapidly Evolving Long Exon Capture: A New Sequence Capture Dataset for Phylogenomics in Amniotes

Within amniotes, the most commonly used reduced representation datasets for phylogenomics are ultraconserved elements (UCEs) and Anchored Hybrid Enrichment (AHE). Utilizing complete squamate genomes, we introduce Rapidly Evolving Long Exon Capture (RELEC), a new phylogenomic sequence capture dataset for amniotes that targets 217 exons that are both rapidly evolving (evolutionary rate faster than RAG1) and relatively long in length (greater than 1,500 bp), among other criteria. We compare the RELEC dataset to UCEs and AHE in squamate reptiles by aligning and analyzing orthologous sequences from 17 squamate genomes, composed of ten snakes and seven lizards. The RELEC dataset outperforms AHE and UCEs by maximizing per-locus genetic variation while maintaining presence and orthology across a range of evolutionary scales. RELEC markers show remarkably higher phylogenetic informativeness than UCE and AHE loci, and RELEC gene trees show much higher similarity to the species tree than AHE or UCE gene trees. Furthermore, with fewer loci, RELEC remains computationally tractable for comprehensive Bayesian coalescent species tree analyses. We contrast RELEC to and discuss important aspects of comparable methods, and demonstrate how RELEC is likely the most effective set of loci for resolving difficult nodes and rapid radiations in amniotes.

0236 ASIH STOYE ECOLOGY & ETHOLOGY I, Thursday 13 July 2017

Catharina Karlsson[1], David Bickford[3], Paul Yambun[2], Ryan Chisholm[3]

[1]*National University of Singapore, Singapore, Singapore,* [2]*Kinabalu Park, Sabah Parks, Sabah, Malaysia,* [3]*Rimba, Selangor, Malaysia*

Temporal Partitioning of Calling Activity in the Amphibian Community at Kinabalu Park

Classically surveys in Southeast Asia for amphibians are conducted within the first hour after sundown. Even when studies are done at various times throughout the night there is a limit to the time a researcher can spend in one site, creating issues with the reliability of the data as some species are potentially active at other times. Classical surveys are also relatively costly in terms of manpower in relation to the amount of data that can be collected. Recent advances in passive acoustic monitoring are now allowing monitoring around the clock whilst minimizing the disturbance to the site. Automated acoustic monitoring has drawbacks, though, in comparison to more classical techniques as they only catch vocalizing individuals, meaning that non-vocalizing individuals are missed. There are also issues with calculating population numbers if individuals cannot be distinguished from each other. This study was conducted in Kinabalu Park, Borneo, Malaysia in 2017. Visual encounter surveys were conducted at the same time as passive acoustic and environmental monitoring units were stationed in the survey transects. We assessed how fast the species–area curve plateaued using the acoustic recorders in comparison to the visual encounter surveys. In addition, we assessed how the community assembly differed using the two methods.

0695 Turtle Conservation, Saturday 15 July 2017

Nancy Karraker[1], Kevin Shoemaker[2]

[1]*University of Rhode Island, Kingston, RI, USA,* [2]*University of Nevada, Reno, Reno, NV, USA*

Effects of Field Mowing on Persistence of Eastern Box Turtle (*Terrapene carolina*) Populations

Populations of Eastern Box Turtles (*Terrapene carolina*) have been impacted by forest loss and roads associated with development. Where suitable protected habitat remains, conservation of populations must be prioritized. A 250-ha historical unit of Fire Island National Seashore in New York is composed largely of mature forest with approximately 11% of the area being fields which must be mowed on an annual basis, potentially putting box turtles at risk during the active season. We conducted mark-recapture surveys for Eastern Box Turtles for seven years to estimate population size and annual survival. To predict the impacts of mowing on population persistence, we randomly placed model turtles in fields and mowed the fields to estimate risk of mortality. We documented a mean density of <1 turtle/ha, which was several times lower than densities reported from other study areas. We found that the population was strongly male-skewed (>2M:F). From our mowing experiment, we estimated that the probability of a turtle in a field being killed by one pass of a mower was 0.40, and mower tires, rather than blades, were responsible for 72% of mortality. Our research

indicates that mowing of fields is highly detrimental to Eastern Box Turtle populations, and we recommend that mowing, which is often necessary to control invasive plants, be conducted outside of the active season of this species.

0473 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Emily Karwacki, Matthew Atkinson, Anna Savage

University of Central Florida, Orlando, FL, USA

A novel quantitative PCR assay specific for the emerging amphibian pathogen *Dermomycoides spp*. reveals widespread infection in larval anurans.

Amphibians as a group have suffered from large-scale population declines across the globe, and disease is a central driving force behind these declines. Most of the focus on these declines has been placed on two globally distributed pathogens, *Batrachochytrium dendrobatidis* (Bd) and *Ranavirus*. However, another emerging pathogen, the protist *Dermomycoides* spp. (hereafter *Dermo*), is linked to mass mortality events in several anuran species throughout much of the Southeastern United States. Molecular resources for detecting *Dermo* have been limited to general protistan primers that amplify a range of organisms, not all of which are necessarily disease agents. Here, we developed a novel quantitative PCR (qPCR) assay that is sensitive and specific for *Dermo*. We then sampled natural amphibian populations in the Southeastern United States to assess the prevalence and intensity of *Dermo* infections across species, months, and regions. Out of 319 sampled individuals, 55 (17.7%) were *Dermo* positive. The infection loads were much higher in the tails of infected animals, and differed based on season, species and location. We have shown that environmental DNA (eDNA) can be used as a method to detect *Dermo* infections without sampling the population of a pond. The use of non-destructive sampling methods will allow future researchers to test populations faster and to have larger sample sizes, thus increasing confidence. Having a better understanding of this pathogen will allow us to build conservation efforts for susceptible species which means we can protect anurans in the future and find new ways to protect them in the present.

0595 AES Genetics, Systematics, & Biogeography, Sunday 16 July 2017

Tom Kashiwagi[1], Andrea Marshall[2], Shannon Corrigan[3], Alistair Dove[4], Rafael de la Parra Venegas[5], Gavin Naylor[3], Edward Heist[1]

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Are there DNA evidences for the new species of Manta ray?

In addition to currently recognized Giant Manta *Manta birostris* and Reef Manta *M. alfredi,* a putative third species of Manta ray in the Atlantic has been hypothesized for almost a decade. However, conclusive molecular support and clear morphological descriptions based on sufficient population and genomic sampling have been lacking. We conducted world-wide population sampling across Florida-USA, Bahamas, Yucatan peninsula-Mexico, Brazil, South Africa, Mozambique, Australia, Indonesia, Japan, Revillagigedo Islands-Mexico and Ecuador. We're using a targeted gene capture and next generation sequencing approach to examine patterns of allele sharing across whole mitochondrial genomes and more than 1000 nuclear exons and their associated introns among the three putative species. These analyses are being interpreted in conjunction with detailed investigations of morphological characters using exhibition specimens held at the Georgia Aquarium. We will update the latest findings at the conference.

0699 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Nathan Katlein, Maria Byrne, Ylenia Chiari

University of South Alabama, Mobile, Alabama, USA

Using Video Manipulation and Video Playback to Examine Influence of Color on Communication in Geckos

Body color and color patterns are fundamental in prey escape mechanisms, thermoregulation mate selection, and intra- and inter-specific communication. Among the various functions, color and color patterns have been observed to be used for individual recognition. Among lizards, geckos vary greatly in color and color pattern. To address the question of the influence of color for individual communication in this group, we will compare gecko behavior in the context of direct individual interaction and playback videos that have been edited using MATLAB. Direct individual interaction will provide a baseline of behaviors occurring during individual encounters with the same or opposite sex within a species. In the video manipulations for playback videos, we will change independently saturation, hue and brightness of the color of the gecko or of the background to uncover the influence that each of these aspects of coloration has on individual recognition in geckos. This approach allows collecting data 1) to assess if individual recognition occurs in geckos; 2) on the type and frequency of individual behavioral displays shown during individual recognition; and 3) to discriminate which component of color, color pattern or background color influence individual recognition in geckos. Our approach to playback experiments is unique in that we will be using video streaming to isolate which aspect of coloration stimulate a response while excluding acoustic and chemical signals. This experiment will set a baseline for future studies on trait evolution in geckos and begin to explain the coloration in such a diverse radiation of lizards.

0195 SSAR SEIBERT ECOLOGY III, Friday 14 July 2017

Tatum Katz, Amanda Zellmer

Occidental College, Los Angeles, CA, USA

Incorporating Model Selection in Predicting the Spread of Invasive Fungal Pathogen *Batrachochytrium salamandrivorans*

Species distribution models (SDMs) have been increasingly used to plan for the spread of invasive species. Here, we evaluate a set of 12 alternative models to determine a best fit model of the spread of a newly emergent, invasive fungal pathogen, *Batrachochytrium salamandrivorans* (Bsal). Bsal is a sister species of the critical *Batrachochytrium dendrobatidis*, but lethally infects salamanders rather than frogs. It likely spread from East Asia to Western Europe where it was discovered following severe fire salamander declines. Producing an SDM of Bsal would allow for careful planning of conservation efforts, ultimately helping curtail the spread of Bsal to other areas. Here we propose that a combination of an ecological niche model of Bsal and a model of salamander species richness is the best predictor of potential Bsal spread.

0756 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Friday 14 July 2017

Shannon Keating, Todd Jackman

Villanova University, Villanova, PA, USA

Assessment of a Gene Capture Method in Resolving the Diplodactylidae Phylogeny

Phylogenomics uses large amounts of genomic data to resolve difficult evolutionary relationships. Methods vary in the degree of loci conservation and size of the molecular markers to be used in phylogenetic inference, and can differ in the effectiveness of phylogenetic utility at different scales of divergence. I present an exon capture method that enriches long, variable exons and uses the sequence data to reconstruct the phylogeny of the gecko family Diplodactylidae. This family is comprised of 25 genera of remarkably diverse geckos found in Australia, New Caledonia, and New Zealand. The diplodactylids have been well studied, but several of the relationships remained unresolved, most notably the placement of the Australian genus *Crenadactylus* and the intergeneric relationships of the New Caledonian taxa, among others. The exons being targeted here are efficient for a study at this taxonomic range because they have the appropriate amount of phylogenetic signal to provide a robust comparison of the diplodactylid geckos while still being conserved enough that loci are successfully captured across the family. The exon sequence data is used to reconstruct the Diplodactylidae phylogeny, lend support to historically contentious nodes, and test for incomplete lineage sorting which can occur during rapid radiations. Once demonstrated as an effective phylogenomic technique, this method can be applied to other model and non-model species and contribute to the resolution of the tree of life.

0173 LFC Contributed II, Friday 14 July 2017

Hubert Keckeis

University of Vienna, Vienna, Austria

Larval Recruitment in a Large River: the role of time, habitat structure and individual constraints.

Several concepts on recruitment have been formulated for marine fish species and populations. Nonetheless, despite a few examples involving economically important species (i.e. salmonids), much less is known about these roles in determining the population variability for freshwater, riverine species. A major issue of a current river restoration program in a free-flowing section of the Austrian Danube is the suitability of restructured areas for settlement of fish larvae. Within an ongoing monitoring program, the yearly fluctuations of larval abundance at different sites is being analyzed in order to gain knowledge about the variability in, and the presence and abundance of, early stages of fish at different mesohabitats (inshore areas of restored and control sites). The spatial distribution and temporal variability is being analyzed with regard to flow variability, habitat structure as well as individual performance (i.e. swimming ability) of the larvae. Combined with information about dispersal and drift, this approach has yielded new insights into major environmental factors affecting the recruitment of fish in large rivers.

0267 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Rachel Keeffe[1], Eric Hilton[2], Cristina Cox Fernandes[1]

[1]*University of Massachusetts, Amherst, Amherst, MA, USA,* [2]*Virginia Institute of Marine Science, Gloucester Point, VA, USA*

Morphology and Osteology of Cranial Sexual Dimorphism in the Amazonian Electric Knifefish *Compsaraia samueli*

Gymnotiformes is a diverse group of Neotropical freshwater fishes, within which some species exhibit pronounced sexual dimorphism. Some dimorphic species are difficult to study because they are scarce in collections, or because sexes can only be distinguished when individuals are mature. In the family Apteronotidae, sexual dimorphism of head shape, including snout lengths, has arisen independently several times. One such species, *Compsaraia samueli,* was originally described based on few individuals. With access to an unusually large sample (130 individuals) of this species, we had the opportunity to examine and describe aspects of its sexual dimorphism, through morphometric and descriptive osteology. The individuals in our sample were collected during the breeding season in a remote stream in the Rio Negro drainage by Dr. Labbish Chao and his students. This large sample contains a wide range of sizes of both sexes, many in advanced stages of maturity. We found that several facial measurements differ strongly between mature males and females. Compared to females, males: (1) exhibit

strongly interlacing dentary and anguloarticular bones; (2) have a straight, elongate lower jaw, whereas that of female is relatively short and curves ventrally; and (3) have larger coronomeckelian. In this presentation we will clarify some aspects of the description of *Compsaraia samueli*, and discuss how to better distinguish females and small males of this species from *Compsaraia compsa*.

0766 Herp Genetics, Saturday 15 July 2017

William Keitt, Michael R.J. Forstner

Texas State University, Texas, USA

Examining the Utility of Environmental DNA (eDNA) as a Potential Survey Alternative to Detect the Rare, and Elusive Houston Toad (*Bufo [=Anaxyrus] houstonensis*)

Environmental DNA (eDNA) is a rapidly growing molecular survey technique that is being increasingly implemented as an alternative survey methodology for aquatic taxa. Despite increasing instances of its use, there have been relatively few published reports validating the efficacy of this method. This study seeks to assess the utility of eDNA in the detection of the endangered Houston Toad (*Bufo [=Anaxyrus] houstonensis*). The Griffith League Ranch (GLR), a primary recovery site of the Houston Toad, was sampled weekly from February to June of 2016, with additional samples collected in the spring of 2017. Nine perennial ponds on the GLR were surveyed and a total of 553 water samples were collected, with 151 representing known positive controls. A conventional PCR assay was done to assess presence/absence based on positive amplification of *B. houstonensis* DNA. Preliminary PCR analyses show that, ca. 77% of the 145 known positive samples showed amplification of Houston Toad DNA, while only 4 of the total 402 pond samples amplified. These preliminary results suggest that conventional detection methodologies for eDNA are susceptible to false negatives and therefore, less reliable than current survey approaches. However, with data collection and analyses ongoing, this offers the opportunity for further methods development research. This includes evaluating the capabilities of more sensitive methodologies, like digital droplet PCR (ddPCR), to determine if this approach would represent a valid alternative survey methodology for rare, elusive, and ephemerally present pond-breeding Bufonids.

0153 Lightning Talks I, Friday 14 July 2017

Crystal Kelehear[1], Cameron Hudson[2], James Mertins[3], Richard Shine[2]

[1]Smithsonian Tropical Research Institute, Panama, Panama, [2]University of Sydney, Sydney, Australia, [3]USDA, Ames, USA

Ticks on toads: first report of exotic ticks (*Amblyomma rotundatum*) parasitizing invasive cane toads (*Rhinella marina*) in Hawai'i

Our surveys of 1401 invasive cane toads (*Rhinella marina*) from the Hawaiian islands of Hawai'i, O'ahu, and Maui revealed the presence of an exotic tick, *Amblyomma rotundatum*. Immature and adult female ticks infested three wild adult toads at a single site in the vicinity of a zoo south of Hilo, Island of Hawai'i, Hawai'i, USA. We found no tick-infested toads on O'ahu or Maui. This tick infests cane toads in their native Neotropical range, but it was excluded from Hawai'i when the original founder toads were introduced over 80 years ago. The circumstances of our discovery suggest that *A. rotundatum* was independently and belatedly introduced to Hawai'i with imported zoo animals, and Hawai'i now joins Florida as the second U.S. state where this tick is established.

0809 Fish Life History, Saturday 15 July 2017

Bryan Keller, Chip Cotton

Florida State University Coastal and Marine Lab, St. Teresa, USA

Preliminary Ageing of Selected Deep Demersal Fishes from the Northern Gulf of Mexico

Due to the global depletion of coastal fisheries, effort has been increasingly pushed into deeper water. Biological information is lacking for many of the species that are now being affected by these deepwater fisheries through both targeted and bycatch interactions. This deficiency is problematic, as an adequate understanding of life history characteristics is central to any stock assessment or fishery management plan. Since 2011, we have conducted 14 GoMRI and FLRACEP funded research cruises to the northeastern Gulf of Mexico, sampling with demersal longlines in depths ranging from 200-2000 meters. Otoliths were collected from teleost fishes and thinly sectioned, to enable visualization of growth bands using a dissecting microscope. For species with small sample sizes (Macrouridae, Phycidae, Moridae, Malacanthidae, and Synaphobranchidae), we will present preliminary ageing data, the first such estimates for most of these species. The king snake eel, *Ophichthus rex*, yielded a more robust sample size (~200 fishes) allowing for the computation of provisional sex-specific growth models. Growth models for *O. rex* will be compared to those in a previous study from ~30 years ago to infer population-level changes in growth.

0738 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Maureen Kelley, Christopher R. Tracy, Ryan P. Walter, Stacey L. McIntyre

California State University Fullerton, Fullerton, CA, USA

Twinning in *Sauromalus ater (=obesus)*, Iguanidae

In April of 2016, we incubated a clutch of 10 eggs from a captive colony of common chuckwallas *(Sauromalus ater (=obesus)*, Iguanidae) at 32°C on vermiculite mixed 1:1 by

mass with water. In June 2016, when the eggs began to hatch, we noticed two individuals emerging from a single egg. These hatchlings were approximately half the body mass of their 5 other surviving siblings (twins: 4.37, 4.25 g; other siblings: 8.06 ± 0.20 g). Twinning in iguanid lizards is a rare phenomenon, so we explored whether these twins were mono- or di-zygotic using eight microsatellites developed for the congeneric *Sauromalus varius*, which we previously used to determine population genetic structure of *S. ater (=obesus)*. We compared their genetic similarity with the remaining seven siblings, from which we were able to retrieve useful DNA samples (both alive and deceased), including the parents, using fragment analysis. We also followed growth of all siblings and found that the surviving twin caught up to the body mass and snout-vent-length of its siblings in approximately four months.

0596 Herp Genetics, Saturday 15 July 2017

Audrey Kelly, Karin Pfennig

University of North Carolina, Chapel Hill, NC, USA

Variation in Hybrid Post-metamorphic Survival Drives Patterns of Introgression in Spadefoot Toads

Hybridization—interbreeding between species—is common in the wild and can lead to gene flow between those species (introgression), with varied consequences. Variation in the outcomes of hybridization depends on the nature and extent of gene exchange, which can be influenced by hybrid fitness. Here we investigate variation in hybrid fitness as a driver of patterns of introgression between two species of toad: the Plains spadefoot (*Spea bombifrons*) and the Mexican spadefoot (*Spea multiplicata*). These species experience differential selection for hybridization: *S. bombifrons* benefits from hybridizing in certain habitats, whereas *S. multiplicata* obtains no benefits from hybridization. Hybrid fitness beyond the tadpole stage in the wild is unknown, and could affect gene exchange between *S. multiplicata* and *S. bombifrons*. We performed a cross-sectional analysis of naturally hybridizing populations to measure post-metamorphic selection on hybrids. Tadpoles and adults from the same populations were genotyped at ten species-specific loci. Comparison of genotype data from tadpoles and adults revealed (1) that hybrids have similar survival to pure species individuals on average but (2) that hybrids more similar to *S. multiplicata* have higher survival than intermediate and *S. bombifrons*-like hybrids. Higher survival of *S. multiplicata*-like hybrids is consistent with the direction of introgression in this region (*S. bombifrons* alleles into *S. multiplicata*), suggesting that differential survival across hybrid genotypes may drive patterns of introgression in this system. Future work will compare these results to hybrid survival in another sympatric region where introgression between the species is in the opposite direction.

0898 General Ichthyology I, Sunday 16 July 2017

Christopher Kenaley, Peter Jordan

Boston College, Chestnut Hill, MA, USA

Body-Size Evolution in Ray-finned Fishes (Actinopterygii): Tempo, Mode, and Ecological Correlates

Body size features prominently in nearly every aspect of animal's biology, including several fitness-related parameters such as fecundity, mating success, energy budget, and life span. Thus, explorations of macroevolutionary trends associated with the tempo and mode of size-evolution are important in understanding the diversity of size in ray-finned fishes. Here we use body length data from 1,400 species of extant actinopterygians and the most current and expansive multi-locus phylogeny for the group to evaluate a multitude of models of log-transformed body-length evolution. We found that the tempo of size evolution in ray-finned fishes is explain best by an Ornstein-Uhlenbeck (OU) process, thereby suggesting that size evolves toward a phenotypic optimal value. In addition, to assess which ecological parameters may contribute to size diversity, we gathered distribution and habitat data for all of our included species. Using phylogenetic generalized least squares analysis under both OU and Brownian motion error models, we found that depth and ecoregion explain 60% of the variation in body length. Together, these results suggest that the evolution of body size is influenced by the ecophysiological constraints of habitat preference.

0110 ASIH STOYE ECOLOGY & ETHOLOGY I, Thursday 13 July 2017

Erin Kenison, Rod Williams

Purdue University, West Lafayette, Indiana, USA

Environmental Conditioning goes Swimmingly for Eastern Hellbenders (*Cryptobranchus alleganiensis alleganiensis*)

Translocation programs often work in conjunction with head-start initiatives. However, captive animals are usually deprived of experiences and stimuli that promote behavioral and morphologic development. This leaves them ill-prepared for release, and ultimately, results in lower probability of translocation success. Captive rearing and translocation efforts are underway for eastern hellbender salamanders (*Cryptobranchus alleganiensis alleganiensis*). Yet, many released individuals are naïve to natural conditions and swept downstream or lost during flood events. To combat naïveté and mimic natural conditions in captivity, we reared hellbenders with and without water current for eighteen months. We investigated morphologic plasticity and swim performance as a function of rearing environment. We found conditioned individuals gained weight more slowly and developed leaner bodies. Although positive through time, the stunted growth rates may have been evidence of greater energy expenditure. Even so, we did not find these morphological changes to be detrimental to hellbenders' swimming ability. After three swim trials, conditioned hellbenders were faster to reach the upstream refuge object and had a higher probability of successfully completing the trial.

Moreover, conditioned hellbenders showed distinct evidence of learning over the three swim trials compared to unconditioned hellbenders. We argue that environmental conditioning, specifically the addition of water current to hellbender rearing environments, better acclimates hellbenders to moving water, improves their ability against high flows, and facilitates learning in a variable environment. If these patterns translate when hellbenders are released into the wild, this novel conditioning technique may be advantageous in increasing the success of future translocation projects.

0819 AES Trophic Ecology/Physiology, Friday 14 July 2017

Steven Kessel[1], Joanne Fraser[2], William Van Bonn[1], Jill Brooks[3], Tristan Guttridge[4], Nigel Hussey[5], Samuel Gruber[4]

[1]Shedd Aquarium, Chicago, IL, USA, [2]Ocean Artworks, Boynton Beach, USA, [3]Carlton University, Ottawa, Canada, [4]Bimini Biological Field Station Foundation, Bimini, Bahamas, [5]University of Windsor, Windsor, Canada

Transcoelomic expulsion of an ingested foreign object by a carcharhinid shark

A wild lemon shark (*Negaprion brevirostris*) was observed to expel an ingested foreign object through its body wall, over a minimum period of 435 days. We observed this lemon shark at a recreational diving feeding site off the coast of Jupiter, Florida, on 13 occasions between 6 December 2014 and 14 December 2016. At the final observation, following expulsion we observed this lemon shark with scar tissue and in apparent healthy condition. At minimum, this lemon shark was able to survive for over a year under perforation of its stomach lining, coelom and body wall. This account provides further evidence for the resilience and recovery capabilities of elasmobranch fishes.

0617 Amphibian Biology, Ecology, & Conservation, Sunday 16 July 2017

Ethan Kessler[1], John Crawford[2], Andrew Kuhns[1], Christopher Phillips[1]

[1]Illinois Natural History Survey, Champaign, IL, USA, [2]National Great Rivers Research and Education Center, East Alton, IL, USA

Local and Landscape Drivers of Amphibian Community Composition across Illinois

Amphibian community composition is influenced by local habitat conditions and landscape features, however, identifying what factors drive shifts in amphibian communities is often difficult. Accurate collection of community and habitat data is difficult and inherent correlation within and among community and habitat factors complicates analyses and the interpretation of results. To determine the major drivers of amphibian assemblages in Illinois, our study utilized an occupancy and detectability sampling scheme for larval and adult amphibian presence at 252 ponds throughout the state to identify local and landscape features driving amphibian communities across the

state. For each pond, local habitat variables (e.g. presence of fish) were measured in situ and landscape scale variables (e.g. percent forest within a buffer) were determined using lidar derivatives and aerial photography (both from public sources). We used a multivariate approach to determine what factors shaped amphibian communities and which species were associated with shifts in community composition. After controlling for geographic location (latitude and longitude), the presence of forest and agriculture on the landscape, as well as the presence of fish were major drivers of amphibian community composition. Ultimately, our results provide quantitative evidence of the factors shaping amphibian communities across the landscape and identified the species most affected.

0074 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jin-Koo Kim

Pukyong National University, Busan, Republic of Korea

Introduction of Marine Fish Resources Bank of Korea (MFRBK)

Convention on Biological Diversity was adopted through international consensus for Biodiversity conservation, sustainable use and benefit-sharing of bio-resources in 1992. Thereafter, Nagoya Protocol for access to genetic resources and benefit-sharing was selected in 2010. Based on this, it needs to establish and operate the Bio-Resources Bank in order to effective use of marine organisms in Korea. In this necessity, a total of 14 Marine Bio-Resources Bank were organized under the direction of the Ministry of Maritime Affairs and Fisheries of Korea until 2014. Among them, Marine Fish Resources Bank of Korea (MFRBK) was established in Pukyong National University on December 2013, and is working on collection, deposition, registration, preservation and supply of diverse marine fish in Korea. Until today, we collected a total of 501 fish species and 10,106 specimens, comprising 38 species of big sized fish (with 288 specimens), 60 species of valuable candidate fish (with 1,522 specimens), 18 species of deep sea fish (with 590 specimens), 180 species of subtropical fish (with 2,352 specimens), 69 species of regional fish (with 2,366 specimens), and 237 species of unexploited fish (with 2,984 specimens). The MFRBK is serviced at the web site: http://cms.pknu.ac.kr/mfrbk.

0440 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Richard Kim[1], Brian Halstead[1], Eric Routman[2], Michael Casazza[1], Julie Andersen[3]

[1]U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, CA, USA, [2]San Francisco State University, San Francisco, CA, USA, [3]Midpeninsula Regional Open Space District, Los Altos, CA, USA

Predator-prey Interactions Between the Endangered San Francisco Gartersnake and the Invasive American Bullfrog Predict the Utility of Invasive Species Removal

Introduced species often disrupt established food webs. Some native predators, however, can come to rely on introduced prey. Understanding the net effects of the non-natives on imperiled predators is crucial in planning conservation measures. The invasive American bullfrog (*Lithobates catesbeianus*) can be prey, predators, and competitors for the critically endangered San Francisco gartersnake (*Thamnophis sirtalis tetrataenia*). We examined the seasonal prey use and selection of a *T. s. tetrataenia* population that co-occurs with *L. catesbeianus* in San Mateo County, California. We quantified the snakes' diet from analyzing their fecal DNA and also quantified anuran abundance as available prey. Prey selection varied by snake body size, although 95% credible intervals overlapped zero. If all prey types are equally available, *T. s. tetrataenia* selected *Rana draytonii* (0.96 [0.09->0.99]) more than *Pseudacris sierra* (0.033 [<0.01-0.83]) and *L. catesbeianus* (<0.01 [<0.01-0.14]). We also examined the degree to which the dietary niche between *T. s. tetrataenia* and *L. catesbeianus* overlapped. Stomach contents of the co-occurring *L. catesbeianus* included *T. s. tetrataenia* and *R. draytonii*, and 49% of their diet was composed of *P. sierra*, an important prey species for young T. *s. tetrataenia* in spring. Given the high degree of diet overlap and rare occurrence of *L. catesbeianus* in the *T. s. tetrataenia* diet (and vice versa), the strongest interaction between these species is likely competition. Eradication of *L. catesbeianus* would likely benefit *T. s. tetrataenia* populations by reducing predation pressure on their shared amphibian prey.

0082 NIA BEST STUDENT POSTER; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Courtney King[2], Sebastián Hernández[1]

[1]Veritas Universidad, San José, Costa Rica, [2]The State University of New York at Geneseo, Geneseo, NY, USA

You're gonna need a better software: evaluating morphological and genetic approaches used to identify shark fins

International bodies such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the International Convention on the Conservation of Migratory Species (CMS) have promoted the conservation of several shark species. However, there is evidence that shark fin traders are still exporting mislabeled and unidentified shark fins, including those from regulated species. Our team has found that iSharkFin, the software currently recommended for shark fin identification, is frequently inaccurate. Shark fin samples and photographs were collected from landing sites in Costa Rica, Chile and Peru. Genetic analysis of tissue samples was used to determine the fin species, and images of the same samples were analyzed in iSharkFin. This allowed us to determine the percentage of samples for which the software correctly identified the species. Results were categorized by fin type (dorsal or pectoral), the side from which the fin was viewed, species, and whether the fin was wet or dry. The software was designed to identify wet fins, and as predicted, rates of misidentification were statistically higher for dry fins. However, wet fins of certain species, included those protected under CITES Appendix II, were also misidentified at

high rates. Based on our research, we suggest improvements in software used for the morphological identification of dry and wet fins, to ensure that officers have the tools to identify the species involved in the international shark fin trade.

0561 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Cragen King[1], Philip A. Hastings[2], Adam Summers[3], Samuel P. Iglesias[4], Kevin W. Conway[1]

[1]Texas A&M University, College Station, TX, USA, [2]Scripps Institution of Oceanography, UC San Diego, La Jolla CA, USA, [3]University of Washington, Friday Harbor, WA, USA, [4]Muséum National d'Histoire Naturelle, Paris, France

Clingfishes Tree of Life

The roughly 160 species and 48 genera of clingfishes (family Gobiesocidae) are currently divided between nine subfamilies in a "phenetic" classification scheme proposed over 60 years ago. Though heavily criticized, this classification is still widely utilized and reflects the paucity of phylogenetic studies conducted on these small and cryptic marine fishes. We provide an overview of an ongoing and international collaborative effort to decipher the phylogenetic relationships of the clingfishes (Family Gobiesocidae) using a combination of molecular (mitochondrial [CO1, 12S] and nuclear [zic1, myh6, ENC1, Gylt & SH3PX3] sequence data) and morphological characters (derived largely from osteology). We present preliminary phylogenetic hypotheses for 81 species of gobiesocid, representing 35 genera and all nine subfamilies. Preliminary results indicate that four of the nine subfamilies (Aspasminae, Diademichthyinae, Diplocrepinae and Trachelochisminae) are not monophyletic. Additionally, preliminary results suggest that many genera also are not monophyletic (e.g., *Arcos*, *Cochleoceps*, *Gobiesox*, *Lepadicthys*, *Lepadogaster*) and many species display deep genetic structure at mitochondrial loci suggesting the presence of species complexes harboring cryptic diversity. Our overall goal is to provide the foundation for a new classification for the Gobiesocidae that is based on phylogenetic hypotheses and a framework for the future investigation of the many interesting anatomical and ecological characters of clingfishes.

0656 AES Conservation & Management II, Saturday 15 July 2017

Irene Kingma, Paddy Walker, Linda Planthof

Dutch Elasmobranch Society, Amsterdam, The Netherlands

How to protect Caribbean sharks: two recent case studies.

There is global consensus that sustainable management of elasmobranch is needed to prevent further decline of populations. But there is no silver bullet to ensure all harvests

are sustainable and unwanted mortality is reduced to zero. Sharks and rays live in a myriad of different ecosystems and with many species being migratory, changing the laws in one country is not enough. The best available scientific knowledge is needed to ensure management achieves the protection of the most vulnerable species and ensures sustainability in the long term. We present our work on two policy frameworks in the Wider Caribbean Region, one linked to environmental legislation, the other to fisheries management. In March 2017, the 15 nations that are signatories to the Specially Protected for Areas and Wildlife (SPAW) Protocol of the Cartagena Convention, the only cross-border legislative tool for the Caribbean, agreed to list 8 species of elasmobranchs to ensure protective management. Simultaneously the Food and Agriculture Organisation of the United Nations developed a Regional Plan of Action for sharks for the Wider Caribbean Region. With these tools now in place new challenges arise for implementation phase to effect real change in the ocean.

0702 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kevin Kingsland[1], Brian Small[2], Michael Lydy[1], Edward Heist[1]

[1]*Southern Illinois University, Carbondale, IL, USA,* [2]*Univerity of Idaho, Hagerman, ID, USA*

Effects of heat stress on growth rate in juvenile Missouri River pallid sturgeon (*Scaphirhynchus albus*) from different thermal regimes

Pallid sturgeon (*Scaphirhynchus albus*) is a large, long-lived, endangered fish species which spans the entire Missouri River (MOR), covering nearly 7° of latitude and a considerable climate range. A captive breeding program supplements pallid sturgeon throughout the MOR. Genetic analyses based on presumably neutral DNA microsatellite markers identified distinct stocks in the upper and lower MOR. Currently stocking is prohibited between upper and lower MOR stocks. However, it is not known whether there are climate-induced adaptive differences between the stocks. We measured growth rate of young-of-year (YOY) pallid sturgeon under elevated rearing temperature. YOY fish were produced from three parent populations: 1) wild fish from upper MOR; 2) wild fish from lower MOR and; 3) captive-reared parents from the upper MOR captive broodstock program. Multiple families from each population were included to control for among-family differences in performance. Fish acclimated at 20°C were randomly assigned to 20°C (control) or 28°C (heat stress) for six-week growth trials. Fish were measured prior to and after the six-week trials to determine whether there were different responses to heat stress among lower MOR, upper MOR, and potentially-domesticated offspring of hatchery-reared captive broodstock. Observed growth rates will serve as a baseline for future studies of gene expression following a 48-hour heat stress challenge, using fish from these same groups. Identification of differentially expressed genes between stocks may provide insight into how endangered fish populations may adapt to warming climate.

0749 ASIH STOYE ECOLOGY & ETHOLOGY II, Thursday 13 July 2017

Lauren Kircher[1], Jessica Noble[1], Joy Young[2], John Baldwin[1]

[1]Florida Atlantic University, Davie, FL, USA, [2]Florida Fish and Wildlife Conservation Commission, Tequesta, FL, USA

Hydrologic Changes in the St. Lucie Estuary and Implications for Snook Movement Patterns

Many animals use environmental cues to initiate movement to search for a habitat where the conditions best optimize their fitness. Common snook (*Centropomus undecimalis*), a tropical euryhaline sportfish, likely use freshwater flow as a spawning cue to move between brackish rivers and nearshore marine environments during the summer months. Higher salinity waters are vital to spawning to ensure egg buoyancy and sperm motility. Management of Lake Okeechobee controls water supply for environmental, agricultural, and public needs. In wet years, Lake Okeechobee releases large pulse discharges of freshwater to the St. Lucie River and estuary to avoid flooding during storm events. While common snook are relatively tolerant to salinity (0-40ppt), there are osmoregulatory costs associated with changing salinities and movement, which may result in decreased immunity, growth, and reproductive success.To understand the effects of changing water conditions on snook movement, we compare changes in water condition patterns (salinity, flow, rainfall, and temperature) in St. Lucie estuary using several environmental open-source databases over multiple years. Passive acoustic telemetry is used to track movement which is then plotted in ArcGIS. Snook should show movement away from cold temperatures and low salinities. The influence of freshwater flow is debated, but we expect more prolonged movement during increased flow. Although this study focuses on large scale movement, it will later be examined for influences on short-term movements, particularly during high pulse events. Future research will model the influences of water parameters on movement to quantify their relationships and further inform management.

0422 Fish Morphology, Saturday 15 July 2017

Matthew Kolmann, Adam Summers

University of Washington, Friday Harbor, WA, USA

It's a hard-knock life - lepidophagy, armor, and injury in piranhas and their allies

The concept of armor in fishes has dogmatically been applied to understanding predator-prey dynamics regarding piscivory, to the exclusion of some other possibilities. We argue that for some armored taxa, like piranhas, intraspecific aggression and defense from confamilial parasitism may be more of an evolutionary driver for armor than defense against predation. Piranhas are frequently conjured in the public mind as aggressive pack hunters, but growing evidence has refuted stories of their savagery. We used micro-computed tomography (μCT) to examine osteological characters in 25+

species of piranhas and their allies. We found both a high incidence of healed and healing injuries, as well as undescribed diversity of armoring of the body, particularly the ventral keel and fin margins. Piranhas will opportunistically 'mutilate' prey fishes, including other piranhas, by removing fin rays and scales over chunks of flesh. This is particularly true of independent evolutions of scale eating by *Catoprion mento* and *Serrasalmus maculatus*. These fishes attack other larger piranhas like *Pygocentrus* and *S. marginatus*. Aggressive behaviors towards confamilials are also evidenced during the breeding season: some of nest-guarding piranhas like *S. marginatus* and *P. nattereri*, actively chase away other fishes and piranhas. Although piranhas may not be more aggressive than other characiform fishes, their dentition and powerful bites require that even moderately aggressive behaviors can lead to potentially mortal wounds.

0342 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Matthew Kolmann[2], Kyle Newton[1], Adam Summers[2]

[1]Florida Atlantic University, Boca Raton, FL, USA, [2]Friday Harbor Labs, University of Washington, Friday Harbor, WA, USA

Diffusible Iodine Contrast Enhanced micro-CT scanning as a method to visualize soft tissue anatomy in elasmobranch fishes

Use of micro-computed tomography scanning (μCT) has revolutionized modern studies in comparative anatomy, systematics, biomechanics, and functional morphology. The combination of μCT with 3D printing is an affordable method to quickly generate teaching models, experimental set ups, and morphological facsimiles. However, μCT is not effective at imaging soft tissues such as fat, muscle, and nervous tissue, which are better suited to methods like magnetic resonance imaging (MRI). We modified the diceCT protocols pioneered by Gignac & Kley (2014), and describe methods for using dilute Lugol's solution (I_2KI) to stain chondrichthyan soft tissues for visualization using μCT. Elasmobranch tissues stain adequately after shorter durations and with lower concentrations of Lugol's solution than has been reported for other vertebrates. Dorso-ventrally compressed batoid fishes stain faster than more fusiform sharks and chimaeras, which is unsurprising given the smaller diffusion distance and higher surface area:volume ratio. Immediate fixation of specimens in buffered formalin is critical to obtaining quality images of elasmobranch soft anatomy, particularly for nervous tissue. We caution against using frozen specimens as soft tissues will degrade or desiccate even prior to eventual fixation. We demonstrate the efficacy of visualizing soft tissues with iodine-enhanced computed tomography (ieCT) across a broad array of chondrichthyan fishes and have produced images of nervous and muscle tissue.

0420 AES Morphology, Sunday 16 July 2017

Matthew Kolmann[1], Fernando Marques[2], Mason Dean[3], James Weaver[4], Nathan Lovejoy[5]

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An adaptive ray-diation? Feeding and dietary diversification in freshwater stingrays.

Freshwater stingrays invaded the prehistoric Amazonian mega-lagoon during the Miocene, and now number 30+ species. They fill an array of trophic niches across South American river basins, from piscivory and insectivory, to mollusk-feeders and crustacean specialists. This ecological diversity coupled with high species richness are noteworthy in elasmobranchs and make the family an apt study system for addressing macroevolutionary questions. We use a 7-gene, fossil-calibrated molecular phylogeny to address whether potamotrygonid stingrays represent an adaptive radiation, and whether this radiation is driven by ecological diet diversification. The evolution of novel dietary niches changed the adaptive landscape of potamotrygonid feeding ecology and morphology, notably with the evolution of piscivorous *Heliotrygon* and *Paratrygon*, mollusk-feeding *Potamotrygon* species (*P. leopoldi* and *P. henlei*), and the insect-feeding specialist *Potamotrygon orbignyi*. Although freshwater rays show an initial burst of ecomorphological disparity, the diversification of the genus *Potamotrygon* swamps the original signal. This more recent diversification event is contemporaneous with the channelization of the lower Amazon and the rise of crustacean-feeding and mollusk-feeding rays in the clearwater Tapajos, Tocantins, and Xingu basins. Our data support the controversial idea that adaptive radiations can occur on a continental scale. We suggest that multiple evolutionary drivers, both ecological and vicariant, have contributed to the evolution of freshwater rays in the South American continent. There remains substantial diversity to be described in South American freshwater rays and this story still has much to tell us about the workings of adaptive radiations.

0887 Lightning Talks II, Friday 14 July 2017

Michelle Koo[1], David Blackburn[2], David Cannatella[3], Alessandro Catenazzi[4], Carol Spencer[1], Vance Vredenburg[5], David Wake[1], Deanna Olson[6]

[1]University of California, Berkeley, CA, USA, [2]University of Florida, Gainesville, FL, USA, [3]University of Texas, Austin, TX, USA, [4]Southern Illinois University, Carbondale, IL, USA, [5]San Francisco State University, San Francisco, CA, USA, [6]USDA Forest Service, Corvallis, OR, USA

AmphibiaWeb's Response to the Global Emerging Infectious Disease Crisis in Amphibians

Amphibians comprise the most endangered group of vertebrates, with about one-third of the world's amphibian species under threat of extinction. Chytridiomycosis, an emerging infectious disease, is especially devastating to many amphibian species, infecting all three living orders (*Batrachochytrium dendrobatidis*, or Bd) or specifically salamanders (*B. salamandrivorans*, or Bsal). One of the founding goals of AmphibiaWeb is to facilitate research in amphibian biodiversity and emerging infectious disease by providing primary information on amphibian biology, taxonomy, and conservation including integrating data from VertNet, producing species accounts, tracking and mapping new species and more. By harnessing informatics tools and networks, we aim to facilitate collaborative efforts nationally and internationally. This is particularly critical to understanding the disease dynamics across many species and in a variety of habitats through time. In collaboration with the US Forest Service, AmphibiaWeb launched a new portal to track Bd and Bsal around the world (https://amphibiandisease.org) but with the aim to facilitate monitoring efforts and data-gathering in the US and Canada where Bsal is anticipated. The portal enables users to find and reference archived datasets in publications, as well as easily download and reuse datasets from previous research. Records can be queried and viewed (as both a list and on a map) by sample, project, taxon, and both disease and morbidity status. Using this portal, researchers can coordinate and collaborate in efforts to understand disease impacts on amphibian biodiversity, including privately sharing data on projects prior to publication.

0048 AES Conservation & Management II, Saturday 15 July 2017

Olga Koubrak

Dalhousie University, Halifax, NS, Canada

A Future for a Forgotten Predator: An Assessment of International Legal Frameworks for Protection and Recovery of the Caribbean Sawfishes *Pristis pristis* and *Pristis pectinata*

Two species of sawfish, *Pristis pristis* and *Pristis pectinata*, used to be common in the coastal waters of the Caribbean Region. However, due to direct and incidental fishing pressures, national and international trade in body parts, and habitat loss, the populations of these ecologically and culturally significant species have drastically declined. This presentation will review global and regional, binding and non-binding legal instruments in effect in the Caribbean Region that encourage states to protect biodiversity in general or address identified threats to sawfishes specifically. The presentation will focus on the obligations assumed by the states that were identified as priority for sawfish conservation in the Region in the 2014 IUCN Shark Specialist Group publication "Sawfish: A Global Strategy for Conservation." Despite the presence of obligations that call upon the states to adopt sawfish conservation and habitat protection measures, low numbers of these fishes in the Caribbean suggest deficiencies in the operation and implementation of the reviewed instruments. The presentation will conclude with a discussion of recommendations such as review and amendment of

management plans for protected areas established under international agreements, increased involvement of intergovernmental organizations in endangered marine species protection in the Region, engagement of non-governmental organizations working on species that share threats and habitats with sawfishes, as well as involvement of the academic community in order to improve implementation of the international obligations and secure a future for these remarkable species.

0317 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Wael Kouched[1], Abdallah Hattour[2]

[1]National Institute of Marine sciences and Technology, Mahdia, Tunisia, [2]National Institute of Marine Sciences and Technology, Salammbo, Tunisia

Spatial Distribution of Tuna Larvae in the Tunisian Waters in Relation with Environmental Parameters

Spatial distribution and ecology of the larvae of tuna species (Atlantic bluefin tuna (*Thunnus thynnus),* albacore *(Thunnus alalunga),* bullet tuna *(Auxis rochei)* and little tuna (*Euthynnus alletteratus)*) were studied during an ichthyoplankton survey carried out in three different areas of Tunisian waters (Northern and Northeast coasts, and the Gulf of Gabes), during the spawning season of bluefin tuna. The main objectives of this survey were to provide information on tuna larvae distribution in Tunisian waters in relation to the environmental parameters. In each survey, regular sampling grids were sampled. CTD casts and oblique Bongo 60 plankton tows were carried out. A total of 496 larvae of Atlantic bluefin tuna, 2684 of bullet tuna, 121 of little tuna and 67 larvae of albacore were identified. Larvae of bullet tuna showed the more widespread distribution, being found at both inshore and offshore stations. Whereas, larvae of the large tuna species (Atlantic bluefin tuna and albacore), were mainly recorded at offshore stations, suggesting that spawning possibly takes place mainly near the shelf break. According to the physical parameters examined, our results indicate that the input of recent surface Atlantic water (AW) masses, play a key role in the spawning strategy of tuna species, whose larvae were mainly caught in the mixed waters resulting from the interaction between recent AW and resident AW, as demonstrated by their preference for salinity values between 36.9 and 37.75.

0592 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Trevor Krabbenhoft, Thomas Dowling

Wayne State University, Detroit, MI, USA

Development of Genetic Markers for Sex Determination, Parentage Assessment, and Population Genetics of Razorback Sucker, *Xyrauchen texanus* (Cypriniformes: Catostomidae)

We present results from a RAD-seq study of 192 individual razorback (*Xyrauchen texanus*) and flannelmouth suckers (*Catostomus latipinnis*). RAD-seq data were used to identify single nucleotide polymorphisms ("SNPs") for parentage analysis, and hybridization and population genomic studies of the Federally Endangered razorback sucker. Samples included adult males and females, which allowed us to identify potential sex-specific markers for genetic sex identification. We map putative sex-linked markers in razorback to the zebrafish (*Danio rerio*) genome to test whether a previously identified sex-determining region on chromosome 4 in zebrafish is also found in catostomids.

0586 Fish Genetics, Saturday 15 July 2017

Trevor Krabbenhoft[1], Daniel Yule[2], Gerald Smith[3], Wendylee Stott[4], Thomas Dowling[1]

[1]Wayne State University, Detroit, MI, USA, [2]Lake Superior Biological Station, Ashland, WI, USA, [3]University of Michigan, Museum of Zoology, Ann Arbor, MI, USA, [4]Michigan State University, East Lansing, MI, USA

Transcriptomics Identifies Genes Associated with Phenotypic Differences among Great Lakes Ciscoes (*Coregonus* spp.)

We sequenced expressed genes ("transcriptome") from the heads of eight individuals from each of the four species of ciscoes found in Lake Superior (*Coregonus artedi*, *C. hoyi*, *C. kiyi*, and *C. zenithicus*). This approach identified sequence polymorphisms (SNPs) within many expressed genes. A number of these SNPs were taxonomically informative (e.g., $F_{ST} > 0.20$) and comparison annotated fish genomes indicated that many of these genes are associated with lipid metabolism (associated with buoyancy and depth preferences) and head shape development (associated with trophic morphology). Patterns of variation in the transcriptome were largely concordant with morphological differences among samples. High-F_{ST} SNPs in genes associated with functional phenotypic variation provide candidates for local adaptation in the cisco species flock. Future studies will be aimed at validating these results with larger sample sizes and more detailed functional genetic analyses.

0519 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Erika Krahl[1], Aaron Schrey[2], Jingou Tong[3], Edward Heist[1]

[1]Center for Fisheries, Aquaculture & Aquatic Sciences, Southern Illinois University Carbondale, Carbondale, IL, USA, [2]Department of Biology, Armstrong State University, Savannah, GA, USA, [3]Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, Hubei, China

Differentiating Between Invasive and Native Populations of Bighead and Silver Carp Using MS-AFLP

Invasive species often face the challenge of overcoming reduced genetic diversity as a result of the founder effect and subsequent population bottlenecks. Epigenetic modifications, such as DNA methylation, have been shown to contribute to phenotypic variation and may be responsible for the ability of invasive species to rapidly adapt to novel environments despite reduced genetic diversity. Silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*H. nobilis*) are two species of invasive carp native to freshwater rivers in eastern Asia. They were introduced to the United States in the early 1970s, and both species have quickly become established in many rivers throughout the United States, including the Illinois River. These two species of invasive Asian carp pose a significant threat to native biota, as well as to lucrative trout and salmon fisheries in the Great Lakes. To test whether the success of silver and bighead carp in the United States is due to increased epigenetic variation, methylation sensitive AFLP (MS-AFLP) markers were used to screen for the presence of DNA methylation. Variation in methylation states between invasive populations of silver and bighead carp from the Illinois River were then compared to populations of carp from the Yangtze, Pearl, and Gan Rivers in their native China.

0217 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Friday 14 July 2017

Alexander Krohn[1], Eveline Diepeveen[2], Ke Bi[1], Erica Rosenblum[1]

[1]University of California, Berkeley, Berkeley, CA, USA, [2]Delft University of Technology, Delft, South Holland, The Netherlands

Local Adaptation Does Not Lead to Genome-Wide Differentiation in Lava Flow Lizards

Adaptation to novel environments can lead to genome-wide divergence when reproductive isolation accumulates between differentially adapted populations. However, local adaptation can also occur without the accumulation of reproductive isolation and correlated genome-wide divergence. Here we study natural replicates of three lizard species on lava flows in the US Chihuahuan desert to investigate the relationship between local adaptation and genomic differentiation. We compare lava and non-lava populations on three different lava flows, which range in age from 5,000 to 750,000 years-old. We collected phenotypic data and find that, although all populations

were reported as melanistic in the literature, only lizards on the youngest and most homogeneously dark lava flows are significantly darker than surrounding non-lava flow lizards. Lizard coloration thus appears to lighten over time as lava flows become older and more interspersed with light sand. However, despite local adaptation to lava flow environments, none of the population comparisons show genome-wide differentiation among habitat types. We collected RADseq data and find only patterns of isolation by distance without any added genetic discontinuities based on habitat transitions. Thus, in this system, genome-wide differentiation does not accompany local adaptation. We discuss our results in the light of peripatric color evolution, the genetics of adaptation and selection-migration balance.

0487 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Chelsea Kross, JD Willson

University of Arkansas, Fayetteville, AR, USA

Effects of non-native vegetation on larval development of a prairie specialist, the Crawfish Frog (*Lithobates areolatus*)

Land-use change is a primary cause of amphibian population declines. Many natural landscapes have been altered for agricultural or urban land-use, resulting in loss or degradation of habitat. Furthermore, nearby land-use change can impact intact breeding wetland vegetation composition. However, the mechanisms by which vegetation alteration impacts amphibian demography are poorly understood, particularly for prairie-associated species. We used a mesocosm approach to investigate how vegetation composition (native prairie or non-native agriculture-associated vegetation [tall fescue grass; *Festuca arundinacea*]), surrounding breeding wetlands and timing of oviposition affected development of the Crawfish Frog (*Lithobates areolatus*), a prairie specialist of conservation concern. Specifically, we measured survival, time to metamorphosis, and size and mass at metamorphosis of larvae added to tanks either 7- or 22-days post-litter addition. We found that larval survival differed between litter types in the 7-day oviposition treatment, with nearly 100% mortality in the fescue grass treatments. Conversely, survival rates were similar across litter types in the 22-day treatment (~43%), and larvae in fescue litter metamorphosed more quickly and were larger post-metamorphosis than larvae raised in prairie vegetation. To investigate mechanisms for mortality in the fescue grass treatment, we conducted a subsequent experiment examining the effects of litter type on dissolved oxygen concentrations. We found very low DO concentrations (<2.0 mg/L) in fescue treatments persisting up to two weeks post-litter addition. These results suggest that amphibian breeding ponds in agricultural landscapes can support successful breeding, but could be ecological traps when timing of inundation and breeding occur simultaneously.

0078 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Ariel Kruger, Peter Morin

Rutgers University, New Brunswick, NJ, USA

Green Frogs Harbor Microbes that Inhibit *Batrachochytrium dendrobatidis*, a Deadly Fungal Pathogen

The cutaneous microbial community can influence host health in amphibians exposed to *Batrachochytrium dendrobatidis* (*Bd*), a fungal pathogen that is a main cause of current amphibian declines. Bacteria isolated from amphibian skin have been shown to confer disease resistance by inhibiting *Bd* growth. Identifying anti-*Bd* cutaneous microbes for use in bioaugmentation strategies is increasingly important with the spread of *Bd.* We aimed to determine if green frogs harbored bacterial strains that inhibit *Bd in vitro* and whether the presence of these microbes varied by site. We swabbed and cultured microbes from the skin of green frog adults and tadpoles at three sites that varied in pH. Bacterial colonies were used in *in vitro* assays to determine if isolated bacteria could inhibit *Bd.* Tadpoles and adult green frogs at all sites harbored cutaneous microbes that completely inhibited *Bd* growth *in vitro*. Green frog adults and tadpoles at the near-neutral pH site harbored the largest number of unique isolates (ANOVA, p=0.11). At each site, tadpoles harbored a higher frequency of inhibitory isolates than adults, but the differences were not significant across sites (ANOVA, p=0.53). In this study, we identified bacteria that could be used as probiotics applied to the skin of susceptible individuals to confer disease resistance and showed that sites that vary in pH do not differ in the frequency of inhibitory isolates present on amphibian skin. Understanding how the cutaneous microbiome changes across sites and life stages will inform conservation strategies for protecting amphibians against *Bd*.

0156 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Kole Kubicek[1], Ralf Britz[2], Kevin Conway[1]

[1]Texas A&M University, College Station, TX, USA, [2]Natural History Museum, London, UK

Ontogeny of the Pectoral Spine in Siluroid and Loricarioid Catfishes

Catfishes (Siluriformes) are characterized by several skeletal autapomorphies including the modification of the anteriormost pectoral-fin ray into a lockable spine. This pectoral-fin spine exhibits wonderful variation in size, shape and ornamentation (including serrations, denticulations and presence of odontodes). Numerous studies have investigated different aspects of the spine in adult stages, including how it locks into place, how it grows through the addition of distal segments and, how it is involved in the production of sound in some taxa. Though well studied in adult stages, relatively little information is available on the early development of the catfish pectoral-fin spine. In order to further our understanding of this unique structure, we document and compare the earliest stages of pectoral-fin spine formation in representative siluroid

(*Noturus gyrinus* and *Ictalurus punctatus*) and loricarioid (*Corydoras panda* and *Ancistrus* sp.) catfishes using a combination of clearing and double staining and serial sectioning. Despite being quite different in the adults, formation of the pectoral-fin spine appears to follow a common ontogenetic pathway independent of the species.

0325 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES SYMPOSIUM – APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Shannon Kuznar[1], Hector Guzman[2]

[1]IPFW University, Fort Wayne, IN, USA, [2]Smithsonian Tropical Research Institute, Panama City, Ancon, Panama

Variation in Sensory Morphology of Scalloped Hammerhead Sharks *Sphyrna lewini* and Trophic Implications

Though the variation in the design of the shark is vast, few iterations are as bizarre or recognizable as the hammerhead's laterally expanded and dorsoventrally flattened heads, termed a "cephalofoil." The uniqueness of this structure among sharks has led to many theories positing its purpose, for instance, that the laterally positioned eyes and nostrils allow for greater sampling ability (klinotaxis) in this family of sharks. In order to assess intra-specific variation of gross morphology, which would identify the conserved or more variable features associated with sensory perception, the external features of the olfactory, optic and electrosensory systems of scalloped hammerheads, *Sphyrna lewini*, were analyzed. Thirty-two juvenile scalloped hammerhead heads were obtained from Panamanian fishermen and photographed for later analysis with ImageJ, and a small dermal tissue sample was saved for a δN15 and δC13 stable isotope analysis to assess trophic level. Preliminary results from multi-dimensional scaling indicate a high degree of similarity among the features that maximize possible sampling area (ex. Maximum Narial Distance) and among the features associated with more direct access of sensory information (ex. light, chemical traces) to receptor organs (ex. Narial Length or Eye Diameter), and both of these groups appear distinct from each other. This would seem to indicate a trade-off on the individual level between sensitivity-favoring and resolution-favoring individuals. The results from the stable isotope analyses will be included when they are available. An additional ontogenetic parameter will also be assessed if any adult *S. lewini* are collected by the time of presentation.

0332 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brianna Ladd, Jaime Alvardo-Bremer

Texas A&M Galveston, Galveston, TX, USA

Microsatellite Discovery in the Common Shovelnose Ray (*Glaucostegus typus*) using Massive Parallel Sequencing Data

The common shovelnose ray is a species of guitarfish found in the Indo West Pacific and is considered threatened by the IUCN redlist. The first documented successful live birth at the downtown aquarium in Houston, Texas yielded 11 stillborn pups with one female and two males of sexual mature size occupying the tank. This study is employing next generation sequencing technologies to identify any genetic polymorphisms that can be amplified using PCR. Primers for microsatellite markers are being used to determine paternity of the pups and to establish whether this species exhibits multiple paternity. Double digest-restriction associated DNA sequencing (ddRAD) was performed on one of the pups and bioinformatics analysis resulted in the identification of thousands of microsatellites. A panel of 15 microsatellites was selected based on certain criteria of optimality, and corresponding primer pairs were developed *in silico* using the QDD 3.1 software using a four step pipe-line in sequence. Additional primer pairs will be developed and tested on various other species of elasmobranchs.

0636 Lizard Conservation, Saturday 15 July 2017

Travis LaDuc[1], Brad Wolaver[1], Ben Labay[2], Jon Paul Pierre[1], C. Michael Duran[3], Toby Hibbitts[4], Wade Ryberg[4], Ian Wright[1], Matt Fujita[5], Corey Roelke[5]

[1]University of Texas at Austin, Austin, TX, USA, [2]Siglo Group, Austin, TX, USA, [3]The Nature Conservancy, TX, USA, [4]Texas A&M University, College Station, TX, USA, [5]University of Texas at Arlington, Arlington, TX, USA

Unraveling the Natural History of the Enigmatic Spot-tailed Earless Lizard (*Holbrookia lacerata*) through Collaborative Research

Little natural history data exists for the wary and infrequently seen Spot-tailed Earless Lizard (*Holbrookia lacerata*). In 2011, the US Fish and Wildlife Service (FWS) found substantial information that listing this species may be warranted. In 2013, the Texas Legislature earmarked money for research studies, through a program in the office of the Texas Comptroller of Public Accounts (TCPA), on species awaiting FWS listing determination. A group from The University of Texas at Austin and The Nature Conservancy were awarded one of the first grants under this new program to work on *Holbrookia lacerata*. Work initiated in 2014 focused on lizard surveys and creating models of lizard habitat and fragmentation of habitat. Because of the potential impacts of a future FWS listing of the lizard species, a species working group composed of stakeholders was organized by the TCPA to provide a direct line of communication between researchers and stakeholders. Following discussions within this group, additional data gaps were identified and approved for additional research funding. Collaborators from Texas A&M University and The University of Texas at Arlington have joined the group to expand field surveys and initiate genetic work. Studies on lizard diet and morphology as well as models projecting future habitat/development have been initiated. An invitation from the FWS to the research group to lead the compilation of the Species Status Assessment for *Holbrookia lacerata* represents a significant step towards transparency and a paradigm shift in the FWS listing process.

0398 SSAR SEIBERT ECOLOGY II, Thursday 13 July 2017

Stephanie Lamb, Eric Liebgold

Salisbury University, Salisbury, MD, USA

Estimating Habitat and Population Parameters of Spotted Turtles (*Clemmys guttata*) on the Delmarva Peninsula

Habitat loss, habitat fragmentation, and the pet trade have led to the decline of many reptilian species, including spotted turtles (*Clemmys guttata*), which is a species of conservation concern in eastern North America. Little is known about populations of these turtles, including population sizes and habitat preferences. If the populations are small, this can cause: sex ratio biases, allee effects, increased nest predation, as well as inbreeding depression or genetic drift. I used mark-recapture methodology to study four populations of *C. guttata* on the Delmarva Peninsula in Maryland and Delaware. Program MARK was used to determine whether the encounter probability of *C. guttata* depends on sex or date, as well as, determines the model with the highest likelihood to estimate population size and sex ratio. I also analyzed habitat preferences, which is vital to understand as *C. guttata* is a habitat specialist. I found that pH, dissolved oxygen, and salinity did not affect *C. guttata* numbers, at least in the range of conditions we tested. These habitat parameters were also used to determine if there is an effect on the number of turtles captured in each breeding pond and the sex ratio. Population sizes were mostly small, with sex ratios varying throughout the season in breeding ponds. These results were used to discuss the implications for the future conservation status of *C. guttata* and how and where *C. guttata* should be managed on the Delmarva Peninsula.

0318 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Dirk Michael Lang[1], Maria del Mar Romero-Aleman[2], Maximina Monzon-Mayor[2]

[1]University of Cape Town, Cape Town, South Africa, [2]University of Las Palmas, Gran Canaria, Spain

Axon Regeneration in the Visual Pathway of the Canary Island Lizard, *Gallotia galloti*

Unlike mammals, many anamniotic vertebrates possess remarkable capacity for tissue repair and regeneration, including the central nervous system (CNS). Teleost fish and urodele amphibians can regenerate severed axons throughout the CNS, while axon regeneration in adult anurans appears restricted to the optic pathway. In reptiles, however, there is a paucity of data on post-injury processes in the CNS. We therefore studied regeneration of retinal ganglion cell (RGC) axons in the visual pathway of the Canary Island lizard, *Gallotia galloti*. This species has a well-developed visual system, allowing for easy experimental manipulation of the optic nerve and behavioural testing. Using anatomical tracing techniques and immunohistochemical analysis, we detected

first signs of re-growth of RGC axons two months after optic nerve transection (ONS). The axon regeneration process continued for the entire observation period of up to two years. Partial recovery of behavioural responses to visual stimuli was observed by one year after ONS. These observations suggest successful axon regeneration, but with an unusually prolonged time course. Against this background, we also studied the expression of neurite-growth inhibitory (NI) proteins, known to prevent CNS axon regeneration in mammals. Our findings indicate that major NI proteins are present, but fail to inhibit RGC axon re-growth in the lizard visual pathway. Up-regulation of axon growth-promoting extracellular matrix proteins (laminin and fibronectin) during the regeneration process was observed and may contribute to successful RGC axon regeneration in *Gallotia galloti*, making this lizard an interesting model for the study of CNS repair.

0674 Herp Environment, Saturday 15 July 2017

Michael Lannoo[1], Rochelle Stiles[2]

[1]*Indiana University School of Medicine, Terre Haute, IN, USA,* [2]*San Francisco Zoo, San Francisco, CA, USA*

Effects of Short-term Climate Variation on a Long-lived Frog

Amphibians have long been considered sensitive indicators of environmental health, and amphibian body condition indices offer a high-resolution metric for tracking this relationship. At mid-continental sites, climate change involves temperature and precipitation extremes with rapid shifts. Recent research shows the effects of climate variation can vary at different temporal scales, and at small scales can drive selection. Here, we address the response of Crawfish Frogs (*Lithobates areolatus*), a long-lived frog, to short-term variations in temperature and precipitation. We assess climate using the Palmer Drought Severity Index (PDSI), and assess body condition using the scaled mass index (SMI). Over the seven years of this study, PDSI values were not correlated with date of first breeding ($r^2 = 0.36$, $P = 0.15$) or with date of peak breeding ($r^2 = 0.11$, $P = 0.47$), but were highly correlated with the date frogs exited breeding wetlands ($r^2 = 0.93$, $P < 0.001$) and, consequently, with length of breeding period ($r^2 = 0.98$, $P < 0.001$). SMI values ranged from an annual average of 90 g to 118 g in gravid females, and from 98 g to 125 g in pre-breeding males. Differences in SMI were positively correlated with PDSI values four months prior to breeding ($r^2 = 0.57$; $P = 0.048$). Fecundity also varied with PDSI, with an average difference in fecundity between wet and dry years of 2,662 eggs per female. This translates into an estimated difference of 137 breeding adults recruited into this population between wet and dry years.

0414 Lizard Ecology, Sunday 16 July 2017

Matthew Lattanzio

Christopher Newport University, Newport News, Virginia, USA

Cool and Connected: The (Spatial) Thermal Ecology of a Montane Lizard

Laboratory data on the thermal sensitivity of performance traits are often used to provide insight into the fitness consequences of variable environmental conditions in nature. However, for territorial lizards exploiting thermally-heterogeneous habitats, individuals should vary in their ability to successfully exploit preferred thermal resources, favoring a population spatial structure where lizards may either cluster centrally around those resources or occupy more-isolated, peripheral areas. Consequently, those peripheral lizards should experience differing environmental conditions compared to centrally-positioned members of their population, which may ultimately affect their body temperatures (Tb) and the form of their thermal reaction norms. I addressed these considerations for adults of a territorial montane lizard species, *Sceloporus jarrovii*, with respect to the thermal sensitivity of their maximum bite force. In general, centrally-located lizards had smaller heads and lower maximal bite force and Tb values compared to lizards on the population periphery. My thermal performance curves revealed that bite force increases with head size, and central lizards had a wider performance breadth than peripheral lizards. Optimal bite force occurred at a Tb similar to that for other physiological traits, but also fell below their preferred Tb. Interestingly, only central lizards exhibited the cooler Tb values sufficient to attain their maximal performance capacity. In contrast, the higher Tb values and narrower performance breadth of peripheral *S. jarrovii* lizards may enhance their susceptibility to environmental variability. I frame my findings with respect to other ecological data on this population to highlight the potential influence of socio-spatial dynamics on a species' thermal physiology.

0435 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kayla Lauger, Erika Nowak, Scott Nichols

Northern Arizona University, Flagstaff, Arizona, USA

Preliminary Hematology Assessments in Narrow-headed Gartersnakes (*Thamnophis rufipunctatus*)

We examined hematology and plasma biochemistry parameters in captive populations of narrow-headed gartersnakes (*Thamnophis rufipunctatus*), focusing on blood cell types that typically serve as indicators of infection. *T. rufipunctatus* is a federally threatened species with established breeding facilities to aid in species recovery. However, captive individuals in geographically distinct breeding facilities have had multiple incidences of infection, sometimes leading to mortality. Erythrocytes, leukocytes (e.g., lymphocytes, azurophils, heterophils etc.) and thrombocytes are often used as indicators of disease in reptiles as their relative numbers change in response to different kinds of infection. Currently, no reference ranges exist for hematological values in *T. rufipunctatus*, which warrants cross-species comparisons. As such, we compared peak-season (May-August) hematological values in captive *T. rufipunctatus* to reference values for wild giant

gartersnakes (*T. gigas*) and valley gartersnakes (*T. sirtalis fitchi*) as a preliminary assessment. We found that 1) median values for lymphocytes in *T. rufipunctatus* were 25% lower than *T. gigas*, and 50% lower than *T. s. fitchi*; 2) median values for azurophils for *T. rufipunctatus* were 33% lower than in *T. gigas*; and 3) median values for heterophils were 25% lower in *T. rufipunctatus* than *T. gigas*, and 20% higher than *T. s. fitchi*. Our preliminary analysis suggests that hematological reference ranges for other species of gartersnake are not appropriate for *T. rufipunctatus*. Establishing species-specific reference ranges for hematology and plasma biochemistry parameters from wild *T. rufipunctatus* may inform health assessments in captive breeding programs, improving conservation efforts.

0751 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Clay Laughrey, Carmen Montana, Christopher Schalk, Kelsey Kralman

Sam Houston State University, Huntsville, Texas, USA

Distribution of Larval Amphibians Along Environmental Gradients in Pond Microhabitats

Microhabitat use reflects a tradeoff between maximizing access to resources while minimizing exposure to antagonistic interactions. Understanding the microhabitats utilized by various organisms is essential in determining how interactions between coexisting species scale up to affect freshwater community structure. Herein we present results from microhabitat surveys in two East Texas fishless ponds, which vary in their habitat heterogeneity. From January 2017 – June 2017, we used a pipe sampler to survey larval amphibians and macroinvertebrates along gradients of water depth and substrate diversity. We measured ten abiotic factors and quantified species richness and abundance at each microhabitat sample. Species richness and abundance were higher in Pond 1, which had greater microhabitat heterogeneity and less canopy cover. In both ponds, tadpole abundance and biomass increased with increasing water depth. We found that large-bodied predators (Order Odonata) occurred in microhabitats with deeper water, dense aquatic vegetation, and flat/sandy substrates. Shallow microhabitats typically contained small-bodied tadpoles. The large-bodied predator species may be displacing the smaller-bodied and more vulnerable organisms to shallower microhabitats. Our findings suggest that water depth, substrate type, and indirect effects by predators may influence distributions of co-existing larval amphibians in lentic environments.

0646 Reptile Conservation, Sunday 16 July 2017

Ashley LaVere[1], Oscar Brenes[2], Kimberly Andrews[3]

[1]*Georgia Sea Turtle Center AmeriCorps, Jekyll Island Authority, Jekyll Island, GA, USA,* [2]*Reserva Playa Tortuga (RPT), Ojochal, OSA Region, Costa Rica,* [3]*Odum School of Ecology, University of Georgia, Athens, GA, USA*

The Cutting Edge: A Rapid Loss of Beach Front Habitat for Reptile Communities in Costa Rica

Costa Rica hosts nearly 6% of the world's biodiversity despite being only the size of West Virginia. As a country lined with beaches on both coasts, much of this biodiversity relies on coastal habitats. This is no different with Playa Tortuga on the Pacific Coast in Ojochal, Osa Region, Costa Rica. Playa Tortuga holds a unique position tucked up against the mountains and at the mouth of the Térraba River, the largest in Costa Rica. Over the past few years, Playa Tortuga has had noticeable loss in beach, threatening shoreline vegetation and reducing eligible habitat for two species of sea turtles and multiple species of snakes and lizards. Resident research organization, Reserva Playa Tortuga, in collaboration with the Jekyll Island Georgia Sea Turtle Center, used low-cost repeatable techniques to quantify erosion on Playa Tortuga from August 2016 to December 2016, the peak of the rainy season. After only two months, the beach experienced a loss of over 13,000 square meters and by the end of the four months over 15,000 square meters had been lost, along with multiple trees and other vegetation. This rapid beach dynamic threatens the stability of the coastal habitat and the wildlife that relies upon it. Using real time data over a four-month interval allowed for mapping of trends, hotspots, and rates of loss providing insight into possible causes and future management plans that can be extended to U.S. coastlines experiencing rapid erosion.

0246 Lizard Ecology, Sunday 16 July 2017

Daniel Leavitt[1], Christopher Schalk[2]

[1]*Arizona Game and Fish Department, Phoenix, Arizona, USA,* [2]*Sam Houston State University, Huntsville, Texas, USA*

Functional perspectives on the dynamics of desert lizard assemblages

New perspectives of community disassembly and reassembly have emerged as environments depart from baseline conditions. A trait-based approach can provide insights as to how changes affect performance of a species and their subsequent response in an assemblage. We quantified dynamics in lizard species and functional diversity in Big Bend National Park (BBNP), USA. BBNP was subjected to and then released from intensive grazing, which has resulted in changes to vegetative composition and cover. We examine changes in local assemblages in the context lizard functional traits, including thermal niche breadth. We hypothesized that temperature specialists were more likely to colonize or be lost from local sites. Species richness was lowest in the 1950s (N = 3 species), and subsequent surveys revealed that species richness increased in both the 1960s and 2000s (N = 6 and N = 8 species, respectively), but not all sites responded uniformly. Functional diversity in this system was not affected by this drastic increase species richness, indicative of functional redundancy in

species traits. Lizards that were added to sites tended to be smaller bodied with lower thermal tolerances. Lizards with high preferred body temperatures were locally extirpated from high elevation sites that experienced high shrub encroachment, likely due to a reduction in the preferred thermal gradients these species. These results reveal that long-term desert lizard functional diversity was maintained, but the consequences of changes to functional diversity at the local scale need to examined further.

0085 ASIH STOYE CONSERVATION II, Friday 14 July 2017

Taylor Lee, Brook Fluker

Arkansas State University, Arkansas, USA

Environmental DNA vs. Traditional Sampling: a Case Study Using the Federally Threatened Leopard Darter, *Percina pantherina*

Traditional methods may not always be reliable when sampling for rare or endangered species. However, the recent development of environmental (e)DNA techniques represents a valuable tool to help counteract inefficiency associated with traditional sampling. One example for which eDNA may be valuable in the detection of a rare species of fish is that of the Leopard Darter, *Percina pantherina*. This federally threatened fish, endemic to the Little River system in Arkansas and Oklahoma, is experiencing a decrease in genetic variation due to drastic population decline. Traditional sampling has failed to detect *P. pantherina* in the Robinson Fork since 2006 and in the Cossatot River since 2011 in annual surveys. The objectives of this project are as follows: 1. compare the effectiveness of eDNA water and substrate sampling techniques; 2. compare potential differences in detectability of *P. pantherina* between eDNA, and traditional methods; and 3. determine if there are extant populations of *P. pantherina* in the Cossatot River and Robinson Fork. Species-specific primers that amplify a fragment of the cytochrome *b* gene were designed and revealed a high degree of specificity for *P. pantherina*. Using PCR, these primers were used to test detectability of *P. pantherina* from eDNA samples. Traditional sampling during 2016 resulted in zero detection of *P. pantherina* within our focal systems. Preliminary eDNA results suggested possible positive hits for *P. pantherina* in all four seasons from 2016.

0818 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Dana Leigh[1], David Mifsud[2], Maegan Stapleton[2], Katherine Greenwald[1]

[1]*Eastern Kentucky University, Ypsilanti, Michigan, USA,* [2]*Herpetological Resource and Management, Chelsea, Michigan, USA*

Genetic Diversity and Effective Population Size of Mudpuppy Salamanders (*Necturus maculosus*) in the St. Clair-Detroit River System

Mudpuppy salamanders are experiencing declines in many parts of their range due to habitat degradation, influx of invasive species, lampricide application, and over-collection. Therefore there is a pressing need to assess the extent of declines and the effective population size of remaining populations. Our study focuses on assessing the genetic structure of past (1990s) and present-day mudpuppy populations in the St. Clair-Detroit River System. We will examine genetic diversity, population structure, and effective population size using microsatellite data. We predict that populations in more isolated or degraded areas will have significantly lower genetic variation and lower effective population size, and will show signatures of recent declines. We also predict reduced genetic diversity in present-day populations when compared to samples collected thirty years ago. Understanding the genetic structure of mudpuppy populations will allow for conservation initiatives targeting those populations most in need of management action.

0615 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Samantha Leigh, Donovan German

University of California, Irvine, Irvine, CA, USA

The Resource Acquisition Strategies of Seagrass-eating Bonnethead Sharks

Sharks have guts optimized for digesting high-protein/high-lipid foods, including many teleosts that humans depend on as food and economic resources. Conversely, omnivores face the difficulty of digesting foods that are low in protein and lipid, and are sheathed in rigid cell walls. Interestingly, the bonnethead shark (*Sphyrna tiburo*) is known to consume copious amounts of seagrass (up to 62% of gut content mass), yet maintains a gut that morphologically reflects its carnivorous ancestry. The objective of this project is to investigate *S. tiburo* digestion to understand whether they can digest seagrass. Bonnethead sharks were held in captivity and fed a 90% seagrass diet equaling 5% of their body weight daily for three weeks. By growing seagrass in chambers enriched with $^{13}CO_2$, the seagrass tissues become labeled with ^{13}C. Blood drawings from the sharks will show (via stable isotope analysis) whether they are assimilating nutritional components of the seagrass. The activities of various digestive enzymes (amylase and cellulase) were measured to determine if bonnetheads have the biochemical tools capable in aiding with seagrass digestion. Growth rate, along with digestibility of seagrass macronutrients were also measured. Preliminary results show that 56% of the total organic matter in seagrass is digested by *S. tiburo.* Since seagrass is approximately 60% fibrous material (cellulose), it is clear that *S. tiburo* are retaining some of the nutrients in seagrass. This project could provide groundbreaking evidence that bonnethead sharks, animals that were previously thought to be solely carnivorous, can benefit from the digestion of seagrass.

0627 AES GRUBER AWARD I, Thursday 13 July 2017

Samantha Leigh[1], Sarah Hoffmann[2], Adam Summers[3], Donovan German[1]

[1]University of California, Irvine, Irvine, CA, USA, [2]Florida Atlantic University, Boca Raton, FL, USA, [3]University of Washington, Friday Harbor, WA, USA

Spiraling into Control: Investigating the Function of the Spiral Intestine in Elasmobranchs

Elasmobranchs (sharks, skates and rays) have an expansion of the intestine that contains a convoluted internal structure called the spiral intestine (SI). It has been supposed, with little basis, that the SI in sharks slows digesta transit rate. We experimentally tested the flow rate using water. The flow rate is slowed by 3.5x through the SI as compared to the straight tube of the proximal intestines (PI) in *Squalus suckleyi*, *Sphyrna tiburo*, *Sphyrna lewini*, and *Carcharhinus limbatus*; four species with radically different intestinal morphology. We found resistance is higher in the SI compared to the PI. In the SI, resistance is higher in the reverse direction, which helps maintain anteroposterior directional flow. We measured the contraction rate of the intestinal smooth muscle of *S. suckleyi*, and found that an average of 48 contractions is necessary for complete transit of a medium viscosity (20 Poise) substance. Finally, we provided the first 3D images of spiral intestines for *S. suckleyi*, *Dasyatis say*, *Rhinoptera bonasus*, and *Sphyrna tiburo*. These 3D reconstructions from CT scans of lyophylized spiral intestines provide a modern replacement for the heavily cited Parker (1885) illustration. This investigation provides a new way of quantifying intestine volume, surface area created by the intestinal folds, and visualizing how flow may occur through the spiral structures. We also provide a mechanism for the quantification of the functional morphology of the SI and open the door to examining the function of the gastrointestinal tract of fishes and sharks through both experimentation and modeling.

0577 Turtle Conservation, Saturday 15 July 2017

Erin Levesque, Andrew Grosse

South Carolina Department of Natural Resources, Charleston, SC, USA

An Evaluation of Culturing Diamondback Terrapins, *Malaclemys terrapin*, in Charleston, SC

During the 2014-2016 mating/nesting season (May through July), viable clutches (1,089 eggs total) from 130 *Malaclemys terrapin* females captured in trammel nets and viable clutches from 24 land-captured terrapins were collected and incubated at either male-producing (27°C) or female producing (31°C) temperatures. There was no difference in hatching success between these groups ($p>0.05$). There was a positive correlation with larger females producing more eggs per clutch and a greater mean egg size. Growth of hatchlings in Year 1 fed one of three diets (fresh fish, ZooMed pellets, or Mazuri pellets) was assessed from October 2014 through April 2015 to evaluate feed type; both groups fed commercial pelleted diets grew significantly more than those fed fish only. A total of

411 “headstarted” (juveniles raised in a hatchery to accelerate growth) terrapins and 227 hatchlings have been released into the Charleston Harbor Estuarine system since 2014. Seventy-seven individuals have been retained to confirm sex, and twenty-three remain in a culture pond at the Waddell Mariculture Center for future investigations of accelerated time to maturity of head-started individuals. Results from this study provided information about how to efficiently capture females, harvest eggs and grow hatchlings/juveniles in order to supplement depleted wild populations. Access to the large number of hatchlings and juveniles that can be cultured in the laboratory also allows investigation of the biology of these naturally cryptic life stages that will allow us to better manage wild populations.

0616 Lizard Conservation, Saturday 15 July 2017

Brenna A. Levine, Marlis R. Douglas, Whitney J. B. Anthonysamy, Casey Brewster, Hayden D. Elliot, Michael E. Douglas

University of Arkansas, Fayetteville, AR, USA

Contemporary Population Connectivity of the Eastern Collared Lizard (*Crotaphytus collaris collaris*) in Arkansas

The Eastern Collared Lizard (*Crotaphytus collaris collaris*) is a species of conservation concern in Arkansas. Although historically common, suppression of the natural fire regime has resulted in fragmentation and loss of the glade habitat the species depends on. Remnant populations are small and isolated, and are hypothesized to experience little or no gene flow and high levels of genetic drift. To stem further decline, habitat restorations were initiated in Arkansas, but despite these efforts, recent extinctions of local populations have been documented. Translocations among sites are planned to supplement populations and increase genetic diversity through managed gene flow. Prior to such actions, and to avoid negative consequences of outbreeding depression, it is necessary to understand genetic structure and contemporary connectivity among remnant populations. To generate a genetic baseline against which to gage effects of conservation actions, DNA samples (N = 282) were collected from 15 locations in Arkansas over a five-year period (2011 = 2016) and genotyped at 10 polymorphic microsatellite loci. Bayesian assignment identified eight distinct gene pools and F_{ST} analyses revealed significant genetic structure at both local and regional scales. Genetic divergence was not a function of geographic distance between sites, but likely due to genetic drift. These findings underscore the importance of evaluating genetic structure and connectivity prior to translocations when remaining populations are small and fragmented, as in the case of Eastern Collared Lizard in Arkansas.

0606 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brenna A. Levine[1], Marlis R. Douglas[1], Julie A. Savidge[2], Bjorn A. Lardner[2], Robert N. Reed[3], Michael E. Douglas[1]

[1]University of Arkansas, Fayetteville, AR, USA, [2]Colorado State University, Fort Collins, CO, USA, [3]United States Geological Survey, Fort Collins, CO, USA

Preliminary Estimates of Relatedness and Kinship in an Experimental Population of Brown Treesnake (*Boiga irregularis*) on Guam

The highly invasive Brown Treesnake (*Boiga irregularis*; 'BTS') has caused ecological and economic harm to Guam since its accidental introduction following World War II. Evaluation of existing control is necessary to ensure that these approaches maintain their efficacy over time. Current BTS control is largely accomplished by baited traps as well as by visual detection and removal by hand. Yet, there is individual heterogeneity in susceptibility to these control efforts, some of which is unexplained by capture-mark-recapture models. The variation among individuals in susceptibility to these methods prompts concern that existing approaches may inadvertently select for a population that is refractory to trapping. But are close kin more similar to each other in trappability than are non-kin, and is this vulnerability a heritable trait? Population genomic approaches, combined with relatedness and kinship analyses, can yield accurate identification of relationships among individuals. Capture histories and trapping data can then be analyzed in the context of relatedness estimates and kinship assignments to address the above questions. Here, we present preliminary estimates of relatedness and kinship among 300 BTS, sampled from a closed, experimental population on Guam, as estimated via analyses of thousands of single nucleotide polymorphisms that were identified by Illumina sequencing of double-digest restriction site associated DNA (ddRAD). Juxtaposition of relatedness and kinship estimates with capture and trapping data will provide insight into whether trappability is a heritable trait.

0181 Reptile Conservation, Sunday 16 July 2017

Craig Lind[1], Ignacio Moore[3], Jeffrey Lorch[4], Terence Farrell[2]

[1]Stockton University, Galloway, NJ, USA, [2]Stetson University, Deland, FL, USA, [3]Virginia Tech, Blacksburg, VA, USA, [4]USGS National Wildlife Health Center, Madison, WI, USA

Patterns of Circulating Corticosterone in a Population of Rattlesnakes Afflicted with Snake Fungal Disease: Stress Hormones as a Potential Mediator of Seasonal Cycles in Disease Severity and Outcomes

Fungal pathogens are often associated with a physiological stress response mediated by the hypothalamo-pituitary-adrenal axis (HPA), and afflicted individuals may incur steep coping costs. Nothing is known regarding how snake fungal disease (SFD) relates to HPA activity, or how seasonal shifts in environment, life history, or HPA activity may interact to drive seasonal patterns of infection severity. To test the hypothesis that SFD is associated with increased HPA activity and to identify potential environmental or

physiological drivers of seasonal infection, we monitored corticosterone, severity of SFD clinical signs, innate immune function, foraging success, body condition, and reproductive status in a population of pigmy rattlesnakes afflicted with SFD. Both plasma corticosterone and the severity of clinical signs of SFD peaked in the winter. Corticosterone levels were elevated and immunocompetence was low in the fall prior to the seasonal rise in SFD severity. Snakes with severe clinical signs were in low body condition and had elevated corticosterone levels compared to uninfected snakes and those with moderate clinical signs. The severity of SFD in the population was negatively related to population-wide estimates of foraging success, body condition, and temperature, and positively correlated with corticosterone levels. Females with clinical signs of SFD were less likely to enter reproductive bouts compared to females without obvious disease. We propose the hypothesis that the seasonal interplay among environment, host energetics, and HPA activity initiates tradeoffs in the fall which drive the increase in SFD prevalence and severity of clinical signs observed in the population through winter.

0483 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Craig Lind[2], Fatima Ramis[1], Donna-Jael Paredes[1], Ignacio Moore[3], Terence Farrell[1]

[1]Stetson University, DeLand, FL, USA, [2]Stockton University, Galloway, NJ, USA, [3]Virginia Tech, Blacksburg, VA, USA

Does maternal Energetic Status, Corticosterone, or Arginine Vasotocin Influence Maternal Care in the Rattlesnake, *Sistrurus miliarius*?

Pitvipers, including pigmy rattlesnakes, display maternal care of free living offspring. We examined the relationships among maternal energetic status, stress hormones, arginine vasotocin (AVT), and maternal care in postpartum pigmy rattlesnakes. We collected 31 pregnant *S. miliarius* in Volusia County, Florida and held them in field enclosures until parturition. We manipulated AVT by intraperitoneal injection and measured both circulating corticosterone (cort) and body condition index (BCI) in postpartum rattlesnake mothers. Mother-offspring spatial relationships were analyzed to measure aggregation for four days after parturition. Despite large variation in postpartum energetic status, no significant relationship between maternal body condition and cort was observed in rattlesnake mothers, and no significant relationship was evident between cort and the level of maternal association with offspring. Our results did not support the hypothesis that energy limited mothers have elevated cort, or that cort is negatively related to maternal care. Injection of AVT did not stimulate maternal care. There was a strong and repeatable positive relationship between postpartum energetic status (BCI) and the level of maternal association. The lack of a significant correlation between BCI and cort indicates that a postparturient glucocorticoid response did not drive the body condition-dependence of association with offspring. We are currently conducting an experimental investigation of the

impacts of supplemental feeding of pregnant females to better understand the relationship between energetic status and the quality of maternal care in rattlesnakes.

0407 ASIH STOYE CONSERVATION II, Friday 14 July 2017

Luke J. Linhoff, Maureen A. Donnelly

Florida International University, Miami, Florida, USA

Evidence of domestication processes in captive-bred amphibians and implications for conservation reintroductions

Captive-bred animals reintroduced to the wild may have lower survival or fitness than wild-born translocated animals because of maladaptive behaviors or physiology derived from captivity. Experiential or genetic changes caused by domestication selection processes may lead to innate and learned behaviors that differentiate captive-bred animals from wild conspecifics. While modern amphibian conservation utilizes captive breeding programs for dozens of threatened species, almost nothing is known about how domestication processes in these programs might impact amphibians, or how domestication may affect reintroduced individuals. We will present the results of three experiments comparing captive-reared and wild anurans (*Dendrobates auratus* and *Oophaga pumilio*). We hypothesized that captive bred amphibians may become 1) habituated to a looming stimulus (e.g. hand entering a cage) that is similar to an approaching predator, 2) develop a reduced tonic immobility defensive response resulting from frequent handling, and 3) exhibit an altered basil metabolic rate from little thermal variation in a captive environment. To test our first hypothesis, we recorded animal's responses when presented with an overhead computer monitor that displayed a looming stimulus that simulated a swooping predator. Second, we compared the anuran's frequency and length of tonic immobility behaviour under a simulated predatory event. Lastly, we compared the anuran's basil metabolic rates during the simulated predatory event. Our experiments showed the first quantitative evidence of the effects of domestication on amphibians, which has broad implications for amphibian ex situ conservation.

0130 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Allison Litmer, Chris Murray

Tennessee Technological University, Cookeville, TN, USA

The Critical Thermal Capacity of Dispersal: Comparative Niche Breadth Among Populations of Mediterranean Gecko (*Hemidactylus turcicus*)

Niche theory and the theory of island biogeography have provided widely accepted explanations for patterns of dispersal, ecological community structure, and geographic distribution. By combining these two theories, trends among distribution and population attributes become apparent. The fundamental niche, and the breadth of that niche, result from evolution on multiple individual traits. Recent work in evolutionary physiology has correlated niche breadth with climatic variation experienced by a lineage. Thus, we can predict that dispersal is constrained by physiological parameters. Dispersing individuals may encounter novel environments and if the physiological capacity to withstand such changes is present then colonization may occur. Therefore, successful dispersers may have broader fundamental niche breadths than non-dispersers. I hypothesize that physiological niche breadth is positively correlated with the distance from the core or "mainland" of a species distribution. Alternatively, niche breadth is correlated with genetic variation, which is known to be greater at the core of a species' population or distribution, and the physiological niche breadth could be negatively correlated with distance from the core of a species distribution. I aim to use comparative assessments of the critical thermal capacity among populations of the invasive Mediterranean gecko (*Hemidactylus turcicus*) to test this idea.

0679 ASIH STOYE ECOLOGY & ETHOLOGY IV, Friday 14 July 2017

Ryan Logan, Christopher Lowe

California State University Long Beach, Long Beach, CA, USA

Area Use and Spawning Activity of Three Exploited Gamefishes on a Large Artificial Reef Inferred from Passive Acoustic Telemetry

Kelp bass (*Paralabrax clathratus*), barred sand bass (*P. nebulifer*) and California sheephead (*Semicossyphus pulcher*) are three important recreational gamefish species in southern California and as such contribute significantly to the local economy. To restore depleted populations, artificial reefs have been used with the assumption that the new habitat will increase fish productivity over time. Here, we describe the fine-scale area use at a range of temporal scales, and presumed spawning related activity inferred from passive acoustic telemetry methods on the largest artificial reef in the United States. Degree of site fidelity to the artificial reef varied considerably across species over a two year monitoring period, with sheephead exhibiting the highest site fidelity. On average, kelp bass had the largest home ranges (0.33 ± 0.13 km^2; 95% kernel utilization distribution), but the amount of area used was similar among species. Area use was also similar to previous findings using comparable methodology. Tagged kelp bass exhibited two different activity patterns during spawning months described as “transient” and “sedentary”, and ~40% of tagged barred sand bass displayed seasonal migratory behavior. Male California sheephead were significantly more active among seasons than females; however, both showed increased activity patterns in summer months. Results of this study indicate that artificial reefs can provide suitable habitat to support depleted gamefish species, although some may benefit more than others. Additionally, assumed

spawning related activity implies artificial reefs can be worthwhile management tools to mitigate depleted coastal marine fishery populations.

0376 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brett Longwith, Brooke Bedal, Mollie F. Cashner

Austin Peay State University, Clarksville, TN, USA

Utility of Eight Microsatellite Loci in Population Genetic Analyses of Southern Redbelly Dace, *Chrosomus erythrogaster*

Species-specific loci allow for differentiation between populations of the same species. These loci may be used to assess gene flow or genetic drift. Allelic diversity was assessed for eight microsatellites loci previously developed for the Blackside Dace, *Chrosomus cumberlandensis*, using two populations (Lab-reared and Millers Creek tributary) of the Southern Redbelly Dace, *Chrosomus erythrogaster*. Lab reared individuals are from a known limited parental stock (2-3 females, 2 males), while the wild population has unknown parentage contribution. Moreover, the lab-reared parental stock originates from a different stream than the wild population, although both populations are from the Cumberland River system drainage. Our goals are to: (1) quantify allelic diversity; (2) assess HWE for the eight loci; (3) and determine the utility of these markers for assessing population structure between these two experimental groups. Due to the low number of cyprinid-specific microsatellite loci, the addition of these data will increase the toolkit available for future population genetic work in various cyprinid species, particularly in the diverse and T&E-rich genus of *Chrosomus*.

0730 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Karem López[1], Rebecca Tarvin[3], Santiago Ron[2], Mileidy Betancourth[4], Adolfo Amézquita[4], David Cannatella[3]

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Is *Epipedobates boulengeri* a Species Complex? Molecular Phylogeny of an Inconspicuous Poison Frog

Most frogs of the genus *Epipedobates*, known as Chocoan poison frogs, are brightly colored and secrete alkaloids as anti-predator defense. A recent phylogenetic analysis of this group revealed very low genetic divergence among species and suggested that *Epipedobates boulengeri* is polyphyletic. The objective of this study was to expand the phylogeny of *Epipedobates boulengeri* and assess its species limits. Three mitochondrial and two nuclear markers were sequenced for 47 individuals across 28 populations

encompassing the whole range of *E. boulengeri*, from the Valle de Cauca, Colombia, to Cotopaxi, Ecuador, including the type-locality (Isla Gorgona, Colombia). We confirmed that some populations of *E. boulengeri* are more closely related to other species, but also identified possible cryptic species, indicating that the delimitation of this species should be reassessed. The low levels of genetic divergence among species of *Epipedobates* (e.g., 2.6% in the 16S gene) highlight the rapid phenotypic diversification of the group and make it an interesting case study for delimitation of species, population genetics and diversification processes. Our results contribute to the understanding of speciation in general and the identification of specific conservation concerns for *E. boulengeri*, which faces high rates of habitat destruction in the Chocó regions of Ecuador and Colombia.

0455 Lizard Conservation, Saturday 15 July 2017

Robert E. Lovich[1], Daniel J. Leavitt[0]

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Celebrating 20 Years of Conservation: Flat-tailed Horned Lizard (*Phrynosoma mcallii*) *Rangewide Management Strategy*

In 2017, the *Rangewide Management Strategy* for the Flat-tailed Horned Lizard turned 20 years old. Given this large period of time, in lizard-years, we will summarize the history, successes, and failures of the *Rangewide Mangement Strategy*. The strategy was established to protect the Flat-tailed Horned Lizard from requiring federal protection and is made up of over 15 partner agencies including municipal, state, and federal partners. Together these partners protect hundred's of thousands of Flat-tailed Horned Lizard habitat and hundred's of thousands of Flat-tailed Horned Lizards. For the last 10 years, monitoring of populations has resulted in learning new aspects of the life history of this species. Here we will share with you the nuts and bolts of the partnership success, the monitoring strategy, and the results of our monitoring.

0442 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Kelsey Low[1], Matthew Allender[2], Christopher Phillips[1], Steven Kimble[3]

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A ranavirus-associated mass mortality event in an Illinois amphibian community

Ranavirus is an infectious pathogen affecting reptiles and amphibians associated with global amphibian population declines, and is one of two notifiable amphibian pathogens

to the OIE. The purpose of this study was to determine the background prevalence of FV3-like ranavirus in amphibian communities at sites in east-central Illinois with recurrent outbreaks in Eastern Box Turtles (*Terrapene carolina carolina*). The Wood Frog (*Rana sylvatica*) was to be used as a sentinel species due to its reported ranavirus sensitivity. 20 *R. sylvatica* individuals of each life stage were to be sampled at eight vernal ponds using skin and oral swabs for adults and metamorphs, and lethal tissue sampling for tadpoles. However, a mass mortality event began while monitoring tadpoles. In response to the mortality event, we collected deceased individuals of any observed species over the next eight weeks at the original eight ponds and at an additional 15 sites wherever mortalities were observed. The event included over 3,000 observed individuals of six species. The highest number of mortalities were observed in *R. sylvatica* (n=752), Silvery Salamanders (*Ambystoma platineum*; n=303), and Chorus Frogs (*Pseudacris* spp.; n=105). The viral isolate was classified as an FV3-like Ranavirus using sequence from several primer pairs, was detected at 10 of the 23 ponds sampled (44%), and infection prevalence ranged from 0% to 100%. Detection of this mortality event in progress highlights the need to continue monitoring this area for ranavirus in ectothermic vertebrates, as an event of this scale had not previously been observed within these sites.

0894 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Mary-Ruth Low[1], Nick Baker[2], John J. H. Wei[3]

[1]Wildlife Reserves Singapore, Singapore, Singapore, [2]Ecology Asia, Singapore, Singapore, [3]Natural Area Consulting Management Services, Western Australia, Australia

Herpetofauna Roadkill Rates Bordering Forest Fragments in an Urban City State

Roads are ubiquitous in human-modified landscapes and are largely responsible for direct impacts on wildlife, especially with regard to vehicular collisions. Herpetofauna are generally susceptible to road-related mortality as they move close to the ground and are thus harder to detect. In Singapore, only ~3% of total land area comprises of protected nature reserve which is made up of old secondary forest and small fragments of primary forest. Nevertheless, these fragments act as habitat strongholds for fauna in a human-dominated landscape. The aims of our study were: 1) to identify the herpetofauna species most susceptible to road mortality, and 2) to determine if roadkill rates differed between roads bordering nature reserves and those bordering urban vegetation. From January-December 2015, fortnightly surveys were conducted on roads which bisect and border nature reserves (n=5) and roads which border urban young secondary forest or scrubland (n=5). Over 26 surveys, 53 carcasses belonging to 19 species were found (58% snakes, 26% lizards, 11% frogs, 5% turtles). More roadkill were found on roads near urban forests (67%) than roads near nature reserves (Mann-Whitney-Wilcoxon Test=45, $p<0.01$). The overall mean of roadkill per month was 4.4±2.7 individuals. Specifically, one roadkill was encountered on average every 7.27 km and

4.86 km of roads per month around nature reserves and urban forests respectively. The findings of these systematic surveys allow nature reserve managers to identify roadkill hotspots and the threatened species that may require impact mitigation by transport authorities.

0531 Herp Environment, Saturday 15 July 2017

Mary-Ruth Low[1], David Bickford[2], Sonja Luz[1]

[1]Wildlife Reserves Singapore, Singapore, Singapore, [2]Rimba, Selangor, Malaysia

Spatial Ecology of the Reticulated Python in Singapore

The reticulated python (*Malayopython reticulatus*) is the longest snake and the largest apex predator on the densely-populated island of Singapore. Human-python interactions are high, with approximately one encounter per day, often resulting in negative publicity for the species. While pythons are capable of reaching lengths of 9 meters and feed on large mammals elsewhere in their range, the adults are comparatively small in Singapore (average SVL=2.3±0.6 m, n = 1680) and they perform a key ecosystem service by subsisting on rats (*Rattus* spp.). However, negative perceptions regarding pythons as pests prevail. Since 2008, approximately 1700 snakes have been captured in conflict situations, marked and released in an ongoing study. Twenty-eight individuals (12 females, 14 males, 2 juveniles) were radio-tracked between Mar 2014 and Jan 2016. Overall, snakes were found to utilize underground burrows and storm drains in the city 76% of the time, indicating ability to adapt to human-dominated landscape. Males had larger home ranges (average 40.5 ha) compared to females (average 12 ha). A habitat composition analysis found that proximity to storm drain openings and forest edge habitats were important contributing factors to python movement. This finding is possibly linked to availability of prey and shelter sites. Knowledge of the species' urban ecology will be useful to help managers in urban areas in dealing with "conflict snakes", as well as allow conservation practitioners to evaluate its adaptability to natural habitat loss in other parts of its range.

0743 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Christopher G. Lowe[1], Emily Meese[1], Sarah Luongo[1], Diego Bernal[2]

[1]Calif. State Univ. Long Beach, Long Beach, CA, USA, [2]Univ. Mass. Dartmouth, Dartmouth, MA, USA

New Advances in Measuring and Modeling Metabolic Costs of Elasmobranchs To Predict the Future

Understanding how changing environmental conditions and fluctuating biotic pressures influence the physiology, behavior and distribution patterns of elasmobranchs can aid in

the development of more successful management. Quantifying metabolic rates, metabolic thermal sensitivity, costs of transport, SDA and energy budgets of elasmobranch fishes has historically been limited to small, shallow water, non-obligate ram ventilating species (< 1 m TL) or juvenile stages of larger species (< 1.25 m TL). While methods for measuring metabolism, largely based on oxygen consumption rates, have been limited by respirometry technology, advances in telemetry and datalogging technology have allowed for a much more detailed estimate of energetic costs for larger, more active elasmobranchs in the wild. Despite these technological advances, there are still large gaps in knowledge on metabolism for batoids and deepwater species. Metabolic Q_{10} (temperature sensitivity) has been measured across a wide range of species (n = 18); however, still relatively little is known about the costs of physiological acclimation and how those costs change as animals approach thermal tolerance limits. Using growing databases of spatially explicit remote sensing environmental data, even baseline metabolic rate, metabolic Q_{10}, and cost of transport data can now be used to develop simple minimum energetic cost models as tools to predict future changes in species distributions and potential changes in migration patterns.

0098 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Winsor Lowe

University of Montana, Montana, USA

A grounded approach to dispersal research

We know dispersal and migration are fundamental ecological and evolutionary process, but it is difficult to study these movement patterns directly in the field. Consequently, research on dispersal and migration often relies heavily on modeling and simulation. There is no doubt that modeling and simulation studies have helped advance theory and understanding of the role of population connectivity in species conservation. However, it is difficult to think of a case where empirical data on animal movement had a greater impact on understanding of species ecology and management than Ray et al.'s work on buffer zones for amphibian breeding ponds. This offshoot of his work on the ecology and evolution of pond-breeding amphibians grew into a long-term interest in the phenotypic and environmental drivers of amphibian movement – both dispersal and migration. This topic allowed him to combine his evolutionary and ecological interests, while remaining firmly grounded in the field. Ray's grounded approach to dispersal research, and the ecology/evolution interface that characterize his work, were great inspirations to me, and continue to be guiding principles of my research. In this talk, I will trace the influence of Ray's empirical approach to dispersal and migration in my own and other's research. I will show the inseparability of ecological and evolutionary perspectives on animal movement for advancing broad conceptual understanding and conservation strategies. Specifically, this overview of Ray's legacy highlights the importance of considering inter- and intraspecific variation in movement patterns,

identifying the phenotypic basis of this variation, and isolating key environmental mediators.

0541 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Cierra Lucas, Scott L. Parker, Amanda DiBella

Coastal Carolina University, Conway, SC, USA

Comparative Digestive Assimilation Efficiency of Snails, Crabs, and Fish in diamondback terrapins (*Malaclemys terrapin*)

Diamondback terrapins (*Malaclemys terrapin*) are important secondary consumers of southeastern saltmarshes. Analyses of fecal samples suggest that terrapins primarily consume periwinkle snails (*Littoraria irrorata*), followed by fiddler crabs (*Uca pugnax*), and small numbers of fish. Optimal foraging models predict that animals pursue food resources that provide the greatest energetic benefit at the lowest acquisition cost. The purpose of this study is to measure the energetic content of these three food items and determine the digestive efficiency associated with each prey type. Laboratory feeding trials were conducted using terrapins collected from the North Inlet National Estuarine Reserve in South Carolina. We measured assimilation efficiency and energy content of periwinkles, fiddler crabs, and mullet (*Mugil cephalus*) using oxygen bomb calorimetry. We predict that mass-specific energy content and assimilation efficiency is highest in fish, followed by fiddler crabs, and lowest in periwinkles. Our data suggest that in the field terrapins preferentially pursue periwinkles due to their low acquisition cost at the expense of lower overall energy content compared to fiddler crabs and fish.

0774 LFC Phenotypic Variation I, Thursday 13 July 2017

Stuart Ludsin[1], Kevin Pangle[2], Lucia Carreon-Martinez[3], Alison Drelich[1], Brian Fryer[3], Daniel Heath[3], Timothy Johnson[4], Julie Reichert[1], Jeffrey Tyson[5], Kyle Wellband[4]

[1]The Ohio State University, Columbus, OH, USA, [2]Central Michigan University, Mt. Pleasant, MI, USA, [3]University of Windsor, Windsor, ON, Canada, [4]Ontario Ministry of Natural Resources and Forestry, Picton, ON, Canada, [5]Ohio Department of Natural Resources-Division of Wildlife, Sandusky, OH, USA

Does variation in larval growth rate affect the recruitment of freshwater fishes? A case study with Lake Erie Yellow Perch

Fast growth during the larval stage has been hypothesized to benefit the subsequent recruitment of marine fishes by reducing predation risk. While this hypothesis has been extensively examined in marine fishes, it has been less studied in freshwater species, the recruitment of which is considered to be driven more by processes operating during the juvenile stage than those operating during the larval stage. Herein, we present findings

from a multidisciplinary investigation that used field collections (2006-2009), laboratory approaches (e.g., otolith growth and micro-chemical analyses; molecular identification of prey in predator diets), and spatially-explicit individual-based modeling to explore how growth rate affects the survival of larval Yellow Perch (*Perca flavescens*) to the age-0 juvenile stage, the life stage at which future recruitment to the fishery (at age-2) is set. We observed differential selection for growth rate during the larval stage, with faster-growing individuals recruiting to the juvenile stage better than their slow-growing counterparts during all study years. Further, we found that the selection against slow-growing larvae was greater outside of turbid nursery habitat than inside of it. Predation appears to underlie these differences, as both predation risk and mortality were found to be greater outside than inside of turbid nursery habitat. Overall, our collective findings highlight the importance of measuring phenotypic (growth-rate) variation in larval fishes in fisheries investigations, while simultaneously demonstrating that the "growth-selective predation hypothesis" has relevance to large freshwater ecosystems such as Lake Erie.

0272 ASIH STOYE GENERAL ICHTHYOLOGY II, Thursday 13 July 2017

William Ludt[1], Christopher Burridge[2], Thomas Near[3], Prosanta Chakrabarty[1]

[1]Louisiana State University, Baton Rouge, LA, USA, [2]University of Tasmania, Hobart, TAS, Australia, [3]Yale University, New Haven, CT, USA

Understanding Anti-Tropical Distributions in Centrarchiformes

The order Centrarchiformes contains 15 families whose relationships have been previously contested. Within this order there are several examples of anti-tropical distributions – a pattern where closely related groups occur on both sides of the tropics, yet are absent within. Several mechanisms have been proposed to explain this distribution pattern, yet the ultimate causes are still unknown for many species. Here we use over 500 ultraconserved elements to broadly examine the relationships among Centrarchiformes. Within Centrachiformes our data strongly support a polyphyletic Cheilodactylidae, with the two South African species of *Cheilodactylus* forming a clade distantly related to the remaining species within the genus. We then used this phylogeny to specifically examine anti-tropical divergences within the remaining members of this genus, which primarily inhabit temperate rocky reef habitats in the southern Pacific, with four species occurring in the northern hemisphere. Using multiple fossil calibrations, we time calibrated our phylogeny to determine the timing of anti-tropical divergence events within this clade. We used this calibrated tree, coupled with stochastic character mapping, as well as multiple biogeographic models, to determine the fit of our data to the mechanisms proposed for anti-tropical distributions. Northern hemisphere species do not form a monophyletic group, suggesting multiple equatorial divergence events for these species. We find evidence supporting Miocene and Plio/Pleistocene divergence events across the tropics explaining the multiple invasions of the northern hemisphere. Together with our biogeographic models, our data suggest

that multiple mechanisms may be responsible for the anti-tropical distribution in this group.

0597 Fish Biogeography & Morphology, Saturday 15 July 2017

Nathan Lujan[1], Mark Sabaj[2], Leandro Sousa[3], Marcella Santos[4], Lúcia Rapp Py-Daniel[5], John Lundberg[2], Brice Noonan[4]

[1]University of Toronto Scarborough, Toronto, ON, Canada, [2]Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA, [3]Universidade Federal do Pará, Altamira, PA, Brazil, [4]University of Mississippi, Oxford, MS, USA, [5]Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, AM, Brazil

Comparative population genomics of seven fish taxa spanning rapids of the lower Xingu River, Amazon Basin, Brazil

During three expeditions from 2013 to 2015, the iXingu Project inventoried aquatic biodiversity across >300 km of the lower and middle Xingu River, from its sea-level confluence with the Amazon to the Great Falls of the lower Iriri River at >120 m above sea level. A restriction associated DNA sequencing and bioinformatics pipeline was used to investigate genetic structure within seven fish genera that span all or most of this geographic range: *Bivibranchia* (Hemiodontidae), *Bryconops* (Characidae), *Cichla* (Cichlidae), *Geophagus* (Cichlidae), *Hypomasticus* (Anostomidae), *Spectracanthicus* (Loricariidae), and *Tometes* (Serrasalmidae). At the largest spatial scale, two morphologically cryptic yet genomically distinct populations of *Bivibranchia fowleri* were codistributed throughout the sample reach, with Pop1 being only collected from dry-season beaches and Pop2 from wet-season beaches. Six genera displayed a pattern in which populations or species were restricted to either the lentic mouth bay or the rapids upstream. Within the upstream rapids, only *Bryconops* displayed a pattern of narrowly restricted endemism in which two unrelated and morphologically distinct genotypes were only observed among high-energy rapids of the Xingu's Big Bend (Volta Grande). The most complicated and perplexing patterns have been those resulting from apparently widespread introgression between two species of *Spectracanthicus* (*S. punctatissimus*, *S. zuanoni*) and the closely related species *Parancistrus nudiventris*. Genomic data from almost 400 individuals of this species complex are being matched to phenotypic data in an effort to unravel mechanisms that maintain these largely distinct morphotypes despite apparently rampant hybridization.

0266 Texas and Mexican Blindcats/Desert Fishes, Saturday 15 July 2017

John G. Lundberg[1], Dean A. Hendrickson[2], Kyle Luckenbill[1], Mariangeles Arce-H.[1]

[1]The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA, [2]University of Texas, Austin, TX, USA

Satan's Skeleton Revealed

Satan eurystomus Hubbs & Bailey 1947, the widemouth blindcat, is endemic to the deep Edwards Aquifer below TX. Monotypic *Satan* is one of four subterranean ictalurids, *Trogloglanis pattersoni*, *Prietella pheatophila* and *P. lundbergi*, that all exhibit common features of stygomorphs: loss of eyes and pigmentation, hypertrophy of some chemo- and mechano- sensory systems, small size, and variously reduced musculoskeletal system. Each species is distinctive in its own ways, and hypotheses about their phylogenetic positions range from separate ancestries of each scattered among the lineages of epigean ictalurids to exclusive monophyly of a strictly subterranean clade. Specimens of *Satan* are rare, thus we used high-resolution CT scans to develop the first detailed, richly illustrated descriptive and comparative study of its skeleton. *Satan* exhibits typical and singular reductive features plus complex structures, e.g. 3 novel symphyses closing the posterior cranial fontanel; an unusually deep temporal fossa; and an ornately shaped dorsal-fin locking spinelet. *Satan* shares 15 synapomorphies with other ictalurid troglobites: the stygomorphisms plus bone and joint reductions. *Satan* shares 11 synapomorphies with *Pylodictis,* including increased numbers of cephalic sensory pores and paired fin rays, and several features associated with predatory suction feeding: wide gape, depressed head, expanded branchiostegal and opercular membranes and anterior extension of epaxial muscle. Incomplete character information, including lack of molecular data for *Satan* and *Trogloglanis*, poor quality of available skeletal preparations for *Trogloglanis* and *Prietella*, and uncertain identifications of some specimens of *Prietella* impede construction of a complete dataset for phylogenetic analysis.

0700 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD; AES SYMPOSIUM – APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Sarah Luongo, Christopher Lowe

California State University Long Beach, Long Beach, CA, USA

Modeling the Effects of ENSO Events on the Metabolic Costs of the CA Horn Shark, *Heterodontus francisci*

Dynamic, heterogeneous thermal conditions are known to affect physiological processes in marine ectotherms, which influence movements, distribution and energetic costs. By quantifying physiological thermal sensitivity of ectothermic elasmobranchs, we can begin to make predictions on the degree to which minimum energetic costs may change across major oceanographic events (e.g., ENSO, PDO, global sea temperature rise). The estimated mean (± SE) standard metabolic rate (SMR; mg O_2 kg^{-1} hr^{-1}) of the CA horn shark, *Heterodontus francisci,* increased with acclimated temperatures (14° - 30.6 ± 3.4, 16° - 33.9 ± 2.6, 20° - 45.4 ± 2.7, and 22°C - 55.2 ± 3.1). This resulted in a mean (± SE) acclimated metabolic Q_{10} of 2.13 (± 0.28), providing a metric to generate predictive models to estimate minimum metabolic costs associated with ENSO events and global

sea temperature rise. The model included daily minimum caloric expenditure and average daily sea surface temperature (SST) over a 12 yr period bracketing a strong ENSO event for southern California. Our model indicated a 18.6% increase in average minimum metabolic costs for the CA horn shark between 2012 and 2015. When comparing change in average minimum metabolic costs from previous ENSO events (2006 and 2009) to the most recent (2015), we see a 16.3% increase in costs over those years. Increasing metabolic costs attributed to the strong 2015 ENSO event, coupled with loss of certain prey may result in reduced population growth of horn shark and influencing emigration from areas of previously suitable habitat.

0386 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Marvin M. F. Lutnesky[1], Brian B. Pasko[2], Thomas R. Brown[2]

[1]Texas A&M University - TX, USA, [2]Eastern New Mexico University, Portales, NM, USA

How May Population Density Influence Rates of Sex Change in Fishes?

Social control of sex change in fishes is widespread. The frequency of social cues that may stimulate or inhibit sex change may be dependent on movement patterns, and thus rates of cue reception may be density dependent. Exploitation (including fishing) may alter population densities, and thus potentially cue frequency. Using a published Individual Oriented Model computer simulation in which individuals optimize movement patterns through space (encounter rates), we explore how the processing of social cues using simple rules (absolute rates, ratio rates, or differential rates) may alter patterns of sex change in fishes as a function of population density. The simulation (typically 10,000 167 min. simulations [samples] resulting in convergence on an encounter rate) consisted of an alpha female moving through territorial space and encountering the male (inhibitory cues) and lower-ranking females (stimulatory cues) that share her territory. We found that different patterns of sex change emerge dependent on the rule used to process information. For example, densities that trigger sex change over a range of territory sizes using the difference rule (stimulation - inhibition) remain fairly stable, but decrease dramatically when using the ratio rule (stimulation / inhibition). Thus, rates of sex change, and potentially the ability of a species to recover from exploitation, may be due in part to how the brain processes information. This work is timely due to the diversity of fishes that change sex, and its multiple and independent evolution. Different management strategies for conservation may be needed if the rules for information processing vary among species.

0305 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Kady Lyons, Katherine Wynne-Edwards

U Calgary, Calgary, AB, Canada

Gestational Steroid Hormone Profiles in Plasma and Histotroph of Pregnant Stingrays: Indications of Embryonic Steroid Synthesis Early in Development

Hormones play a crucial role in the initiation and maintenance of pregnancy in live-bearing vertebrates. Despite the range of maternal provisioning strategies, little research has been investigated into the pathways of communication between elasmobranch embryos and their mothers, particularly with regards to hormone signaling. Pregnant round stingrays (*Urobatis halleri*) were captured from two sites in southern California and samples of plasma and uterine fluid (histotroph) were sampled at multiple points through their gestational period. Tissue samples were analyzed for a suite of steroid hormones using a liquid chromatography system connected with tandem mass spectrometer equipped with electrospray ionization source. Many more hormones were detected in histotroph samples compared to their plasma pairs and often at higher concentrations. In particular, progesterone and testosterone significantly increased in histotroph during early gestation and declined thereafter. Interestingly, the peak in histotroph hormone concentrations coincided with the appearance of secondary sex characteristics (i.e. presence/absence of claspers). This study represents one of the first to examine a suite of steroid hormones in elasmobranch histotroph over the course of gestation and the findings indicate that embryonic steroidogenesis not only comes online early in gestation, but likely also has a hand in sexual differentiation of early-term embryos.

0298 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Kady Lyons[1], Dovi Kacev[2], David Gillett[3], Antonella Preti[2], Heidi Dewar[2], Suzanne Kohin[2]

[1]U Calgary, Calgary, AB, Canada, [2]Southwest Fisheries Science Center, La Jolla, CA, USA, [3]Southern California Coastal Water Research Project, Costa Mesa, CA, USA

Using Organochlorine Contaminants as a Tool to Examine Ecological Physiology in Three Species of Pelagic Sharks

Elasmobranchs typically occupy higher trophic levels in food webs and, consequently, have a propensity to accumulate high organochlorine contaminant (OC) concentrations. However, not all sharks accumulate the same types of contaminants or at the same rate, making use of OCs a potential ecological tool. Bioaccumulation with respect to ontogeny was examined among three species of pelagic sharks (Shortfin Mako *Isurus oxyrhincus*, Common Thresher *Alopias vulpinus*, and Blue Shark *Prionace glauca*) that have varying diets and life history characteristics. Using recently collected and archived tissue from sharks caught in southern California, an area known for high contaminant levels, organic contaminants (polychlorinated biphenyls and chlorinated pesticides) were measured in livers of both females and males from a range of size classes for all species. Significant differences were found in OC concentrations among species and by

size. In addition, random forest analysis was able to distinguish species based on their contaminant signatures with a high degree of accuracy. The results of this study suggest that foraging ecology and species-specific life history characteristics impact the accumulation of organic contaminants.

0358 AES Conservation & Management I, Saturday 15 July 2017

Catherine Macdonald[1], Julia Wester[2]

[1]*University of Miami, Miami, FL, USA,* [2]*Field School, Coconut Grove, FL, USA*

Media Coverage of Shark Attacks in Cape Town, South Africa, 1850-2000

This paper uses newspaper articles (n=231) from the Cape Times and Cape Argus, published in Cape Town, South Africa, to measure changing human attitudes towards sharks and the risk of shark attack between 1850 and 2000. It analyzes popular reporting on the risks, causes, and social responses to human-shark interaction over time, tracing patterns of incidents and assessing ways in which public attitudes and journalistic approaches have evolved during the last 150 years. Findings, based on both qualitative analysis of articles and quantitative data (generated through word counts and topic coding) suggest that the types of information considered important and the discourse around shark attack has changed gradually but significantly. Evidence from this data set shows that a shift in the way the media talked about sharks was underway even at the height of hysteria surrounding the release of the movie "Jaws," long before explicit conservations about shark conservation were commonly part of public discourse. Findings reveal that historical data can help us understand the human-shark relationship diachronically, over longer time scales than are typically studied, and that this perspective could helpfully be factored into future management and conservation of shark species.

0220 HL GRADUATE RESEARCH AWARD, Friday 14 July 2017

Andrew MacLaren, Shawn McCracken, Michael Forstner

Texas State University, Texas, USA

Automated Detection of the Endangered Houston Toad's (*Bufo* [=*Anaxyrus*] *houstonensis*) Vocalization

Monitoring for many threatened or endangered anurans is carried out by detection of auditory vocalizations alone. This includes the Houston Toad, a relictual species endemic to East-Central Texas. Improved methods for producing survey data are of primary interest to researchers. Here we describe the development of a recognizer capable of detecting the call of the Houston Toad with a high degree of certainty using the software's SongScope and Kaleidoscope. Additionally, we utilize these data to re-evaluate the environmental conditions that induce male chorusing in this endangered

toad. Audio monitoring was achieved using SongMeter Acoustic Recorders placed near breeding locations. A subset of data were gathered and subdivided into three independent categories: training-data, incorporated into our recognizer; test-data, possessing a known number of vocalizations, a benchmark for recognizer performance; validation-data, audio captured from a single site in a single season, analyzed digitally and manually (i.e. human listener) to compare efficacy of each approach. These methods were repeated for Kaleidoscope. The successful recognizer was then applied to all audio collected in years 2010-2016. The presence/absence of Houston Toad chorusing was correlated with environmental data provided by NOAA. Our recognizer built in SongScope proved >97% effective at detecting Houston Toad vocalizations. Kaleidoscope proved more effective, simply by correcting for errors inherent in earlier software generations. Our autecological study utilizing automated detection data revealed male chorusing response to barometric pressure, temperature, and humidity inconsistent to previous reports from human performed call surveys.

0866 Herp Ecology II, Friday 14 July 2017

John Maerz, Jillian Howard, Kira McEntire

University of Georgia, Athens, GA, USA

Climate affects spatial patterns of hybridization between two salamander species

Models of climate effects on species rarely address ecological or evolutionary interactions between species. Recent syntheses suggest that studies of hybrid zones can directly address this challenge. Adaptive introgression within hybrid zones can create novel phenotypes that may alter species' responses to environmental change in ways that cannot be predicted by current models. Despite recognition of the importance of introgression, particularly among taxa that have undergone recent radiation, there remain relatively few studies of animal hybrid zone dynamics and eco-evolutionary responses to climate. *Plethodon shermani* and *P. teyahalee* hybridize extensively within the 4000 acre Coweeta basin in western North Carolina. We used color phenotype scores of more than 5,000 individuals from 96 sites across the basin to demonstrate the strong relationship between hybrid phenotype distribution and climate, most notably mean annual precipitation. Our results show that traits of both parent lineages are distributed within hybrids in relation to local climate. We hypothesize that the parent lineages of *P. shermani* and *P. teyahalee* represent broader "phenotypic syndromes" adapted to wetter or drier climates, respectively, and that the high spatial heterogeneity in climate is creating novel, adaptive phenotypes. If confirmed, adaptive introgression between these species would potentially alter species' responses to the shifting climate.

0359 LFC Physiological Performance II, Sunday 16 July 2017

Edward Mager

University of North Texas, Denton, TX, USA

Gulf of Mexico Oil Pollution and Larval Fish Physiology

Much has been learned in the years following the 2010 Deepwater Horizon (DWH) event regarding the impacts of crude oil exposure on the survival and physiology of larval fish native to coastal and pelagic habitats of the northern Gulf of Mexico (GoM). Nearly a decade's worth of research prior to DWH focused on elucidating the morphological and functional effects of polycyclic aromatic hydrocarbons, the primary toxic component of oil, on the cardiovascular system in developing early life stage fish. This work revealed a suite of functional and morphological defects (e.g., impaired cardiac looping, reduced ventricular contractility, bradycardia) that may vary among species, yet consistently culminate in a characteristic phenotype of pericardial edema. While the cardiotoxic phenotype is also clearly elicited in GoM larval fish exposed to oil, additional novel physiological impacts have recently come to light for such species with likely implications for survival. Notably, oil exposure to the pelagic mahi-mahi at elevated temperature increases energy consumption and yolk depletion rate as well as induces premature negative buoyancy and increases the sinking rate of embryos. Additionally, recent time-course studies of embryonic/larval GoM fish have revealed novel transcriptional responses to oil exposure suggesting developmental impairment to the neurological, renal and skeletal muscle systems and altered cholesterol biosynthesis. Follow-up studies focusing on neurological impacts have provided potential links from such transcriptional responses to, among other effects, reductions in visual acuity of oil-exposed larvae. Supported in part by a grant from GoMRI (Grant No: SA-1520) to the RECOVER consortium.

0199 Herp Morphology & Development, Saturday 15 July 2017

Jessica Maisano[1], Travis LaDuc[1], Christopher Bell[1], Diane Barber[2]

[1]*The University of Texas, Austin, Texas, USA,* [2]*Fort Worth Zoo, Fort Worth, Texas, USA*

The Cephalic Osteoderms of *Varanus komodoensis* as Revealed by High-Resolution X-ray Computed Tomography

Osteoderms constitute a morphological system that plays an important role in squamate systematics. However, their study has always been difficult due to their isolated occurrence in the skin, among the first organs to be removed during the skeletonization process. High-resolution X-ray computed tomography (HRXCT) offers a nondestructive means of visualizing osteoderms both in their natural relationship to each other and to the underlying cranial bones. While it is often stated that *Varanus komodoensis* has a 'chain mail' of osteoderms, this morphological system was never described in this charismatic taxon. Further, given its size, it can be expected that *V. komodoensis* would present the pinnacle of osteoderm development in extant varanids, a group that tends to have weakly-developed cephalic osteoderms or none at all. Indeed, our HRXCT scan of a 19-year-old captive individual from the Fort Worth Zoo reveals an elaborate mesh of

cephalic osteoderms that are incredibly numerous and morphologically diverse. We describe this skeletal system and compare it to the cephalic osteoderms in other varanoids.

0104 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Christopher Malinowski[1], Felicia Coleman[2], Christopher Koenig[2]

[1]Florida State University, Tallahassee, FL, USA, [2]Florida State University, Coastal and Marine Laboratory, St. Teresa, FL, USA

Mercury in Atlantic Goliath Grouper (*Epinephelus itajara*): sources, bioaccumulation patterns, and potential impacts to population recovery

Coastal fish populations are facing burgeoning and unprecedented threats to their health and sustainability, and many have undergone substantial declines in recent decades. Along with overfishing and habitat destruction, elevated levels of industrial contaminants are at the epicenter of this issue. Of particular concern is mercury because of its neurotoxic effects, its ability to bioaccumulation in some forms, and because we have tripled mercury levels in the upper ocean since the beginning of the Industrial Revolution. For large, long-lived fishes, like the Atlantic Goliath Grouper (*Epinephelus itajara*) (*i.e.,* can grow up to ~3 m/400 kg), mercury toxicity may result in severe tissue damage, neurological impairment, reduced growth and development, starvation, disrupted blood chemistry (*e.g.*, immune system function), reduced reproductive success, and higher rates of mortality. Goliath Grouper life history and behavioral traits—long-lived, late maturation, large, and strong site fidelity—make them a useful species to model regional, habitat-specific, and ontogenetic patterns in bioaccumulation of mercury and its effects. For this study, we investigated (1) the effects of mercury on health and reproduction; and (2) diet and stable isotope patterns (N, C, S) to determine the sources of mercury and the relationship between mercury intake, assimilation and accumulation.

0613 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Nadya Mamoozadeh, Jan McDowell, John Graves

Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA

An Assessment of Genetic Population Structure for Striped Marlin (*Kajikia audax*) in the Pacific and Indian Oceans Using Genome-wide SNPs

A major challenge to the management of highly migratory marine fishes is the identification of management units appropriate for species that display long distance

movements, frequently traverse international boundaries, and that may comprise seasonally mixed stocks. A variety of approaches have been used to infer the number of biological units present for a marine fish species in a particular region, including population genetic assessments based on the use of molecular tools; however, the ability to resolve the low levels of genetic differentiation anticipated for populations of many marine fishes has traditionally been limited by the use of small numbers of molecular markers. Recent widespread availability of next-generation sequencing technology now facilitates powerful genome-wide assessments of intraspecific connectivity. In this study, the genetic population structure of striped marlin (*Kajikia audax*) is evaluated using a genomic approach and sample collections from throughout the Pacific and, for the first time, Indian oceans. Results from this study suggest the presence of a genetically distinct population of striped marlin in the Indian Ocean, and provide key insights into inter-oceanic connectivity between striped marlin from the Pacific and Indian oceans. A number of genetically distinct populations were also detected in the Pacific Ocean and is consistent with inferences from previous studies. Collectively, results from this study provide information useful for reducing uncertainties currently associated with the management of striped marlin throughout the species range, and demonstrate the utility of genome-wide assessments of intraspecific connectivity in highly migratory marine fishes.

0635 AES Trophic Ecology/Physiology, Friday 14 July 2017

Kaitlyn A. Manishin[1], Kenneth J. Goldman[2], Margaret Short[1], Curry J. Cunningham[3], Peter Westley[1], Andrew C. Seitz[1]

[1]University of Alaska Fairbanks, Fairbanks, AK, USA, [2]Alaska Department of Fish and Game, Homer, AK, USA, [3]NOAA, Juneau, AK, USA

Estimates of annual salmon shark consumption

Salmon sharks (*Lamna ditropis*) are relatively large, endothermic sharks that inhabit the top trophic level in the Bering Sea. Though they are thought to be an apex predator, their role in the ecosystem remains poorly understood. For example, the biomass of prey fish annually consumed by salmon sharks is unknown. To better understand one aspect of predation by salmon sharks in the Bering Sea, we estimated annual food consumption for an average adult salmon shark. Per capita consumption estimates were calculated using three different methods drawing on a mixture of literature from salmon sharks and closely related species: 1) a percentage of predator body weight per day (daily ration), 2) the fitted parameters of a generalized von Bertalanffy growth curve, and 3) a bioenergetics mass balance equation. The agreement (or disagreement) of these estimates acts as a measure of uncertainty around the calculated values. Scaling per capita consumption estimates to a population level is most sensitive to the population size of salmon sharks, which is unknown. As a result, we present a range of population consumption estimates examined in comparison to biomass removed by commercial fisheries.

0080 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kyle Mara[1], Avi Kaplan[2], Michael Balsai[2], Jennifer Cromley[3], Tony Perez[4], Ting Dai[2], Yona Davidson[2]

[1]University of Southern Indiana, Evansville, IN, USA, [2]Temple University, Philadelphia, PA, USA, [3]University of Illinois, Champaign, IL, USA, [4]Old Dominion University, Norfolk, VA, USA

How Instructors Can Enhance Biology Students' Motivation, Learning, and Grades Through Brief Relevance Writing and Worked Examples Interventions

The high failure rates of students in "gateway" STEM courses has been a persistent problem for biology programs nationwide. Common wisdom contends that addressing this problem requires major curricular overhauls. As large systematic changes are often impractical, we propose an alternative approach: supplementing the regular instruction with brief online modules targeting specific motivational and cognitive (learning) mechanisms. We conducted an intervention study to test the effects of different combinations of cognitive and motivational modules on undergraduate Introductory Biology students' motivation, biology reasoning, course achievement, and intentions to remain in science. Introductory Biology students at a large urban university were randomly assigned to a no-treatment control condition or one of nine combinations of cognition-motivation modules. In this poster, we report on a subset of these data: the cognitive module of Worked Examples (demonstrations of biology problem solving) and the motivation module of Relevance Writing (brief open-ended writing assignments about connections of biology concepts to one's life). While the overall study may necessitate collaboration between biology instructors and educational science researchers, Worked Examples and Relevance Writing interventions are easy to implement and integrate with existing course content. Increased student engagement in these modules led to higher motivation, biology reasoning, and course grades. These findings support the effectiveness of delivering brief supplemental cognition-motivation modules online to students' success in introductory biology courses. This easily implemented intervention can utilize online tools such as Blackboard, Canvas, or Moodle, and takes the burden off faculty to radically change their instruction when such change is not practical.

0599 LFC Contributed III, Saturday 15 July 2017

Katrin Marancik[1], David Richardson[2], Jeffrey Guyon[3], Molly Lutcavage[4], Benjamin Galuardi[6], Chi Hin Lam[4], Harvey Walsh[2], Sharon Wildes[3], Douglas Yates[3], Jonathan Hare[2]

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Dartmouth, Fairhaven, MA, USA, [6]Greater Atlantic Regional Fisheries Office, NMFS, NOAA, Gloucester, MA, USA

Discovery of a Slope Sea spawning ground for Atlantic bluefin tuna (*Thunnus thynnus*)

The movements of Atlantic bluefin tuna (*Thunnus thynnus*) are among the best documented of any highly migratory species, but how to interpret these migrations within the broader context of life history and population structure remains controversial. Currently, Atlantic bluefin tuna are managed as an early-maturing eastern stock, which spawns in the Mediterranean Sea, and a late-maturing western stock, which spawns in the Gulf of Mexico. However, electronic-tagging studies show that many bluefin tuna, assumed to be of a mature size, do not visit either spawning ground during the spawning season. Evidence of a Slope Sea spawning ground has existed since a longline cruise in the area from June to July 1957, but targeted surveys for bluefin tuna larvae in the Slope Sea were never performed, and most research over the past few decades has dismissed the idea that substantial levels of spawning occur in the western Atlantic outside of the Gulf of Mexico. Here, we use multiple years of opportunistic and targeted ichthyoplankton sampling to present unequivocal evidence that the Slope Sea is an important bluefin tuna spawning ground. Overall, the discovery of a bluefin tuna spawning ground highlights the need to further integrate traditional shipboard sampling with electronic tagging studies in testing many of the long-held assumptions that underlie the management of this iconic species. The possibility that there are additional undocumented bluefin tuna spawning grounds should continue to be evaluated.

0382 SSAR SEIBERT ECOLOGY III, Friday 14 July 2017

Kelsey A. Marchand[1], Christopher M. Somers[1], Ray G. Poulin[2]

[1]University of Regina, Regina, Saskatchewan, Canada, [2]Royal Saskatchewan Museum, Regina, Saskatchewan, Canada

You are Where you Eat: Isotopic Resource Use of Urban Western Painted Turtles (*Chrysemys picta bellii*) in Regina, Saskatchewan

Stable isotope analyses enable unprecedented insight into the ecology of aquatic species using only a small tissue sample. Recently developed Bayesian statistical methods also generate a unique quantitative perspective on niche and resource use. In this study, we used stable isotopes of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) in nail samples from western painted turtles (n = 77) in Regina, Saskatchewan to examine resource-use variation within and among individuals in an urban population. Western painted turtles are known to be generalist omnivores, so we predicted that there would be little systematic isotopic variation by sex, location, or age class. In contrast to our predictions, standard isotopic ellipses varied by habitat, and there was only ~30% isotopic niche overlap between the sexes. Mixing models for source apportionment in MixSIAR revealed that the documented isotopic variation was influenced by a variety of factors, including sex,

body size, habitat, and primary diet items. For example, adult female turtles consume substantially more crayfish than adult males or subadults of either sex. To our knowledge, this is the first application of stable isotopes derived from nail samples to examine resource use in western painted turtles.

0357 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Zachary J. Marcou[1], Josh B. Pierce[2], D. Craig Rudolph[2], Stephen J. Mullin[1]

[1]Dept. of Biology, Stephen F. Austin State Univ., Nacogdoches, Texas, USA, [2]Southern Research Station, U.S. Forest Service, Nacogdoches, Texas, USA

Detection and Activity Patterns of Snakes in Large Parcels of Contiguous Habitat

Traditional methods for the sampling of snake communities do not lend themselves well to effective assessment of community composition over large areas of suitable habitat (>100 ha). Furthermore, they rarely provide accurate depictions of the activity patterns of the species therein, on either a daily or seasonal basis. This is especially true if resources with which snakes typically associate (e.g., overwintering sites, water bodies, migration routes, etc.) are limited in their availability, not localized, or in some other way, difficult to monitor. Recent advances in technology have improved the resolution and efficiency of wildlife cameras, allowing detection of snakes at the species level. We sampled snakes in a ~7000-ha portion of the Angelina National Forest (ANF; east Texas) using 20 game cameras that captured images every 30 sec at the open intersections of drift fence arrays. We detected an assemblage of 18 species representing three families of snakes: Colubridae, Elapidae, and Viperidae. We determined whether or not the time of detection correlated with other variables (e.g., habitat or weather conditions), and how seasonal shifts in some species' diel cycles might influence the frequency of their detection. We discuss our results as they pertain to management of ANF and snake conservation in the region.

0817 Amphibian Conservation III, Sunday 16 July 2017

Madeleine Marsh, Shashwat Sirsi, Michael Forstner

Texas State University, TX, USA

Evaluating the effects of Red Imported Fire Ants (*Solenopsis invicta*) on Juvenile Houston Toads (*Bufo* = [*Anaxyrus*] *houstonensis*) in a Coastal Prairie Grassland in Southeast Texas

First described in 1953 in Houston, Texas, the Houston toad (*Bufo* = [*Anaxyrus*] *houstonensis)* was among the first amphibians to be listed as federally endangered in the

United States. Houston toads have suffered range-wide declines primarily due to habitat loss, while predation by invasive species is also considered contributory to declines. In this study, we investigated the effects of the invasive red imported fire ant (RIFA) (*Solenopsis invicta*), on the survival of juvenile Houston toads at the Attwater Prairie Chicken National Wildlife Refuge (APCNWR). Formerly, APCNWR was the focus of a reintroduction project, but was considered ineffective as no subsequent occurrence was observed and the site was deemed unsuitable for the toad. Impacts by RIFA on Houston toad juveniles during reintroduction efforts are one reason implicated for that lack of suitability. To examine potential RIFA impacts, we evaluated growth and survival among treatments using a mixed-effects for repeated measures model and Program MARK, respectively, for treated and untreated plots. Based on our results, we found that RIFA had no effect on growth or survivorship of juvenile toads. Additionally, we were able to draw some conclusions of Houston toad habitat based on other trends present in the data that support connectivity of habitats being vital to the success of the juveniles of this species. APCNWR represents juvenile dispersal habitat, one of the most critical and least understood ecological aspects for Houston toad management. The results from this study also assist with assessing new sites for reintroduction and population restoration efforts.

0033 Fish Ecology II, Sunday 16 July 2017

Edie Marsh-Matthews, William Matthews

University of Oklahoma, Norman, OK, USA

Temperature affects recruitment of Western Mosquitofish, *Gambusia affinis*, in mesocosms.

Our analyses of long-term collections in Oklahoma streams by the late Jimmie Pigg suggested that population size of Western Mosquitofish in July was correlated with temperature the previous April. To examine this correlation experimentally, we stocked 16 pregnant female mosquitofish in each of eight mesocosm units at the University of Oklahoma Aquatic Research Facility on 9 May 2014. Four units were covered with shadecloth and four were left exposed. Water temperature in exposed units was as much as 5 C higher than that in shaded units on days with full sun. The experiment was ended on 21 July 2014 (74 days later) at which time all fish were retrieved from mesocosms and preserved for enumeration in the laboratory. In most units, all females originally stocked were retrieved, so it was possible to determine which individuals had been born in the mesocosms. Overall, there were significantly more recruited individuals in the exposed mesocosm units than in the shaded units. These results are consistent with the field observations and suggest that variation in recruitment in mosquitofish populations is related to environmental temperatures, with higher recruitment in warmer waters. Given that *Gambusia* species are known to be invasive outside of their native ranges, these results have important implications for the potential interaction between climate change and introduction of mosquitofishes.

0445 AES Genetics, Systematics, & Biogeography, Sunday 16 July 2017

Andrea Marshall[1], Tom Kashiwagi[1], Harry Webb[3], Al Dove[3]

[1]Marine Megafauna Foundation, Truckee, California, USA, [2]Center for Fisheries, Aquaculture, & Aquatic Sciences, Southern Illinois University Carbondale, Carbondale, Illinois, USA, [3]Georgia Aquarium, Atlanta, Georgia, USA

Growing Evidence for a Distinct Third Species of Manta Ray

Devilrays (Family Mobulidae) are currently divided into two distinctive genera, *Mobula* Rafinesque, 1810 and *Manta* Bancroft, 1828, however recent analyses show the genus *Mobula* as paraphyletic with the inclusion of *Manta* species. Once considered to be monotypic, the genus *Manta* was revised in 2011, with two living species described, *Manta alfredi* and *Manta birostris*. A third putative species was additionally proposed but lacked conclusive molecular support and a clear morphological description. Field surveys as well as comprehensive reviews of historical records and examinations of museum specimens support a growing body of evidence of a third species of manta ray. Examination of living specimens housed in the Georgia Aquarium, USA has confirmed that individuals of the putative species have distinct diagnostic characteristics. The putative species appears, for the most part, to be geographically isolated from other *Manta* species, although interactions with *Manta birostris* are believed to occur within its range. Its geographic distribution is still being clarified but preliminary findings show it to occur exclusively within the Atlantic and associated water bodies. Seasonal aggregation areas have been identified but population-level studies are in their infancy and there is a distinct paucity of ecological information on this putative species. As a regional endemic, with a smaller distribution than the other two species of *Manta*, which are currently listed as Vulnerable to Extinction on the IUCN Redlist of Endangered Species, research on this putative species should be a priority.

0106 Herp Ecology I, Friday 14 July 2017

Christopher Marshall[1], Joshua Cullen[1], Mehsin Al-Ansi[2]

[1]Texas A&M University, Galveston, TX, USA, [2]Qatar University, Doha, Qatar

Hawksbill Sea Turtle (*Eretmochelys imbricata*) Spatial Movement in an Extreme Environment: The Arabian Gulf as a Living Laboratory for Investigating Organismal Response to Climate Change

Sea turtles are an interesting model system to investigate organismal responses to extreme habitats. Air and water temperatures of the Arabian Gulf regularly exceed 50^{o}C and 30^{o}C, respectively and marine habitats are hypersaline. Female hawksbill sea turtles in Qatar exhibit a significantly smaller body size and reduced fecundity presumably due to life in this extreme environment. Our goal was to investigate movement and habitat

use of hawksbills as part of a conservation program in Qatar. Turtles were captured in-water by hand or on the beach post-nesting. Satellite tags were affixed onto the hard shells and deployed. A Bayesian state space model was used to calculate error-adjusted geolocations from Argos-derived movement tracks. Additionally, an incorporated behavioral switching model provided insights into habitat use and a mixed model investigated which environmental parameters were influential to hawksbill movement. Hawksbill sea turtles remained within the Gulf, but moved widely throughout the southern basin. Behavior was variable, but overall turtles traveled directly and quickly to distinct shallow habitats and then remained in discrete regions for weeks at a time, presumably foraging. Sea surface temperature had the most significant effect on movement. During summer months, turtles consistently moved toward a steep drop-off consistent throughout the southern gulf at the 30-40 m isobath. We hypothesize that turtles sought out thermal refuge since these areas coincided with the cooler waters of the southern Arabian Gulf loop current. The need to spend time over cooler but deeper habitat may negatively impact energy acquisition, growth and reproductive output.

0684 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Friday 14 July 2017

Thomas Marshall[1], Carlos Baca[1], Decio Correa[2], Michael Forstner[1], Dittmar Hahn[1], David Rodriguez[1]

[1]Texas State University, TX, USA, [2]University of Texas at Austin, Austin, TX, USA

Population Genomics of Amphibian Chytrid in Central and East Texas

Chytridiomycosis, an emerging infectious disease caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), is responsible for declines in amphibian populations worldwide. *Bd* was first described in the 1990s, and there is still much to learn about its regional diversity and origin. The Global Panzootic Lineage (*Bd*-GPL) has been responsible for devastating amphibian population declines and extinctions in Central and South America, Australia, and the western U.S., while a few localized endemic lineages have been discovered in regions of Brazil and Asia that have not experienced such severe chytridiomycosis outbreaks and mortality events. There are still several geographic gaps in our knowledge of *Bd* genetics, and relatively few studies have focused on regions in which *Bd* exhibits low virulence, creating a bias in our current knowledge of the pathogen's diversity. One such region that has not seen disease-associated declines is the state of Texas. Although this pathogen has been detected from amphibians in the state, strains had not been characterized genetically prior to this study. Here, we isolated, cultured, and used next-generation sequencing to characterize strains of *Bd* in Central and East Texas. Our results indicate a diversity of *Bd* genotypes, but all strains analyzed thus far belong to the invasive GPL. By turning our attention to regions such as Texas, we seek to gain a more complete evolutionary picture of *Bd*, and a better understanding of why chytridiomycosis outbreaks that impact amphibian populations tend to occur in certain areas and not others.

0338 Lightning Talks I, Friday 14 July 2017

Amanda Martin, Karen Root

Bowling Green State University, Bowling Green, OH, USA

Comparing Complementary Tracking Methods for Reptiles in Ohio

Reptiles are facing large global declines as a result of habitat loss, which makes it crucial to understand their interactions with the environment. Radio telemetry examines spatial patterns by identifying home ranges, habitat use, and dispersal; however it has limitations when examining fine-scale movements. Fine-scale movement patterns provide important insights for managers (e.g., habitat connectivity). Researchers have used thread trailing, a well-established method, and fluorescent powder, a relatively new method to examine detailed paths. We examined fine-scale movement patterns of eastern box turtles (*Terrapene carolina carolina*) using fluorescent powder, thread trailing, and radio telemetry to better understand daily movement patterns. We found that thread trailing and radio telemetry underestimated movement patterns compared to fluorescent powder. Thread trailing had more linear pathways, while fluorescent powder delineated more curves. Fluorescent powder provides similar results as thread trailing and we suggest that fluorescent powder is a more useful tool for examining movement patterns because it is less invasive. Radio telemetry is useful for relocating turtles, but it is an insufficient method for identifying distance traveled. Our study found that radio telemetry underestimated distance traveled by half because it uses straight-line path analysis. To continue our work, we are using radio telemetry combined with fluorescent powder to track reptiles in the Oak Openings Region in northwestern Ohio. We will expand our work by including several snake species to test whether fluorescent powder is a suitable method for tracking them and to compare movement patterns. We expect to find differential movement patterns among reptilian species.

0705 Snake Biology II & Snake Genomics, Sunday 16 July 2017

Bradley T. Martin[1], Marlis R. Douglas[1], Andrew T. Holycross[2], Stephen P. Mackessy[3], Michael E. Douglas[1]

[1]University of Arkansas, Fayetteville, AR, USA, [2]Arizona State University, Tempe, AZ, USA, [3]University of Northern Colorado, Greeley, CO, USA

Population Genomics of the Western and Desert Massasaugas (*Sistrurus catenatus tergeminus* and *S. c. edwardsii*)

The Western (*Sistrurus catenatus tergeminus*) and Desert (*S. c. edwardsii*) Massasauga are distributed across the midwestern and southwestern United States, respectively, and both are of conservation concern. Their populations are declining, in part, due to habitat loss and fragmentation, and both are spread across wide geographic areas in which population structure may be apparent. The presence of several small, geographically isolated populations (e.g., in Missouri and Colorado) may also represent distinct gene

pools. Thus, our goals were to 1) identify population structure within *S. c. tergeminus* and *S. c. edwardsii*, and 2) assess admixture near contact zones between the two taxa. To do so, we assayed Single-Nucleotide-Polymorphism (SNP) variation across the genome of ~45 *S. c. tergeminus* and ~20 *S. c. edwardsii*, as well as ~15 Eastern Massasauga (*S. c. catenatus*), using double digest restriction-site associated DNA (ddRAD) sequencing. Our data indicate population structure within *S. c. tergeminus,* and we found populations within *S. c. edwardsii* that appear to have a high occurrence of admixture with *S. c. tergeminus*. These analyses provide valuable insight for conservation strategies, including potential designation of Management Units (MUs). Furthermore, the extent of admixture seen between *S. c. tergeminus* and *S. c. edwardsii* may be indicative of recent habitat degradation.

0831 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Daniel Martin[1], Larissa Bailey[1], Cameron Aldridge[1], Robert Reed[2], Daniel Manier[2]

[1]Colorado State University, Fort Collins, CO, USA, [2]U.S. Geological Survey, Fort Collins, CO, USA

A Comparison of Species Distribution and Occupancy Models for Informing Reptile Conservation

Conservation planning requires an understanding of how environmental factors influence wildlife distributions. This data-based planning is particularly relevant for species that may not be able to respond adequately to a rapidly-changing environment. Here, we are interested in how different modeling approaches could be used to inform conservation planning for the Texas Horned Lizard (*Phrynosoma cornutum*), a species thought to be in decline in the Great Plains. This region is characterized by gradients across natural (e.g., temperature, precipitation) and anthropogenic (e.g., habitat loss) attributes, and is suited for investigation of relationships between environmental variation and reptile distributions. Species Distribution Models (SDMs) are one approach used in this effort. While SDMs enable use of historic records of occurrence (i.e., detections), modeled estimates of occurrence don't account for imperfect detection, and don't have associated estimates of precision. Occupancy models do account for imperfect detection and provide estimates of precision, but require somewhat more robust data collection methods. Defensible conservation plans should incorporate measures of uncertainty and account for bias caused by imperfect detection. We compare contemporary SDMs and Occupancy models of the Texas Horned Lizard distribution in the Great Plains. Based on this comparison, we suggest approaches for data collection and analysis that would enable validation of these models and reduce sampling bias. Results from this effort will improve insight into environmental drivers of change in reptile distributions, and better inform conservation actions.

0585 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Lindsey Martin, Brook Fluker

Arkansas State University, Jonesboro, AR, USA

Effects of Black-spot Disease on the Body Condition of Bleeding Shiners, *Luxilus zonatus*

Black-spot disease is common in freshwater fishes and results from encystment of digenetic trematodes into the fins and flesh of the fish. The fish serves as an intermediate host in the life cycle of the trematode, and deposits melanin around the cyst as an immune response, producing the black spots for which the disease is named. Several studies have documented the occurrence of black-spot disease on game fishes, but little is known about how the trematode infestations affect the health or body condition of small stream fishes. The objective of this study was to evaluate the prevalence of black-spot infection in the Bleeding Shiner (*Luxilus zonatus*) throughout Myatt Creek, a tributary to the Spring River in northeastern Arkansas. Specimens collected in the 1970s were obtained from the Arkansas State University Museum of Zoology (ASUMZ) and examined for abundance and location of black-spot infection. Infection rates will be compared to body condition (weight/length ratios) and overall body shape using geometric morphometric techniques. In order to compare potential changes in infection rates in Myatt Creek over the past 40 years, ASUMZ specimens collected in the 1970s will be compared to freshly collected specimens.

0625 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Rene Martin, Matthew Davis

St. Cloud State University, St. Cloud, MN, USA

Repeated Evolution of Heterodonty in Lanternfishes (Teleostei: Myctophiformes)

Lanternfishes (Teleostei: Myctophiformes) are among the most species-rich (~250 species) and abundant (~50% of midwater fish biomass) mesopelagic (200–1000 m) fish lineages in oceanic systems worldwide. They are characterized by bioluminescent photophores and structures that produce and emit light. Few studies have focused on the anatomical structures associated with feeding in lanternfishes. Recent work indicates that there is considerable variation in mouth sizes across lanternfishes, which may be indicative of niche differentiation in the open ocean. This study seeks to investigate variation in dentition of the oral jaws of lanternfishes, with a focus on the repeated evolution of heterodonty in these fishes. When placed in context of a novel data-rich hypothesis of evolutionary relationships for lanternfishes, we have identified that heterodonty has repeatedly evolved across the lanternfish radiation, and is present in over 1/3 of lanternfish biodiversity. We find that oral jaw bones with heterodonty are

restricted to the dentary and premaxilla, while other tooth-bearing bones of the oral jaws (palatine and mesopterygoid [=endopterygoid]) lack heterodont dentition.

0565 Fish Morphology, Saturday 15 July 2017

Christopher Martinez[1], Matthew McGee[2], Peter Wainwright[1]

[1]*University of California, Davis, Davis, CA, USA,* [2]*Monash University, Victoria, Australia*

Evolution of Feeding Kinesis in African Cichlids

Evolution of the feeding apparatus in modern bony fishes has been dominated by a trend of dissociation among skeletal components in the head and jaw, resulting in increasingly mobile forms. We are interested in the relationship between head and body shape and the capacity for kinesis during feeding. We compared feeding strikes in the trophically and morphologically diverse cichlids of the East African rift lakes, Malawi and Tanganyika. We used geometric morphometrics to quantify feeding kinesis as trajectories of shapes through multidimensional shape space. We analyzed videos recorded at 1000 f/s of 326 feeding strikes from 56 species, all of which are represented in a published phylogeny, based on ultraconserved elements. While starting head and jaw shape was significantly related to the degree of kinesis achieved while feeding, it explained only about 10% of the total variance. This is a surprisingly weak relationship given that the cichlid feeding mechanism is considered to be a series of mechanical linkage systems with determinant motion. Thus, a major feature of the cichlid feeding system, the amount of output kinesis it produces, cannot be explained by head and jaw morphology alone. We also find a significant but weak relationship between body shape and feeding kinesis, indicating largely independent evolution between these body regions.

0781 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jackson Martinez, Travis Richards, Jay Rooker, R.J. David Wells

Texas A&M University at Galveston, Galveston, TX, USA

Feeding Ecology of the Sargassum Frogfish (*Histrio histrio*) in the Gulf of Mexico

Due to the lack of structure in the pelagic environment, it is hypothesized that *Sargassum* mats provide predation refuge for many species including several economically valuable fish species. As a locally abundant ambush predator permanently residing within the *Sargassum*, the Sargassum Frogfish, *Histrio histrio*, potentially represents a persistent top-down influence within a habitat critical to the survival of juvenile fishes. The objective of this study is to describe the feeding ecology of the Sargassum Frogfish and to elucidate its role as a potential predator within the *Sargassum* habitat. 46 frogfish samples were

collected during research cruises in June and July of 2015 and 2016 and were analyzed for stomach content and stable isotope analysis. Stomach content analysis yielded 66 prey items including caridean shrimp, polychaete worms, isopods, and teleost fishes. Stable isotope data of $\delta^{13}C$ suggest frogfish utilize carbon derived from pelagic sources (phytoplankton) while $\delta^{15}N$ data suggest frogfish function as mid-level predators. It is hypothesized that Sargassum Frogfish undergo an ontogenetic shift in diet but due to a limited size range within our samples, no clear shift was identified. However, with additional samples, we expect to see a change in diet from invertebrates to teleost fishes. This study will provide insight into the feeding ecology of the Sargassum Frogfish and will further our understanding of its role within *Sargassum* communities.

0907 Fish Conservation I, Sunday 16 July 2017

Ángel L. Martínez-González[1], Fredys F. Segura-Guevara[1], Glenys Tordecilla-Petro[2], Charles W. Olaya-Nieto[1]

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Length–Weight Relationship of Mayupa *Sternopygus macrurus* in the Low Sinu River, Colombia

The length–weight relationship of Mayupa *Sternopygus macrurus* Bloch collected in the Low Sinu River, Colombia, was estimated. The length-weight relationship and condition factor were estimated with the equation $TW = a\ TL^b$ and $Cf = TW/TL^b$, respectively. The size ranged between 39.5-112.0 cm TL, the total weight between 132.0-1847.0 grams, and the mean length in the catch estimated was 73.4 cm TL. Length-weight relationship estimated was $TW = 0.028\ (\pm 0.17)\ TL^{2.39\ (\pm 0.09)}$, n = 542, r =0.91, were the monthly growth coefficient ranged between 1.57 (September) and 2.88 (June), being negative allometric for the study year, with statistically significant differences, while the condition factor ranged from 0.004 (June) and 1.011 (September), without statistically significant differences. Analyzing the condition factor, spawning season of Mayupa and hydrological cycle of Sinu River, correlation was found between them only in descending and low waters.

0568 ASIH STOYE CONSERVATION I, Thursday 13 July 2017

Katie Mascovich, Kimberly Andrews

Odum School of Ecology, University of Georgia, Athens, Georgia, USA

Messages in the Sand: Nesting Loggerhead Sea Turtle (*Caretta caretta*) Crawl Behavior on a Developed Beach

A nesting sea turtle's path indicates the amount of that animal's energy expenditure; more energy is spent as a path becomes less direct. To better understand how anthropogenic factors influence crawl behavior, we collected data on 132 loggerhead sea turtle (*Caretta caretta*) tracks on Jekyll Island, Georgia, USA. We used a straightness index (straight distance to water divided by distance the turtle crawled) and path index (distance the turtle crawled divided by number of turns along the crawl divided by straight distance to water) to examine the effect of human intervention and infrastructure on track patterns. A turtle's out-crawl (return to ocean) was classified as being undisturbed, program (followed by education program), and restrained (restrained for processing). The mean straightness indices for undisturbed, program, and restrained out-crawls were 0.91, 0.92, and 0.77, respectively. A Kruskall Wallis test with post hoc pairwise comparisons showed that restrained crawls differed significantly from undisturbed and program out-crawls ($\chi^2_2 = 25.76$, $p < 0.05$). A one-way ANOVA with post hoc Tukey HSD determined that path indices for natural (0.41) and restrained (0.16) out-crawls were significantly different from each other, but neither significantly differed from program out-crawls (0.28; $F_{2,127} = 14.69$, $p < 0.0001$). Additionally, the type of light visible from crawls was classified as none visible, only ambient, only point-source, or both ambient and point-source. Neither the straightness nor path indices significantly differed between lighting groups. These results indicate that intervention by managers is an effective technique to mitigate human interaction and lighting infrastructure.

0550 Herp Genetics, Saturday 15 July 2017

Audrey Matheny, Laura Kimmel, Gary Thomas, Emily Gertrand, Susan McKenna, Samah Houmam, Allyson Fenwick

University of Central Oklahoma, Edmond, OK, USA

Comparative Genetic Structure of Mediterranean Geckos (*Hemidactylus turcicus*) across Central Oklahoma

Exotic species are good models for understanding ecological and evolutionary processes because they adapt to new habitats over observable time periods. Mediterranean geckos engage in commensal relationships with humans and have been introduced throughout the world. Central Oklahoma is at the northern edge of the U.S. range and likely near the limit of the species' climate tolerance. During 1963-1965 and 1985-1997, geckos were repeatedly introduced from Goose Island State Park in Texas to Howell Hall at the University of Central Oklahoma (UCO). At the Oklahoma City Zoo, geckos escaped from the Herpetarium at an unknown date. Geckos escaped from labs at the University of Oklahoma (OU) near the current locations of Sutton Hall and the old Clock Tower before the mid-1960s. We expect the UCO and Texas populations to cluster together and the OKC Zoo and OU populations to cluster separately from each other and UCO and Texas. Within the UCO, OKC Zoo, and OU populations we expect to find evidence of stepping stone pattern of colonization from the source building. We collected tissue samples from 10-20 individuals on occupied buildings at each location and genotyped

16 previously published microsatellites. Preliminary STRUCTURE and differentiation analyses show two genetic clusters; one including UCO and Texas as expected, and the other including OKC Zoo and OU, which is unexpected. We are also analyzing RAD-Seq libraries for a subset of UCO samples. Future research will expand sampling to gecko introductions along a north/south corridor.

0255 AES Ecology II, Sunday 16 July 2017

Philip Matich[1], Jeremy Kiszka[2], Johann Mourier[3], Serge Planes[3], Michael Heithaus[2]

[1]Sam Houston State University, Huntsville, TX, USA, [2]Florida International University, Miami, FL, USA, [3]Centre de Recherches Insulaires et Observatoire de l'Environnement, Perpignan, France

Species co-occurrence affects the trophic interactions of two juvenile reef shark species in tropical lagoon nurseries in Moorea (French Polynesia)

Coastal ecosystems serve as nursery habitats for a variety of taxa, including sharks, highlighting their ecological importance. However, these ecosystems are some of the most threatened in the world. Changes in environmental conditions, resource availability, and habitat quality are leading to shifts in species distributions and abundances, which theory predicts will have considerable effects across food webs. As such, understanding the adaptive capabilities of species is critical for identifying species and habitats of concern. We used plasma 13C and 15N values from juvenile blacktip reef sharks (*Carcharhinus melanopterus*) and juvenile sicklefin lemon sharks (*Negaprion acutidens*) in Moorea, French Polynesia to investigate how species co-occurrence affects niche shifts and trophic flexibility. Previous research suggests that juvenile sharks are capable of adjusting their foraging tactics to account for changes in food availability, and our findings here suggest that juvenile sharks are also able to account for changes in competition. Co-occurrence led to shifts in the trophic interactions of both blacktip reef sharks and sicklefin lemon sharks, leading to trophic niche partitioning, which did not appear to affect life history traits. Trophic plasticity suggests these sharks are able to account for changes in community structure, resource availability, and intra-guild competition, and may fill similar functional roles in the absence of the other species, which is important as environmental change and human impacts persist in coral reef ecosystems.

0257 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Philip Matich[1], John Mohan[2], Jeffrey Plumlee[2], Tom TinHan[2], R.J. David Wells[2], Mark Fisher[3]

[1]*Sam Houston State University, Huntsville, TX, USA,* [2]*Texas A & M University Galveston, Galveston, TX, USA,* [3]*Texas Parks and Wildlife Department, Rockport, TX, USA*

Factors shaping the co-occurrence of two juvenile shark species along the Texas Gulf Coast

Top-down effects are ubiquitous across ecosystems, however continued declines of many predators suggests that the reduction and loss of direct and indirect effects predators impose may lead to considerable changes in community structure. Coastal sharks have been particularly affected, with declines not only altering community composition, but potentially shark behavior and life histories, compounding effects on food web structure and resilience. As such, understanding interactions among sharks is important for predicting the consequences of potential future declines. Using data from long-term coastal gill net surveys in Texas, USA, we quantified blacktip shark (*Carcharhinus limbatus*) and bull shark (*C. leucas*) concentrations, and evaluated how environmental factors and shark sizes affected co-occurrence within and across species as an important step in understanding the factors that lead to greater spatial overlap and competition. Co-occurrence varied spatially and temporally, with a significant increase in co-occurrence from the 1970s-2010s, and a significant decrease in bull shark concentrations through time. Changes in environmental conditions, specifically increasing salinities, may have been responsible for increased blacktip and bull shark co-occurrence, which in turn may have led to decreased bull shark concentrations as a mechanism to reduce intraspecific competition. Plasticity in habitat use patterns suggest that each species is capable of adjusting to changing salinities attributed to sea level rise and variability in freshwater inflow, which may be important as climate change and human impacts alter hydrologies within Gulf Coast estuaries.

0032 Fish Ecology II, Sunday 16 July 2017

Bill Matthews[1], Bob Nairn[1], Nick Shepheerd[1], Zach Zbinden[2], Aaron Geheber[3], Edie Marsh-Matthews[1]

[1]*University of Oklahoma, Norman, OK, USA,* [2]*University of Arkansas, Fayetteville, AR, USA,* [3]*University of Central Missouri, Warrensburg, MO, USA*

Fishes of a Heavy Metal Contaminated Superfund Stream (Tar Creek, Oklahoma) after Operation of a Passive Treatment System

Mining in the Tri-State Mining District of Oklahoma, Kansas, and Missouri from 1891 to 1971 resulted in massive excavation of huge underground rooms, and extraction of many millions of tons of lead and zinc. After cessation of mining operations, these huge caverns slowly filled with water, until artesian pressure resulted in extrusion of heavily contaminated waters to the surface through bore holes or other exit points within the Tar Creek Superfund site. Fishes in the Tar Creek watershed have been heavily impacted by this heavy metal contamination such that in some natural stream channels only Western Mosquitofish and a few Green Sunfish survived. From 2004 to 2007 we

monitored fishes in an Unnamed Tributary (UT) to Tar Creek, Tar Creek proper, and reference sites. In 2008, a passive treatment system (PTS) of ponds was installed to treat the contaminated water and remove or reduce heavy metals. The system decreased concentrations of iron, zinc, lead, cadmium and arsenic by more than 96% and produced an effluent meeting hardness-adjusted, in-stream water quality criteria. From 2009 through our most recent samples in 2016, there was marked improvement of the fish community at sites within the receiving system. But a new source of highly contaminated water is now being treated with a new PTS that came on line in February 2017. We shall follow effects of the new PTS on fishes for the next several years.

0686 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Jessica Maxfield, Kathleen Cole

University of Hawaii Manoa, Honolulu, HI, USA

Shifting From Egg to Sperm Production in Bisexual Fishes: What Does an Ovotestis Have to do?

There are five clades in the family Gobiidae that have evolved hermaphroditism, possibly independently. Here we examine changes in ovotestis structure for two serially hermaphroditic species representing two different clades, *Eviota epiphanes* and *Lythrypnus dalli*. We focused on the transition from oocyte to sperm production among same 'sex' pairs, using histology to generate a morphological time series of transitional states. We found that the basic processes of transition were similar for both species. However, differences were also observed. In *L. dalli* the spermatogenic tissue had two clear sites of origin in the gonad while in *E. epiphanes,* there were no clear points of origin of spermatogenic tissue. Among *E. epiphane*s pairs, both individuals started to transition in 29% of all pairs, suggesting a contest for who would become male. Among *L. dalli* pairs, such contests were rarer, with only 14% of all pairs initiating joint transformation. The ovotestis transformation to sperm production in *L. dalli* was also initiated and completed more rapidly. Interestingly, the larger-size *L. dalli* also produced much smaller-sized sperm than *E. epiphanes*. While still in its early stages, our study indicates that the process of transitioning from ova to sperm production in these two serial hermaphrodites is not identical. Next, we will be looking at gene expression patterns during transition in these two species to see if differences in gene networks and/or pathways exist.

0511 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Brittany L. McCall, Brook L. Fluker

Arkansas State University, Jonesboro, AR, USA

Stability at Low Densities or Endangered? Spatiotemporal Population Dynamics of the Caddo Madtom (*Noturus taylori*)

The Caddo Madtom (*Noturus taylori*), an endemic to the Ouachita Mountain Ecoregion, was one of 404 species petitioned for listing on the Endangered Species Act by the Center for Biological Diversity. A previous survey stressed concerns of a population decline with evidence of small effective population sizes, historical between-drainage differentiation, and recent reservoir-induced within drainage differentiation. With microsatellite DNA loci, mitochondrial (mt) cytochrome *b* DNA sequence data, and intensive seasonal sampling we tested multiple hypotheses involving patterns of within and among drainage connectivity, spatiotemporal population dynamics, and habitat preferences. Preliminary Bayesian phylogeographic analysis of mtDNA using coalescent models resolved the Caddo and Ouachita river drainages as reciprocally monophyletic with recent divergence in the late Pleistocene (approx. 125,000 years ago). Microsatellite DNA data suggest a similar pattern of significant between drainage differentiation (Fst = 0.20, $P < 0.001$). Of 15 historic localities, 11 have been thoroughly sampled for presence/absence, with presence at 8 of the 11 localities. For the five localities included in the seasonal survey, an increase in mean relative abundance was observed from spring to summer in the Caddo River (0.29 to 9.05 CPUE, respectively) and in the Ouachita River (0.09 to 4.75 CPUE, respectively). Analyses of habitat preference using nonmetric multidimensional scaling suggest differences between the Caddo and Ouachita drainages, as well as differences between headwater and mainstem localities. Results from this study will aid in future listing decisions by U.S Fish and Wildlife, and state rankings by the Arkansas Game and Fish Commission.

0520 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brittany L. McCall, Brook L. Fluker

Arkansas State University, Jonesboro, AR, USA

Status Survey and Conservation Genetic Assessment of the Paleback Darter, *Etheostoma pallididorsum*

The Paleback Darter (*Etheostoma pallididorsum*), an endemic to the Ouachita Mountain Ecoregion, is a Species of Greatest Conservation Need in Arkansas. Additionally, in response to concern of a population decline from a prior allozyme study, *E. pallididorsum* is one of 404 species petitioned for listing on the Endangered Species Act by the Center for Biological Diversity. The objectives of this project were to survey historic localities, estimate size-distribution data and relative abundance on a seasonal basis, and assess population dynamics with microsatellite DNA loci. Average relative abundance (catch per unit effort) for all four seasonal sites was similar between winter and spring (0.36 and 0.39, respectively), with highest values in the summer (0.94). Over all seasons, relative abundance was similar between Caddo and Ouachita drainages (0.59 and 0.54, respectively). Preliminary analyses of microsatellite DNA loci revealed low, but significant genetic structure among localities (Fst = 0.054, $P < 0.001$), with the highest

levels of structure observed between river drainages. Population genetic diversity is relatively low (mean *He* = 0.59; mean alleles per locus = 5.06), but comparable to close relatives *E. boschungi* (mean *He* = 0.67; mean alleles per locus = 6.74) and *E. tuscumbia* (mean *He* = 0.57; mean alleles per locus = 5.53). Preliminarily, these results suggest that *E. pallididorsum* is relatively stable and abundant at sampled historic localities. Future analyses will provide updated information on range-wide presence/absence, and a better understanding of historical and contemporary connectivity among the Caddo and Ouachita river drainages.

0845 Lightning Talks II, Friday 14 July 2017

John McCall, Michael Sandel

University of West Alabama, Livingston, Alabama, USA

Invasive Green Swordtails (*Xiphophorus helleri*) at Two North Florida Sites

The green swordtail (*Xiphophorus helleri*) is invasive in a number of locales around the world. Native to Mexico and Central America, *X. helleri* has established itself at widespread sites in the U.S. This report documents the presence of feral populations of *X. helleri* in two North Florida streams on opposite ends of the Florida panhandle. Collections made in 2007, 2014, and 2016 revealed the presence of a reproductive population of *X. helleri* in a small stream flowing through Hurlburt Field, a U.S. Air Force installation in Okaloosa County in the western part of the panhandle. The invasive swordtails made up 80% of the fish assemblage, which also included the mosquitofish (*Gambusia holbrooki)* and the least killifish (*Heterandria formosa).* Later in 2016, *X. helleri* was collected from Little Fishweir Creek in Jacksonville, Florida. Again, the fish assemblage was dominated by the invasive poeciliid. This stream is a tributary of the larger Big Fishweir Creek, which empties into the St. Johns River. The sampling site is less than one mile from the St. Johns. The presence of *X. helleri* in these two widely separated locations in the Florida panhandle suggests that it may, in fact, be relatively widespread throughout North Florida. It should be noted that the streams share certain attributes. Both are small streams supporting a relatively low diversity of native fish species, flowing through heavily populated areas. Such streams are likely highly subject to aquarium release and subsequent invasions.

0603 Amphibian Conservation III, Sunday 16 July 2017

Emily McCallen, Bart Kraus, Nick Burgmeier, Songlin Fei, Rod Williams

Purdue University, West Lafayette, IN, USA

Movement and Habitat Use in Eastern Hellbenders (*Cryptobranchus alleganiensis alleganiensis*) Following Population Augmentation

Eastern Hellbenders (*Cryptobranchus alleganiensis alleganiensis*) are threatened in many parts of their range. Conservation actions, including population augmentations and reintroductions, may be necessary to ensure the future viability of vulnerable Eastern Hellbender populations. In Indiana, the rapidly declining population is now restricted to a single river. While augmentation may improve recruitment within this population by increasing local densities, it is important to understand the effects of these management actions on both long-term residents and translocated individuals. In order to determine the suitability of such an approach in Indiana, we monitored the movement and habitat use of 42 Eastern Hellbenders at two sites that underwent population augmentations. We radio-tracked three cohorts over multiple seasons: wild, adult residents; captive-reared, juvenile translocates; and wild, adult translocates. We examined general patterns of dispersal and calculated linear and mean convex polygon home ranges for each tracked hellbender. We used a series of generalized linear mixed models to compare movement patterns and habitat use between groups. We saw a low incidence of dispersal from translocation sites even among wild, adult translocates. Wild, adult translocates had larger home ranges than residents, but the magnitude of these differences decreased over time. Captive-reared, juveniles had similar home range sizes as adult translocates, but appeared to utilize suboptimal habitats compared to adults. This is the first study to demonstrate the suitability of population augmentations in low-density Eastern Hellbender populations. It also establishes the potential of techniques such as soft-releases and habitat enrichment to improve translocation success in Hellbenders.

0675 AES Behavior, Sunday 16 July 2017

Michael McCallister[1], Manuela Sales[1], Andrew Smith[2], John Mandelman[3], Andy Danylchuck[4], Matthew Ajemian[1]

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Field Observations of Mating Behavior in Two Species of Myliobatid Stingrays

Information on the mating behavior of elasmobranchs has been historically limited to observations in captivity. For batoids, observations of mating behavior from the wild are limited to a few species. Here, we present video documentation of two new cases of wild mating behavior in two species of myliobatid stingrays. On July 20, 2013, a male and female cownose ray (*Rhinoptera bonasus*) were observed mating in shallow coastal waters off New Jersey. On August 19, 2014, two spotted eagle rays (*Aetobatus narinari*) were observed mating in Harrington Sound, Bermuda. In both cases, video footage documented all stages of the mating sequence previously described in the literature: 1) close following, 2) pre-copulatory biting, 3) copulation/insertion, 4) resting, and 5) separation. The mating behavior observed for both *A. narinari* and *R. bonasus* is

consistent with observations in mating behavior described for both captive spotted eagle rays and the flapnose ray (*R. javanica*), a sister species of *R. bonasus*. To our knowledge, this is the first time a complete mating sequence has been documented in the wild for either species. Additionally, in both cases, we noted that the female ray was considerably darker in color than the male, which may be evidence of a visual pre-copulation cue, as seen in other fishes. The similarity of the mating behaviors presented here, and those observed in other ray species (e.g., *M. birostris*, *M. californica*, and *D. americana*) provides further support to the hypothesis that mating behavior may be highly conserved among the batoids.

0403 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Friday 14 July 2017

Evan McCartney-Melstad[1], Jannet Vu[2], H. Bradley Shaffer[1]

[1]University of California, Los Angeles, Los Angeles, CA, USA, [2]Stony Brook University, Stony Brook, NY, USA

Fine-Scale Population Genomics of Protected Tiger Salamanders (*Ambystoma tigrinum*) on Long Island, NY Reveals a Highly Structured Species Impacted by Major Roads

We sequenced thousands of nuclear loci in hundreds of individuals to characterize the population structure of state-endangered tiger salamanders (*Ambystoma tigrinum*) on Long Island and quantify the impacts of human development. We uncovered highly genetically structured populations over an exceptionally small spatial scale (approximately 40 km^2) in an increasingly human-modified landscape. We explore the geological and anthropological drivers of this genetic structure, as well as factors influencing the effective population size of ponds on the landscape. This study demonstrates the added value of genomic approaches in molecular ecology, as these patterns were not apparent in an earlier study of the same system using microsatellite loci.

0030 AES Genetics, Systematics, & Biogeography, Sunday 16 July 2017

Margaret McClain[1], Austin Gallagher[2], Neil Hammerschlag[2], Marcus Drymon[3], Dean Grubbs[4], Tristan Guttridge[5], Toby Daly-Engel[1]

[1]University of West Florida, Pensacola, FL, USA, [2]University of Miami, Coral Gables, FL, USA, [3]University of South Alabama, Mobile, AL, USA, [4]Florida State University, Tallahassee, FL, USA, [5]Bimini Biological Field Station, Bimini, BS, Bahamas

Connectivity and Relatedness in Tiger Sharks between the Gulf of Mexico and the West Atlantic

Shark dispersal for the purposes of reproduction is generally poorly understood, including that of Tiger Sharks (*Galeocerdo cuvier*), a large, circumglobal, coastal-pelagic species (Randall, 1992, Werry et al, 2014). While it has been found that both gravid and non-gravid females will often group together without males, no discrete mating areas or nursery grounds for tiger sharks have yet been identified in the Gulf of Mexico or West Atlantic Ocean (Sulikowski et al, 2016). Juvenile tiger sharks show some site fidelity, but adults appear to have large ranges, and their movement patterns are largely unknown (Werry et al, 2014). This research aims to identify reproductive relatedness including patterns in site fidelity and kinship among sites within and between the Gulf of Mexico and the West Atlantic (Bahamas). Using highly polymorphic microsatellite DNA fragment analyses, we will examine the relatedness of individuals from four sites, two in the Bahamas and two in the northern Gulf. We will use assignment testing to identify potential distribution corridors and critical habitat for tiger sharks, and examine genetic connectivity between broad geographic regions. Based on dispersal patterns observed in other large coastal shark species (Blower et al, 2012), we hypothesize that there will be shallow structure between the different sample sites due to habitat variation and philopatry. We further hypothesize that this structure will be male-biased, reflecting the female dependence on coastal nursery habitat.

0881 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jan McDowell, Heidi Brightman

Virginia Institute of Marine Science, Gloucester Point, VA, USA

A genetic-based investigation of blueline tilefish (*Caulolatilus microps*)

Blueline tilefish, *Caulolatilus microps*, also known as grey tilefish (Goode and Bean 1878), is a bottom dweller found at depths of 240-780 feet. Blueline tilefish is a member of the family Malacanthidae and have historically been reported to occur along the continental shelf from Virginia to the Campeche Banks of Mexico, occupying the same habitat as groupers and snappers. Although North Carolina was previously considered to be the northern extent of the species range, concentrations have recently been discovered in Virginia and Maryland, with reports as far north as Montauk, NY. The life-history parameters of blueline tilefish make them particularly vulnerable to overfishing; they are long-lived and grow slowly, with an estimated lifespan of up to 43 years and a maximum size of 900 mm fork length. The recent development of an unregulated fishery from New Jersey northward led to a substantial increase in commercial and recreational landings in the U.S. mid-Atlantic, raising concern about the sustainability of the resource. Meanwhile, the lack of information about stock structure led to uncertainty concerning appropriate management. In this study we developed 25 polymorphic microsatellite loci and used these loci to analyze 490 samples from the U.S. east coast range from New York to the southern Florida Keys and 15 samples from western Florida in the Gulf of Mexico. Although the sedentary nature of adults suggests population structure, there was no evidence that blueline tilefish are comprised of genetically distinct populations along the U.S. East Coast.

0878 Fish Genetics, Saturday 15 July 2017

Jan McDowell, Hamish Small

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Genetic assessment of the population structure of Tautog, *Tautoga onitis*

Tautog, *Tautoga onitis* (Linnaeus, 1758), which aggregate around structured habitat (wrecks, rocks, and bridge pilings etc.), are slow to mature and have a low reproductive rate relative to other teleosts. Like other reef fishes, tautog is extremely vulnerable to overexploitation. Tagging studies indicate that tautog undergo limited movements, with an onshore offshore pattern of migration but no evidence of either long-range or north-south migration, suggesting that distinct stocks might exist along the Atlantic coast. In 2016 four regional management groupings were initiated to account for the limited north-south migration and regional harvest patterns. Given that overfishing is still occurring in two regional management units, understanding the stock structure is critical for appropriate management. To investigate the population structure of tautog, we developed and applied 21 microsatellite loci to samples collected from North Carolina, Virginia, Maryland, Connecticut, and Massachusetts from 2014-2017. In addition, a subset of these samples were shipped to Diversity Arrays Technology in Canberra, Australia, for downstream genome reduction and next-generation sequencing, resulting in identification of 4148 short sequences (~70bp) containing SNPs. This data was used to test the hypothesis that tautog comprise a single genetic stock across its U.S. East Coast range.

0076 ASIH STOYE ECOLOGY & ETHOLOGY I, Thursday 13 July 2017

Kira McEntire, John Maerz

University of Georgia, Athens, GA, USA

Integrating Biophysical and Individual Based Models to Simulate How Habitat Structure and Behavior Moderate Salamander Sensitivity to Climate

Understanding how climate affects species is a long-standing question in ecology. On an individual level, organisms directly interact with microclimate, which is altered by vegetative structure. Ultimately, the organism's integration with microclimate is governed by its physiology, but behavior can moderate these interactions. We used an individual based modeling (IBM) approach, incorporating biophysical models, to explore the interactions of vegetative structure and behavior on an organism's physiological interactions with climate using woodland salamanders (genus *Plethodon*) as a model organism. The IBM was simulated using four different versions across the same area of Southern Appalachia, where steep rainfall gradients naturally exist. We estimated salamander activity time for a climate only model (baseline), a model

including vegetative heterogeneity (presence of midstory canopy plants across half of the area), a model including the ability to climb plants (a potential behavioral strategy to alter climate interactions), and a model including both vegetative heterogeneity and climbing behavior. The simulations suggest vegetative structure and behavior both act to moderate the impact of a rainfall gradient by boosting overall activity times. This effect was most pronounced for juvenile and hatchling salamanders. The two factors had seasonally distinguishable effects, with overall increases in foraging time primarily occurring in the fall. Activity increases were smaller in spring and summer months, with the increases focused in the drier areas. Future species distribution models (or similar) should consider the moderating influences of vegetative structure and behavior on species responses to climate change.

0438 ASIH STOYE GENERAL ICHTHYOLOGY III, Friday 14 July 2017

Caitlin McGarigal, Chris Lowe

CSU Long Beach, CA, USA

Behavioral Effects of Angling and Handling Stresses on Kelp Bass, *Paralabrax clathratus*, in Southern California

Catch and release is a common regulatory strategy for many gamefish species, including kelp bass (*Paralabrax clathratus*), yet effects of capture-related stresses on fish physiology and behavior are species-specific and remain largely unknown. Quantifying these impacts, and identifying best practices, will aid in managing the economically and ecologically valuable kelp bass fishery in southern California. Fish movement and activity following catch and release were evaluated in the Catalina Island Marine Life Reserve using a VRAP receiver array and acoustic accelerometers (Vemco Ltd, USA; V9A). To evaluate effects of stress on behavior fish were caught on hook and line, force-fed a transmitter, and released; control fish were fed squid with a hidden transmitter underwater by divers. All fish were tracked until tag was regurgitated (range 2-8 d) and recovered. Area (m^2) of the core range (50% KUD) and home range (90% KUD) were significantly reduced in fish caught and released for the first 6 hrs at liberty, but was similar to that of control fish by 18-24 hrs post-release. Kelp bass exhibit diel behavioral patterns with highest activity (acceleration, m/s^2) during crepuscular periods. Caught and released fish exhibited fewer episodes of high activity (associated with normal foraging, predator avoidance, and reproductive activities) than control fish for 24 hr post-release, but resumed normal activity within 48 hr. Capture and handling stresses may result in some behavioral impacts (reduced area use and activity) but individuals appear to rapidly recover.

0103 Herp Environment, Saturday 15 July 2017

Jay McGhee

Northwest Missouri State University, Maryville, Missouri, USA

Use of PVC Pipe Refugia to Assess Summer Pond Use in Cope's Gray Treefrogs

Ponds act as important breeding sites for amphibian species such as Cope's Gray Treefrog (*Hyla chrysoscelis*), and determining how individuals use such ponds can be important to conservation efforts. We examined the use of four ponds during the breeding season by this species on a site bordering Mozingo Lake in Nodaway County, Missouri over a two year period. We used arrays of PVC pipe refugia to monitor usage centered on randomly selected trees bordering the pond. Pipes were placed in a straight line in the following categories: 2m away from the tree in the direction moving away from the pond, attached to the tree, 2m away from the tree in the direction towards the pond, and 5m away from the tree in the direction towards the pond. We compared specific treefrog choice of PVC refugia relative to their pond in terms of canopy cover and internal pipe temperature. Eighty-four tree frogs made use of 52% of 64 pipes. We found that one pond was used by a greater number of treefrogs than the others (c^2=22.78, df = 9, P = 0.0067). Thirty-six percent of individual treefrogs (5 out of 14) significantly selected for PVC pipe refugia under canopy cover. No treefrogs selected for internal temperature relative to randomly selected refugia (0 out of 9). These results suggest a high level of variation in pond selection during the breeding season, as well as variation in selection of pipe refuges with canopy cover being a potentially useful determinant of pipe choice.

0446 ASIH STOYE ECOLOGY & ETHOLOGY I, Thursday 13 July 2017

Donald McKnight, Roger Huerlimann, Lin Schwarzkopf, Ross Alford, Deborah Bower, Kyall Zenger

James Cook University, Townsville, QLD, Australia

The Role of Microbial Communities in the Recovery of Rainforest Frogs

The amphibian chytrid fungus (*Batrachochytrium dendrobatidis*; *Bd*) has caused many amphibian species to decline worldwide. However, some of the species that declined have subsequently recovered. The cause of these recoveries is poorly understood, but changes in the frogs' microbiomes is a possible contributor. To test this possibility, we are comparing the microbiomes of the following four species of Australian frog in both low and high *Bd* prevalence locations: Stoney Creek frog (*Litoria wilcoxii*), green-eyed treefrog (*Litoria serrata*), waterfall frog (*Litoria nannotis*), and Australian lace-lid frog (*Litoria dayi*). All four species are found along the same streams and have persisted at warm, low-elevation sites (<300 m elevation), but each species has a different history with *Bd* at the cooler, upland sites. At high elevations, *L. wilcoxii* never declined, *L. serrata* declined and recovered, *L. nannotis* disappeared and has subsequently returned, and *L. dayi* disappeared and has yet to return. We are using next generation sequencing to examine the bacterial and fungal communities of these species at both high and low elevation sites. If microbial communities played a role in the history of declines and

recoveries in these species, then we expect that *L. wilcoxii* populations and recovered upland populations of *L. serrata* and *L. nannotis* will have a high proportion of anti-fungal bacteria compared to populations of *L. dayi* and low elevation populations of *L. nannotis* and *L. serrata*. The results of this study will be presented and will have important implications for managing wild frog populations and designing recovery plans.

0432 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Christian McNabb, Megan Novak, Scott L. Parker

Coastal Carolina University, Conway, South Carolina, USA

A comparative analysis of microhabitat use by the southern copperhead (*Agkistrodon contortrix contortrix*) between a fragmented and non-fragmented environment in Horry County, SC

Habitat fragmentation influences spatial ecology and habitat use of many vertebrate species. The southern copperhead (*Agkistrodon contortrix contortrix*) is a common venomous snake in South Carolina and is found in both fragmented and non-fragmented habitats. The purpose of this study was to quantify microhabitat use of copperheads inhabiting fragmented (Coastal Carolina University, CCU) and non-fragmented (Waccamaw National Wildlife Refuge, WNWR) habitats in Conway, SC. From May to October, 2016, we actively searched for *A. contortrix* and tracked individuals (n = 72) using thread bobbins every other day. For each snake observation, microhabitat data (e.g. substrate type, canopy cover, herbaceous cover, woody debris, woody stem density) was recorded using a 1m^2 quadrat. Time of day, season, and habitat location (forest edge, core, open) were also recorded. At CCU, snakes preferred edge habitats (89% of observations) and preferred microhabitats consisting of pine straw or leaf litter (72% of observations). The remaining 38% of microhabitat observations consisted of other microhabitats (e.g. within woody debris, within shrubs, atop gravel, under soil). In contrast to CCU, snakes at WNWR were observed in core (52%) and in edge habitats (43%), with 5% of observations occurring in open habitat with no apparent difference in microhabitat preference (i.e. snakes were observed with relatively equal frequency among microhabitat types). Prey availability, habitat preference, and suitable thermal environment likely influences microhabitat choices. These results suggest that habitat fragmentation may alter how animals use the available habitat resources in their environment.

0194 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; Poster Session II, Rio Grande Exhibit

Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Jessica McQuigg, Michelle Boone

Miami University, Oxford, Ohio, USA

Examining the Effect of Host Condition and Temperature on Interactions between Amphibian Chytrid Fungus and Native Anurans

Amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), is an emerging infectious disease responsible for amphibian declines and extinctions globally, yet factors that influence disease outbreaks are not well understood. The complex host-pathogen interactions between amphibian species and Bd are influenced by environmental conditions, such as temperature, and host condition. The objective of this study was to examine how host condition influenced the susceptibility of American toad (*Anaxyrus americanus*) and wood frog (*Lithobates sylvaticus*) metamorphs to Bd exposure at 17°C or 25°C-temperatures within the thermal optima of Bd. I measured the effects of Bd exposure across temperatures on growth, and pre-winter and overwintering survival of small or large metamorphs. My central hypothesis was that anuran body condition and environmental temperature would interact to influence the impacts of Bd on growth and survival. Amphibians were reared to metamorphosis in mesocosms at high and low densities to produce small and large body sizes at metamorphosis respectively. Juveniles were exposed to Bd post-metamorphosis and examined for survival and growth for 82 days prior to overwintering. While temperature had no effect on the impact of Bd, Bd-exposed individuals experienced reduced terrestrial growth compared with control animals. Pre-winter survival was not impacted by Bd exposure, however, exposed American toads experienced 100% mortality overwinter and exposed wood frogs experienced increased mortality compared with control anurans. These results suggest that Midwestern amphibians may experience sub-lethal effects of Bd exposure and substantially decreased overwintering survival which could have impacts on population dynamics and increase the risk of local extirpation.

0356 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kenzie Medley, Alicia Mathis

Missouri State University, Springfield, MO, USA

When Territorial Salamanders Cheat: A Test of the Dear Enemy Phenomenon in Southern Red-backed Salamanders

The "dear enemy" hypothesis states that a territory owner shows reduced aggression toward a neighbor once territorial boundaries are established. Neighbors that do not restrict their activity to the agreed upon territory boundaries can be characterized as "cheaters" and might be subject to retaliation. To establish territory boundaries, we exposed each focal Southern Red-backed Salamander, *Plethodon serratus,* to reflections

produced from a mirror located on one side of an arena for a week. To simulate a cheating neighbor, we moved the mirror to the other side of the arena; a cooperating neighbor was simulated by replacing the mirror in its original location. Salamanders exposed to the cheating "neighbor" were significantly more aggressive than salamanders exposed to the cooperating "neighbor". Discrimination against "cheating" neighbors is consistent with the dear enemy hypothesis.

0558 AES GRUBER AWARD II, Thursday 13 July 2017

Emily Meese, Chris Lowe

CSULB Shark Lab, Long Beach, CA, USA

Diel movements and fine-scale activity patterns across heterogeneous thermal environments of the CA horn shark, *Heterodontus francisci*

Because water temperature influences internal body temperatures of ectothermic sharks, it is considered the key environmental variable to directly influence their physiology (e.g., metabolism) and behavior (e.g., movement patterns, feeding rates). This project uses active acoustic telemetry and accelerometer data loggers (ADLs) to quantify diel movements and fine-scale activity rates of horn sharks (*Heterodontus francisci*) as they move through a heterogeneous thermal environment. At Catalina Island, nine horn sharks (1.8 - 3.5 kg) were fitted with custom tag packages that include an acoustic transmitter (Vemco, V9-6L) and an ADL which records 3D body acceleration, depth, and temperature. Each shark was continuously tracked for 24 hrs. After being tagged, individuals tended to rest in shallower, warmer water during the day. Diel movement spaces ranged from 1,140 m^2 to 44,440 m^2 of space, with 67% of their movement activities occurring at night. Horn sharks spent approximately 65% of daytime hours resting, whereas only 32% of nighttime hours were spent resting. During the nighttime activity periods, sharks experienced up to a 10°C difference while traversing deeper (>30 m habitat). Sharks were found being active in temperatures from 9°C to 24°C. Differences by size and sex were additionally examined to determine what mechanisms influence horn shark activity. Quantifying horn shark movements and activity across heterogenous environments will allow us to quantify their energetic landscape and to predict how changing ocean temperatures may affect the distribution and behavior of this kelp forest associated species.

0651 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Andrew Meiborg, John Peterson

University of Wisconsin-Platteville, Platteville, WI, USA

Effects of Weather Variability and Distance on the Viabilty of Automated Recording Systems for use in the Monitoring of Wisconsin's Endangered Cricket Frog, *Acris blanchardi*

The Blanchard's cricket frog is Wisconsin's only endangered amphibian. The Blanchard's cricket frog requires riverbanks with cracks and crevices in which to overwinter because they are not freeze tolerant. Riverbank development in Wisconsin has the potential to damage important habitat for this species. The Wisconsin DNR has put guidelines into place that minimize such practices in areas where cricket frogs are present. To determine cricket frog presence, surveys must be conducted by an individual approved by the Endangered Resources Review Program. Bringing an approved individual on site to conduct a cricket frog survey is expensive and paid for by the landowner. An option for reducing these costs is the use of recording devices in place of a human surveyor. To see if this is a viable option we compared recording devices to human surveyors and determined their ability to discern calls from various distances. Recorded cricket frog calls were broadcasted at a wetland and surveys were conducted at various distances and during variable whether conditions. Meters were found to be a viable analog for human observers when monitoring frog populations. Additionally, wind direction with respect to the call source was found to play a significant role in max call discernibility. Results would suggest placement of recording devices as well as human observers at a would have an impact on population monitoring.

0014 Amphibian Conservation I, Sunday 16 July 2017

Joseph R. Mendelson III

Zoo Atlanta, Atlanta, GA, USA

10 Years of the Amphibian Ark: An overview of amphibian conservation-breeding programs

As part of the IUCN global Amphibian Conservation Action Plan, published in 2007, IUCN and World Association of Zoos and Aquariums formed the Amphibian Ark program to advise and build capacity for ex-situ conservation-breeding programs worldwide. The 10 year anniversary of the program offers an opportunity to review the successes, failures, and challenges of the captive breeding components of the overall ongoing challenges of amphibian conservation, including those directly associated with Amphibian Ark or not so.

0827 LFC Physiological Performance III, Sunday 16 July 2017

Jose Fernando Mendez Sanchez

Universidad Autonoma del Estado de Mexico, Estado de Mexico, Mexico

Physiology of Larval Air Breathing Fish

The same physiological mechanisms to get over the environmental threat experienced by water-breathing fish larvae plus an "on time" developmental program for an air-breathing organ are the survival challenges for the air-breathing fish larvae. Aquatic hypoxia is the main environmental pressure for the transition between the extraction of O_2 from the water and the extraction of O_2 from air. Thus, air-breathing fish larvae develop an air-breathing-organ which requires the ability to increase ventilation of the gas exchange organs, accompanied by appropriate changes in blood perfusion of these organs. This presentation reviews our state of knowledge of the air-breathing fish larvae physiological traits and the techniques to measure them. A comparative analysis of different species of air-breathing fish larvae is presented on how hypoxia affects the cardiovascular and respiration physiology and air-breathing-organ morphology as well as its consequences on survivorship, the promotion of developmental plasticity and different larval life styles. Additionally, the question is asked: How is the onset of key physiological processes related to the beginning of the air-breathing, and can this event be moved on the developmental time by the influence of hypoxia?

0250 Reptile Behavior, Friday 14 July 2017

Mark Merchant[1], Dusty Savage[1], Amos Cooper[2], Chris Murray[3]

[1]McNeese State University, Lake Charles, LA, USA, [2]Texas Parks and Wildlife, Port Arthur, TX, USA, [3]Tennessee Tech University, Cookville, TN, USA

Nest Maintenance and Defense Regimens of the American Alligator (*Alligator mississippiensis*)

We employed camera traps, under the influence of small circuit boards, which captured photographs of alligator nest areas in a time-lapse fashion. The data revealed that alligators visit their nests frequently initially after the eggs are laid, and then nest attendance decreases rapidly during the first week of incubation. We observed a steady decline from 0.56 to 0.06 visits/nest/day during the first eight days of incubation throughout the first eight days of the first season (2011), and 0.42 to 0.08 during the second season (2012). However, nest visitation increased dramatically near the end of the 65-day incubation period. In addition, most of the visits occurred during the night time, with only 14.8 and 35.3% of visits during the daytime during the 2011 and 2012 field seasons, respectively. A large portion of the daytime visits were recorded during hatching and hatchling movement from the nest site.

0500 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Arianne Messerman, Manuel Leal, Raymond Semlitsch

University of Missouri, Columbia, Missouri, USA

Juvenile Survival Among Ringed Salamanders (*Ambystoma annulatum*)

Declining amphibian populations have been noted across the globe, and this taxon is now widely considered to be the most threatened among vertebrates. Mole salamanders in the genus *Ambystoma* are not exempt from this trend, with approximately 63% of these diverse species under federal protection in at least one country in which they occur. Life history data describing these at-risk species are needed to predict the responses of populations to differing management strategies and habitat changes. Such projections will be useful for selecting efficient conservation plans for declining populations. Due to the fossorial nature of juvenile and adult *Ambystoma* in many species, few data currently exist describing the vital rates of these life stages. To reduce this gap in our knowledge and inform models of *Ambystoma* population demography, I conducted an eight-month capture-mark-recapture study within outdoor enclosures to empirically estimate juvenile survival rates among ringed salamanders (*Ambystoma annulatum*). These survival estimates are some of the only available vital rate data for juvenile ringed salamanders, a rare endemic species of the Ozark and Ouachita Mountains. As a test of methodology, I further identified how survival rates and abiotic conditions changed between forested enclosures and enclosures designed to mimic forest habitat. In doing so, I have evaluated the realism of conditions in the non-forested enclosures, and improved the enclosure architecture for future studies examining vital rates in terrestrial ambystomatids. The results of this research will improve our ability to accurately model population dynamics and management outcomes for Ringed Salamanders and similar ambystomatids.

0480 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Matthew Metcalf, Wendy Brosse, John Herman

Florida Gulf Coast University, Fort Myers, Florida, USA

Population Dynamics of the Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) on Florida Gulf Coast University's Campus

Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*) are the largest venomous snakes in North America, endemic to the Lower Coastal Plains of the Southeastern United States. The species is not listed for state or federal protection but is currently under review due to habitat loss, fragmentation, and wanton killings. As an ambush predator, *C. adamanteus* may remain stationary for several days in wait of prey. Despite such a large body size, their sedentary lifestyle results in relatively small landscape movements. Limited studies have looked at the spatial ecology and population dynamics of this species, but is especially lacking in south Florida. This on-going research is being conducted on a university campus in southwest Florida which boasts approximately 160 hectares of conservation land (over half of its total land) surrounding its core facilities. Herein we report general home range use and morphometrics for these individuals as well as general information in regards to neonates occurring within the campus site.

0477 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Matthew Metcalf, Edwin M. Everham III, John Herman

Florida Gulf Coast University, Fort Myers, Florida, USA

Landscape Ecology of Eastern Indigo Snakes (*Drymarchon couperi*) in Southwest Florida

The Eastern Indigo Snake (*Drymarchon couperi*) is a large, non-venomous snake endemic to the southeastern United States. This species was listed as federally threatened in 1978 and still holds this status. Studies have documented *D. couperi* as having the largest home range for any native snake species in North America. However, a majority of these studies focused on populations from their northern ranges in southern Georgia and north-central Florida. Due to climatic and habitat differences between south Georgia and south Florida, basic life history may vary for this species. Additionally, southern populations are uniquely interacting with exotic sympatric species, such as the Burmese Pythons (*Python bivittatus*), that may affect *D. couperi* landscape use. We conducted a radio-telemetry study in the Rookery Bay National Estuarine Research Reserve in Collier County, Florida. Herein we report our data in regards to *D. couperi* home range sizes and spatial use in a southwest Florida nature reserve. These findings will allow a more complete understanding of *D. couperi* life history traits such as home range sizes, refugia use, seasonal variability, and general behavior in southwest Florida, which should inform management plans for the southern populations of this species.

0406 SSAR SEIBERT ECOLOGY I, Thursday 13 July 2017

Madeline Michels-Boyce[1], John Krenz[1], Rachel Cohen[1], Nora Ibarguengoytia[2]

[1]Minnesota State University, Mankato, Mankato, Minnesota, USA, [2]Centro Regional Universitario Bariloche, Universidad Nacional del Comahue, San Carlos de Bariloche, Río Negro, Argentina

Cold-climate adaptation in lizards: A common-garden experiment

In order to survive winters in cold climates, organisms may prepare physiologically by storing energy and reducing metabolism and behaviorally by retreating to a suitable refuge. In ectotherms, decreasing temperature or photoperiod or both can be the proximate cause of the onset of brumation but it's not clear whether both factors are necessary to stimulate physiological changes. If brumation in response to seasonal cues is an adaptation, then ecotypic variation in responses by latitude should exist. To detect such ecotypic variation, we collected five-lined skinks (*Plestiodon fasciatus*) from two latitudes (Minnesota and Texas). To distinguish the effects of photoperiod and temperature on brumation, we exposed lizards from both latitudes to either decreasing or constant regimes of each of the two factors (four treatments total). We predicted that behavioral responses (e.g., food consumption) would be cued by a reduced photoperiod,

while most physiological responses (e.g., liver glycogen levels, oxygen consumption, and others) would be cued by temperature. We also predicted that the lizards from the high latitude would store more energy and have lower critical thermal minima than lizards from the low latitude. Results for several response variables will be presented but, for example, decreasing temperatures increased mass-specific oxygen consumption but decreasing photoperiod decreased oxygen consumption. High-latitude lizards consumed more oxygen than low-latitude lizards. The presence of north-south ecotypic variation in cold adaptation and physiological responses to wintering cues would be important considerations in species conservation in the face of climate change.

0312 Fish Ecology II, Sunday 16 July 2017

Rosanna Milligan, Tracey Sutton

NOVA Southeastern University, Dania Beach, FL, USA

Quantifying Pelagic Habitat Use by Myctophids in the Northern Gulf of Mexico

Deep pelagic ecosystems are some of the largest on Earth but are amongst the least understood. As human impacts on the deep oceans continue to increase, there is an urgent need to understand the processes that influence pelagic fauna, particularly in deep waters. One of the most globally-important taxa are the Myctophidae, which are a ubiquitous component of the deep-pelagic micronekton and play key roles in the vertical and horizontal transfer of energy between ecosystems. In the present study, quantitative, depth-stratified trawl data were analysed to assess the distributions of the dominant myctophid species in relation to physical and chemical environmental variables in the northern Gulf of Mexico (GoM) during summer 2011. The data were collected through the NOAA-supported Offshore Nekton Sampling and Analysis Program. Significant correlations to meso-scale features associated with the Loop Current were observed at depths to 1000 m, but the effects were weak and only explained 6 - 11% of the observed variance in assemblage composition. These results indicate that myctophid assemblages were well-mixed in 2011 and suggest high dispersal rates across the study region (>500 km). These findings have implications for understanding the sensitivity of myctophid populations following different forms of disturbance.

0233 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Alice Millikin[1], Sarah Woodley[3], Drew Davis[2], Jim Anderson[1]

[1]West Virginia University, Morgantown, WV, USA, [2]University of South Dakota, Vermillion, SD, USA, [3]Duquesne University, Pittsburgh, PA, USA

Factors Influencing Salamander Hormones in Created Wetlands

Small isolated wetlands are critical breeding habitat for many amphibians. Many of these wetlands are susceptible to destruction due to lack of regulation. Therefore, it is important to create new suitable habitat that can sustain healthy wildlife populations to mitigate loss. Concentrations of corticosterone, a hormone related to stress, development, and growth, can indicate a populations' physiological health and habitat quality. The objective of our research was to determine if habitat characteristics in created wetlands influence corticosterone levels of Spotted Salamander (*Ambystoma maculatum*) larvae. From May-June in 2015 and 2016, we sampled Spotted Salamander larvae (n=10/wetland) in 26 wetlands created between 2011 and 2014 in the Monongahela National Forest, West Virginia. We collected environmental data including vegetation cover and water quality at each wetland. Analysis indicates that larval total length and wetland water temperature are positively correlated with corticosterone and the best predictors for corticosterone levels. Vegetation cover also showed a positive correlation with corticosterone levels. Our results can improve understanding of the relationship between physiological conditions and habitat quality and how it can be used to interpret wildlife population health and habitat degradation.

0880 ASIH STOYE GENERAL ICHTHYOLOGY I, Thursday 13 July 2017

Joshua Millwood[1], Michael Sandel[1], David Neely[2]

[1]The University of West Alabama, Livingston, AL, USA, [2]Tennessee Aquarium Research Institute, Chattanooga, TN, USA

Environmental and Phylogenetic Effects on the Dermal Microbiome of Mobile Basin Sculpin (Teleostei: *Cottus*)

The sculpin family (Cottidae) ranks among the lesser-known taxa comprising a freshwater biodiversity hotspot in the Mobile River Basin. Morphological conservatism among sculpin species has confounded efforts to resolve alpha taxonomy, to the extent that most recent descriptions have relied heavily on molecular phylogenetics. Eastern *Cottus* species are important water quality bioindicators, but this sensitivity to anthropogenic stressors correlates with relatively high extinction risk. This risk imparts a need to understand the physiological mechanisms associated with stress response, including protection from environmental pathogens. A relatively new area of study in fishes is the dermal mucosal microbiome. The importance of microbes within the human dermis has been well documented, but the dermal mucosa (slime) of teleosts represents an unexplored microscopic ecosystem. We investigate the microbial flora of these fishes to discover correlations among microbiome, host genetics, and environment while also examining the phylogenetics of known Mobile Basin populations. This study looks at the microbiome of the four recognized species/subspecies within the Mobile Basin and how they group within the Uranidea clade, while also examining the alpha diversity among the different populations. Two of these populations occur at the extreme southern reaches of the habitat range and are focused on for ecological and geographical significance. These populations may be most important in regards to conservation efforts.

0148 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES SYMPOSIUM – APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Brittany Minnig[1], James Gelsleichter[1], Dean Grubbs[2]

[1]*University of North Florida, Jacksonville, FL, USA,* [2]*Florida State University, Tallahassee, FL, USA*

Plasma 8-hydroxy-2'-deoxyguanosine as a Biomarker of PAH Exposure in Gulper Sharks, *Centrophorus granulosus*, Exposed to the Deepwater Horizon Oil Spill

The Deepwater Horizon (DWH) Oil Spill was the largest oil spill in history, resulting in excessive amounts of contaminants released into the Gulf of Mexico. Polycyclic aromatic hydrocarbons (PAHs) are constituents found within the oil that pose the greatest health concern for marine life in and around the various contamination zones. These carcinogenic compounds have a high lipophilicity allowing them to bioaccumulate and localize in fat stores. PAHs are documented as being capable of inducing high amounts of intracellular reactive oxygen species (ROS), causing increased oxidative damage to biomolecules. Normally, antioxidants repair these damaged systems and replace depleted macromolecules, but this function is hindered when DNA degradation occurs and corrupts the integrity of the genome. 8-hydroxy-2'-deoxyguanosine (8-OHdG) is formed as a byproduct of oxidative DNA damage caused by ROS, making it a useful biomarker of pollutant exposure and effects. In the present study, plasma from gulper sharks, *Centrophorus granulosus*, collected from the spill zone between 2-6 years after the spill was tested for 8-OHdG. Higher concentrations of plasma 8-OHdG were exhibited in individuals 2-4 years after the oil spill, perhaps signifying increased oxidative stress during this period. However, a large decline in plasma 8-OHdG was observed in samples collected 4-5 years after the spill, likely suggesting recovery. To our knowledge, this is the first study of its kind to observe plasma 8-OHdG as a biomarker of exposure to pollutants in marine life.

0449 LFC Contributed IV, Saturday 15 July 2017

Tony Miskiewicz

Wollongong City Council, Wollongong, NSW, Australia

Comparative assessment of morphological and pigmentation characters during larval development of species of 10 genera of F. Gobiidae and two genera of F. Eleotridae

The Gobiidei are a very diverse group of fish comprising nine families with about 270 genera and 2,210 species. There have been a variety of studies undertaken using morphological, osteological and molecular characters of adults to investigate

phylogenetic relationships within the group. Larval developmental series collected from southern Australian waters of 10 genera of F. Gobiidae (210 genera, 1,950 spp) *Arenigobius, Afurcagobius, Favonigobius, Gobiopterus, Paedogobius, Psuedogobius, Redigobius*, *Nesogobius, Bathygobius* and *Tasmanogobius*, and two genera of F. Eleotridae (35 genera 155 sp) *Hypseleotris* and *Philypnodon* were assessed. For larval development series of species from these 12 genera, ontogenetic changes in morphometric characters and pigmentation patterns and the size at development of fins, notochord flexion and transition to juveniles for each genus will be described and compared. There was considerable variation in these larval characters between the two families and between genera. The larval development characters are assessed to determine similarities and differences between genera and then compared with the proposed lineages for these genera based on adult characters.

0823 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kelsey Mitchell, Thomas Mast, Katherine Greenwald

Eastern Michigan University, Ypsilanti, Michigan, USA

Comparison of Skin Glands of Sexual and Unisexual *Ambystoma* Salamanders Using Scanning Electron Microscopy

Cutaneous mucous and granular glands are characteristic of amphibians and play an integral role in predator defense mechanisms. In *Ambystoma* salamanders, these dermal glands are concentrated along the back and dorsal ridge of the tail. Unisexual (all female) *Ambystoma* salamanders reproduce via kleptogenesis, in which insemination by a sympatric sexual male is necessary to trigger egg development. The zygote can develop gynogenetically or via incorporation of the male's genome into the ovum. This unique reproductive mode results in individuals having biotypes (genome combinations) ranging from diploid to pentaploid. Although unisexual salamanders have persisted for 6 million years, kleptogenesis has ecological drawbacks. For example, unisexual salamanders have low dispersal ability and reduced fecundity relative to sexual taxa. The purpose of this study was to ascertain if unisexual salamanders have a higher concentration of cutaneous glands on the dorsal ridge of the tail when compared to *Ambystoma laterale*, one of the sympatric sperm donors. Genotyped tail tips from both *Ambystoma laterale* and triploid unisexual salamanders were imaged using an Amray Scanning Electron 1820 Microscope. Preliminary data suggests that unisexual *Ambystoma* salamanders not only have higher concentrations of cutaneous glands on the dorsal tail ridge, but larger glands as well. The larger number and size of dermal glands may offer the unisexuals greater protection against predation when compared to sympatric sexual taxa.

0404 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Shawna Mitchell[1], Kasey Benesh[2], Fernando Serrano[3], Bernie Kuhajda[1]

[1]*Tennessee Aquarium Conservation Institute, Chattanooga, Tennessee, USA,* [2]*Auburn University, Auburn, Alabama, USA,* [3]*Young Harris College, Young Harris, Georgia, USA*

Microhabitat preferences and diet competition with non-native centrarchid for the endangered Laurel Dace (*Chrosomus saylori*)

The Laurel Dace (*Chrosomus saylori*) is an endangered species endemic to the upper Tennessee River Basin in Tennessee. Laurel Dace historically occupied only eight streams on Walden Ridge of the Cumberland Plateau. Recent sampling indicates this species is currently restricted to five streams, and it is only common in one stream. Microhabitat variables and diet competition with non-native species were studied in order to understand possible drivers contributing to their small population size. A total of 66 sites (pools) were sampled in Bumbee Creek and Lick Branch for microhabitat data, including presence of *C. saylori*, water volume, water depth, substrate type, canopy cover and silt depth. There was a significant correlation ($p<0.05$) in mean water depth and mean water volume between pools where Laurel Dace were present versus absent. The stomach contents of Laurel Dace and its non-native competitors, Green Sunfish (*Lepomis cyanellus*) and Bluegill (*L. macrochirus*), were examined for five localities. Laurel Dace were obtained from preserved specimens at the University of Tennessee Etnier Ichthyological Collection. Based on limited data, *C. saylori* diet consisted primarily of terrestrial and aquatic invertebrates in warmer months and primarily plant matter (algae) in colder months. Overlaps in diet between *C. saylori* and centrarchids was evident. In order to protect this unique species, it is imperative that these studies expand to other occupied streams in order to better understand how the Laurel Dace interacts with both abiotic and biotic factors within its environment.

0249 Fish Conservation I, Sunday 16 July 2017

Shawna Mitchell[1], Bernard Kuhajda[1], Matt Kulp[2], Dave Kazyak[3], Jason Henegar[4], Tim King[3], Anna George[1]

[1]*Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA,* [2]*Great Smoky Mountains National Park, Gatlinburg, TN, USA,* [3]*U.S. Geological Survey, Leetown Science Center, Kearneysville, WV, USA,* [4]*Tennessee Wildlife Resources Agency, Nashville, TN, USA*

Assortative mating in a headwater Appalachian stream: a case study from the Great Smoky Mountains National Park

Southern Appalachian Brook Trout (*Salvelinus fontinalis*) have lost about 75% of their range in the Great Smoky Mountain National Park since the early 1900s due to logging and the introduction of non-native Rainbow Trout (*Oncorhynchus mykiss*). Following the removal of Rainbow Trout, about 320 Brook Trout from Indian Camp, Little Greenbrier and Cosby Creeks were reintroduced into Leconte Creek, TN in 1999. Eleven years post restoration, 84% of all Brook Trout in Leconte Creek were derived from same source

stream parentage. These findings suggested the presence of selective assortative mating among the genetically divergent source populations. In order to test if selective assortative mating was causing these findings, broodstock from Indian Camp, Little Greenbrier, and Cosby Creeks were brought to the Tennessee Aquarium Conservation Institute. Three control and six experimental crosses between these three streams were artificially spawned in a controlled hatchery setting and fertilized eggs were raised until the fry absorbed their yolk sac. After 2 years of spawning, 27 of 42 attempted crosses were successful (eggs hatched). Successful control crosses (9 out of 18 attempts) had an average fertilization rate of 91.5%, average eye up rate of 61.2% and an average hatch rate of 56.1%. Successful experimental crosses (18 out of 24 attempts) had an average fertilization rate of 95.3%, average eye up rate of 37.6% and an average hatch rate of 30.4%. Gamete production peaked at different times, suggesting that local adaptation to environmental cues may have had an effect on peak ripeness of these fish.

0265 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Tim Mitchell, Daniel Warner

Auburn University, Auburn, AL, USA

Seasonal Shifts in *Anolis sagrei* Reproduction Invoke Challenges for Scientific Reproducibility

The ability to reproduce experiments and results is a central component of the scientific method, yet exactly replicating experiments can be challenging when there is a field component. I leverage multiple iterations of anole breeding colonies to assess whether estimates of key reproductive traits of anoles are reliably repeatable. I used wild caught adult anoles (*Anolis sagrei*) to start three temporally replicated laboratory breeding colonies for egg and hatchling production within the same calendar year. These breeding colonies had nearly identical husbandry conditions yet varied by the capture date of the adult animals from the field. Preliminary results show that, despite consistency in breeding colony husbandry, anoles show variation in key reproductive traits such as egg and hatchling size consistent with seasonal shifts in reproductive effort. Further analyses will quantify variation in other reproductive traits, such as inter-clutch interval, total reproductive effort, and whether this variation is related to seasonal shifts in female body size. This project provides insights into seasonal shifts in reproductive effort in anoles. It also highlights that subtle differences in methodologies (such as capture date of study animals) may influence the interpretations of results. Though this suggestion may seem obvious, it also may be frequently overlooked.

0269 Lightning Talks I, Friday 14 July 2017

Tim Mitchell, Sarin Tiatragul, Renata Brandt, Josh Hall, Brian Folt

Auburn University, Auburn, AL, USA

Agama the Grouch: Testing Dumpster Selection of Non-Native Rock Lizards in an Urban Landscape

Understanding how animals use novel habitats is a key goal of invasion biology and urban ecology. The African Rock Agama *(Agama agama)* is native to sub-Saharan Africa but has been introduced and is reproducing in south Florida. The Rock Agama is a saxicolous lizard, yet natural rocks are nearly completely absent in parts of their introduced range in Florida. How do these lizards utilize the human-modified landscape, given the absence of the species' preferred habitat? Field observations suggested agamas use dumpsters as home sites because dumpsters provide refugia and attract invertebrate prey. In this study, we performed repeated surveys of commercial dumpsters (N = 50) interspersed within a neighborhood in Miami, Florida, where *Agama* occur in high density. We measured habitat variables hypothesized to influence agama site selection, including dumpster dimensions, dumpster contents, thermal properties of the dumpster, and surrounding habitat features. Because agamas use habitat narrow rock crevices in their natural range, we hypothesized that dumpster clearance (gap between pavement and bottom of dumpster) and contents (e.g., the presence of food resources) will strongly predict dumpster use. We discuss how our results have implications for predicting the spread of this and other invasive lizards across urban landscapes.

0230 Fish Morphology, Saturday 15 July 2017

Iliana Mock, Kevin Conway

Texas A&M University, College Station, TX, USA

An Investigation of Oral Keratinization in North American Minnows (Teleostei: Cyprinidae)

Despite a lack of oral jaw teeth, algivory is widespread across the order Cypriniformes and is often accompanied by various morphological adaptations, including keratinization of the epithelium covering the mouthparts. Oral keratinization has been well studied in several algivorous species of Old World cyprinid yet little is known about the diversity, distribution and nature of oral keratinization in North American cyprinids, many of which are obligate algivores. In this study, we utilize a combination of scanning electron microscopy (SEM) and histology to investigate the distribution and nature of keratinized oral epithelia in 55 species representing 50 genera of North American minnows. Three general character states of keratinized oral epithelia were observed in the North American minnows examined, including: non-keratinized, keratinized-squamous, and keratinized-unculiferous. A phylogenetic comparative approach was used to investigate the relationships between the shape (s-shaped/coiled) and length of the gut tract relative to the type of keratinized oral epithelia present in members of the 'Western' and 'Shiner' clades of North American minnows. A positive correlation was detected between the type of gut tract and type of keratinized oral epithelia present within the 'Western' clade though no such correlation was detected

within the 'Shiner' clade. Keratinization of oral surfaces is not restricted to algivorous taxa amongst North American cyprinids and this suggests that keratinization of oral surfaces may serve a number of different roles in the life history of North American cyprinids.

0805 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Cassandra M. Modahl, Stephen P. Mackessy

University of Northern Colorado, Greeley, CO, USA

Unusual sources of mRNA: snake venoms

Venomous snakes and their venoms provide models for the study of molecular evolutionary processes leading to adaptation and genotype-phenotype relationships. To compare venom complexity and protein sequences, venom gland transcriptomes are assembled, which usually requires the sacrifice of snakes for tissue. However, toxin transcripts are also present in venoms, offering the possibility of obtaining cDNA sequences directly from venom. These unknown venom protein cDNAs are obtained by the use of primers designed from conserved signal peptide sequences within each venom protein superfamily. This technique was used to assemble a partial venom gland transcriptome for the Middle American Rattlesnake (*Crotalus simus tzabcan*) by amplifying sequences for phospholipases A_2, serine proteases, C-lectins, and metalloproteinases from within venom. Phospholipase A_2 sequences were also recovered from the venoms of several rattlesnakes and an elapid snake (*Pseudechis porphyriacus*), and three-finger toxin sequences were recovered from multiple rear-fanged snake species, demonstrating that the three major clades of advanced snakes (Elapidae, Viperidae, Colubridae) have stable mRNA present in their venoms. These cDNA sequences from venom were then used to explore potential activities derived from protein sequence similarities and evolutionary histories within these large multigene superfamilies. Venom-derived sequences can also be used to aid in characterizing venoms that lack proteomic profiles and identify sequence characteristics indicating specific envenomation profiles. This approach, requiring only venom, provides access to cDNA sequences in the absence of living specimens, even from commercial venom sources, to evaluate important regional differences in venom composition and to study snake venom protein evolution.

0795 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Brian Moe, Charles Cotton

Florida State University, Tallahassee, FL, USA

Estimates of age, growth, and maturity for the little gulper *Centrophorus* cf. *uyato* in the Northern Gulf of Mexico

Although half of all shark species occur below depths of 200 meters, very little is known about their basic life-histories. Deep-water sharks, are perceived to have much more conservative life-histories than coastal and pelagic species, likely making them more susceptible to overexploitation. The little gulper shark, *Centrophorus* cf. *uyato*, is a mid-size deep-water species inhabiting temperate to tropical latitudes globally. *Centrophorus* cf *uyato* is presumed to have very conservative life-history characteristics, as has been documented for congeneric species. Though no fisheries presently target deep-water sharks in the Gulf of Mexico, there is a growing worldwide shift targeting deeper fishes with conservative life-histories which are especially susceptible to depletion. *Centrophorus* cf. *uyato* and other congeners in New South Wales experienced a 99% population decline after 20 years of commercial fishing. Furthermore, commercial trawl fisheries operate in the depth range of *C.* cf *uyato*, likely resulting in substantial bycatch mortality. Therefore, it would be prudent to address critical information gaps in the life-history of *C.* cf *uyato*, allowing for the proper management in active fisheries, and pro-active regulations in areas where fisheries have not yet developed. This study provides the first descriptions of age, growth, and maturity for *C.* cf. *uyato* in the Northern Gulf of Mexico. This study shows that *C.* cf *uyato* in the Gulf of Mexico lives over 60 years, matures at 85% of its maximum length, and produces just one pup per reproductive cycle. These results will inform demographic models for predicting population responses to fishing pressure.

0456 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Bekah Mongold[1], Abigail Berkey[1], Rayna Bell[4], William Flint[2], Steve Gotte[3], Oliver Hyman[2], Roy McDiarmid[3], David McLeod[2], Daniel Mulcahy[4]

[1]Eastern Mennonite University, Harrisonburg, VA, USA, [2]James Madison University, Harrisonburg, VA, USA, [3]United States Geological Survey, Suitland, MD, USA, [4]Smithsonian Institution, Washington, DC, USA

A Biological Survey Unit Type Locality Project: Collecting Genome-Quality, Topotypic Vouchers for Salamanders in Virginia

Despite the importance of DNA evidence for taxonomic studies and conservation, many historical type materials lack corresponding genetic samples and DNA extraction from formalin-fixed type materials (i.e. most herpetological specimens) and older specimens is difficult. This absence of genome-grade tissue samples from type materials limits contemporary molecular research questions and restricts conservation and management decisions. A standardized model for collecting genome-quality, topotypic vouchers is needed. To this end, we conducted a pilot project to resurvey type localities and collect high-quality voucher specimens and genome-grade tissue samples from three focal areas in Virginia that represent 13 salamander type localities (2 families, 5 genera, and 17 species). Additionally, because chytrid fungi (Bd and Bsal) pose a threat to Virginia's salamander diversity, we swabbed individuals to sample for these pathogens. Specimens and genetic vouchers were deposited in the National Museum of Natural History and distribution data added to the USGS Biodiversity Information Serving Our

Nation (BISON) mapping resource. Undergraduate students enrolled in biology courses at two local institutions were involved in all aspects of the project from specimen collection to data processing and archiving. Our sampling protocol could easily be adapted by other regional institutions to "crowd-source" the effort to obtain genome-quality, topotypic vouchers for all North American vertebrate taxa.

0497 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Carmen G. Montana[1], Elford Liverpool[2], Donald C. Taphorn[3], Hernán López-Fernández[4], Karen Alofs[5]

[1]Sam Houston State University, Huntsville, TX, USA, [2]Centre for the Study of Biodiversity, Turkeyen, Guyana, [3]Royal Ontario Museum, Toronto, Canada, [4]Royal Ontario Museum, Toronto, Canada, [5]Royal Ontario Museum, Toronto, Canada

Trophic relationships and mercury levels in a Neotropical river food web

Contamination of water bodies by inorganic mercury (Hg) due to mining activities in the lower Mazaruni River, Guyana, contributes to mercury concentration in fish tissues. We measured total mercury (THg) concentrations in fishes from mined and non-mined sites in the Lower Mazaruni River. We also used stable isotopes analysis ($\delta^{13}C$ and $\delta^{15}N$) to estimate trophic position of fishes. Average THg concentrations of fish species varied between sites ranging between 0.20mg/kg to 8.80mg/kg in mined sites; and from 0.10mg/kg to 1.36mg/kg in non-mined sites. A positive relationship was observed between THg and $\delta^{15}N$ values of some fish species including omnivores, carnivores and piscivores. On average, non-mined sites appeared to have longer food chains than mined sites. Trophic magnification was observed above 1 mg/kg suggesting that mercury bioaccumulation occurs in the food web, and fish diet appears to be the main route for this element into the food chain. Several of the fish species surveyed and used for local food consumption had THg levels higher than the World Health Organization (0.5mg/kg). Our data suggest that Amerindian communities and settlements located along the riversides of the Mazaruni River are exposed to dangerous levels of mercury through fish consumption, but possibly also any other fish-eating wildlife. The freshwater fish fauna of the Mazaruni River is unique in the Neotropics, with high diversity and incredible endemism in its headwaters. The recent increase in has gold mining operations seriously threaten riparian forest, the riverine fauna and all food-web components of the Mazaruni aquatic system.

0677 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jennie Mook[1], Raymond Moody[2], Eric Schauber[1]

[1]*Southern Illinois University Carbondale, Carbondale, IL, USA,* [2]*Tinker Air Force Base, Midwest City, OK, USA*

Harmonic Radar: Long-Term Herpetofauna Tracking Using a Tiny Tag

The Texas horned lizard (*Phrynosoma cornutum*) is an imperiled species that has experienced declines throughout much of its range. While there has been considerable research contributed on this species, there is still little known about the hatchling life stage. Until now, monitoring hatchlings has proven difficult due to their small size (<1 g) and our limited technology. However, harmonic radar has long been used as a method to track invertebrates and may be a viable method for tracking other small organisms. Harmonic radar tracks individuals by employing a device that serves as a transmitter and a receiver. This device emits a continuous radar wave which is then reflected back at twice the frequency by a transponder attached to an animal. The aim of this study was to evaluate the efficacy of harmonic radar for tracking hatchling horned lizards. From 2014-2016, we experimented with transponder design which resulted in using a Schottky barrier diode (S2) attached to an aluminum antenna and encased in PET plastic. This transponder weighed <0.05 g and had a detection distance of 6 m. Using this method, we successfully tracked 125 Texas horned lizard hatchlings and juveniles, 11 of which were monitored for 4-12 months. More transponder modifications are needed to increase the detection distance while minimizing the size and obtrusiveness of the design. Our work shows that harmonic radar has potential as an option for long-term tracking of very small vertebrates, particularly with improved transponder design.

0672 ASIH STOYE ECOLOGY & ETHOLOGY III, Friday 14 July 2017

Jennie Mook[1], Raymond Moody[2], Eric Schauber[1]

[1]*Southern Illinois University Carbondale, Carbondale, IL, USA,* [2]*Tinker Air Force Base, Midwest City, OK, USA*

The Social Behavior and Ecology of Hatchling Texas Horned Lizards (*Phrynosoma cornutum*)

Texas horned lizard (*Phrynosoma cornutum*) ecology and behavior has been well documented in the literature. However, little is known about the hatchling life stage of *Phrynosoma*, likely due to difficulties in monitoring them given their small size (< 1 g). During 2014-2016, we used harmonic radar to study hatchling *P. cornutum* survival, home-range size, and behavior on an urban air force base in Oklahoma. The mean (± SE) annual home-range size of hatchlings (n=129) was 0.10 ± 0.069 ha using 95% KDEs. Unlike adults that burrow separately underground during winter, we observed hatchlings clustering together and stacking on top of each other above ground. This behavior has never before been documented in *Phrynosoma* and suggests that *P. cornutum* may have more social complexity than currently understood. This study not only elucidates the basic ecology and dormancy behaviors of an enigmatic life stage, but

also provides a more complete understanding of an imperiled species facing declines throughout its range.

0807 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brad Moon[1], Gabriel Spanghero Vicente Ferreira[2], David Penning[3]

[1]University of Louisiana at Lafayette, Lafayette, LA, USA, [2]Instituto de Biociências, Letras e Ciências Exatas - UNESP/IBILCE, São José do Rio Preto - SP, Brazil, [3]Missouri Southern State University, Joplin, MO, USA

High Performance in a Tight Spot: Snake Predation Pressures Below vs. Above Ground

Many predators feed in microenvironments that may constrain their movements and obscure or block our observation and study. For example, constricting snakes probably often feed on mammals underground in tunnels, where space may be too limited for typical coiling and constriction. In such circumstances, some snakes will press prey against the wall of a tunnel with part of the snake's body, in a predatory behavior that has been called "pinioning." Pinioning serves the same purposes as constriction, to restrain and incapacitate prey before ingestion. However, pinioning behavior is not well known and pinioning performance in tunnels has not yet been quantified or compared to typical constriction on open surfaces. We measured the pinioning pressures of kingsnakes in simulated tunnels and compared them to typical constriction pressures on the surface. Pinioning and constriction pressures are good measures of predation performance because they reflect a key variable (pressure) that can directly incapacitate the prey. We found that pinioning pressures in tunnels were higher than constriction pressures on open surfaces. These results indicate that snakes can exert impressively high predation pressures underground as well as on the surface, and more generally that predation performance is not always reduced in microenvironments that impose constraints on predatory movements.

0582 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Shaundon Moore, Kirsten Nicholson

Central Michigan University, Mt. Pleasant, MI, USA

Linking Habitat Structure with Microgeographic Divergence in Red-backed Salamander (*Plethodon cinereus*) Behavior

Behavioral divergence can occur when populations inhabiting heterogeneous environments become locally adapted. For dispersal limited species, local habitat characteristics may promote behavioral divergence at small spatial scales within populations. Previous studies have focused on adaptive behavioral divergence across distinct or fragmented landscapes, but relatively little is known regarding adaptive

divergence within continuous landscapes. *Plethodon cinereus* is a lungless, terrestrial salamander native to eastern North American forests that occupies a diverse range of microhabitats. Here, we examine whether microhabitat characteristics may promote intra-population behavioral divergence within this species across a continuous landscape. Threats related to water loss and desiccation pose a significant physiological constraint on *P. cinereus* movement, and home-ranges are typically restricted to <25 m^2. Thus, there is potential for individuals to be locally adapted to microhabitat characteristics. We will quantify foraging and territoriality related behaviors in *P. cinereus* collected from survey plots established within an unfragmented field site within mid-Michigan. Environmental data will be collected at each capture location and ordination will be used to visualize and characterize the microhabitats occupied by each salamander. Observed behavioral patterns will be recorded across survey plots and capture locations from distances of 100 – 2000 meters. Distinct microhabitat features could separately explain some, but not all differences in foraging and territoriality behavioral traits. We expect to find that, for dispersal limited species, behaviors may be structured at fine-scale levels within continuous landscapes. However, the degree to which sub-populations diverge in behavioral characteristics depends on a combination of species ecology and environmental heterogeneity.

0673 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Nickolas Moreno, Scott Glaberman, David Nelson, Ylenia Chiari

University of South Alabama, Mobile, Alabama, USA

A Multidisciplinary Approach to Evaluate the Conservation Status of the Alabama Red-Bellied Turtle (*Pseudemys alabamensis*)

Pseudemys alabamensis (Alabama red-bellied turtle) is an endemic that occurs only in the lower drainage systems of Alabama and Mississippi. It is classified as endangered by the U.S. Fish and Wildlife and on the IUCN Red List. *P. alabamensis* represents an ideal system for examining the impact of ecological stressors on endangered species and their habitat. The range for this species is narrow around Mobile Bay, Alabama, which is contains heavily urbanized areas with potential to have large amounts of chemical runoff. Furthermore, some chemicals that may be found in runoff at sites where this species occurs have the potential to be genotoxic (*e.g.*, inducing DNA damage). Across its distribution range, human-made barriers (e.g., roads) and salt or brackish water bodies may impede free movements of individuals of this species and thus gene flow among populations. With little currently known about *P. alabamensis*, assessment of the genetic diversity and of the effects of urbanization across the species range will help identify genetically distinct populations as well as populations suffering from small population size, high DNA damage and to establish the effect that habitat quality has on these species characteristics. This will permit to develop management strategies and effective conservation actions, such as identifying areas requiring habitat restoration, as my results will be shared with state agencies and the US Fish & Wildlife. This integrated approach will serve as a model for future studies to identify priority areas for

conservation within the Southeast US and species deserving highest conservation priority.

0314 Lightning Talks II, Friday 14 July 2017

Clark Morgan, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

A Survey of Shark Abundance on Northeast Florida Beaches

Long-term abundance surveys are necessary for identifying trends in the status of fish populations that are the target of commercial and/or recreational fisheries. This is especially the case for populations of certain fish like sharks and their relatives, which grow slowly and often take a long period of time to rebuild from fishery-associated declines. In this presentation, we provide preliminary data on the species composition and abundance of shark populations that use nearshore waters on the northeast Florida coast from the initial years of a new survey focusing on shark abundance in coastal habitats. The overall goal of this survey is to examine long-term patterns in large and small coastal shark abundance on northeast Florida beaches along with conducting more comprehensive assessments of shark life history, especially reproduction, so that still-unclear questions about certain commercially- and/or recreationally-important shark species can be addressed. In particular, we are concerned about the current status of aggressively managed large and small coastal shark species that have traditionally made up a significant contribution of commercial or recreational shark landings.

0120 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Cynthia Morris, Matthew Lattanzio

Christopher Newport University, Newport News, Virginia, USA

Ecological and Physiological Factors Affecting the Escape Responses of Tree Lizards (*Urosaurus ornatus*)

For lizards, Optimal Escape Theory has been used to successfully describe the tradeoff between the costs of escape and the risks of predation, particularly with respect to variation in predator traits (e.g., approach angle or speed). In contrast, the effects of other ecological factors on a lizard's flight response, or their mode of escape, have received scant attention. We evaluated the effects of sex, macro- (site-level) and micro- (perch substrate) habitat use, body temperature, and perch temperatures (initial and final perch) on the flight-initiation and flight distances, and escape tactics (run or squirrel), of adult tree lizards (*Urosaurus ornatus*) at three sites differing in fire history within the Appleton-Whittell Research Ranch near Elgin, Arizona. Perch use shifted

from a bias towards snags to trees moving from non-burned to burned sites for both sexes. Overall, flight-initiation distance was affected by site and body temperature only, with lizards from a frequently-burned habitat, and lizards with low body temperatures, fleeing sooner than other lizards. Lizard body temperature was also positively correlated with perch temperature, and those lizards initially on cooler perches tended to flee to warmer locations. We detected no effects of any of our predictors on flight distance. Finally, in terms of their escape tactics, all lizards preferred running over squirreling, regardless of sex, site, or perch use. Overall, our findings support that wariness in *U. ornatus* may be influenced by both ecological and physiological conditions, and that their escape responses may also provide a thermal benefit.

0652 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Hannah Morris[1], Juan D. Daza[1], Aaron M. Bauer[2]

[1]Sam Houston State University, Huntsville, Texas, USA, [2]Villanova University, Villanova, Pennsylvania, USA

On the Occurrence of the Stapedial Foramen in Geckos

The stapedial (internal carotid) artery has three possible paths in squamates, it may perforate the otostapes through the stapedial foramen, it might pass in front of or behind an imperforated otostapes. A perforated otostaopes is a plesiomorphic feature among squamate reptiles, being recorded only in dibamids and gekkotans. The presence of a stapedial foramen is a common feature used to diagnose gecko groups, therefore the presence or absence of this structure could be useful for categorizing higher level groups of geckos, and possibly all squamates. The most extensive review of this trait in gekkotans was completed 30 years ago and included a survey of 46 gekkotan genera. Here we reviewed specimens from virtually all gekkotan genera using HRCT data, and surveyed the distribution of this feature in the light of recent molecular analyses. The foramen is absent in all pygopodoideans, and present among all eublepharids and sphaerodactylids. The stapedial foramen is present in half of the phyllodactylid genera, where it has been lost multiple times, and is present in the majority of the gekkonid genera (60%). Using the current molecular topology as a working hypothesis, the presence of the stapedial foramen is inferenced as ambiguous on the crown group, although this structure is present in a 99-million-year old fossil from Myanmmar that is kin to all geckos.

0223 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Megan Mosier, Lynda Miller

Christian Brothers University, Memphis, TN, USA

Population Variation in Two Species of Ambystomatid Salamanders

Variation in populations are frequently caused by restrictions in gene flow. Those restrictions can be caused by vicariant events such as mountain ranges or large rivers. We examined preserved specimens from two species of ambystomatid salamanders that were separated by the Mississippi River. Morphometric measurements of *Ambystoma opacum* and *A. texanum* populations from Arkansas and Tennessee were compared to determine if geographic separation had an effect on the body size or limb length. *Ambystoma opacum* from the Tennessee populations was significantly larger in both front limb and hind limb length than those collected in Arkansas. *Ambystoma texanum* was significantly larger in front limb and snout to vent length in Arkansas populations than those in Tennessee. Differences in morphometrics may be influenced by environmental pressures, competition in the larval stage, or differences in the microhabitats on either side of the river.

0297 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jeanette Moss[1], Aumbriel Schwirian[1], Anna Jackson[1], Mark Welch[1], Glenn Gerber[2]

[1]*Mississippi State University, Mississippi State, MS, USA,* [2]*San Diego Zoo Institute for Conservation Research, San Diego, CA, USA*

Multiple-paternity in an insular lizard, the Sister Islands rock iguana (*Cyclura nubila caymanensis*)

Social behaviors that influence individual reproductive output can have important consequences for long-term population viability due to reductions in effective number of breeders and genetic deterioration. Female polyandry, a taxonomically widespread strategy that can result in multiple-paternity (MP) and reproductive skew, has been invoked as a mechanism for boosting individual reproductive output and enhancing offspring geometric mean fitness. While MP has been extensively studied in laboratory crosses and captive pedigrees, studies of wild populations are often limited by a lack of detailed pedigree information and small clutch sizes. However, molecular fingerprinting tools and the development of novel likelihood approaches have greatly expanded the applicability of parentage analyses to empirical datasets. In this study, molecular techniques are employed to investigate the prevalence of MP in an insular population of *Cyclura nubila caymanensis*, or the Sister Islands Rock Iguana (SIRI), a critically endangered taxon endemic to Little Cayman and Cayman Brac. A total of 50 clutches sampled on Little Cayman in the years 2015 and 2016 were genotyped at 14 microsatellite loci and evaluated for evidence of MP using the full-pedigree likelihood approach implemented in the program COLONY. Nearly half of all clutches were found to be multiply sired, suggesting that female polyandry is common in rock iguanas. Paternal contributions are skewed in most clutches, which may reflect assortative mating to avoid inbreeding. Depressed rates of MP and significant dominance of few

males was observed at a high-density, human-supplemented site, suggesting that resource abundance and competition can impact effective number of breeders.

0300 SSAR SEIBERT ECOLOGY I, Thursday 13 July 2017

Jeanette Moss[1], Mark Welch[1], Glenn Gerber[2], Schwirian Aumbriel[1], Jackson Anna[1]

[1]Mississippi State University, Mississippi State, MS, USA, [2]San Diego Zoo Institute for Conservation Research, San Diego, CA, USA

Behavioral ecology of the critically endangered Sister Islands rock iguana (*Cyclura nubila caymanensis*): ongoing investigations into patterns of mate choice, dispersal, and nesting

The West Indian rock iguanas (genus: *Cyclura*) comprise one of the most endangered groups of lizards in the world. Patterns of habitat use and gene flow among these large herbivores are structured by complex social systems and diverse life histories, an understanding of which is critical to predicting future responses to population reduction and fragmentation. For example, negative assortative mating and dispersal patterns that promote admixture may be important mechanisms for inbreeding avoidance in insular populations. We employ a combination of direct field observation and molecular fingerprinting to investigate patterns of female mate choice, nest site selection, and kin structuring in the Sister Islands rock iguana (*Cyclura nubila caymanensis*). With the pedigree data obtained through nest site monitoring and whole clutch genetic sampling, we make likelihood inferences of parentage and sibship, estimate rates of multiple-paternity, and assess patterns of assortative mating exhibited by females. To further investigate reproductive strategies, we employ nest excavation, mark-recapture, and radio telemetry approaches to identify intrinsic and environmental factors that influence female dispersal and maintain traditional communal sites. Finally, we examine the genetic relatedness among spatial aggregates of nesters to investigate the possible role for kin structuring and natal philopatry in shaping population genetic structure and nest distributions. The diversity of observed behaviors in this population suggests that reproductive success may be achieved through a broad range of strategies and that dispersal is largely random. However, home territory overlap and philopatry appear to largely guide female choice with regards to mates and nesting sites.

0118 AES GRUBER AWARD I, Thursday 13 July 2017

Kat Mowle, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Characterization of vitellogenesis in the bonnethead shark *Sphyrna tiburo* in the Northwestern Atlantic Ocean

Vitellogenin (Vtg) is a precursor to yolk-proteins that is known to be produced in the liver under the control of the hormone estradiol (E2) in reproductively active females of most non-mammalian vertebrates. Previous studies have examined Vtg production in a wide variety of fishes, but no studies to date have done so in a placental viviparous elasmobranch. Therefore, the purpose of this study is to examine Vtg production in a viviparous shark species, the yolk-sac placental bonnethead shark *Sphyrna tiburo*. Specifically, this study focuses on determining where Vtg is produced in *S. tiburo*, how reproductive steroid hormones influence Vtg production, and what temporal patterns occur in Vtg levels throughout the species' reproductive cycle. To date, Vtg presence in the plasma has been assessed using immunoblotting; preliminary results have detected Vtg only in the plasma of mature females collected during the spring period of follicular development. Immunohistochemistry has also been conducted; these assays have confirmed the liver is the site of Vtg synthesis in *S. tiburo*. Preliminary evidence also suggests that E2 and progesterone (P4) play a role in regulating this process, with immunohistochemistry detecting the receptors for both hormones within the liver. To further examine where Vtg is synthesized, in situ hybridization assays will be conducted for liver and ovarian tissues. The role that E2 and P4 play in regulating Vtg synthesis will also be further assessed by exposing cultures of liver slices to the hormones and measuring Vtg production.

0182 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Marta Moyano[1], Björn Illing[2], Lars Christiansen[1], Myron A. Peck[1]

[1]*University of Hamburg, Hamburg, Germany,* [2]*Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Australia*

Linking Rates of Metabolism and Growth in Marine Fish Larvae

The intricate relationship between metabolism and growth is still largely unexplored in early life stages of fish. In the present study, we investigated the metabolic rates of Atlantic herring (*Clupea harengus*) larvae and their links to body size, growth and feeding environment. First, standard metabolic rate (*SMR*) was estimated at 5-15°C in larvae (10-24 mm body length) from two herring populations (North and Baltic Sea), and a temperature-dependent allometric equation was generated. Second, in two of three trials, *SMR* was downregulated (up to 30%) four days after larvae experienced sub-optimal feeding conditions. Inter-individual differences in SMR and recent nutritional condition (RNA-DNA ratio) in those larvae were unrelated. Third, the link between *SMR* and short- (otolith marginal increment width) and long-term growth (size-at-age, otolith diameter-at-age) was investigated. Inter-individual differences in *SMR* under ad libitum conditions were not explained by any of the recent or long-term growth indicators, but a negative relationship between *SMR* and otolith core (formed between hatching and first feeding) was observed. The present results are very valuable for exploring how food limitation may influence larval growth and survival in the sea, as well as for parameterizing bioenergetic models. Furthermore, they revisit the potential

of otoliths and RNA-DNA ratio for combined field studies on growth and physiology to understanding fish performance under a future changing environment.

0239 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Marta Moyano, Joan Martorell, Katrin Engler, Myron A. Peck

University of Hamburg, Hamburg, Germany

Thermal Impacts on the Ontogeny of Routine Swimming and Foraging Behavior in Atlantic Herring Larvae

Understanding ontogenetic changes in swimming behavior can provide insight into the mechanisms impacting larval survival in the field. Well-developed swimming abilities can confer larvae with increased survival advantages in terms of a better foraging capacity (e.g. larger water volumes searched, faster attacks) and escape responses when encountering predators. In this study, we measured routine swimming and foraging behavior in spring-spawned Atlantic herring (*Clupea harengus*) larvae reared at 7 and 13°C. Routine swimming was estimated throughout larval ontogeny (10 to 22 mm body length) by video image analysis of groups of 20 larvae (5-L tanks, 48-h duration). Foraging behavior (feeding strike frequency, pause duration, pause frequency) was estimated from those videos and on larvae within rearing tanks (90-L containers). Furthermore, one short-term experiment was performed to observe changes in foraging behavior during short-term starvation followed by a re-feeding period. These results expand our knowledge on the impact of prey shortage and on the magnitude of diel cycles in foraging behavior and routine swimming in marine temperate larvae. Such results are essential to parameterize individual, physiological-based models, which have proven to be very useful to explore factors affecting larval growth and survival in the field.

0280 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Andy Mueller, C.M. Gienger

Austin Peay State University, Clarksville, TN, USA

Comparative Thermal Ecology of *Agkistrodon contortrix* and *Agkistrodon piscivorus*

Body temperature is directly related to the physiology and behavior of ectotherms and the ability to thermoregulate is crucial for the survival and development of the organism. *Agkistrodon contortrix* (Copperhead snakes) and *Agkistrodon piscivorus* (Cottonmouth snakes) are relatively common, wide-ranging viperids, and their sit-and-wait ambush foraging strategy suggests that they are more likely to be passive thermoconformers within their thermal environment than active thermoregulators.

Evaluating the thermal ecology of these species requires knowing the body temperature of the snakes (T_b), the operative temperatures available to snakes in their environment (T_e), and the preferred body temperature range of the species (T_{set}). We calculated effectiveness of thermoregulation (E) and thermal exploitation (Ex) to compare the degree to which snakes actively thermoregulate in their differing habitats. The T_{set} for both species is nearly identical at 24.9-27.8°C for copperheads and 24.9-27.9°C for cottonmouths. Cottonmouths have a significantly higher index for the months of May, June, and July indicating that they are more effective thermoregulators than copperheads during mid active season. Although it does appear that cottonmouths also have a higher Ex across the active season, they are not significantly different than copperheads.

0841 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Christopher Mull[1], Kara Yopak[2], Nicholas Dulvy[1]

[1]Simon Fraser University, Burnaby, BC, Canada, [2]University of North Carolina, Wilmington, NC, USA

Can you spare some brain: how life history and ecology have shaped brain size evolution in sharks and rays

Brain size likely evolves through a combination of selection and constraints. Increased brain size has been associated with greater behavioral flexibility across vertebrates, yet comes at a high energetic cost due to the metabolic demand of development and maintenance of neural tissue. In sharks and rays, increased relative brain size has been documented in species that occupy spatially complex shallow water habitats, particularly in reef sharks and stingrays. Yet, we have also shown that increased maternal investment via matrotrophy, particularly via placentotrophy and lipid histotrophy, is also strongly associated with increased brain size. A key unknown is the cause and effect relationship underlying the correlation of habitat and life history with brain size. Did the evolution of live-bearing and matrotrophy help overcome the energetic constraints of increased brain size, or was it a result of selection from ecological lifestyle? We address these questions in two steps: First we test for the correlated evolution of relative brain size with reproductive mode, maternal investment, depth, and habitat. We predict that increasing brain size is correlated with the evolution of increased maternal investment through matrotrophy, and with the colonization of warm shallow habitats. Secondly, we attempt to tease apart the cause and effect relationships between brain size, body size, life history, and ecology using phylogenetically corrected path analysis.

0044 Lightning Talks I, Friday 14 July 2017

Bruce Mundy[1], Mackenzie Gerringer[2], Jørgen Nielsen[3], Patricia Fryer[4], Astrid Leitner[2]

[1]NOAA NMFS Pacific Islands Fisheries Science Center, Honolulu, Hawaii, USA, [2]Department of Oceanography, University of Hawaii, Honolulu, Hawaii, USA, [3]Natural History Museum of Denmark, Copenhagen, Denmark, [4]Hawaii Institute of Geophysics and Planetology, University of Hawaii, Honolulu, Hawaii, USA

First in situ observation of an aphyonid fish (Teleostei, Ophidiiformes, Bythitidae)

Aphyonids are poorly-known, live-bearing brotulas (Ophidiiformes, Bythitidae) that until recently were considered to be in a distinct family, Aphyonidae. A single, ca. 9.3 cm total length aphyonid observed during a remotely-operated vehicle survey in the Mariana Archipelago at 2504 m on Explorer Ridge (20.68152°N, 145.08750°E) is the first seen alive in its natural habitat. Collection to verify its identification was not possible, but based on observations it was a species of either *Barathronus* or *Nybelinella*. The fish swam 1-10 cm over sediment between rocks and small boulders on a 45° talus slope. Swimming speeds were consistently slow, 0.33 ± 0.15 body lengths per second, and the fish appeared to be neutrally buoyant. Although there are few other records of aphyonid-clade fishes in the Pacific away from continental margins, this observation suggests that they will be found elsewhere in the basin when appropriate methods are used to detect these small fishes in the high-relief, rugose habitats of central Pacific oceanic islands and seamounts.

0502 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kelly Murman, Thomas LaDuke

East Stroudsburg University, East Stroudsburg, PA, USA

A Comparative Dietary Analysis of Five Species in the Streamside Salamander Guild (Plethodontidae) in Eastern Pennsylvania

In this ongoing study, the diets of five species of streamside salamander (*Desmognathus fuscus, Desmognathus ochrophaeus, Eurycea bislineata, Gyrinophilus porphyriticus,* and *Pseudotriton ruber*) are being analyzed using a non-lethal stomach flushing technique. The gut contents are being compared to invertebrate samples collected from the environment to assess similarity and attempt to determine where these species forage for food and whether there is evidence for prey selectivity. This project is also examining whether or not the composition of the species assemblage affects the diet of the member species by sampling at multiple localities with different assemblages. Sampling occurs in spring, mid-summer, and fall in order to determine if there are any seasonal shifts in the diets of these species. To date, all stomach contents examined have revealed a mixture of aquatic and terrestrial prey items regardless of the habitat preferences of the salamanders. Analyses will compare the proportions of aquatic and terrestrial prey consumed among and between species and sites.

0681 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Shannon Murphy[1], Mark Erdmann[2], Joshua Drew[1]

[1]Columbia University, New York, USA, [2]Conservation International, Auckland, New Zealand

Satellite Tracking Reef Manta Rays (*Manta alfredi*) in Papua New Guinea to Inform Conservation Management

The reef manta ray, *Manta alfredi*, is a charismatic species that has captured the attention of people all over the world. This species of ray is popular among divers and tourists because of its large size and habit of appearing in groups. Recently, there has been an increased demand in Asian fish markets for manta ray gill plates, thin cartilage filaments used by the ray to feed, due to cultural beliefs that gill plates have medicinal properties. Manta rays only produce one or two pups at a time, have slow maturation times, and tend to aggregate in large groups. These factors make ray populations vulnerable to pressures from local fisheries. Gonubalabala is a remote island situated off of Milne Bay, Papua New Guinea, that is home to an under-studied aggregation of manta rays. My research objective is to characterize the movement of manta rays around Milne Bay using satellite telemetry to inform conservation management. Satellite tags will be able to provide real time GPS locations of each manta, as well as collect important habitat data such as temperature and depth. I hypothesize that there will be a clear spatial pattern of movement of this population of manta rays around Milne Bay. If there is a clear spatial pattern of movement, one or multiple community-based marine protected areas (MPAs) could be developed to specifically protect areas where mantas spend considerable amounts of time. The development of a MPA in the coastal waters of Gonubalabala can also promote ecotourism.

0393 LFC Multi-Stressor Effects, Friday 14 July 2017

Christopher Murray, Jacob Snyder, Hannes Baumann

University of Connecticut Department of Marine Sciences, Groton, CT, USA

A Multi-Factorial Evaluation of Temperature Dependent CO2-Effects in a Coastal Forage Fish

How marine fish respond to ocean acidification will likely be influenced by temperature, yet multi-factorial studies remain rare. We conducted a fully-factorial, CO_2 × temperature experiment where offspring of wild Atlantic silversides (*Menidia menidia)* were reared at three CO_2 levels (control, ~400; high, ~2,000; and extreme, 4,000 µatm) crossed with three temperatures (17°, 20°, and 24°C). Offspring were reared from fertilization until reaching ~10 mm standard length. Survival to hatch was generally high and unaffected by CO_2 level across temperature treatments. At 20° and 24°, overall survival (fertilization to experiment termination) was similar across CO_2 levels. At 17°C

overall survival (% mean survival ± SD) was significantly greater at high (53 ± 21 %) and extreme CO_2 (52 ± 10 %) compared to control conditions (30 ± 8%). A significant CO_2 × temperature interaction on hatch lengths was detected. At 24°, hatched larvae (mean ± SD) were significantly shorter in high (5.32 ± 0.22 mm) and extreme CO_2 (5.21 ± 0.27 mm) compared to control larvae (5.51 ± 0.28 mm). Similarly at 20° larvae from extreme CO_2 (5.40 ± 0.28 mm) were significantly shorter than control samples (5.54 ± 0.27). However, no such CO_2 effect was found at 17°. Post-hatch growth rates were significantly influenced by temperature but not CO_2 level. Our experiment demonstrated a significant CO_2 × temperature interaction on hatch lengths of an important forage fish, where elevated CO_2 reduces hatchling size at warmer temperatures. The increased offspring survival under elevated CO_2 at low temperature warrants further investigation.

0316 Lightning Talks II, Friday 14 July 2017

Erin Muths[1], Brad Lambert[2], Scott Schneider[2], Larissa Bailey[3]

[1]U.S. Geological Survey, Fort Collins, CO, USA, [2]Colorado Natural Heritage Program, Fort Collins, CO, USA, [3]Colorado State University, Fort Collins, CO, USA

Survival and the probability of movement in boreal toads: Implications for conservation

The probability of persistence is a touchstone in assessing extinction risk and in formulating conservation strategies. Persistence of populations of animals depends on multiple, inter-related factors including demography and the probability of successful movements away from natal sites (e.g. colonization). Survival is one of those factors, but differences in survival rates within a year is seldom assessed. Movement is also recognized a critical factor in persistence and influences gene flow, adaptation, and individual fitness. Movement can be addressed quantitatively at different spatial scales and multiple time scales, and qualitatively from many different perspectives, but despite a rich body of literature focusing on amphibian movements, there has been little attention given to a more probabilistic approach to assessing frequency of movements; specifically, the probability of movements, by adults, among breeding sites within a metapopulation or the probability of dispersal movements by adults completely outside of a metapopulation. We present data from boreal toads (*Anaxyrus boreas*) in Colorado and relate how this information about survival and toad movement can inform conservation concerns such as the spread of disease.

0729 Herp Biogeography & Phylogeography I, Sunday 16 July 2017

Edward Myers, Frank Burbrink

American Museum of Natural History, New York, NY, USA

Does ecological divergence promote speciation across a biogeographic barrier?

Understanding the process of speciation is central to evolutionary biology. However, whether speciation is driven largely by neutral or adaptive processes remains unknown for most groups of organisms as well as across biogeographic barriers. Here we test hypotheses regarding the importance of ecological speciation across thirteen codistributed snake species pairs in the Chihuahuan and Sonoran Deserts. In order to do so we integrate coalescent modeling of subgenomic data, environmental niche models, and geometric morphometrics. We provide evidence that head shape, a surrogate for feeding ecology, co-varies with the rate of migration between sister species pairs. The association of these two metrics is such that as ecological differences increase, the strength of genetic isolation also increases. Ultimately, this demonstrates that ecologically mediated speciation is a widespread cause of species diversification across the arid southwest of North America.

0708 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jason Myrand, Erika Nowak

Northern Arizona University, Flagstaff, Arizona, USA

Microhabitat Use of Northern Mexican Gartersnakes (*Thamnophis eques megalops*) in an Intermittent Stream near Central Arizona

Northern Mexican gartersnakes (*Thamnophis eques megalops*) are federally-listed as Threatened with proposed designation of critical habitat under the Endangered Species Act. Monitoring and understanding microhabitat use of *T. e. megalops* is imperative for developing a recovery plan for this species. We have conducted intensive visual encounter surveys, minnow trapping, and radio-telemetry for *T. e. megalops* at three sites along Lower Tonto Creek, Arizona, near the confluence with Roosevelt Lake since the fall of 2014. This section of the stream tends to be intermittent by drying up in the summer and is typically refilled through winter snowmelt, summer monsoonal flooding, and high precipitation events. We detected 66 *T. e. megalops* at our site between 2014 and 2016. Our overall catch per unit effort for visual encounter surveys was 0.03 snakes per person-hour, and catch per unit effort for minnow trapping was 0.03 snakes per person-hour. Our preliminary radio-telemetry results indicate that this species selects sites with high vegetative cover (74 - 95%) and typically close to water (an average distance to water was 56.89 m ± 19.24). The four most common macrohabitats used were riparian woodland (22%), meadow (22%), aquatic edge (17%), and dry edge (15%). During the winter months, we documented snakes moving out of den sites in response to snowmelt flooding. We recommend investing in intensive search efforts during any presence/absence surveys for this cryptic species. Our results build on previous *T. eques megalops* studies that inform management decisions for recovery and conservation of this species in intermittent streams.

0152 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Leah Nagel, James Gibbs

State University of New York-College of Environmental Science of Forestry, Syracuse, NY, USA

From Egg to Adult: Factors Influencing Amphibian Survival in Small, Isolated Wetlands

Vernal pools are small, temporary wetlands that support unique aquatic communities and provide important nursery habitat for a number of amphibians, including threatened and endangered species. Throughout the northeastern U.S., studies of pool-breeding amphibians have largely focused on breeding effort—egg mass counts—to both identify and characterize the quality of vernal pools. However, few studies track amphibian survival. Failure to do so can potentially lead to skewed conclusions about habitat quality if oviposition does not accurately predict juvenile production. With this study, we assessed the effects of pool heterogeneity on the larval survival of two pool-breeding amphibians, spotted salamanders (*Ambystoma maculatum*) and wood frogs (*Lithobates sylvaticus*). A total of 74 pools in two sites in central New York were surveyed biweekly throughout the spring and summer to track pool volume and other abiotic factors. Amphibian survival was assessed with egg mass counts at peak oviposition, and a combination of visual encounter and stove pipe surveys to track larval occupancy throughout the sampling period. Out of the 74 pools sampled, spotted salamanders bred in 67 pools and wood frogs in 51; however, only 24 and 19 pools hosted salamander and frog larvae, respectively. Of 24 pools that dried during the sampling period, amphibian larvae were observed in just 6—all of which dried before larvae metamorphosed. By better understanding the factors that drive amphibian survival in vernal pools, we can more accurately characterize habitat quality of vernal pools and better prioritize them for protection.

0750 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Priya Nanjappa

Association of Fish & Wildlife Agencies, Washington, DC, USA

Science and the Real World: How Ray's Conservation Legacy has Influenced Management and Policy

Wetland conservation and protection practices and policies would not be what they are today without the work by Ray Semlitsch and his students. Ray was a founding member of Partners in Amphibian and Reptile Conservation (PARC). His work was instrumental in demonstrating the value, and need for protections, for small, isolated wetlands. He also led seminal research that provided management agencies with the concept of core

habitat. State and federal management agencies benefited from his research by having better information to manage wetlands, forests, and timber production lands, and thus their amphibian and reptile inhabitants. His papers are often cited in habitat management guidance, critical habitat determinations for federally threatened and endangered species, and in species recovery planning. In this talk, I will provide some examples of how Ray's visionary thinking and approach to applied conservation has contributed to a legacy of real world, science-based conservation.

0466 AES Ecology I, Sunday 16 July 2017

Krupskaya Narváez[1], Filip Osaer[1]

[1]ElasmoCan, Asociación Canaria para la Investigación y Conservación de los Elasmobranquios, Las Palmas de Gran Canaria, Spain, [2]Fundación Colombiana para la Investigación y Conservación de Tiburones y Rayas, SQUALUS, Cali, Colombia

ANGELSHARK-ID: Creating a baseline for long-term angelshark monitoring in the Canary Islands

ANGELSHARK-ID is a research action created for long-term monitoring of angelsharks *Squatina squatina* in the Canary Islands, employing photo-identification. The aim of the project is to generate scientific base knowledge that allows the development of effective species management, while minimizing research impacts to the studied populations. In the absence of local knowledge of *S. squatina* in the Canarian Archipelago, data and tissue samples were collected during visual underwater census in coastal areas since 2006. The use of body marks was evaluated for viability in individual identification and the detection of short, medium and long-term resightings. Our results indicate that the innovative way of implementing photo-identification for *S. squatina* is a technique that meets our objectives. More than 90% of the sightings could be characterized for individual identification, and resightings were detected in juveniles and in adults up to nine years after their first observation. This methodology allows the description of activities, behaviour, population structure, habitat use, growth and longevity, as well as to identify critical habitats and potential threats. Genetic (ongoing) and isotopic assessment of the tissue samples will further help to inform conservation management.

0505 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Ann-Elizabeth Nash

University of Northern Colorado, Greeley, CO, USA

The Social Network and Evidence for Personality in the Spiny-Tailed Iguana, *Ctenosaura similis*

Animal personalities are defined as consistent differences among individuals in response to ecologically relevant stimuli. Groups or species may exhibit a behavioral

syndrome through consistency in individual behavior across situations. Evolutionary theory predicts individuals within a population should adapt their behavior in response to the current environment. Evidence from diverse taxa suggests instead that behavior is constrained by behavioral syndromes or personalities. Recently, incorporating personality into a social network analysis (SNA) framework has been advocated, characterizing the role different personalities play. To relate personalities to aspects of social organization, presence of behavioral types was established in the Spiny-Tailed Iguana, *Ctenosaura similis*, and quantified through two assays. 24 lizards were captured and outfitted with proximity tags to record social interaction data. Additionally, each individual was assayed for activity and exploration in a 9 m^2 arena containing a raptor model as a predator proxy. Individuals were also assayed for boldness using flight initiation distance (FID). There was strong support for different personalities in FID, with some individuals fleeing at distances >20.0 m while others remained stationary until <0.5 m. Exploration measures also substantiated different personalities, with skewed distributions of behavior. However, there is no evidence of a behavioral syndrome; bold animals were not predictably more exploratory or in close proximity to a predator model. Absence of a syndrome suggests behavioral flexibility in *C. similis*, avoiding, for example, mating aggression toward conspecifics carried over into inappropriate encounters with predators. Finally, personality may influence social structure, with bold individuals non-randomly distributed across the group.

0560 AES GRUBER AWARD I, Thursday 13 July 2017

Cody Nash[1], Jill Hendon[2], Toby Daly-Engel[1]

[1]*University of West Florida, Pensacola, FL, USA,* [2]*Gulf Coast Research Laboratory, The University of Southern Mississippi, Ocean Springs, MS, USA*

Reproductive periodicity and the frequency of multiple paternity in the finetooth shark, *Carcharhinus isodon*, in the Northern Gulf of Mexico

The mating behaviors of sharks are poorly understood largely because of the obvious complications of direct observation. However, information about reproduction is essential for forming effective management plans for species that are impacted by human activity. Sharks reach sexual maturity relatively slowly, so can have difficulty recovering from heavy fishing pressure or other sources of population decline. It has recently become apparent through genetic studies that polyandry is prevalent among the elasmobranchs (sharks, skates, and rays). Polyandry has been shown to result in multiple paternity - or multiple sires in individual broods - in almost all species studied to date. However, the adaptive advantage of this behavior is not clear. We are using polymorphic microsatellite markers to determine the frequency of multiple paternity in a small coastal shark of the Northern Gulf of Mexico, the finetooth shark (*Carcharhinus isodon*). This species has shown evidence of co-occurring annual and biennial reproductive periodicities within this region. We will compare the frequency of multiple paternity between individuals with each periodicity in order to determine if paternity is impacted significantly by long-term sperm storage and/or mate encounter rate.

Preliminary results indicate that at least some larger litters are multiply-sired. The final results of this study will allow us to compare *C. isodon* to other related species to help determine how life history characteristics can impact mating behavior.

0539 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Lauren Naylor, Joshua Drew

Columbia University, New York, New York, USA

Anthropogenic Influence on Mangrove-dependent Fisheries in Fiji

Fisheries play a critical role in food security throughout the world, particularly in developing countries. Throughout the Pacific Island region, coastal fisheries constitute an essential part of local livelihoods as they contribute to both subsistence and market-based economies, while also serving as the primary source of protein for local communities. Mangrove ecosystems are of particular importance to many commercially important fish species in this region, as they provide crucial nursery habitat that promotes juvenile survivorship. As these fish not only provide an important source of income, but also a source of protein for local people, the health of local communities is intimately tied with the health of the ecosystem. In the face of increasing pressure from human activities, this project aims to build a baseline of overall health for mangrove-dependent fisheries in Fiji, and offer insight into their future vitality. For this project we examined the relationship between the degree of anthropogenic pressure and a) the availability of habitat for species of fish and invertebrates b) species richness in mangrove ecosystems and c) the quality of fish health. We found varying responses which underscore the importance of assessing a multi-pronged approach to research in tropical small scale fisheries.

0089 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Wesley Neely, Norman Dronen

Texas A&M University, College Station, Texas, USA

Parasites from Four Species of Threatened Malaysian Freshwater Turtles

The Chinese food and traditional medicine market supports unsustainable illegal harvesting of threatened and endangered species, oftentimes pushing these species to extinction. One prominent case is the consumption of freshwater turtles, which has led to the endangerment and extinction of many Oriental turtle species. On December 11th, 2001, the Customs and Excise Department and the Agriculture, Fisheries, and Conservation Department of Hong Kong seized 9,500 illegally harvested turtles from twelve different species that were destined for the Chinese food market. While some of the turtles confiscated could be rehabilitated and returned to the wild, many of the turtles were dead or dying and thus were sent to the USA for parasite studies. Forty individuals representing four species were sent to the University of Florida and examined for parasites. These turtles were the Malayan box turtle, *Cuora amboinensis*, the giant Asian pond turtle, *Heosemys grandis*, the Malaysian giant turtle, *Orlitia borneensis*, and the black marsh turtle, *Siebenrockiella crassicollis*. The parasites of these turtles were subsequently transferred to the Laboratory of Parasitology, Department of Wildlife and

Fisheries Sciences, Texas A&M University for further examination. Thirteen species of parasites (nine nematodes, three trematodes, and one leech) were recovered. *Cuora amboinensis*, *S. crassicollis*, and *H. grandis* are considered to be threatened and *O. borneensis* endangered according to the IUCN red list. Since these species are threatened or endangered, the current study will increase metazoan parasite biodiversity data of these scarcely studied protected freshwater turtles.

0161 SSAR SEIBERT ECOLOGY I, Thursday 13 July 2017

Heather Neilly, Eric Nordberg, Jeremy VanDerWal, Lin Schwarzkopf

James Cook University, Townsville, QLD, Australia

Arboreality Increases Reptile Community Resilience to Disturbance From Livestock Grazing

Domestic livestock grazing directly alters habitat features and communities of ground-dwelling animals, but its effects on arboreal habitats and communities are poorly known. While grazing has been implicated in the decline of many vertebrate species, some are apparently resilient to the effects of grazing, either benefiting from structural changes at ground level or avoiding them, as may be the case with arboreal species. Here we examine both arboreal and terrestrial habitat features and reptile community responses to grazing to determine whether arboreal reptile species are more resilient than terrestrial species. We conducted reptile surveys among four different grazing treatments and in two vegetation types, at a 19-year experimental grazing trial in northern Australia. We utilized overall measures of abundance and diversity, community analyses, and individual species analyses at landscape and microhabitat scales to compare the grazing response of arboreal and terrestrial reptile assemblages. Arboreal reptile species were resilient to the impact of domestic livestock grazing whereas terrestrial reptiles were negatively affected by heavy grazing. Terrestrial reptiles were positively associated with structural complexity measures (e.g., % grass cover, leaf litter, woody debris), which were greatly reduced in heavily grazed areas. Arboreal lizards responded positively to microhabitat features such as tree hollows. Our results indicate that arboreal and terrestrial reptiles have a differing response to the impact of livestock grazing. Arboreal reptiles showed resilience in a landscape that is grazed but where trees have not been cleared. We highlight the importance of retaining trees in rangelands for both terrestrial and arboreal microhabitats.

0323 Snake Biology II & Snake Genomics, Sunday 16 July 2017

Dalton Neuharth[1], Connor Adams[1], Shelby Frizzell[1], Wade Ryberg[1], Toby Hibbitts[2], Josh Pierce[3], Craig Rudolph[3], Timothy Johnson[1]

[1]*Texas A&M Institute of Renewable Natural Resources, College Station, TX, USA,* [2]*Texas A&M University, College Station, TX, USA,* [3]*USDA Forest Service, Nacogdoches, TX, USA*

A Novel Method of Snake Detection Using Time-lapse Triggered Camera Traps

Advancements in game camera technology have allowed researchers to explore new methodologies for studying the distributions and ecologies of vertebrate species, particularly mammals. Passive infrared (PIR) and active infrared (AIR) triggered cameras are now widely used in wildlife research; however, these studies are often species specific and are unreliable for studying poikilothermic species such as snakes. Many modern camera traps include a programmable time-lapse trigger feature, which could resolve these problems. To evaluate this method, we conducted surveys for snakes throughout east Texas pine forests using time-lapse triggered cameras and a traditional drift fence design. These camera trap arrays consisted of a Reconyx PC800 mounted on a pole positioned in the center of the array, with the camera lens perpendicular to the ground. Twenty-six of these camera arrays were distributed across 7 sites and programmed to take a picture of the trap area every 30 seconds from 0545 to 2200. Here we present the results of our survey effort from March to October of 2016 and compare these results to traditional funnel trap arrays in similar habitats, operating in the same region at the same time. We obtained 8,388,078 images that resulted in 523 observations of 18 snake species. Our findings suggest that time-lapse triggered cameras in conjunction with a traditional drift fence design can be an effective method for surveying across snake taxa and that capture rates are better than those acquired by traditional funnel traps.

0777 SSAR SEIBERT ECOLOGY II, Thursday 13 July 2017

Brent Newman[1], Scott Henke[1], Susan Koenig[2], David Wester[1], Humberto Perotto-Baldivieso[1], Taylor Shedd[1]

[1]*Texas A&M University-Kingsville, Kingsville, Texas, USA,* [2]*Windsor Research Centre, Windsor, Trelawny Parish, Jamaica*

Determining the Suitability of the Jamaican Boa (*Chilabothrus subflavus*) for Short-Distance Translocation in Cockpit Country, Jamaica

The Jamaican Boa *Chilabothrus subflavus* (Boidae) is a Jamaican-protected species whose numbers and distribution have declined during the last century. In order to protect Jamaican Boas, translocation has been recommended as a conservation strategy. From December 2010 to November 2012 a short-distance translocation (SDT) of seven resident female Jamaican Boas in Windsor, Trelawny Parish, Jamaica was conducted to assess the effects of SDT on the survivability, home range size and microhabitat use of translocated individuals. A subset of seven resident (non-translocated) Jamaican Boas radiotracked in Windsor from November 2008 to June 2009 was used for comparison to SDT snake data. No mortalities or significant differences in home range size were recorded for SDT

as compared to resident female Jamaican Boas in Windsor. Visual detectability was higher for resident as compared to SDT snakes, however, both groups utilized arboreal microhabitats in greater proportion to terrestrial locations. Both groups were found in areas characterized by tall, canopy layer trees with vines and epiphytes, but SDT boas utilized larger trees with greater epiphyte densities than resident snakes. Results suggest short-distance translocation has potential as a management strategy for the conservation of Jamaican Boa populations in Jamaica.

0771 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brent Newman[1], Nicole Witzel[1], Laura Horton[2], William Sutton[1], Jeronimo Silva[1], Brittaney Hogan[1], Dominique Harris[1]

[1]Tennessee State University, Nashville, Tennessee, USA, [2]Belmont University, Nashville, Tennessee, USA

Assessing Biodiversity and Leech (Hirudinea) Parasitism of Semi-aquatic Turtles in an Urbanized Wetland in Tennessee

Turtles are a major biodiversity component and often play a keystone role in wetland ecosystems. From April 2016 through September 2016 we surveyed an aquatic turtle community in a ~5 ha palustrine, emergent wetland adjacent to the Tennessee State University Agricultural Research and Extension Center. Large, single-opening baited hoop-net traps were used to sample for turtles. For all captured turtles we recorded morphometric data, provided individual notch codes for future identification and if present, collected external leeches. Overall, we captured four turtle species including the Red-eared Slider (*Trachemys scripta elegans, n* = 169), Common Snapping Turtle (*Chelydra serpentine, n* = 22), Stinkpot (*Sternotherus odoratus, n*= 4), and Spiny Softshell Turtle (*Apalone spinifera, n* = 1). Leeches collected from captured turtles represented four different genera under phylum Hirudinea including the Desserobdella, Placobdella, and Helobdella. Collectively, our data will be compared to other wetlands of similar physiognomy throughout the region to provide an estimate of overall species diversity and wetland condition as well as parasite-host relationships of semi-aquatic turtles in the southeastern United States.

0844 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jillian Newman, Kyle Barrett

Clemson University, Clemson, South Carolina, USA

Distribution and Occupancy of Green Salamanders in South Carolina

Green salamanders, *Aneides aeneus* (Plethodontidae), are experiencing a significant decline in the Blue Ridge Escarpment. The IUCN lists this salamander as "Near Threatened" globally and the state of South Carolina lists it as "Critically Imperiled." Two likely threats to green salamanders include habitat loss and climate change. This species is also vulnerable to extinction due to its patchy distribution, which stems from the species' dependency on rocky outcrops for at least a portion of its life cycle. Many of the historical localities in South Carolina have not been surveyed in 25 years or more. We sought to determine the current status of green salamanders in South Carolina by reassessing historically occupied locations and newly discovered potential habitat. We conducted visual encounter surveys at rock outcrops and adjacent forests (N = 61), and collected habitat variables at each site to determine factors influencing green salamander occupancy. We constructed a number of models that incorporated covariates for both occupancy and detection probability and compared them using an AIC framework. Detection probability was positively influenced by salamander activity while occupancy probability decreased with increasing elevation. Of the 51 sites that we surveyed with known historical occurrences, green salamanders were only detected at 45.1% of these sites. This suggests the possibility of local extinctions and a range contraction; however, throughout the survey period we also discovered new occupied sites. These data on habitat requirements and previously unknown populations will aid conservation and management efforts for the species in the Blue Ridge Escarpment.

0339 AES GRUBER AWARD II, Thursday 13 July 2017

Kyle Newton, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Cognition and magnetoreception in the yellow stingray, *Urobatis jamaicensis*, and their potential roles in elasmobranch orientation and navigation

Sharks, skates, and rays are hypothesized to use the geomagnetic field (GMF) as a cue to orient and navigate during migrations. However, few studies have examined the magnetic sense and cognitive abilities of elasmobranchs. The yellow stingray, *Urobatis jamaicensis*, is a small, demersal batoid that has proven to be an excellent model for elasmobranch cognitive and magnetoreception research. We employed behavioral conditioning to demonstrate that the yellow stingray can learn to discriminate between magnetic and non-magnetic stimuli, and remember behavioral tasks for at least six months. Yellow stingrays can detect, and discriminate between, changes in the strength and inclination angle of the GMF. These are cues that magnetoreceptive species can use as a bicoordinate grid, or possibly a cognitive map, to derive a sense of their current location with respect to a goal. The yellow stingray can use the polarity (north and south poles) of the GMF as a cue to solve a navigational task. This indicates that this species might gain a sense of direction, and orient itself with respect to the GMF using a polarity compass. Throughout all training procedures, the yellow stingray could use different types of magnetic cues as conditioning stimuli equally well, and it learned tasks faster under subsequent reversal training. However, there were differences in performance

between the sexes depending upon whether subjects were reinforced using appetitive or aversive stimuli. These results support the notion that elasmobranch fishes have the sensory and cognitive capabilities to use the geomagnetic field to orient and navigate.

0458 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Katie Nickles[1], Yinan Hu[1], John Majoris[2], Peter Buston[2], Jacqueline Webb[1]

[1]*University of Rhode Island, Kingston, RI, USA,* [2]*Boston University, Boston, MA, USA*

Ontogeny of the Lateral Line System in a Caribbean Reef Goby, *Elacatinus lori*

Elacatinus lori is a sponge-dwelling neon goby that is endemic to the Mesoamerican Barrier Reef. It has emerged as a model species for the study of population connectivity and mechanisms of navigation during the pelagic larval phase. The purpose of this study was to analyze the ontogeny of the lateral line (LL) system in *Elacatinus lori* to start to understand its potential contribution to the sensory biology of pelagic larvae and post-settlement individuals. Twenty-four individuals (3 mm TL - 62 mm SL) were imaged using 4-di-2-ASP (vital fluorescent mitochondrial stain) revealing superficial neuromasts (SN) on the head, trunk, and tail. Data from paraffin histology, SEM, and μCT, provided additional information on neuromast and cranial LL canal morphology. SN distribution maps showed that SNs are present in young larvae, discrete SN lines develop, then SNs continue to proliferate, and papillae on which the SNs sit become apparent at the time of settlement. The LL system of gobies is typically quite complex, with 100's to 1000's of SNs arranged in numerous lines on the head and body. The ability to rear *E. lori*, which has a relatively small number of SNs, provided an additional opportunity to interpret variation in the complex SN distributions reported among other species. Thus, the SN lines in *E. lori* were compared to those in other *Elacatinus* species, *Tigrigobius* (sister genus), and other gobiids, as reported in the literature to aid in the interpretation of SN proliferation in these fishes. Funded by NSF grant 1459546 to JFW.

0041 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Bradley Nissen, Nathan Bendik

City of Austin, Austin, Texas, USA

Seasonal Changes in the Body Condition of *Eurycea sosorum* and *Eurycea tonkawae*

Body condition is commonly used in wildlife studies as an indicator of an animal's fitness, and can have valuable implications to ecologists. Seasonality is known to drive various biological processes in many ecosystems, however in groundwater systems the effects of seasonal changes are not typically as pronounced or well-known. In this study, we examined the effects of seasonality on the body condition of two different species of

central Texas spring salamanders, the Barton Springs Salamander (*Eurycea sosorum*) and the Jollyville Plateau Salamander (*Eurycea tonkawae*). These two neotenic species inhabit different springs and groundwater systems of two separate segments of the Edwards Aquifer in Austin, Texas. We conducted a 3 year, multi-season mark-recapture study of both species, using digital photographs of individuals (N = 2233) and photoID software (WILD-ID) to identify recaptures. We digitally measured body length and tail width of each individual. Body condition of individuals was calculated using residuals from a linear regression of tail width and body length. We used tail width as a measure of body condition because salamanders store energy reserves (lipids) in their tails. Both species exhibited seasonal differences in body condition, which was lowest in the winter and generally higher in the spring and summer. There was an interaction between gravidity and season, with gravid individuals having a lower body condition during the fall and winter (when the proportion of gravid individuals is the greatest) compared to non-gravid individuals.

0411 Lightning Talks II, Friday 14 July 2017

Fahmida Khalique Nitu[1], Mahatub Khan Badhon[2], Md Kutub Uddin[2], Enamul Mazid Khan Siddique[3]

[1]Bianibazar Government College, Sylhet, Bangladesh, [2]Save Our Sea, Dhaka, Bangladesh, [3]IUCN Bangladesh Country Office, Dhaka, Bangladesh

Identifying Priorities of Elasmobranch Biodiversity Conservation in the Bay of Bengal, Bangladesh

Our review evaluates the current scenario of elasmobranch conservation in Bangladesh and identifies future priorities. Using the framework from Royal society's Measuring Biodiversity for Conservation, literature review and Key Informant Interviews coupled with field observation were conducted. Review finds a total record of 77 species, however Key Informants affirm the lack of taxonomic scrutiny in literature. Owing to the limited scope of studies in using taxonomic identification methods, and studying distribution and abundance of species has resulted significant Linnaean, Wallacean and Prestonian shortfalls in the existing knowledge base. The 2015 national IUCN Red List of Threatened Species does not assess elasmobranch due to the knowledge shortfalls, nevertheless 34 species are globally threatened among the species reported in Bangladesh. Wildlife (Conservation and Security) Act, 2012 identifies 29 species as 'protected wild animal' and prohibits elasmobranch fishing in the Sundarban Reserve Forests. Being a party of CITES has arguably little impact as monitoring facilities in the land ports are absent, resulting dry products of listed species vulnerable to exporting in neighbouring countries. Analyzing the scenario, our review recommends that scientific information and evidence on the habitat and population is necessary to assess the conservation status of elasmobranch fauna that will inform policy. Besides, a collaboration mechanism among the policy implementing agencies (particularly, Forest Department and Department of Fisheries), awareness building at grassroots level

fishermen and traders and regional collaboration among neighbouring countries have been prioritised.

0609 ASIH STOYE ECOLOGY & ETHOLOGY II, Thursday 13 July 2017

Jessica Noble[1], Lauren Kircher[1], Matia Gringas[1], Lissette Geubelle[1], Joy Young[2], John Baldwin[1]

[1]Florida Atlantic University, Davie, Florida, USA, [2]Florida Fish and Wildlife Conservation Commission, Tequesta, Florida, USA

Effects of a Disturbance Event on Fine Scale Movement and Population Dynamics of an Estuarine Sportfish

Disturbance events (ex: wildfires, extreme temperature shifts, disease) are occurrences that are increased in magnitude, duration, and/or frequency compared to natural disturbances within the normal disturbance regime. Effects of disturbance events can impact a population through changes in behavior and population dynamics. This project will identify overwintering movement behavior of common snook (*Centropomus undecimalis*), and describe the changes in their overwintering home range size and habitat choice in relation to the 2010 extreme cold event by using acoustic telemetry. The study will be focused on overwintering season (October-April), highlighting the time period of the cold event (Jan 2-13) between years 2009-2012. Previous studies have described spawning sites and spawning site fidelity of common snook, however overwintering movement patterns within the Indian River Lagoon are still unknown. In addition to looking at the effect of the disturbance event on overwintering behavior, this study also aims to establish overwintering movement patterns for the first time using acoustic telemetry. To determine the effect the cold event had on population dynamics Fisheries Independent Monitoring (FIM) survey data, provided by FWRI, will be used to look at sex ratio, abundance, fish length frequency, age class, body condition, and gonadosomatic index. The goal is to understand fine scale movements under normal and disturbance event conditions, as well as the impacts of a disturbance event on short term and long term population dynamics.

0162 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Eric Nordberg, Lexie Edwards, Lin Schwarzkopf

James Cook University, Townsville, QLD, Australia

Terrestrial Invertebrates as Formidable Predators of Vertebrates: An Underestimated Guild

Predator–prey interactions have critical influences on wildlife populations, but are rarely observed. Thus, there are many anecdotal observations of predation events, but they are seldom quantified in nature. Vertebrates are the top predators in many systems, but large invertebrates may be important predators of small vertebrates. We used several approaches to determine the relative frequency of predation by invertebrates on vertebrates in terrestrial systems, where it is not often studied. We conducted 500 man-hours of visual surveys and compiled observations of in situ predation events from 2014 – 2016 in north Queensland, Australia. Observing a predation event in nature was rare: in 500 man-hours of visual searches, we only observed 9 instances of predation (vertebrates consuming another vertebrate, n = 4; invertebrates consuming a vertebrate, n = 5). We also deployed model lizards, to measure attack frequencies and found that 6.8 – 23.3 % of model attacks were by invertebrate predators, depending on seasonal variation. Although rarely observed, we suggest that predation events by invertebrates as predators of vertebrate prey should not be overlooked in terrestrial systems. Invertebrate predators are likely important predators of small vertebrates, similar to more "typical" predators such as snakes, birds, and mammals.

0108 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

José Novaes[1], Camila Bezerra[1], Rodrigo Costa[1], Danielle Peretti[2]

[1]*Universidade Federal Rural so Semi-Árido, Mossoró/RN, Brazil,* [2]*Universidade do Estado do Rio Grande do Norte, Mossoró/Rn, Brazil*

Decrease in Reservoir Levels Induced by Prolonged Drought as a Threat to Fish Species of Different Trophic Guilds in a Tropical Semi-Arid Environment

The objective of the study was to evaluate if the decrease in the water level of a tropical semi-arid reservoir affected the length-weight relationship and condition factor of fish of different trophic guilds: insectivorous (*Triportheus signatus*), carnivorous (*Hoplias malabaricus*) carcinophagous (*Plagioscion squamosissimus*), omnivorous (*Leporinus piau*) and detritivorous (*Curimatella lepidura*). The experiment was carried out between 2010 and 2015 in the reservoir of Santa Cruz, Northeast Brazil, and during the study period, the reservoir level decreased from 93.99% of its capacity to 31.43% due to the absence of precipitation. The standard length (cm) and total weight (g) of the captured fish were recorded. The parameters of the length-weight relationship, by year for each species, were estimated by linear regression after log-transforming the data, and the condition factor used was relative weight. Both *T. signatus* (ANCOVA: df = 5, F = 12.27, $p < 0.001$), due to a possible decrease in insects, and *C. lepidura* (ANCOVA: df = 5; F = 10.22, $p < 0.001$), due to the decrease in the organic matter input, presented differences between the slopes of the length-weight relationship. Only *T. signatus* presented a significant difference (ANOVA: df = 5; F = 13.18; $p < 0.001$) in condition factor, with the lowest value in 2015 compared to those of other years. The study showed that the insectivorous species *T. signatus* was the most sensitive to the prolonged drought event. Thus, insectivorous species demand greater attention for conservation in semi-arid lentic environments in the event of prolonged drought.

0366 ASIH STOYE ECOLOGY & ETHOLOGY IV, Friday 14 July 2017

Megan Novak, Scott L. Parker

Coastal Carolina University, Conway, SC, USA

Spatial Ecology of the Southern Copperhead in a Fragmented and Non-fragmented Habitat: Knot your Average Study

Spatial ecology of animals is influenced by habitat type and their physical environment. Habitat fragmentation can potentially alter the habitat type and directly affects the spatial and temporal distribution of resources available within the physical environment. The southern copperhead (*Agkistrodon contortrix contortrix*) is a habitat generalist occurring in woodlands, farmlands, as well as suburban neighborhoods. In this study, we quantified habitat use and movement patterns of *A. contortrix* within a fragmented environment and non-fragmented environment. We measured the effective distance moved (EDM), the straight-line distance moved (SLD), and the occupied area (OA) of *A. contortrix* in a non-fragmented habitat (Waccamaw National Wildlife Refuge, WNWR, n=20 snakes) and a fragmented habitat (Coastal Carolina University, CCU, n=22 snakes) from May to October, 2016 in Conway, SC, USA. Copperheads were tracked by attaching a thread bobbin to the snake and following the trail of thread as the snake moved through its environment. Longitude, latitude, habitat location (forest core, edge, open), date and time were recorded every two days for each snake. Copperheads at CCU had a smaller OA than those in the WNWR (OA_{CCU}=1037.8m^2, OA_{WNWR}=2310.9m^2). Copperheads at the fragmented CCU site increased their daily movements (EDM: 20m/48hr) from summer to autumn, whereas snakes in the non-fragmented WNWR decreased their movements (EDM: 15m/48hr) between the two seasons. The reason for this increase in activity in the fragmented habitat is unclear, but possibly due to differences in food resource accessibility or availability winter brumation sites.

0528 ASIH STOYE ECOLOGY & ETHOLOGY III, Friday 14 July 2017

Michael Novotny, Tracey Sutton

Nova Southeastern University, Dania Beach, FL, USA

Assemblage structure and trophic ecology of the bathypelagic fish family Platytroctidae in the northern Gulf of Mexico

Members of the family Playtroctidae are circumglobal (except the Mediterranean Sea), and primarily inhabit bathypelagic depths. Due to the rarity of specimens, this taxon has received little focused attention, despite recent evidence suggesting its predominance in the bathypelagic ichthyofauna. Within the Gulf of Mexico (GoM), a highly diverse deep-pelagic system, only four species have been reported. An extensive bathypelagic trawl series in the northern GoM collected 16 species of platytroctids, 12 of which are new

records. In this study the abundance, distribution, and diet of the five dominant species (*Mentodus facilis*, *Platytroctes apus*, *Barbantus curvifrons*, *Mentodus mesalirus*, and *Maulisia microlepis*) were examined. All species were collected from tows below 700 meters, with no individuals collected from tows above 700 meters. Evidence suggests that platytroctids actively avoid standard rectangular midwater trawls, evidenced by catches with a large, high-speed rope trawl. Preliminary data suggest that platytroctids consume gelatinous zooplankton, with occasional predation on crustaceous zooplankton. The majority of platytroctids examined in this study had empty stomachs, indicating that they feed infrequently, prey is rapidly digested, or both. No feeding guild shift was observed with growth, however ration appeared to increase with body size.

0512 AES Ecology II, Sunday 16 July 2017

Rob Nowicki[1], Mike Heithaus[2], Jordan Thomson[3], Derek Burkholder[4], Kirk Gastrich[2], Aaron Wirsing[5]

[1]Mote Marine Laboratory, Summerland Key, FL, USA, [2]Florida International University, North Miami, FL, USA, [3]Deakin University, Victoria, Australia, [4]Nova Southeastern University, Fort Lauderdale, FL, USA, [5]University of Washington, Seattle, WA, USA

Does widespread resource loss influence trophic characteristics of tiger sharks?

Food web structure is an integral property of ecosystems, and can influence myriad ecosystem processes from nutrient transport to herbivory intensity. While there have been multiple studies investigating the role of resource loss on food web structure, questions yet remain about consumer responses to such events. Understanding to what degree resource losses alter food webs can allow us to better predict how disturbances and resource losses may propagate up food webs. Here, we use stable isotope analysis of Carbon and Nitrogen and a widespread loss of seagrass following a marine heat wave in Shark Bay, Western Australia, to evaluate whether loss in this portion of the resource base has altered trophic properties of tiger shark populations. Preliminary data indicate that while tiger sharks remain generalists on a population level, the average $\Delta^{13}C$ value of tiger shark tissues decreased, suggesting a lower incorporation of the seagrass base. This work suggests that the widespread resource loss has in fact propagated to tiger sharks, despite no evidence of population level shark declines. Ongoing work will evaluate whether this reflects a change in tiger shark diet preferences, or changes in feeding patterns of their herbivorous prey.

0259 LFC Multi-Stressor Effects, Friday 14 July 2017; LFC SALLY L. RICHARDSON BEST STUDENT PAPER

Janet Nye[1], Hannes Baumann[2], Teresa Schwemmer[1]

[1]School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, NY, USA, [2]Department of Marine Sciences, University of Connecticut, Avery Point, CT, USA

Physiological Effects of Increased Temperature and Carbon Dioxide on Atlantic Silverside Early Life Stages

There is a critical need to mechanistically understand the combined effects of multiple stressors on fish physiology to better anticipate population consequences of marine climate change. We conducted a series of 2 x 2 and 3 x 3 temperature and carbon dioxide partial pressure (pCO_2) factorial experiments on embryos and larvae of the Atlantic silverside, *Menidia menidia*. Recent work has shown that high pCO_2 inhibits growth and survival of Atlantic silversides when exposed at the egg and early larval stage, suggesting that the energy required to cope with high pCO_2 leaves less energy for survival and growth. To elucidate the physiological effects of high temperature and pCO_2 on Atlantic silversides and the mechanisms of coping with these stressors, we quantified the temperature-dependent metabolic costs of high pCO_2 using microrespirometry to measure oxygen consumption rates. Our preliminary results agree with our predictions that increased temperature and pCO_2 raise metabolic costs, thus increasing oxygen consumption rates. We also measured abundance and size of ionocytes, the ion-exchanging cells, using immunohistochemical staining. We hypothesized that ionocyte size and abundance increase under high pCO_2 because it requires greater capacity for acid-base regulation. We expect the severity of effects on metabolic rates and ionocytes to decrease in fish spawned later in the spawning season due to transgenerational plasticity, by which the conditions adults experience in the wild influence the phenotypes of their offspring. Recent evidence suggests that this mechanism reduces sensitivity to high pCO_2 in Atlantic silversides and high temperature in other fishes.

0117 Snake Biology II & Snake Genomics, Sunday 16 July 2017

Kyle O'Connell, Eric Smith, Matthew Fujita

University of Texas at Arlington, Arlington, TX, USA

Species delimitation of North American whipsnakes and the effects of missing SNP data on phylogenetic analyses

A stable alpha taxonomy is essential to understanding evolutionary processes and achieving effective conservation aims. Taxonomy depends on the identification of independently evolutionary lineages, and the delimitation of these lineages based on multiple lines of evidence. Coalescent species delimitation within an integrative framework has increased the rigor of the delimitation process. Here we use genome-wide SNP data and coalescent species delimitation to explore lineage relationships within several North American whipsnake species, and to test the species status of three of those lineages. We find support for the elevation of two previous subspecies to full species status, and confirm the species status of a third species. This study demonstrates

the power of molecular data, paired with model-based delimitation methods, to identify evolutionary lineage relationships, and to delimit previously overlooked evolutionary species within well-studied taxa.

0171 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Katherine O'Donnell, Susan Walls

U.S. Geological Survey, Gainesville, FL, USA

Bridging the research-management gap: Effective conservation decisions for flatwoods salamanders through adaptive management

Globally, amphibians are among the most imperiled taxa; 35 native amphibian species are currently listed under the U.S. Endangered Species Act. Preventing extinction often requires both in situ actions (i.e., protecting species in their natural habitats) and ex situ strategies (i.e., conservation breeding programs). Conservation decisions about actions for federally-protected species are complex because managers must address regulatory requirements in addition to complicated biological issues. Thus, effectively evaluating the costs, risks, and benefits of recovery actions requires input from various stakeholders, including scientists, agency personnel, non-governmental organizations, and land managers. The flatwoods salamanders (*Ambystoma cingulatum* and *A. bishopi*) are federally-protected species native to the southeastern United States, but these species lack complete recovery plans. Substantial uncertainty regarding the effectiveness of possible conservation actions hinders recovery planning. In 2013, we established the informal Flatwoods Salamander Working Group to coordinate conservation actions among researchers and land managers. We opted to formally confront the complexity and uncertainty about potential recovery actions using structured decision making (SDM) - a process that decomposes a decision into key components: problem identification, management objectives, potential actions, prediction models, and optimization processes that reconcile tradeoffs. In this talk, I will present a summary of two SDM workshops, discuss decision outcomes, and highlight current efforts toward species recovery. I will also discuss the advantages of using adaptive management (a type of SDM) in resolving conservation problems involving data deficiencies, disagreements among stakeholders, and decision paralysis (delays in implementing actions due to uncertainty).

0822 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kiernan Oknefski, Alexa Trujillo, Matthew Lawrance, Anna Savage

University of Central Florida, Orlando, Florida, USA

Impact of Genetic Structure on Pathogen Dynamics in North American Ranid Frogs

Rapid global amphibian declines caused by infectious diseases have raised questions about how pathogens interact with host species and contribute to lineage diversification and persistence over time. The two most impactful amphibian pathogens are Ranavirus and *Batrachochytrium dendrobatidis* (Bd). Ranavirus is an Iridovirus that causes mass mortality in amphibians by inducing liver necrosis, and Bd causes the skin fungal disease chytridiomycosis that is linked to declines and extinctions of amphibians worldwide. The influence of host genetic variation on susceptibility to pathogens such as Ranavirus and Bd remains poorly understood for a wide variety of taxa, but some studies suggest susceptibility of Ranavirus and Bd differs between host populations. We previously characterized Ranavirus and Bd infection states in larval amphibians collected from populations of the North American ranid frogs *Lithobates catesbaenia*, *Lithobates sphencephalus*, and *Lithobates palustris* utilizing quantitative PCR (qPCR). Here, we sequence ND2, ND4 and cytochrome B mitochondrial genes and conduct population genetic analyses, then relate population diversity to pathogen dynamics to determine if patterns of disease susceptibility are associated with individual or population level genetic variation. The results of this study will expand our understanding of the pathogen-host interface and address host demography as a potential explanation for disease variation across declining *Lithobates* species. This, in turn, will improve our ability to conserve threatened amphibian species and to predict and mitigate future declines.

0870 General Ichthyology I, Sunday 16 July 2017

Ronald Oldfield[2], Mimi Guo[2], Jacob Hooks[2], Abhinav Kakuturu[2], Jeffrey Sommer[2], Shelly McCain[1], William Lutterschmidt[1], Tom Lorenz[3], Adam Cohen[4], Dean Hendrickson[4]

[1]Sam Houston State University, Huntsville, TX, USA, [2]Case Western Reserve University, Cleveland, OH, USA, [3]Georgia Southwestern State University, Americus, GA, USA, [4]The University of Texas at Austin, Austin, TX, USA

Taxonomy and Osmoregulatory Capacity in Non-Native *Herichthys* Cichlid Fishes in the Gulf Coast Region of the United States

Cichlid fishes are commonly introduced and successfully establish populations in the southern US. The Rio Grande Cichlid, *Herichthys cyanoguttatus*, is a cichlid species native to the drainages of the Gulf Coast of northern Mexico and southern Texas that has been introduced to several sites in the US. *Herichthys cyanoguttatus* in Texas primarily occupy inland riverine habitats while non-native *Herichthys cf. cyanoguttatus* in Louisiana occupy a coastal, and often estuarine, environment. First, we formally evaluate the taxonomic status of non-native *Herichthys cf. cyanoguttatus* populations in Texas and Louisiana based on morphological features. Next, we compare osmoregulatory ability between a population in Texas and a population in Louisiana to determine whether their difference

in habitats might be more likely due to the different places humans released them or due to differences in ability to live in various salinities, and if the two populations thus might be predisposed to invade different habitat types. The *Herichthys cf. cyanoguttatus* specimens we sampled in Louisiana had an obliquely oriented mouth, a rounded ventral profile, and larger iridescent spots than those in Texas, and we conclude that their taxonomic identity is not *H. cyanoguttatus* but is *H. carpintis*. Surprisingly, we found little difference in osmoregulatory capability between the two species, indicating that the differences in geographic distribution between them is due to where they were released and not due to differences in ability to survive in water of different salinities, and that we should not expect differences in invasion potential between the two species based on salinity.

0854 Amphibian Conservation I, Sunday 16 July 2017

Jennifer Olori, Sofia Windstam

SUNY Oswego, Oswego, NY, USA

Multi-year Prevalence and Co-infection Dynamics of Ranavirus and Chytrid Fungus in Central New York

Although *Batrachochytrium dendrobatidis* (Bd) and ranavirus (Rv) are major contributors to global amphibian declines, few studies have compared the dynamics of these pathogens across multiple years in a single region, and investigations of co-infection are nearly absent. To document long-term prevalence patterns and identify potential infection co-factors, an ongoing survey of amphibians in Oswego County, NY, was begun in 2012. During the first four years, 564 individuals from 14 species were tested for the presence of both pathogens using a standardized end-point PCR protocol. From 2012-2015, Rv prevalence was relatively stable (23 to 38%), whereas Bd prevalence fluctuated annually, exhibiting peaks of 25-26% in 2012 and 2015, and lows of 2-6% in 2013 and 2014. Co-infections were rare but present in all years, and also varied annually, ranging from 0.6-10% of tested individuals. Additionally, females of our most commonly sampled species, *Lithobates clamitans* (n=267), were significantly more likely than males to test positive for Rv, a result that resembles patterns associated with sexually transmitted infections in humans involving super-spreaders. Bd prevalence showed no sex bias, and the larger fluctuations in annual prevalence demonstrate that Bd is more sensitive to seasonal environmental variation than is Rv. Although the rarity of co-infections suggests a current lack of strong synergism between Bd and Rv, the annual fluctuations in co-infection rates closely track those of Bd. We suggest that as the limiting factor, future changes in Bd virulence or geographic range resulting from climate change could increase the susceptibility of amphibians to multiple pathogens.

0696 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Emily Olson, Matthew Davis

St. Cloud State University, St. Cloud, MN, USA

The Widespread Evolution of Fangs in Ray-finned Fishes

Numerous lineages of vertebrates have evolved greatly enlarged fang-like teeth that serve a number of functions. This includes a variety of lineages of ray-finned fishes, in which these teeth often are hypothesized to use fangs for piercing and restraining prey. This study explores the repeated evolution of fangs in ray-finned fishes using a densely-sampled phylogeny to infer how many times fang-like teeth have independently evolved across the evolutionary history of ray-finned fishes. Character evolution of fangs among ray-finned fishes is investigated using a taxonomically robust hypothesis of actinopterygian evolutionary relationships based on nuclear and mitochondrial data.

0496 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Richard Orton, Lance McBrayer

Georgia Southern University, Statesboro, Georgia, USA

Corridors Facilitate Gene Flow in a Fragmented Landscape

Anthropogenic disturbance is likely to influence dispersal and population size by altering habitat quality and connectivity. In turn, genetic diversity within and among populations will be impacted. Thus, species with limited vagility and specific habitat preferences may be particularly susceptible to landscape-altering events. Populations of the Florida scrub lizard (*Sceloporus woodi*) within the Ocala National Forest (ONF) are subjected to prescribed fire, fire suppression and clearcutting. Stands of longleaf pine within the ONF are maintained on a biannual cycle of prescribed burning and harbor large populations of *S. woodi.* Meanwhile, clear-cut stands of sand pine scrub (SPS) only temporarily provide suitable habitat for *S. woodi*. We predict that *S. woodi* disperse from stands of SPS as vegetation density increases in the absence of a natural fire regimen. The objective of this study is to quantify temporal and spatial genetic diversity in *S. woodi* populations in the ONF and assess any correlation with habitat management practices. To this end, we used microsatellite markers to quantify genetic variation in *S. woodi* at two time points separated by approximately five generations, and spatial analyses to test for correlations between landscape metrics and genetic diversity. Microsatellite markers revealed a weak population genetic structure that was better described by a least cost path, than by Euclidean distance. Temporal shifts in genetic diversity are also correlated with several patch metrics, including habitat quality and proximity. Our data suggest that corridors may be important for facilitating gene flow between populations of terrestrial species in managed landscapes.

0501 Herp Ecology III, Friday 14 July 2017

Richard Orton, Lance McBrayer

Georgia Southern University, Statesboro, Georgia, USA

Predation Alters Local Adaptation and Sexual Dichromatism

Animal coloration is often viewed as an adaptive response to predation. For example, crypsis can increase fitness for prey animals by blending their visual signal with the local background, thus reducing the probability of detection by visual predators. Because crypsis is dependent on the visual background, and visual backgrounds frequently vary across space, local adaptation in dorsal color is common for species that are often exposed to visual predators. *Sceloporus woodi*, a small, sexually dimorphic, diurnal lizard, occupies stands of longleaf pine and sand pine scrub habitats. In the Ocala National Forest (ONF), these habitats contrast in substrate type and abundance. Here, we use a combination of calibrated photographs, spectrometry, and data collected in the field to examine the effects of spatial heterogeneity and sex on animal color and pattern. First, we used clay models to demonstrate that selection pressure from visual predators in the ONF is contingent on crypsis, and that predation is higher in sand pine scrub habitats. We also show that subpopulations of *S. woodi* have locally adapted in the ONF. Furthermore, the degree of crypsis is related to predation intensity, and females more closely match the color of visual backgrounds than males. Finally, using data collected in the field, we correlate crypsis with intersexual differences in escape behavior and microhabitat use. Our data suggest that local adaptation and sexual dichromatism may be influenced by selection pressure from visual predators.

0461 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Filip Osaer[1], Krupskaya Narváez[1]

[1]ElasmoCan, Asociación Canaria para la Investigación y Conservación de los Elasmobranquios, Las Palmas de Gran Canaria, Spain, [2]Fundación Colombiana para la Investigación y Conservación de Tiburones y Rayas, SQUALUS, Cali, Colombia

HAMMERHEAD SHARK RESEARCH: Knowledge from the populations in the Canary Islands

HAMMERHEAD SHARK RESEARCH is a project that studies hammerhead sharks *Sphyrna spp*. in the Canary Islands with the aim to contribute scientific base knowledge of these species in an understudied distribution. Hammerheads are prone to bycatch in a wide range of fishery gears and interesting for shark fin trade, which make them vulnerable to overexploitation considering their life history characteristics. Species knowledge in the Canary Islands is limited to the presence of the scalloped hammerhead shark *S. lewini* and the smooth hammerhead shark *S. zygaena*, isolated records about behaviour, and scant sighting reports by citizens in social media. To get insights into the population dynamics, tagging and tissue sampling is combined with biological and fisheries data collection in four of the seven islands from the Canarian Archipelago. The professional and recreational fishing communities are actively involved in the study,

and are together with citizens encouraged to report sightings of tagged and untagged individuals. To date, our results have revealed three potential critical habitats for *S. zygaena* in the islands of Gran Canaria, Fuerteventura and Lanzarote. In addition, tissue samples were collected, post-release behaviour monitored and relationship with ectoparasites established. Future data collection and subsequent analysis is required to document the first local knowledge that can help in effective decision making for the species.

0164 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Brittany Ousterhout[2], William Peterman[4], Thomas Anderson[3], Dana Drake[5], Jacob Burkhart[1], Freya Rowland[1], Raymond Semlitsch[1]

[1]University of Missouri, Columbia, MO, USA, [2]University of Arkansas, Fayetteville, AR, USA, [3]University of Kansas, Lawrence, KS, USA, [4]Ohio State University, Columbus, OH, USA, [5]University of Connecticut, Storrs, CT, USA

Are hot-spots consistent? Spatiotemporal variation and annual synchrony in larval abundance of pond-breeding salamanders

Understanding variation in the spatial dynamics of populations has important implications for the stability of metapopulations and managing species of conservation concern. While a significant body of literature examines the theory of spatial dynamics, empirical studies that assess spatial and temporal dynamics in nature remain uncommon. To test whether a pond-breeding amphibian exhibits source-sink dynamics, we conducted extensive surveys of 200 ponds over three years in south-central Missouri for larvae of the ringed salamander (*Ambystoma annulatum*), an endemic species of the Ozark Highlands. We then used a graph theoretical parameterization of the metapopulation mean lifetime model to assess which ponds acted as demographic sources or sinks, and if these designations were temporally or spatially autocorrelated. Preliminary results indicate variation in the production of salamander larvae, with spatial variation being 4 – 10 times greater than temporal variation. While the abundance of larvae within a pond was correlated among years, we did not find strong support for the abundance of larvae being spatial autocorrelated. Our findings support the hot-spot model of source-sink dynamics, which predicts that only a few populations actually contribute to metapopulation processes. Knowing this dynamic structure, and how it might be affected by species life history requirements, changes in habitat quality, and their interaction with stochastic processes, is essential for understanding how management strategies can balance conservation of important source ponds with the loss of some sink ponds to meet socio-economic demands of growth.

0492 Fish Biogeography & Morphology, Saturday 15 July 2017

Hannah Owens

University of Florida, Gainesville, FL, USA

Seeing the Invisible: Biogeographic Breaks in Circumtropical Billfishes (Istiophoridae and Xiphiidae)

Billfishes of the families Xiphidae and Istiophoridae are epipelagic and circumtropical, with pelagic larvae and highly vagile adult stages. Despite their putative ability to disperse nearly globally, several currently-recognized species pairs have disjunct Atlantic and Indo-Pacific distributions. These patterns have been attributed both to hard geologic barriers such as the closing of the Isthmus of Panama, and soft oceanographic barriers such as the formation of the cold-water Banguela Barrier. While these distributional patterns are not unique to billfishes, this commercially-important clade presents an ideal system in which to develop unique biogeographic hypothesis tests that are more broadly applicable to other marine groups. Present-day locality data were collected from databases of georeferenced observations and museum vouchers and integrated with observed primary productivity and physiochemical data using an ensemble correlative ecological niche modeling approach. Resulting distributional models were then used to test hypotheses that oceanographic properties play a part in defining the distributional ranges of billfishes, and whether primary productivity or physiochemical properties are more likely drivers of putative breaks. Ancestral niche reconstructions projected into modeled paleoceanographic conditions were subsequently used to infer ancestral *Tetrapturus*, *Kajikia*, *Makaira*, and *Istiophorus* distributions. Results suggest a combination of hard and soft biogeographic barriers, combined with changing ocean conditions throughout geologic history, have limited billfish dispersal; resulting allopatric speciation events likely led to the present geographic distribution of billfish biodiversity.

0891 LFC Physiological Performance II, Sunday 16 July 2017

Elias Oziolor, Cole Matson

Baylor University, Waco, TX, USA

Evolutionary toxicology: Genetic adaptation in Gulf killifish (*Fundulus grandis*) populations chronically exposed to environmental contaminants

The Houston Ship Channel (HSC) in Galveston Bay is an aquatic environment with a long history of contamination, including polychlorinated dibenzodioxins (PCDD), polychlorinated dibenzofurans (PCDF), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Populations of Gulf killifish from the HSC have adapted to resist the developmental cardiovascular deformities associated with dioxin-like compound (DLCs) exposures in fish embryos. Embryos from HSC populations were up to 1,000x more resistant to PCB126- and 2-5x more resistant to coal tar-induced cardiovascular teratogenesis. A gradient of resistance was identified across

Galveston Bay that strongly correlated with contamination levels in the aquatic environment, as measured in sediment, fish and passive samplers. This polluted environment provides a unique opportunity to explore the mechanisms of evolution to anthropogenic contaminants in natural populations. A population genomic analysis was conducted to identify regions under selective pressure, and to study the evolutionary processes driving the adaptive response.

0583 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Lance Paden[1], Kimberly Andrews[1], Carmen Candal[2], James Renner[3]

[1]Odum School of Ecology, University of Georgia, Athens, GA, USA, [2]Georgia Sea Turtle Center, Jekyll Island State Park Authority, Jekyll Island, GA, USA, [3]Southern Ionics Minerals LLC, 116 Hamilton St., Saint Simons Island, GA, USA

Use of Prescribed Fire to Increase Detectability of Gopher Tortoise Burrows Prior to Relocation

The relocation of gopher tortoise (*Gopherus polyphemus*) populations has become a commonly used mitigation strategy where their presence conflicts with industrial, agricultural, commercial, or residential development needs. In order to strive for a "no tortoise left behind" policy, we seek survey approaches that increase our detectability of covert, hidden burrows, especially those of juveniles in dense vegetation. Additionally, moving a more fully intact community would presumably reduce the impacts to important tortoise social networks, and hopefully, increase the likelihood of re-establishment and reduce the overall stress of relocation on individuals. In 2016, we conducted a large translocation of over 100 tortoises from approximately 16 hectares of sandhill forest habitat. Initial surveys revealed a high density of hatchling and juvenile tortoises. We conducted a prescribed burn to clear out dense herbaceous groundcover that small tortoises use to help hide their burrows and therefore increase burrow detectability. Here, we present pre- and post-burn survey results of both tortoise and armadillo burrows. Fire proved to be an excellent tool to increase survey efficiency and accuracy, resulting in a more effective extraction and translocation of animals. Approximately 22% of all gopher tortoise and armadillo burrows in the impact area were detected post-burn, indicating that many burrows would not have been detected solely using pre-burn surveys. Proper detection of burrows is also crucial to detecting priority commensal species, such as eastern indigo snakes, Florida pine snakes, and gopher frogs, which may also rely on tortoise and armadillo burrows and are worthy of mitigation action.

0210 Lightning Talks I, Friday 14 July 2017

Nicole Palenske

Central College, Pella, Iowa, USA

A Herpetological Survey of the Carlson-Kuyper Field Station in Iowa

The Carlson-Kuyper Field Station is a 62 acre nature preserve and outdoor laboratory located approximately 50 miles southwest of Des Moines, Iowa and 12 miles from the Central College campus in Pella, Iowa. The land is adjacent to Lake Red Rock and wildlife areas maintained by the Corps of Engineers. The land contains wooded valleys, restored prairies, and a pond near the center of the property. In March of 2017, I began to conduct a baseline herpetological survey of the Carlson-Kuyper Field Station. The objectives of the survey are to 1.) Develop a standardized monitoring protocol for herpetofauna; 2.) Determine population status estimates for herpetofauna; and 3.) Characterize and analyze habitat preferences of species for future conservation. Through the work of this baseline herpetological survey, I will gain a better understanding of the herpetofauna at the field station and will develop future projects engaging undergraduate students in research.

0354 Fish Ecology I, Sunday 16 July 2017

Grayce Palmer[1], Derek Hogan[1], Blair Sterba-Boatwright[1], Deborah Overath[2]

[1]Texas A&M - Corpus Christi, Corpus Christi, Texas, USA, [2]Del Mar College, Corpus Christi, Texas, USA

Invasive lionfish *Pterois volitans* reduce the density but not the genetic diversity of a native reef fish

The Indo-Pacific red lionfish *Pterois volitans* has spread throughout the western Atlantic causing declines in biomass and diversity of native species at local reefs; worst-case scenarios predict species extinctions and ecosystem phase shifts. While reductions in reef fish population density and recruitment are evident, it is not known whether lionfish are reducing genetic diversity of native species, a major driver of extinction in natural populations. A before-after control-impact experiment was used to determine whether lionfish removals cause an increase in density of native species and genetic diversity in one species, the bicolor damselfish *Stegastes partitus*. We found that removing lionfish significantly augmented the density of several reef fish species. However, while allelic frequencies in bicolor damselfish recruits changed after removals, genetic diversity did not increase substantially despite a 3-fold increase in recruit density. Responses to lionfish removal differed among native species; rare species with small population sizes may be more susceptible to recruitment failure and diversity loss as a result of lionfish predation than widespread species with large populations

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0132 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kristin Palmrose, James Gelsleichter

University of North Florida, Jacksonville, FL, USA

Reproductive Endocrinology of the Blacktip Shark, *Carcharhinus limbatus*, off the Southeastern U.S. Coast

It is useful to study the reproductive endocrinology of sharks because it provides greater information on the factors that regulate reproduction in these fish. It also provides non-lethal tools for addressing questions about reproduction that are relevant to fisheries management. Although past studies have examined reproductive endocrinology of several shark species, there has been surprisingly little focus on biennially reproducing placental viviparous sharks. With the intention of strengthening work on this group, this study examined plasma gonadal steroid concentrations in the blacktip shark, *Carcharhinus limbatus,* in relation to stage of maturity and reproductive stage. Blood samples and biological measurements were collected from 87 animals along the southeast U.S. coast. Female plasma estradiol concentrations showed no obvious inflection in relation to reported size-at-maturity (established to be ≥ 155 cm STL), but rather showed higher than expected levels in "sub-adult" animals (75-150 cm STL). Male plasma testosterone concentrations exhibited an obvious inflection in relation to maturity. In relation to month of capture, female estradiol levels portrayed two clusters of animals (i.e., a "high [>150 pg/mL] estradiol", presumably non-pregnant group and a "low [<150 pg/mL] estradiol", presumably pregnant group), which was anticipated based on the reproductive periodicity of this species and general knowledge about the importance of estradiol in regulating follicular development. Several individuals in the "low" and "high" estradiol groups were confirmed to be pregnant or non-pregnant, respectively, using ultrasonography, confirming our predictions. As anticipated testosterone levels peaked in the months May-June, correlating with the reproduction pattern found in the female sharks.

0811 Amphibian Conservation III, Sunday 16 July 2017

Anjana Parandhaman, Madeleine J. Marsh, Michael R. J. Forstner

Texas State University, San Marcos/Texas, USA

Testing the Effectiveness of Captive Propagation as a Management Strategy for the Endangered Houston Toad (*Bufo* [=*Anaxyrus*] *houstonensis*)

The Houston Toad (*Bufo* [=*Anaxyrus*] *houstonensis*) is endemic to east-central Texas and has continued to decline, despite being federally listed as endangered. This decline in population is generally consequent to large-scale habitat loss. Reintroduction and population supplementation projects, via assurance colonies at the Houston Zoo, have been among the management approaches used in recent attempts to arrest this decline. Over the last three years, supplementation efforts have focused on recovery sites in Bastrop County. This includes the acclimation and release of egg strands/juveniles into predator exclusion devices, to enable greater transition rates of neonates and juveniles to adult stages. Released egg strands are monitored through to the emergent metamorph stage. These supplementation efforts are evaluated by determining naïve occupancy of the same sites, through auditory surveys for chorusing adult male Houston Toads.

Toads are captured, marked, and a tissue sample is taken for genetic mark-recapture analyses. Chorusing males have increased in number, this year, at historically occupied sites and have been detected at previously unoccupied sites (>10 years). These reflect sites that were supplemented in 2015 and 2016. The provenance of these adult Houston Toads, captured during nocturnal call surveys, is being determined with a pedigree analysis using microsatellite markers. The results suggest that captive propagation/headstarting have shown success, however this management approach should not be considered in isolation to ensure long-term persistence of the species.

0808 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Anjana Parandhaman, Shawn F. McCracken, Michael R. J. Forstner

Texas State University, Texas, USA

Modeling Habitat Suitability for the State Threatened Texas Tortoise, *Gopherus berlandieri*, in the Eastern Region of its Range

The Texas Tortoise, *Gopherus berlandieri,* has a small geographic range in the USA and faces threats due to habitat loss and alteration. Despite being a Texas state threatened reptile, it is surprisingly understudied. In particular, the eastern portion of the species range has historically low detections of tortoises, either because of less suitable habitat or the region being under surveyed. Assessing habitat suitability, and determining whether this region still supports the species, will aid in its conservation. Road surveys were conducted from March to October of 2014. Georeferenced tortoise locations, along with museum records, were compiled from online databases, and used to model habitat suitability with Maxent (v3.3.k). The model predicted relatively small patches of suitable habitat remaining in the eastern region for this tortoise. The largest extent of suitable habitat was detected in the western region and far south Texas, as well as some patches outside the historical range. This spatially explicit analysis allows for a redirection of conservation management efforts to highly suitable habitat patches that are at high risk of fragmentation and alteration. Limitations to our study include inaccessible large private landholdings with potential tortoise habitat and a single season of fieldwork. Until we are able to gain a better understanding of the effects of ongoing disturbances in the region, and considering our very low number of observations (seven in total) despite extensive survey effort, it is imperative that we continue monitoring to validate and update our model, to aid in the management of this threatened species.

0375 AES Trophic Ecology/Physiology, Friday 14 July 2017

Sebastian Pardo, Nicholas Dulvy

Simon Fraser University, Vancouver, BC, Canada

Body mass, temperature, and depth independently shape productivity in sharks and rays

An important challenge in ecology is to develop a mechanistic understanding of what drives a species' productivity as this underpins our understanding of fishing limits, extinction risk, and recovery potential. Metabolic theory postulates that body mass and temperature drive productivity of species. In sharks and their relatives, hereafter referred to as sharks and rays, productivity is known to be lower in larger species, but also in those living at greater depths. While the deep ocean is associated with colder temperatures, other factors such as food availability and physiological constraints may influence the low productivities observed in deep sea sharks and rays independently of temperature. We use an information theoretic approach while accounting for phylogenetic relatedness to evaluate the relative importance of temperature and depth on productivity and the mass scaling of this relationship. We show that both temperature and depth have separate yet independent effects on productivity of sharks and rays, such that species living in deeper, colder waters have lower productivities. Furthermore, temperature also correlates with changes in the mass scaling coefficient as cold-water species have shallower mass scaling coefficients. These findings underline that there are multiple processes acting in concert which limit the productivity of deep sea sharks and rays and provide a useful template for assessing productivity of species based on easily accessible information such as temperature and depth, particularly for the most data poor species.

0513 ASIH STOYE GENERAL ICHTHYOLOGY I, Thursday 13 July 2017

C. Elyse Parker, Kyle R. Piller

Southeastern Louisiana University, Hammond, LA, USA

Using statistical model choice to infer the biogeographic history of the live-bearing splitfins (Cyprinodontiformes: Goodeinae) in the Mesa Central of Mexico

The subfamily Goodeinae (Cyprinodontiformes: Goodeidae) comprises approximately 40 viviparous species distributed across the Mesa Central, a high-elevation plateau located in central Mexico. The hydrologic configuration of the region has been continuously altered by widespread tectonic and volcanic activity since at least the early Miocene, resulting in repeated compartmentalization and connection of major drainage basins and potentially driving complex patterns of allopatric speciation in isolated basins and dispersal and range evolution into connected basins. The primary objective of this study was to infer the biogeographic history of the subfamily Goodeinae in the geographically complex Mesa Central using a novel molecular dataset analyzed within Maximum Likelihood and Bayesian frameworks. We were also interested in comparing the statistical fit of our data to several different models commonly used for inferring species range evolution (e.g. DIVA, DEC, BayArea). Phylogenetic relationships within the subfamily were recovered by analyzing a nuclear DNA dataset of 6 exons and 2

introns using maximum likelihood and Bayesian approaches. A time-calibrated phylogeny of the group was generated from this nuclear dataset using the oldest goodeid fossil, *Tapatia occidentalis*, as well as several external fossils to calibrate the ages of several nodes. Finally, we used the program BioGeoBEARS to statistically test which range evolution model best fit our data and to infer the biogeographic history of the group under the best-fit model. Our results not only present novel phylogenetic and biogeographic hypotheses for the subfamily Goodeinae, but also highlight the importance of statistical model choice in inferring biogeographic scenarios.

0523 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

C. Elyse Parker[1], Wilfredo Matamoros[2], Caleb D. McMahan[3], Diego Elías[4], Kyle R. Piller[1]

[1]Southeastern Louisiana University, Hammond, LA, USA, [2]Instituto de Ciencias Biológicas, Universidad de Ciencias y Artes de Chiapas, Tuxtla Gutiérrez, Chiapas, Mexico, [3]The Field Museum of Natural History, Chicago, IL, USA, [4]Museum of Natural Science, Louisiana State University, Baton Rouge, LA, USA

Phylogeography and population genetic structure of *Profundulus hildebrandi* (Profundulidae), a microendemic from southern Mexico

The family Profundulidae (Cyprinodontiformes) includes eight species distributed from southern Mexico into Guatemala, Honduras, and El Salvador. Most species inhabit high-elevation headwater streams and possess relatively restricted distributional ranges. The species *Profundulus hildebrandi*, which exhibits a highly restricted distribution in the Valley of San Cristobal (VSC) in Chiapas, Mexico, has long been thought to exemplify a case of microendemism within the family. Recently, however, the species has been discovered to occupy additional stream habitats at lower elevations outside of the valley, reaching localities up to 150 kilometers east and west of the VSC. These surrounding sites appear to be physically disconnected from the endorheic VSC, indicating potential genetic divergence of populations isolated within the valley from populations in adjacent systems. The objectives of this study were to examine the phylogeographic history of *Profundulus hildebrandi* across its range of distribution and to examine directionality and magnitude of gene flow among populations within and outside of the VSC. Our study investigated genetic structure among multiple *P. hildebrandi* populations spanning 18 localities. Results from population genetic analyses shed light on the complex patterns of gene flow among populations of *P. hildebrandi* and demonstrate the utility of molecular datasets in revealing fine scale population structure.

0821 Reptile Behavior, Friday 14 July 2017

Rocky Parker, Sydney Ashton, Shannon Richard

James Madison University, Harrisonburg, VA, USA

Inhibition of Snake Courtship Behavior via Heterospecific Odor

Snakes use skin lipids as scent markers of species, sex, and reproductive condition. In no other species is this more clearly understood than the red-sided garter snake, *Thamnophis sirtalis parietalis*. The garter snake pheromone is a mixture of several long-chain hydrocarbons (saturated and monounsaturated methyl ketones), the proportions of which affect female attractiveness to males. Another colubrid, the brown treesnake (*Boiga irregularis*), produces a similar mixture of methyl ketones which have potential roles as pheromones in this invasive species. In the spring of 2016, we tested female *Boiga* methyl ketones with wild male garter snakes during the spring breeding season in Manitoba, Canada. The *Boiga* ketones induced avoidance behavior (pausing, arrest of chemosensory sampling) in courting male garter snakes. In a Y-maze, male garter snakes paused often and took longer to follow female garter snake pheromone trails if the trails were interruped with *Boiga* ketones. We did not observe this when neutral *Boiga* lipids were used instead nor when we interrupted Y-maze trails with garter snake ketone extracts. We conclude that brown treesnake ketodienes (diunsaturated ketones), the only additional compounds present in *Boiga* ketones but missing from garter snakes, evolved to mask the reproductive signal encoded by ketomonoenes that function as pheromones in multiple Thamnophiine snakes. To our knowledge, this is the first evidence of interspecific chemical masking of pheromones in a reptile.

0355 Herp Morphology & Development, Saturday 15 July 2017

Scott Parker, Valerie Dimkovikj

Coastal Carolina University, Conway, South Carolina, USA

Comparative Responses to Hypobaric Versus Regional Hypoxia in Reptilian Embryos

Oxygen limitation during embryonic development can occur due to reduction in atmospheric oxygen partial pressure within the nest (hypobaric hypoxia), or a reduction in blood O2 uptake in fetal membranes (regional hypoxia). Embryos from oviparous amniotes such as reptiles, provide a convenient model system for studying fundamental developmental consequences of hypoxia on embryonic development. The purpose of this study is to quantify the effects of hypobaric hypoxia versus regional hypoxia on growth and differentiation of lizard embryos. Hypobaric hypoxia was induced by incubating eggs of Gekkonid lizards at 9% or 21% O_2. Regional hypoxia was induced in gecko embryos by painting 3/4 of the eggshell surface with paraffin wax to reduce the available surface area for gas exchange. Eggs from each treatment combination were incubated at 28 °C for 10 days. Effects of hypobaric and regional hypoxia on development of experimental and control embryos was evaluated by measuring embryo O_2 consumption, embryo heart rate, developmental stage, and dry mass. Preliminary results indicate that embryos from both hypobaric and regional hypoxia treatments responded with reduced growth, differentiation, and oxygen consumption, whereas

embryo heart mass increased relative to embryo body mass in the hypobaric and regional hypoxia treatments. Increased relative heart mass presumably increases cardiac stroke volume to improve blood perfusion of the chorioallantois. Results indicate that embryos possess considerable plasticity in capacity to respond and survive in both hypobaric and regional hypoxia. This is the first comparative study on responses of amniote embryos to incubation under hypobaric versus regional hypoxia conditions.

0703 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jason Parks, Peter Berendzen

University of Northern Iowa, Cedar Falls, Iowa, USA

A comparison of the population genetic structure of the rainbow darter, *Etheostoma caeruleum*, in glaciated and unglaciated environments

The rainbow darter, *Etheostoma caeruleum*, is a member of the Central Highlands ichthyofauna, distributed in the unglaciated regions of the Ozark, Quachita and Appalachian highlands and the glaciated regions of the upper Mississippi River and Great Lakes drainages. Populations within the upper Mississippi River drainage are hypothesised to have expanded out of a refugium in the Ozark Plateau. Within this region, rainbow darters have a disjunct distribution, shaped by historical glacial activity of the region. A recent landscape genetics study of the rainbow darter in the upper Mississippi River drainage revealed a single genetic population with a uniform distribution of genetic diversity across localities. This study concluded that this signature is indicative of recent expansion into the region following glacial retreat and not reflective of contemporary population structure. The objective of this study is to compare the population genetic structure of the rainbow darter from the unglaciated environment in the Ozark Plateau, to the observations in upper Mississippi River drainage. Microsatellite markers were used to estimate overall genetic diversity, population substructure and gene flow for comparison. Preliminary results will be presented.

0486 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Meghan Parsley

Western Kentucky University, Bowling Green, KY, USA

Adaptive Variation in Tiger Salamander Populations

Threatened amphibians face an unknown future in a time of rapidly changing environment due to global climate change. Since amphibians are often perceived to be indicators of ecosystem health in various habitats, understanding the causes of their declines can also improve our perception of threats to other species in those ecosystems. Molecular techniques have allowed us to further explore these threats by estimating

genetic variation and predicting evolutionary adaptive potential of amphibian species. Determining populations with the greatest adaptive potential to changing environmental variables may be a viable conservation strategy and aid in management efforts. We utilized targeted exon capture methods to identify adaptive variation in response to changing environmental variables in California tiger salamanders (CTS; *Ambystoma californiense*), a species threatened by land use change and hybridization with barred tiger salamanders (*A. mavortium*). We sampled tiger salamanders from ponds along a N/S transect extending from the highly admixed hybrid sward at the southern end of the range to the largely non-admixed northern portion of the CTS range. These six populations were samples at one historical time interval and one contemporary time interval. Our sequencing strategy resulted in 150 million sequence reads for 96 individuals among the six study sites. Using contemporary and historical climate data for the study area, we identified genomic regions that appear to be associated with deterministic environmental change. These data provide a glimpse into the potential for wild populations of CTS to respond to the predicted climatic changes for California.

0644 Herp Environment, Saturday 15 July 2017

Katie Parson[1], Kimberly Andrews[2], Terry Norton[3], Joseph Colbert[3]

[1]Georgia Sea Turtle Center AmeriCorps, Jekyll Island Authority, Jekyll Island, GA, USA, [2]Odum School of Ecology, University of Georgia, Athens, GA, USA, [3]Georgia Sea Turtle Center, Jekyll Island Authority, Jekyll Island, GA, USA

The Influence of Temperature Fluctuations and Habitats on the Surface Activity and Reproduction of Eastern Diamondback Rattlesnakes in Coastal Climates

Eastern diamondback rattlesnakes (*Crotalus adamanteus*) have evolved to be opportunistic, driven by short-term, small-scale temperature cues and habitat changes. With changing climates, rapid and erratic temperature fluctuations have become commonplace. These abiotic dynamics are additive to those experienced by changing habitat conditions on barrier islands due to shifting shorelines and microhabitat succession. We investigated the role of temperature in driving surface activity and energy expenditure and the associated physiological consequences. Specifically, we noted foraging success through observed boluses and posture indicators, monthly changes in body mass, and reproductive success through monitoring of gravid females. We observed temperature to be a strong driver overall in surfacing activity and foraging success and maintenance of body mass. Average overwintering weight fluctuation from 12 snakes over two seasons was approximately 9.5% body weight loss. In addition, birthing weight was calculated from four females with an average weight loss of 25.1%. Further, we found that habitat and thermal microclimates also influence surfacing behavior, and therefore foraging success, body mass, and reproduction. Specifically, we observed the highest rates of activity in open dune and marsh habitats. Conversely, maritime forest snakes surfaced less frequently and lost less body mass (1.4%) in the winter, but also fed and reproduced at reduced rates during the active season. Despite

an evolutionary predisposition to handle dynamic conditions, climate change may be occurring at rates and scales that are not conducive to healthy trade-offs between activity patterns and physiological capacity.

0731 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kristene Parsons, Jan McDowell, Heidi Brightman, Eric Hilton, Robert Latour

Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA

Two new species of Butterfly Ray (Myliobatiformes: Gymnuridae) from the U.S. Atlantic and Gulf of Mexico coasts

The Smooth Butterfly Ray, *Gymnura micrura* Bloch & Schneider 1801, is considered a warm temperate and tropical batoid species that occurs in coastal Atlantic waters from the U.S. to Brazil. Recent life history studies on the species from U.S. waters revealed geographic differences in traits (e.g., maximum size, fecundity, morphological characters) that generated uncertainty in the taxonomic status of *G. micrura*. Previous taxonomic descriptions do not account for sexual dimorphism or ontogenetic variations in body shape, and a holotype is not available for comparison of U.S. specimens to type material. Resolving the taxonomy of the species is crucial for the assessment of populations and their vulnerability to fisheries, and to advance our understanding of the biodiversity of coastal U.S. ecosystems where they occur. Using fresh and preserved material from the type locality (Suriname) and the U.S. Atlantic and Gulf of Mexico coasts, the present study analyzed morphological and molecular data to assess the validity of *G. micrura*. Multivariate analyses of morphometric data, discrete morphological characters (e.g. color patterns), and genetic analyses using mitochondrial (ND2) and nuclear (Rag-1) gene sequences revealed unique taxa in the U.S. Atlantic and Gulf of Mexico. Descriptions and diagnoses for the two new species will be presented.

0826 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Melanie Partin

Southeastern Louisiana University, Hammond, LA, USA

Physiological Stress in *Hyla chrysoscelis*- Could Traffic Noise be a Contributing Factor?

Noise pollution is an increasing concern throughout the world due to potential impacts it could have on the environment and wildlife, particularly in species using acoustic communication. Changes in calling characteristics in anurans and other animals in response to noise have been well established in the literature. It has been speculated that these changes could lead to increased metabolic costs of calling. Traffic noise has been shown to cause physiological stress in different organisms. Raised concentrations

of corticosterone has been found in White's tree frogs and female wood frogs in response to traffic noise. I seek to test the hypothesis that *Hyla chrysoscelis* males will exhibit a physiological stress response through increased corticosterone to high levels of traffic noise. When corticosterone concentration increases, it leads to changes in leucocyte profiles, namely increasing Neutrophil/Lymphocyte cell ratios, which also can be used as a method of assessing stress. Fieldwork was conducted at six sites, three of which were temporary pools in the presence of high traffic noise, while the others were in pristine sites (lacking traffic noise). 100µl blood samples were taken through cardiac puncture with heparinized hypodermic needles, and corticosterone concentrations are being measured via ELISA assays. A significant increase in Neutrophil/Lymphocyte ratios was found in Noisy vs. pristine sites. Primarily, the increase in the ratios centered on one Noisy site in particular, with no significant difference between the other sites. This implies that excessive traffic noise could be deleterious for anurans, which could influence conservation concerns of many species.

0547 NIA BEST STUDENT PAPER, Friday 14 July 2017

Murilo Pastana[1], Aléssio Datovo[1], Flávio Bockmann[2]

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Morphology of the cephalic laterosensory system of Characiformes (Teleostei; Ostariophysi) with comments on its phylogenetic implications

The cephalic lateral line canal and associated branches are relatively conserved among several lineages of fishes. Although well documented and successfully employed in phylogenetic analyses of some ostariophysans (e.g. Siluriformes and Cypriniformes), detailed descriptions of the lateral line system are very scarce in the Characiformes, hampering the interpretation of homologies and its use in phylogenetic analyses within the order. A complete description of the cephalic laterosensory system of Characiformes was performed, with the sampling all families and subfamilies of the order, and at least one representative of the other ostariophysan orders. The morphology of the cephalic laterosensory canals is relatively conserved across characiforms, allowing the identification of homologies for all canal segments and branches. At least one putative synapomorphy for the Characiformes, and 10 synapomorphies for diverse subgroups of the order are proposed (i.e. Erythrinoidea, Prochilodontidae, Acestrorhynchidae, Chilodontidae, Crenuchidae). This represents a considerable number of new characters bearing on the higher-level phylogeny of the Characiformes and demonstrates that the morphology of the cephalic laterosensory system is a rich source of phylogenetic information. It is expected that these results pave the way for further studies on the cephalic laterosensory system focused both on smaller subgroups of Characiformes and higher levels of the ostariophysan phylogeny.

0540 NIA BEST STUDENT POSTER; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Murilo Pastana[1], Alessio Datovo[1], David Johnson[2]

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Phylogeny of the Stromateiformes (Teleostei: Percomorphacea) based on morphological data

The division Percomorphacea encompass the major diversity of living fishes, with nearly 17,000 species that correspond to a fourth of all extant vertebrates. Although the monophyly of the Percomorphacea is well supported by both anatomical and molecular data, the internal resolution of this clade remains contentious in several aspects. Among the 30 orders currently assigned to Percomorphacea, Stromateiformes is a small group with 77 species distributed in 16 genera and six families. Morphological studies corroborate the monophyly of this order based on the sharing of unique anatomical features, such as the presence of a toothed musculous pharyngeal sac and a subdermal canal system scattered over the head. Such analyses, however, employed a few outgroup taxa. Molecular analyses with larger taxon samplings, in turn, never recover the monophyly of the Stromateiformes, intercalating its representatives among other percomorph families that, in combination, form a large clade termed Pelagiaria. The phylogenetic allocation of rare taxa, such as *Amarsipus* and *Tetragonurus*, and the interfamilial relationships of the Stromateiformes are also surrounded by controversies. A preliminary phylogenetic analysis was performed based on 75 characters from external anatomy, osteology, and musculature and 46 taxa (10 stromateiforms and 36 outgroups, most of them belonging to the Pelagiaria). This analysis yields a monophyletic Stromateiformes, even with inclusion of a large number of members of the Pelagiaria, corroborating previous morphological hypotheses. Within the Stromateiformes, the analysis corroborates both morphological and molecular hypotheses resulting in a non-monophyletic Centrolophidae, and a monophyletic Stromateidae.

0409 SSAR SEIBERT ECOLOGY III, Friday 14 July 2017

Bailey Patillo, Matthew Parris

University of Memphis, Memphis, TN, USA

Impacts of Larval Exposure to Predators and Post-metamorphic Exposure to Chytrid Fungus on Growth in Spotted Salamanders

Due to their complex life-history, amphibians experience varied challenges throughout multiple life-stages. Often, conditions experienced during the larval stage impact responses to those experienced during the post-metamorphic stage. Aquatic predators are a common stressor to larval amphibians, with exposure to predator cues often having lasting effects. In salamanders, larvae are not susceptible to the fungal pathogen

Batrachochytrium dendrobatidis (*Bd*), however, post-metamorphic individuals can carry sublethal infections that may be detrimental. To examine the influence of larval exposure to predators on the post-metamorphic response of spotted salamanders (*Ambystoma maculatum*) to *Bd*, we calculated the average daily change in mass and SVL of post-metamorphic salamanders reared in the presence or absence of nonlethal dragonfly larvae predation cues and subsequently exposed to *Bd*. Significant independent effects of predation cues and *Bd* exposure were seen on post-metamorphic daily change in mass and SVL. Follow-up univariate analyses showed a non-significant trend for salamanders exposed to both stressors to exhibit reduced mass gain. Pairwise comparisons revealed that these salamanders significantly differed in mass gain from all other groups. Further, this was the only group that lost mass, losing an average of 1.872±0.411 mg per day. As juvenile growth influences survival, time to reproductive maturity, and fecundity, exposure to aquatic predators during early life and *Bd* during the post-metamorphic stage may have lasting impacts on salamander populations even in the absence of direct mortality. Further, these results highlight the importance of considering combinations of stressors that occur throughout multiple life stages.

0895 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Michael Pauers[1,2,3]

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What Exactly is *Labeotropheus curvirostris* (Ahl 1927)?

When the genus *Labeotropheus* was first described by Ahl in 1927, he included two species, *L. fuelleborni* and *L. curvirostris.* Ahl distinguished these species based on what he felt was a more broadly curved snout in *L. curvirostris.* A later examination of the type specimens by Trewavas (1935) resulted in their synonymy; Trewavas felt the curvature of the snout of *L. curvirostris* was not sufficiently different from that of *L. fuelleborni.* Here I examine the enigmatic *L. curvirostris*, comparing its morphology to that of its two sympatric congeners, *L. fuelleborni* and *L. trewavasae,* demonstrating its unique and unusual morphology, and identifying questions regarding its taxonomy.

0896 Fish Biogeography & Morphology, Saturday 15 July 2017

Michael Pauers[1,2,3], Cassandra Turinske[0]

[1]Milwaukee Public Museum, Milwaukee, WI, USA, [2]UW-Waukesha, Waukesha, WI, USA, [3]UW-Milwaukee School of Freshwater Sciences, Milwaukee, WI, USA

Patterns of morphological divergence in the Orangespotted sunfish, *Lepomis humilis*, in Wisconsin and throughout the United States

Despite the popularity of the centrarchid sunfishes for food and sport, many species have been poorly studied, especially with regards to geographical divergence. The Orangespotted sunfish, *Lepomis humilis*, is one such species. We have examined differences in the morphology of this species throughout Wisconsin, as well as throughout the United States. In Wisconsin, we have identified one unique population, on the basis of lateral line scale number, and we explore possible sources of this variation. Among populations throughout the US, we have discovered a slight difference between northern and southern populations, but, surprisingly, no other unusually-scaled populations like the one found in Wisconsin.

0095 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Eva Paulus, Michael P Robinson

Barry University, Miami, FL, USA

Advertising Weapons: a Comparative Analysis of the Colors of the Caudal Spines of Surgeonfishes (Acanthuridae)

All species of surgeonfish (Acanthuridae) have one to multiple spines on their caudal peduncles presumably used as weapons during aggressive intraspecific interactions. These spines vary among species in their degree of conspicuousness. In some species, these spines are apparently advertised with colorful accents whereas in other species the spines almost appear absent because of masking colors. Surgeonfishes also have a diverse array of social systems, ranging from territorial individuals to schools of hundreds. We are attempting to determine the role of the spine and the underlying social explanations for why some fish would advertise while other fish hide their spines. We conducted surveys to assess the conspicuousness of the spines of surgeonfishes. Humans rated the conspicuousness of the caudal spines on a scale from 1 (least conspicuous) to ten (most). Fish ranged from 1 to 10 with an average value of 5.324±0.042. When analyzed in light of phylogenetic relationships, we determined that group-living species were more likely to have conspicuous spine coloration than solitary ones. This appears to contradict the idea that the coloration of these spines is to advertise them for intraspecific communication.

0810 Reptile Behavior, Friday 14 July 2017

Gregory Pauly

Natural History Museum of Los Angeles County, Los Angeles, California, USA

Citizen Science is Transforming the Study of Squamate Mating Behavior: An Example from Alligator Lizards (*Elgaria*)

Studies of organismal behavior often have to focus on species that are common and conspicuous so that researchers can obtain adequate sample sizes for meaningful

inferences. As a result, for many species, we lack all but the most cursory understanding of fundamental behaviors. For some species, this problem can be resolved by crowdsourcing data collection through citizen science projects. Here, I demonstrate the utility of citizen science for studying mating behavior of two widespread, relatively common species of alligator lizards, *Elgaria multicarinata* and *Elgaria coerulea*. Standard sources of natural history information, including published accounts and museum databases, document the timing of breeding for only a handful of observations per species. Observations available through citizen science databases, however, provide over 20 times as many records, generating sample sizes adequate for studying variation over multiple breeding seasons and across latitudinal and elevational gradients. Critically, most of these records were generated in fewer than four years of promoting a citizen science project, in this case the Reptiles and Amphibians of Southern California (RASCals) Citizen Science Project. Using citizen science to study mating behavior has previously been used successfully in studies of birds and frogs; the advent of photo-vouchered citizen science platforms, such as iNaturalist, increases the opportunity for similar studies in many other species.

0737 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Joseph Pechmann[1], David Scott[2], Brian Metts[2], Erin Cork[3], Stacey Lance[2]

[1]Western Carolina University, Cullowhee, NC, USA, [2]Savannah River Ecology Laboratory, Aiken, SC, USA, [3]University of Georgia, Athens, GA, USA

Shifts in the Salamander Community Over 36 Years at an Isolated Wetland: Has Climate Change Altered Wetland Habitat and Hydroperiod?

Geographically isolated wetlands (GIW) constitute critically important habitat for many plant and animal species, including threatened, endangered and at-risk species. Numerous pond-breeding amphibians rely on GIW for larval development and juvenile recruitment. Recruitment success for these species is determined largely by wetland hydroperiod, both directly (via the amount of time water is available for larval development) and indirectly (via effects on predatory and competitive interactions). Most pond-breeding amphibians have adaptations to subsets of conditions along the hydroperiod continuum; i.e., there are 'short-,' 'intermediate-,' and 'long-hydroperiod' species. Climate change has the potential to exacerbate the increasingly serious problem of amphibian decline by inducing shifts in average pond filling and drying dates, and thus the hydroperiod, of GIW. Hydroperiod reduction, along with altered fire regimes, may contribute to increased tree canopy coverage within GIW. Tree canopy closure may further shorten hydroperiods and also slow the growth and development of amphibian larvae. We examined the dynamics of a salamander community over 36 years in relation to changes in environmental variables and average wetland hydroperiod. During that period community dominance shifted from several long-hydroperiod species (e.g., *Ambystoma talpoideum*, *A. tigrinum*, *Notophthalmus viridescens*) to one short-hydroperiod

species (*A. opacum*). Species changes appear to be primarily related to shortened hydroperiods, later wetland filling, altered drought frequency and severity, canopy closure, and their combined effects on juvenile recruitment. Changes in hydroperiod dynamics of GIW across the landscape are likely to influence local population persistence, as well as metapopulation dynamics by altering exchange rates of amphibians among wetlands.

0247 LFC Contributed II, Friday 14 July 2017

Myron Peck[1], Catriona Clemmesen[2], Marc Hufnagl[1], Björn Illing[4], Paul Kotterba[3], Marta Moyano[1], Matthias Paulsen[2], Patrick Polte[3]

[1]University of Hamburg, Hamburg, Germany, [2]Helmholz Center for Ocean Research, IfM GEOMAR, Kiel, Germany, [3]Thünen-Institute of Baltic Sea Fisheries, Rostock, Germany, [4]James Cook University, Townsville, Australia

Bottom-up and Top-down Processes Impacting Early Life Stages of Herring (*Clupea harengus*) in the Southwest Baltic: A Synthesis of Recent Laboratory, Field and Modelling Studies

A series of laboratory, field, and modelling studies has been conducted since 2010 to assess bottom-up and/or top-down processes influencing the growth and survival of early life stages of herring (*Clupea harengus*) in the southwest Baltic Sea. In a key spawning area, an extensive field sampling campaign and predator-exclusion experiments suggested intense predation mortality of newly spawned eggs. In some years and during specific periods, resident, nearshore fish were estimated to consumed up to ~40% of the herring spawn while, in contrast, larvae appear to suffer very low rates of predation mortality. In terms of bottom-up processes, the presence of algae and protists during the yolk sac period increased the window of first feeding and led to increased size-at-age throughout the larval period in laboratory. In exogenously feeding larvae, field measurements of the abundance and quality (fatty acid composition) of the dominant zooplankton and larval growth rate suggested temperature- and density-dependent prey thresholds below (above) which larval growth and nutritional condition was relatively low (high). Laboratory measurements of thermal physiology suggest that temperatures experienced by late-stage (15- to 20-mm) larvae in the late spring may exceed upper tolerance limits, agreeing with the timing of migration to deeper, colder offshore waters. A physiological-based foraging and growth model correctly depicts the prey concentrations and temperatures limiting growth and survival. This suite of laboratory, field and modeling studies has helped us disentangle the plethora of factors and mechanisms impacting early life stage survival and year-class success of SW Baltic herring.

0143 LFC Phenotypic Variation I, Thursday 13 July 2017

Pierre Pepin

Fisheries and Oceans Canada, St. John's, NL, Canada

Feeding Patterns in Larval Fish: How Taxonomy, Behaviour and Morphology affect Differences among Individuals and Species

Because individual growth histories have important implications to the likelihood of survival, knowing the drivers of variations in feeding among larvae can help us understand how the early life stages of fish may respond to variations in prey availability. In this study, I use data on individual stomach contents to describe length-dependent differences in feeding success of 11 species of larval fish found in coastal waters of Newfoundland. In addition to differences in average ingestion rates, the dispersion in number of prey per stomach indicates that each species perceives the patchiness of their prey environment in slightly different ways. Subtle differences in gape-at-length appear to have a statistically significant in the number of prey in the stomachs of larvae. In contrast, the length-dependent rate of change in niche breadth appears to have much weaker influence in the variation in the number of prey among individual stomach. However, the upper quartile of larvae, in terms of prey per stomach, ingest a much greater diversity of taxa than individuals in the lower three quartiles of the population. If higher individual larval growth is linked to stochastic incidences of high ingestion rates of diverse prey arrays, identifying environmental conditions suitable for strong survival, based on the principle that growth and mortality rate linked, may have to consider how larval fish respond to changes in zooplankton community structure and abundance.

0349 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Larissa Pereira[1], Friedrich Keppeler[2], Angelo Agostinho[1], Kirk Winemiller[2]

[1]*Universidade Estadual de Maringá, Maringá, Paraná, Brazil,* [2]*Texas A&M University, College Station, Texas, USA*

Is There a Relationship between Fish Cannibalism and Latitude or Species Richness?

Cannibalism has been commonly observed in fish from northern and alpine regions and less frequently reported for subtropical and tropical fish in more diverse communities. Assuming all else being equal, cannibalism should be more common in communities with lower species richness because the probability of encountering conspecific versus heterospecific prey would be higher. A global dataset was compiled to determine if cannibalism occurrence is associated with species richness and latitude. Cannibalism occurrence, local species richness and latitude were recorded for 4,100 populations of 2,314 teleost fish species. Relationships between cannibalism, species richness and latitude were evaluated using generalized linear mixed models. Species richness was an important predictor of cannibalism, with occurrences more frequently reported for

assemblages containing fewer species. Cannibalism was positively related with latitude for both marine and freshwater ecosystems in the Northern Hemisphere, but not in the Southern Hemisphere. The regression slope for the relationship was steeper for freshwater than marine fishes. In general, cannibalism is more frequent in communities with lower species richness, and the relationship between cannibalism and latitude is stronger in the Northern Hemisphere. In the Southern Hemisphere, weaker latitudinal gradients of fish species richness may account for the weak relationship between cannibalism and latitude. Cannibalism may be more common in freshwater than marine systems because freshwater habitats tend to be smaller and more closed to dispersal. Cannibalism should have greatest potential to influence fish population dynamics in freshwater systems at high northern latitudes.

0581 Amphibian Biology, Ecology, & Conservation, Sunday 16 July 2017

Leah Perez, D. Brent Burt, Matthew A. Kwiatkowski

Stephen F. Austin State University, Nacogdoches, Texas, USA

The Evolution of Potential Color Signals in Hylid Frogs

The study of anuran color has generally focused on a limited number of groups that exhibit aposematism. However, a growing number of studies show that some anuran colors can act as mating signals. Given this evidence on color and mate selection, and recent evidence that frogs can see color at night, the use of color as a signal may be more widespread in anurans than previously thought. Many frogs possess colors on lateral, inguinal, and femoral areas of the body that contrast with colors of the dorsum and limbs. Anurans can hide the lateral inguinal, and femoral colors by pulling the hindlimbs close to the body. We investigated evolutionary patterns of color patches in a relatively diverse anuran family, Hylidae. Species were scored for the presence of yellow, orange, red, or blue patches based on information available through AmphibiaWeb. Using published phylogenies, evolutionary gains and losses of yellow patches were reconstructed using parsimony and likelihood methods to examine rates of change. The ancestral state of the Family Hylidae was presence of lateral, inguinal, or femoral color patch, which are widespread among species. These patches were lost numerous times within the family, including genera such as *Acris*, *Aplastodiscus*, *Cyclorana*, two separate clades within *Hypsiboas*, *Lysapus*, *Osteocephalus*, and a large clade of *Pseudacris*. Our results suggest color patches that could act as social signals are widespread in Hylidae and supports growing evidence that visual signaling may be more common in anurans than previously realized.

0419 LFC Physiological Performance IV, Sunday 16 July 2017

Prescilla Perrichon

University of North Texas, Denton, Texas, USA

Behavioral Tools for Assessing Neurophysiological Performances in Fish Early Life Stages

Small fish are excellent models for genetics and developmental biology (e.g. zebrafish, medaka, killifish), and offer various advantages over traditional rodent models, especially for neurobehavioral research. Although neurotoxicity of chemicals and pharmaceuticals have been well established, behavioral phenotypes associated to these neurological disorders are still poorly understood. Since considerable attention has been expressed from world regulatory agencies in development and validation of high throughput screening for human health risk assessment, larval fish provide useful alternative for studying the developing vertebrate nervous system. This presentation indicates how small model fish encode, process and traduce information in terms of neurobehavioral responses from their environment. Larval sensory and motor behavior functions (e.g. locomotor, optomotor, touch-elicited reflexes) will be explored through emerging analytical challenges using computerized digital video live tracking. During the last decade, these behavioral bioassays have considerably gained popularity and may provide in the near future the best noninvasive and efficient tools for understanding neurodevelopmental and neurobehavioral processes from drugs exposure or toxic environment.

0424 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Prescilla Perrichon[1], Edward Mager[1], Christina Pasparakis[2], John Stieglitz[2], Daniel Benetti[2], Martin Grosell[2], Warren Burggren[1]

[1]University of North Texas, Denton, Texas, USA, [2]University of Miami, RSMAS, Miami, Florida, USA

Temperature Influence upon Cardiotoxicity of Deepwater Horizon in Larval Mahi-mahi (*Coryphaena hippurus*)

In 2010 the Deepwater Horizon incident, the largest marine oil spill in US history, exposed spawning pelagic fish species, including mahi-mahi (*Coryphaena hippurus*), to toxic compounds such as polycyclic aromatic hydrocarbons (PAHs). Developing fish are especially vulnerable to the toxicity of crude oil-derived PAHs and exhibit a suite of developmental and morphological defects. Despite a rich literature on the topic, physiological significance of toxicity on larval heart performance is still lacking, particularly when interacting environmental factors are changing. Against this backdrop, this study investigated cardiac performance in larval stages of mahi-mahi exposed to Deepwater Horizon oil and under two rearing temperatures, 26° and 30°C. Mahi-mahi embryos were exposed to oil-enhance sea water for 24 hours. Incidence of edema, heart rate, stroke volume and cardiac output were monitored in 56 hpf larvae. At a rearing temperature of 26°C, oil-exposed larvae displayed strong bradycardias, a drastic reduction of stroke volume and cardiac output and a high proportion of pericardial edemas. A correlation existed between the severity of edema and the reduction of heart performance. Increased rearing temperature at 30°C led to a reduction

of PAH concentration at the end of exposure and appeared to play a protective role reducing severity of edemas. However, heart performance was not reduced. These cardiovascular impairments, regardless of water temperature, might lead to a high energy cost by the organism and increasing oxygen demands to restore homeostasis and perform key physiological function (e.g. swimming, feeding) required for survival.

0115 AES Morphology, Sunday 16 July 2017

Flavia Petean[1], Marcelo de Carvalho[0]

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Taxonomic Review and Comparative Morphology of the Species of the Genus *Isistius* Gill, 1864 (Chondrichthyes: Squaliformes: Dalatiidae)

The genus *Isistius* Gill (1864) belongs to the family Dalatiidae and has currently three valid species recognized in the literature: *Isistius brasiliensis* Quoy & Gaimard (1824), *I. plutodus* Garrick & Springer (1964), and *I. labialis* Meng, Zhu & Li (1985). The most common species, *I. brasiliensis*, has a wide geographic distribution and can be found in subtemperate and tropical seas circumglobally; a comparative analysis of specimens from different localities throughout its range, however, had never been done. The morphological variation of this species along its entire distribution has been thoroughly analyzed, elucidating that it represents a single widespread species and that *I. labialis* is a junior synonym of *I. brasiliensis*. The other species, *I. plutodus*, is known from only few specimens, also distributed worldwide. A detailed comparative analysis of available material of *I. plutodus* was undertaken verifying its validity. Therefore, the present study analyzed in detail the external morphology (coloration, dentition, dermal denticles), internal morphology (skeleton, musculature), and lateral line canals of the known species of *Isistius*, also covering morphometric and meristic aspects, to better define the genus and species.

0123 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

William Peterman[1], Rio Schondelmeyer[0]

[1]The Ohio State University, Columbus, Ohio, USA, [2]University of Missouri, Columbia, Missouri, USA

The Role of Genetic Diversity and Stress on Growth and Survival in Wood Frogs

Genetic diversity is generally accepted as being important to individual fitness and the evolutionary potential of populations. However, there is little understanding about how

reductions in genetic diversity can affect fitness in amphibian populations. In this study, we experimentally examined the effects of genetic diversity on larval growth and survival of Wood Frogs, building upon previous research describing declining genetic diversity of Wood Frogs near the edge of their Midwestern range in Missouri. Tadpoles were collected from three conservation areas and raised under controlled conditions in outdoor mesocosms. To accelerate larval development and create a more stressful environment, the water level of half of the mesocosms was systematically lowered throughout the experiment. Parameters measured in the experiment included maximal burst swimming speed of tadpoles, tadpole growth rate, survival to metamorphosis, time to metamorphosis, as well as metamorph length, mass, femur length, and body condition. Each metamorph was also genotyped at eight microsatellite loci. Overall, there were significant growth and survival differences between conservation areas and treatments. The number of metamorphs, tadpole size, time to metamorphosis, and femur size at metamorphosis differed significantly among conservation areas and by treatments. A reduction in genetic diversity significantly increased the time to metamorphosis, decreased the number of metamorphs, and decreased the body condition of metamorphs. The drying treatment caused tadpoles to metamorphose sooner and with shorter legs, which increased their probability of dying following metamorphosis. Results of this experiment indicate that genetic diversity should be an important consideration when managing amphibians populations.

0863 AES Conservation & Management I, Saturday 15 July 2017

Cheston Peterson[1], R. Dean Grubbs[2]

[1]Florida State University, Tallahassee, FL, USA, [2]FSU Coastal and Marine Laboratory, St. Teresa, FL, USA

A Selectivity Comparison of Gillnet and Longline Fishing Gear Composed of a Range of Mesh and Hook Sizes Using Data from Coastal Shark Survey

Data from surveys using different fishery gear types and sizes are often compared or combined, despite differences in size- and species-selectivity among gear types. We use data from a long-term, fishery-independent study to examine differences in size- and species-selectivity based on gear type, hook and mesh size, and bait. We found longline gear outfitted with a range of hook sizes to select for a broader size range of sharks, and therefore a greater number of species, than gillnets composed of a range of mesh sizes. However, one species - bonnethead sharks (*Sphyrna tiburo*) - was caught with high frequency in gillnets and was nearly absent in longline catches - presumably due to the bait used. Additionally, we found bait type to affect catch rates of large coastal shark species when using either Spanish mackerel (*Scomberomorus maculatus*) or pieces of small coastal sharks (Atlantic sharpnose sharks, *Rhizoprionodon terraenovae*, and bonnethead sharks). Our analyses suggest these characteristics of fishing gear affect selectivity, and we suggest future studies of elasmobranch distribution, abundance, and life history strongly consider the selective properties of the fishing gear used.

0629 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Christopher Peterson

The University of Texas, Austin, TX, USA

Spatial variation in *Anolis conspersus* toepad lamellae

Anole toepad scales (lamellae) are a functionally significant morphological character. Evidence suggests that lamellae count is associated with different habitat use (perch height and diameter) among anoles of the Greater Antilles; however, these associations often do not hold within species. I examined variation in hind limb lamellae morphology in 286 adult *Anolis conspersus,* identified associations with ecological and morphological covariates, and investigated spatial trends across the species distribution. Intraspecific toepad variation could provide a greater understanding of anole habitat use and ecology.

0799 Amphibian Conservation II, Sunday 16 July 2017

John Peterson[1], Nick Boehme[1], Tyler Sternbach[1], Gary Casper[2]

[1]University of Wisconsin-Platteville, Platteville, WI, USA, [2]University of Wisconsin-Milwaukee Field Station, Saukville, WI, USA

Should frog vocalization surveys be conducted later at night?

As amphibian populations decline around the world there is need for more effective population monitoring. Frog vocalization surveys often assess population occupancy and abundance a few times per year at one time of day. We suggest that automated recording systems may be an effective tool for monitoring frog occupancy and abundance. We monitored occupancy and abundance of Gray Treefrogs (*Hyla sp.*), Green Frogs (*Lithobates clamitans*), and state-endangered Blanchard's Cricket Frogs (*Acris blanchardi*) at five wetlands in southwest Wisconsin in 2014 and 2015. Occupancy (detection frequency) and abundance (call index) were determined hourly throughout the afternoon and evening across the month of June. Occupancy and abundance were also assessed at peak daily calling times throughout the summer. Occupancy and abundance displayed similar trends on both daily and seasonal time scales. Additionally, sites with greater daily occupancy and abundance tended to also have greater values throughout the season. For all species, sites with lower occupancy and abundance tended to peak later in the evening for a shorter number of hours. These results suggest that it may be advantageous to conduct frog vocalizations surveys later in the evening than previously thought.

0165 Fish Conservation II, Sunday 16 July 2017

Mark Peterson[1], Todd Slack[2], Erik Lang[3]

[1]University of Southern Mississippi, Ocean Springs, MS, USA, [2]USACE-ERDC, Vicksburg, MS, USA, [3]LDWF, Baton Rouge, LA, USA

Fundulus jenkinsi (Evermann 1892) (Saltmarsh Topminnow) in Coastal Mississippi Watersheds, with Comments on Range-Wide Occurrences Based on Non-Vouchered and Museum Records

Fundulus jenkinsi (Saltmarsh Topminnow) is listed as "at risk" by the USFWS and as a Tier 2 conservation priority in Mississippi, in part, because of marsh-habitat loss due to storms, urbanization, its specialized habitat requirements, and limited geographic distribution. To provide additional quantitative data for conservation planning, our objectives were to (1) determine the distribution and abundance of Saltmarsh Topminnow within coastal Mississippi, (2) characterize its habitat requirements, and (3) organize and present all Saltmarsh Topminnow data records (non-vouchered and museum records and those from this study) for use in the development of management/conservation plans. We collected 497 fish and associated habitat data from 27 February to 1 August 2009. PCA produced 3 meaningful components: 1) a landscape-position axis (32.40% of the total variance), 2) a seasonal/spatial axis of species occurrence (18.99%), and 3) a geomorphic bank-slope axis (18.78%). Ninety-six percent of all fish (representing 78.8% of collection effort) were captured in water with salinity <13 psu. We compiled 831 geo-referenced occurrences from 1891 to 2015. To better quantify and conserve the closely linked habitat requirements of this species within a reduced salinity range, additional sampling should be focused in under-sampled areas between Lake Borgne, LA, to west of Galveston Bay, TX.

0663 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Matthew Pierson, Chris Gienger

Austin Peay State University, Clarksville, TN, USA

Metabolic Response to Predation Risk in *Agkistrodon contortrix*

Direct interactions between predators and prey can have fatal consequences, typically resulting in the predator consuming the prey. Indirect interactions can also have consequences by modifying an organism's physiology or behavior. This study examines how snakes metabolically rate respond to the chemical scent cue of a known predator. We measured the effect of Coyote scent (urine) on resting metabolism of Copperheads, and this provides insight into the snakes' internal response to chemical cues in the environment. Overall, the responses to the coyote urine stimulus were very modest, and among the five individuals tested only one showed a significant response to chemical stimulus. Even after adjusting for mass-specific VO2, there was very little change in measurements. Other studies show that snakes respond to various chemical cues, none have demonstrated a response metabolically to predator chemical cues. With such a

small sample size, our priority was to first develop a successful method of quantifying such a response among snakes.

0176 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Amanda Pinion, Kevin Conway

Texas A&M University, College Station, TX, USA

A new terminology for cranial tubercles demonstrated using multiple species and genera of North American Minnows (Teleostei: Cyprinidae)

Members of the Cyprinidae often display sexual dimorphism in the size and number of tubercles present on the surface of the head, body, and fins, and characters of tuberculation often are useful for distinguishing between sister taxa. Previous studies on the tubercles of cyprinids have used different terms to describe the location and arrangement of tubercles on the surface of the head rendering it difficult to make general comparisons between studies. We introduce a new terminology for cranial tubercles based on location in relation to the cephalic lateral line system and underlying cranial bones. We demonstrate the utility of this terminology for comparative studies using representatives of several North American cyprinid genera, including *Notropis, Macrhybopsis, Pimephales and Cyprinella*. Additionally, we demonstrate the utility of this terminology for taxonomic studies by documenting differences in cranial tuberculation between three members of the *Miniellus* subgroup of *Notropis* (*Notropis stramineus, N. procne and N. topeka*) and between populations of the widespread *N. stramineus*.

0917 Lightning Talks II, Friday 14 July 2017

Nicolas Pinte[1], Vincent Zintzen[2], Laurent Duchatelet[1], Ulrich Martin[1], Jérôme Mallefet[1]

[1]Catholic University of Louvain, Louvain-la-neuve, Brabanb Wallon, Belgium, [2]New Zealand Department of Conservation, Wellington, New Zealand

Swimming speed velocity of deep-water sharks infer by stereo video footage analyses

The ecology of deep-water sharks is still poorly documented. The improvement of technology these last years allowed to get more and more information about these animals. One classical method to get information on deep-sea organisms is the stereo video recording. Between 2009 and 2010, the faunal diversity of New-Zealand continental slopes was studied using stereo baited remote underwater video deployments from 50 to 1200 meter depth. Up to now, fauna diversity was the most commonly data extracted from this video deployment. Here we will show another use of stereo video footages to extract the swimming speed of deep-water sharks. Indeed, the

deep-water sharks swimming velocity is still unknown due to the difficulty to catch these sharks and keep them alive in captivity. The use of stereo video allows a 3D reconstruction of shark's movements in their environment allowing to follow their displacements and all parameters which characterize this one such as cruise and maximal swimming velocities. The data obtained by this method show that all deep-water sharks are not slow swimmers as commonly thought and that small luminous sharks seem to exhibit a faster cruise swimming speed than their non-luminous counterparts. This result could be supplementary evidence to the "isolume follower" hypothesis which says that luminous sharks should swim rapidly in the water column to correlate their ventral light emission with the surrounding ambient light of their environment in order to disappear from bottom predator's sight. Experimental design developments are in progress to extract more data from stereo video.

0643 AES Conservation & Management II, Saturday 15 July 2017

Linda Planthof, Paddy Walker, Irene Kingma

Dutch Elasmobranch Society, Amsterdam, The Netherlands

Elasmobranch Management in the European Union: Progress and Challenges

Elasmobranchs in Europe are managed under the Common Fisheries Policy (CFP) of the European Union, as well as through international conventions, Regional Fisheries Management Organizations, and regulations at the Member State level. After the first introduction of quotas for elasmobranchs in 1998, shark management progressed with the adoption of the Community Plan of Action for the Conservation and Management of Sharks, a finning ban, and the designation of prohibited species. The CFP has been undergoing a major reform since 2013 with consequences for elasmobranch management. Especially the adoption of a landing obligation poses new challenges. The obligation will make the landing of all species that are subject to catch limits compulsory. As most elasmobranch species are taken as bycatch, a limited quota for these species will effectively 'choke' the target fishery. An improvement of species-specific data and cooperation with the fisheries sector is now needed to deal with the challenges associated with the new policy changes. Therefore, we propose steps forward and research priorities for successful management.

0285 Lightning Talks II, Friday 14 July 2017

Renata Platenberg

University of the Virgin Islands, St Thomas, U.S. Virgin Islands

Self-recovery in the Caribbean: The Snake That Made it Back on its Own

Caribbean snakes have been besieged by severe threats over the past several centuries. Non-native predators coupled with habitat loss have driven many endemic snakes to

localized extinctions, particularly the diurnal ground dwellers. Efforts to reverse these trends can be culturally, financially, and ecologically challenging and do not always result in desired population restorations. The Puerto Rican Racer (*Borikenophis portoricensis*) is an exception. The racer is native across the Puerto Rican Bank, but has been extirpated from the human-inhabited islands of St. Thomas and St. John in the US Virgin Islands, primarily due to high numbers of mongoose (*Herpestes auropunctatus*). The snakes do, however, persist in abundance on nearby mongoose-free islands. At some point in the 1990s the mongoose populations on the eastern end of St. Thomas crashed, and there has been a slow recolonization of that part of the island by racers who have been arriving by sea, on their own, from nearby islands. Which islands are providing the source population is unknown. This offers an interesting study into metapopulation dynamics, species colonizations, and over-water movement. The results can provide valuable direction for island species conservation and insight into species invasions. Collaborators interested in these questions would be most welcome to participate in this study.

0704 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jeffrey Plumlee[1], Jay Rooker[1], Brooke Shipley[2], David Wells[1]

[1]Texas A&M University at Galveston, Galveston, TX, USA, [2]Texas Parks and Wildlife Department, Austin, TX, USA

Feeding ecology of reef fishes utilizing fatty acid and stable isotope biomarkers

In the northwestern Gulf of Mexico (NW GoM), artificial reefs harbor rich biodiversity and support a wide variety of trophic relationships. How these trophic relationships affect the functionality of artificial reefs as habitat for fishes is widely debated and requires additional studies with multiple techniques. The feeding ecology of three reef fishes; Red Snapper (*Lutjanus campechanus*), Pigfish (*Orthopristis chrysoptera*), and Tomtate (*Haemulon aurolineatum*) was examined in the NW GoM. A total of 75 fishes (29 Red Snapper, 28 Tomtate, and 18 Pigfish) were collected off of high relief (toppled platforms) artificial reef structure and 18 Red Snapper were collected off of low relief (concrete rubble and pyramids) artificial reef structure. All individuals had both epaxial muscle and liver tissue analyzed for stable isotope (carbon, nitrogen, and sulfur) ratios and fatty acid signatures to reveal long-term (months) and short-term (days to weeks) feeding strategies, respectively. Differences among species existed within the high relief structure and between high and low relief structures for Red Snapper using both biomarkers. In addition, dietary shifts were estimated comparing fast turnover tissue (liver) and slow turnover tissue (epaxial muscle). The equilibrium of the isotopic ratios and fatty acid signatures in long-term tissues versus short-term tissues can indicate dietary stability, while biomarkers that are not in equilibrium can indicate recent dietary flux. This study provides important ecosystem-based feeding information of reef associated fishes on artificial reefs in the NW GoM.

0727 AES Ecology I, Sunday 16 July 2017

Jeffrey Plumlee[1], Kaylan Dance[1], Phillip Matich[2], John Mohan[1], Travis Richards[1], Thomas TinHan[1], David Wells[1]

[1]Texas A&M University at Galveston, Galveston, TX, USA, [2]Sam Houston State University, Huntsville, TX, USA

Community structure of elasmobranchs in estuaries along the northwest Gulf of Mexico

Bays and estuaries in the northwest Gulf of Mexico (NW GoM) harbor high biodiversity and serve as essential fish habitat to many predatory species such as sharks and rays. For many coastal elasmobranchs, estuaries function as nursery habitat and feeding grounds. Elasmobranch community structure was analyzed among eight bays along the Texas coast utilizing bi-annual fisheries independent gillnet surveys conducted by Texas Parks and Wildlife Department over three decades (1984 - 2014). Ten species made up 99.4% of the elasmobranchs collected; 36.1% Bull Sharks (*Carcharhinus leucas*),17.6% Bonnetheads (*Sphyrna tiburo*), 16.4% Cownose Rays (*Rhinoptera bonasus*), 13.0% Blacktip Sharks (*Carcharhinus limbatus*), 6.3% Atlantic Stingrays (*Dasyatis sabina*), 2.9% Atlantic Sharpnose Sharks (*Rhizoprionodon terraenovae*), 2.4 % Spinner Sharks (*Carcharhinus brevipinna*), 2.1% Scalloped Hammerheads (*Sphyrna lewini*), 1.7% Finetooth Sharks (*Carcharhinus isodon*), and 0.9% Lemon Sharks (*Negaprion brevirostris*). Temporal and spatial differences in community structure were investigated across all bays using analysis of similarity (ANOSIM) with corresponding similarity percentage analysis (SIMPER) in PRIMER. Environmental variables including temperature, salinity, depth, dissolved oxygen, and turbidity were analyzed with GAMs to elucidate trends in CPUE for individual elasmobranch species. Among the three decades examined, elasmobranch community structure significantly changed among individual estuaries and decades. Northern estuaries were dominated by Bull Sharks while southern estuaries were dominated by Cownose Rays. Salinity was the most important environmental variable in predicting individual elasmobranch species abundance. Understanding these long-term trends in community structure can provide both baseline data and insight to the role of specific estuaries for elasmobranch species in the NW GoM.

0068 Fish Reproduction & Development, Saturday 15 July 2017

Gianluca Polgar[1], Hans-Georg Rupp[2], Hieu Van Mai[3], Atsushi Ishimatsu[4]

[1]Universiti Brunei Darussalam, Bandar Seri Begawan, Brunei Darussalam, [2]St. Angela-Schule, Königstein im Taunus, Germany, [3]Can Tho University, Can Tho, Viet Nam, [4]Nagasaki University, Nagasaki, Japan

Observations on the Reproductive Cycle of the Mudskipper, *Periophthalmus variabilis* (Teleostei, Gobioidei) in Semi-natural Conditions

Mudskippers are amphibious gobies (Gobiidae, Oxudercinae) that live in peritidal tropical and subtropical habitats of the Western Atlantic and Indo-Pacific regions. The behavioral reproductive cycle has been described in a few species, but several details are missing. A description of the breeding cycle of *Periophthalmus variabilis* is provided, using three complete reproductive events in an experimental tank equipped with simulated tides and a mud slope. Underground observations allowed us to describe that spawning and fertilisation behaviours occur in a water-filled egg chamber, which is subsequently filled with air by the male. As previously documented in a congeneric species, the male maintains the air-phase contained in the egg chamber during the development of the embryos, performing air-gulping and shuttling behaviors during low tide. Some videos also show an 'upside-down-tail-waving' behaviour inside the shaft of one of the two openings of the burrow, that the male performs during high tide, before or during the hatching event, which is here proposed as the mechanism of larval dispersal out of the burrow.

0087 Lightning Talks I, Friday 14 July 2017

Sinlan Poo[1], Ming-Feng Chuang[2], Yeong-Choy Kam[2]

[1]Memphis Zoo, Memphis, TN, USA, [2]Tunghai University, Taichung, Taiwan

Oviposition Site Selection between the Sexes: Examination of a Treefrog with Male Territoriality and Biparental Care

Oviposition sites selected by parents can protect offspring from competition, predation, and harsh environmental conditions. Though sites are selected by females in most amphibians, the distinction between male and female choice can be blurred in species with territorial males. Using a phytotelm-breeding frog with male territoriality and biparental care, we examined 342 oviposition sites to determine (1) male choice based on site characteristics (height, hole diameter, hole depth, and water depth), (2) female choice based on site characteristics and male characteristics (snout-vent length and body condition), and (3) hatching success based on site characteristics. We hypothesized that either one or both sexes would select oviposition site based on characteristics that would correlate with higher offspring survivorship. We found males preferred sites with larger hole depth and water depth, while females showed no preference for sites or males. However, hatching success was not correlated with site characteristics preferred by males. Our findings provide empirical evidence of male oviposition site selection in an amphibian with male territoriality. Contrary to our predictions, we did not find evidence of offspring benefits based on parental site preferences. We suspect this is due to a threshold of habitat suitability reached by male-selected sites or advantages some sites may offer for larval development.

0035 LFC Contributed III, Saturday 15 July 2017

Steven Porter[1], Lorenzo Ciannelli[2]

[1]*NOAA, Alaska Fisheries Science Center, Seattle, WA, USA,* [2]*Oregon State University, Corvallis, OR, USA*

Contrasting Flathead Sole (*Hippoglossoides elassodon*) spawning in the southeastern Bering Sea during warm and cold periods

Over the last decade and half a pattern of alternating multi-year warm (2001-2005, 2014 to present) and cold (2007-2013) periods has occurred during the spring, summer and fall in the southeastern Bering Sea. These periods are defined by ocean temperature and are related to the amount of sea ice present in early spring. Flathead Sole (*Hippoglossoides elassodon*) inhabit the southeastern Bering Sea and bottom water temperature has been shown to alter their spatial distribution, thus temperature can potentially influence where they will spawn. Our objective was to infer Flathead Sole spawning area in the southeastern Bering Sea from egg distribution and assess how warm and cold periods affected it. Egg abundance (number/10m^2) was determined from ichthyoplankton surveys conducted in the spring during the last warm and cold periods. We used generalized additive models to analyze Flathead Sole spawning. During the warm period, eggs were abundant over a wide area of the southeastern Bering Sea shelf indicating that temperature most likely did not limit where spawning occurred. In response to low temperatures during the cold period, spawning area contracted and shifted west. Thermal conditions altering the location of spawning can affect subsequent advection of larvae toward nursery areas. Stronger Flathead Sole recruitment years have been associated with eastward on-shelf springtime winds that may advect larvae toward nursery areas. Those winds are present during warm years suggesting that warm conditions may be beneficial for Flathead Sole recruitment. Our results provide insight to understanding the adaptability of this species to climate variability.

0101 Herp Biogeography & Phylogeography I, Sunday 16 July 2017

Daniel Portik[1], Adam Leache[2], Danielle Rivera[1], David Blackburn[3], Matthew Fujita[1]

[1]*University of Texas at Arlington, Arlington, Texas, USA,* [2]*University of Washington, Seattle, Washington, USA,* [3]*Florida Museum of Natural History, University of Florida, Gainesville, Florida, USA*

Evaluating mechanisms of diversification in a Guineo-Congolian forest frog using demographic model selection

The accumulation of biodiversity in tropical forests can occur through multiple allopatric and parapatric models of diversification, including forest refugia, riverine barriers, and ecological gradients. Considerable debate surrounds the dominant diversification process, particularly in the West African Lower Guinea forests, which contain a complex geographic arrangement of topographic features and historical refugia. We investigated alternative mechanisms of diversification in a forest frog, *Scotobleps gabonicus*, using genomic data to identify populations and to perform demographic model selection and spatially explicit analyses. On deeper timescales, we

found overwhelming support for allopatric models involving population divergence in isolation with subsequent expansion and gene flow, consistent with the forest refugia hypothesis. These population divergences occurred simultaneously and conform to predictions based on several climatically stable regions we inferred through ecological niche modeling. Though forest refugia played a prominent role in the initial diversification of *S. gabonicus*, the high elevation reliefs of the Cameroonian Volcanic Line also influenced historical gene flow, and additionally we found support for riverine barriers either maintaining population divergences or driving more recent population splitting. We outline limitations of studies involving limited geographic sampling or exclusively organelle loci, especially regarding their ability to distinguish between alternative allopatric models, and demonstrate the importance of investigating genome-wide variation in a model-testing framework. Though some patterns in our study may be species-specific or related to life history traits of amphibians, additional comparative studies utilizing genomic data can begin to separate shared historical processes from idiosyncratic influences on the demographic histories of Lower Guinea taxa.

0059 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Andrew Powers, Tim J. Karels

CSU Northridge, Northridge, CA, USA

Effect of Habitat Fragmentation on Snakes in the Southern California Chaparral

Urbanization creates fragments of natural habitat causing negative effects on wildlife diversity and dispersion. Studies of habitat fragmentation have focused on lizards, mammals, and birds, but rarely on snakes. Studies have shown in areas of high fragmentation and urbanization, lizard diversity becomes lower. However, this trend might not carry across all reptile groups. I will explore the relationship between snake diversity and habitat fragmentation in Thousand Oaks, California. My study will be the first to focus on newly fragmented chaparral patches. I will capture and identify snakes to species, and I will record mass, length, and sex in order to quantify snake diversity and population composition. I expect to find differences in snake species composition dependent upon patch size and age, with greater diversity in larger and younger patches. I also predict that diversity and average body size of larger snakes will be positively related to patch size.

0813 Amphibian Conservation III, Sunday 16 July 2017

James Prather, Shawn McCracken, Michael Forstner

Texas State University, TX, USA

Increasing Habitat Connectivity of the Endangered Houston Toad (*Bufo houstonensis*) in the Lost Pines Ecological Area.

Infrastructure development continues to increase to keep pace with the growth and expansion of human populations. Core infrastructure, such as roads, results in wildlife mortality and continued fragmentation of available habitat. Artificial wildlife-corridors are a potential solution to mitigating wildlife-motorist collisions and maintaining habitat connectivity. Such structures are components toward conservation stewardship of both species and landscapes. The Lost Pines region is home to the endemic, and endangered, Houston Toad. These structures serve as mitigation efforts to allow the Houston Toad and other wildlife a safe passage among habitat patches despite barriers to dispersal. Highway 290 in Bastrop County bisects critical habitat of the endangered Houston Toad. Wildlife corridors have now been installed at locations based on previous data indicating areas of high wildlife traffic. Our study applies a suite of monitoring techniques to determine usage of artificial wildlife corridors along section the roadway. Monitoring techniques include camera trapping and wildlife mortality surveys (walking and driving). In order to determine usage of these corridors, camera traps were placed at the opening of each culvert. Wildlife mortality surveys along the roadway seek to determine areas of high density, and examine mortality densities post-installation of corridors. Preliminary analysis compared wildlife mortality observations found in the construction area during pre-construction and during construction. These results show no difference in mortality observations between treatments. However, there is a significant difference in observations between survey methods (walking vs driving). Currently, there are no camera trap detections of wildlife utilizing the crossing structures at each location.

0608 AES Life History, Sunday 16 July 2017

Harold Pratt[1], Theo Pratt[2], Dani Morley[3], Susan Lowerre-Barbieri4[4], Angela Collins[5], Jeffrey Carrier[6], Kristen Hart[7]

[1]Mote Marine Laboratory, Tropical Research Laboratory, Summerland Key, FL, USA, [2]Elasmobranch Field Research Association, Summerland Key, FL, USA, [3]Florida Fish and Wildlife Conservation Commissiony, Marathon, FL, USA, [4]Florida Fish and Wildlife Conservation Commission, St Petersburg, FL, USA, [5]Florida Fish and Wildlife Conservation Commission, St Petersburg, FL, USA, [6]Albion College, Albion, MI, USA, [7]U.S. Geological Survey, Davie, FL, USA

Partial Migration of the Nurse shark, *Ginglymostoma cirratum*, from the Dry Tortugas Islands

Nurse sharks have not been previously known to migrate. Nurse sharks of the Dry Tortugas (DRTO) mating population return to the Dry Tortugas Courtship and Mating Ground (DTCMG) annually to triennially during the June and early July mating seasons. In 22 years we have followed the movements of 76 recaptured adults of a total of 115 tagged adults. Telemetry detections of 40 females tagged with acoustic transmitters

show that most tagged and presumably post-partum females are continuously present in the DRTO in the fall, winter and spring following the June mating season but these females depart in late March to early May. Detections reveal these females avoid the DTCMG during the next mating season, returning from late summer to fall. Telemetry records of nine of 17 adult males that co-habited with these females in the DTCMG depart DRTO waters every July. Both genders may overwinter in the DRTO, but the location of these sharks during the summer/fall absence has remained unexplained. Between 2011 and 2016 three males and five females with transmitters were detected to quickly migrate up the west coast of Florida to locations in the waters off Tampa Bay (~335km). Six others were detected in the lower Florida Keys (~292 km). Nine sharks returned to DRTO; one returned six times. Some overwintered and some resumed courtship in June, demonstrating both resident and migratory contingents within their population, or partial migration and an ability to navigate with high spatial and temporal precision.

0330 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Tyleia Prendergast, Lynnette Sievert

Emporia State University, Emporia, Kansas, USA

Effects of Digestion on Temperature Selection and Meal Size on SDA in Cornsnakes (*Pantherophis guttatus*)

Behavioral regulation of body temperature affects the rate of digestion and has implications for the number of times snakes can eat during their active season. Our purpose was to study the effect of postprandial temperature selection and meal size on the energetics of cornsnakes. We measured temperature selection of individual cornsnakes during a fast and through digestion of a meal size of 10% of the snake's body mass. We monitored oxygen consumption of cornsnakes during a fast, while digesting a meal that was 10% of each snake's body mass, and while digesting a meal that was 16% of body mass. Selected body temperatures peaked on day 2 post-feeding at 27.3 ± 1.0° C and returned to pre-feeding temperatures 6 days after ingesting meals. Meal size did not affect the magnitude of increase in oxygen consumption or the length of time to return to pre-feeding levels. Oxygen consumption for snakes digesting a meal that was 10% of body mass peaked at 24 h post-feeding (177.9 ± 19.3 µL/g·h), and for snakes digesting meals of 16% of body mass it peaked at 36 h post-feeding (171.5 ± 17.2 µL/g·h). Oxygen consumption rates returned to pre-feeding levels by 96 h for both meal sizes.

0124 AES GRUBER AWARD IV, Friday 14 July 2017

Bianca Prohaska, R Dean Grubbs

Florida State University, Tallahassee, FL, USA

Stress Physiology of Deep Demersal Sharks in the Gulf of Mexico

Prior to the Deep Water Horizon oil spill, little research effort was focused on studying the physiology of deep demersal sharks inhabiting the Gulf of Mexico. While the physiology of these fishes remains virtually unknown, they are still routinely captured in commercial fisheries, both as targeted catch and as bycatch. With the absence of basic biological data, effective management plans cannot be formulated, making populations highly susceptible to declines. Also unknown is what effects the oil spill has had and will continue to have on these organisms, and if the effects have the potential to result in population declines. Blood chemistry analysis can be used as a method of assessing physiological stress in elasmobranchs, and using this method three main questions will be addressed: 1) What are the baseline blood chemical parameters in deep demersal elasmobranchs? 2) Are the stress responses in these species ecologically-mediated or taxonomically-mediated? 3) Are there significant differences in blood chemical profiles between elasmobranchs potentially affected by the oil spill and those captured in less affected areas? Preliminary results suggest that stress responses are relatively similar among the seven elasmobranch species that have been sampled thus far, including *Mustelus sinusmexicanis, M. canis, Squalus cubensis, S. c.f. mitsukurii*, *Centrophorous uyato, C. granulosus*, and *Hexanchus griseus*. However, lactate concentrations in *M. sinusmexicanus,* and *S. cubensis* are relatively higher than that of the other species sampled, potentially suggesting a depth mediated stress response.

0320 ASIH STOYE ECOLOGY & ETHOLOGY III, Friday 14 July 2017

Nina Pruzinsky, Tracey Sutton

Nova Southeastern University, Dania Beach, FL, USA

Faunal Composition and Spatiotemporal Dynamics of Tuna (Family: Scombridae) Early Life Stages in the Oceanic Gulf of Mexico

Fishes within the family Scombridae (tunas, mackerels and bonitos) are of high economic and ecological value in the Gulf of Mexico (GoM), as they are heavily targeted by commercial and recreational fisheries. In coastal and open-ocean environments, adult tunas are high-level predators, while larval and juvenile tunas serve as prey for numerous species. Much is known about the distribution and abundance of adult tunas, but high taxonomic uncertainty and limited knowledge regarding the distributional patterns of larval and juvenile tunas have led to an "operational taxonomic unit" gap in our understanding of tuna ecology. This study examined the spatiotemporal dynamics of larval scombrids collected in the northern GoM from April to September, 2011, as part of the Offshore Nekton Sampling and Analysis Program. The distribution and relative abundance of the family Scombridae collected from the sea surface to 1500 m depth were characterized with respect to depth, time of year, and in relation to mesoscale oceanographic features. Generalized linear models were used to investigate the relationships between several environmental parameters and scombrid abundances in the epipelagic waters of the oceanic GoM. The dominant species collected in this study were *Euthynnus alletteratus* and *Thunnus atlanticus*. *Euthynnus alletteratus* abundances were highly seasonal and marginally influenced by fronts and day/night cycle. Higher

abundances of *T. atlanticus* were associated low chlorophyll *a* concentrations. Integrated aspects of scombrid ecology in continental shelf and oceanic environments will be used to enhance management and conservation efforts for this highly important taxon.

0555 NIA BEST STUDENT POSTER; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Yasmin Quintana Morales[1], Christian Barrientos[2]

[1]Texas A&M University, College Station, Texas, USA, [2]Universidad de San Carlos de Guatemala, Guatemala, Guatemala

Fish assemblages associated with macrophyte patches in lakes of Guatemala

Aquatic macrophytes provide habitat, shelter and food for fishes in lakes, rivers and wetlands. Several studies have shown that fish assemblages in macrophyte beds are influenced by patch size and environmental conditions. We studied the fish assemblages, density and biomass in macrophyte patches two largest lakes in northern Guatemala: Lake Petén Itzá (100 km2) and Lake Izabal (600 km2) located in the Gulf of México and Caribbean drainages, respectively. Fishes were sampled in macrophyte patches using 100-m2 block nets and rotenone. Macrophyte area coverage, species composition and biomass were measured in each patch. Dominant macrophytes in Petén Itzá were *Vallisneria americana*, followed by *Potamogeton illinoensis* and *Chara* sp.; dominant macrophytes in Lake Izabal were *Hydrilla verticillata, Nimphae ampla*, and *P. illinoiensis*. Fish species richness was similar in the lakes, but composition differed. Petén Itzá samples yielded 19 species, with 75% of biomass consisting of *Thorichthys affinis, Mayaheros urophthalmus* and *Poecilia mexicana*. Izabal samples had 22 species, with biomass dominated by 7 cichlids and *Atherinella meeki*. Lake Izabal had marine species, including *Hyporhamphus roberti, Strongylura notata* and *Mugil curema*. Additional factors that may affect Lake Izabal fish assemblages include predators, invasive plants and local fishing methods.

0661 Lizard Ecology, Sunday 16 July 2017

Dan Rabosky

Museum of Zoology, University of Michigan, Ann Arbor, Michigan, USA

From Arid Australia to the Amazon: Comparative Ecology of the World's Most Diverse Squamate Communities

Arid Australia and the humid neotropics harbor the most diverse syntopic assemblages of squamate reptiles on Earth. However, the extent to which general principles of community organization might pertain to similarly species-rich communities from radically different physiographic landscapes remains poorly known. Here, I contrast

patterns of community structure between these two systems to better understand the role of evolutionary history and contemporary ecological interactions in shaping patterns of species richness, abundance, and resource use. Using a phylogenetic comparative framework, I address the contributions of distinct evolutionary radiations to the squamate faunas of these regions and quantify the importance of phylogenetic niche conservatism for contemporary patterns of trophic ecology and habitat use among co-occurring species. I consider how broad-scale macroevolutionary trends in the tempo and mode of ecological trait evolution in major squamate clades influences the assembly and structure of local communities. I conclude that, while some features of these systems can be described by sweeping generalizations, a richer understanding of how and why these iconic communities have become so diverse requires a renewed attention to foundational natural history data.

0135 Amphibian Conservation II, Sunday 16 July 2017

Muhammad Rais, Ayesha Akram, Muhammad Saeed, Sadia Munir, Saleha Abbassi, Tariq Mahmood, Maqsood Anwar

PMAS Arid Agriculture University Rawalpindi, Rawalpindi, Punjab, Pakistan

Anuran Assemblage and Identification of Sites for Population Monitoring in Sub-tropical Scrub and Pine Forest, Rawalpindi and Islamabad Capital Territory, Pakistan

We employed standard time-constrained survey method, visual encounter survey, to document anuran species diversity in sub-tropical scrub forest (STSF) and sub-tropical pine forest (STPF) of Rawalpindi District and Islamabad Capital Territory during spring and summer seasons of 2014 and 2015. We recorded a total of nine anuran species: Indus Valley Toad (*Duttaphrynus stomaticus*), South-east Asian Toad (*Duttaphrynus melanostictus*), Ant Frog (*Microhyla ornata*), Hazara Torrent Frog (*Allopaa hazarensis*), Skittering Frog (*Euphlyctis cyanophlyctis*), Cricket Frog (*Fejervarya limnocharis*), Murree Hills Frog (*Nanorana vicina*), Bull Frog (*Hoplobatrachus tigerinus*) and Indian Burrowing Frog (*Sphaerotheca breviceps*). The similarity index revealed 80% similar anuran fauna between the two habitats. We recorded more anuran species (eight species) from sub-tropical pine forest with two unique species (22% uniqueness index). The species included South-east Indian endemic species- Murree Hills Frog and Pakistan's endemic anuran- Hazara Torrent. We attribute high elevation with associated high precipitation and low temperature, and freshwater torrent springs to this relatively high endemism in sub-tropical pine forest. Of the 79 sites visited, we identified 30 sites (STSF 13 sites; STPF 17 sites) as significant for monitoring of populations of anurans. We found that egg mass count, calling index and tadpole count can be used for monitoring of populations of anuran species of the area except Hazara Torrent Frog and Murree Hills Frog for which only tadpole count is recommended. We suggest regular monitoring of anuran populations, particularly endemics and inclusion of management of their habitat at landscape level in future development projects of the area.

0667 General Ichthyology II, Sunday 16 July 2017

Kristian Ramkissoon, Tracey Sutton

Nova Southeastern University, Davie, FL, USA

Species composition, abundance and vertical distribution of the numerically dominant meso-to-bathypelagic fish genus *Cyclothone* (Stomiiformes; Gonostomatidae) in the northern Gulf of Mexico

The vertical ecology of the numerically dominant bristlemouths (Gonostomatidae: *Cyclothone*) is a key component of the distribution of overall biomass in the deep-pelagic ocean. The genus *Cyclothone* are cosmopolitan throughout the world's deep oceans. As a result of their global presence and abundance, *Cyclothone* play a major role in many oceanic ecosystem attributes, including the deep-scattering layer and the cycle and distribution of carbon in the deep-pelagic realm. Here we report on the species composition, abundance and vertical distribution of *Cyclothone* from the northern Gulf of Mexico (GoM), collected during an extensive epi- to bathypelagic (1500 m) sampling series. The *Cyclothone* specimens analyzed in this study represent roughly 33% of the total biomass collected during this series. *Cyclothone pallida* was the numerically dominant species collected, comprising 52% of the collected *Cyclothone* biomass, and also showed the widest vertical depth range. *Cyclothone acclinidens*, *Cyclothone alba*, *Cyclothone braueri*, *Cyclothone obscura*, and *Cyclothone pseudopallida* accounted for 7.28%, 5%, 4.35%, 12.62%, and 13.1% of the collected *Cyclothone* biomass, respectively. No evidence of diel vertical migration was seen in any of the six species investigated. These data provide baseline data for what may be the most abundant fish genus in the GoM, and perhaps the World Ocean.

0136 LFC Contributed I, Friday 14 July 2017

Jessica Randall[1], Morgan Busby[2], Adam Spear[2], Kathy Mier[2]

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Spatial and Temporal Variation of Summer Ichthyoplankton Assemblages in the Northeast Chukchi Sea 2010 - 2015

During the summers of 2010 - 2015, ichthyoplankton surveys were conducted by the Alaska Fisheries Science Center with funding from the Bureau of Ocean Energy Management in the Northeast Chukchi Sea. A Tucker sled equipped with two nets was used to sample both benthic and pelagic habitats. To examine temporal and spatial assemblage structure with a focus on Arctic Cod (*Boreogadus saida*), an ecologically important species of Arctic food webs, catch data from each net were analyzed independently. Cluster analysis and correlation coefficients were used to identify groups of similar species composition by station and to relate observed groups to environmental

data. Although benthic catch data did not reflect any clear patterns of group occurrence or distribution, analysis of pelagic data indicates a shift in predominant groups across the study period. In years of warm summer temperatures (sea surface 4 - 11˚C) in the Chukchi Sea, 2010 and 2011, groups were primarily typified by Yellowfin Sole (*Limanda aspera*). The following years, 2012 and 2013, temperatures were much colder (sea surface -1 - 9˚C) resulting in the prevalence of Arctic cod within groups. Other dominant taxa across groups from both habitats include Bering flounder (*Hippoglossoides robustus*) and Arctic Sand Lance (*Ammodytes hexapterus*). Both sea surface and bottom water temperature were significant ($p < 0.001$) factors explaining variation. These findings help inform ecosystem-based management strategies as the Arctic larval fish communities may continue to shift with the rapidly changing environment.

0832 SSAR SEIBERT CONSERVATION, Friday 14 July 2017

Rhett M. Rautsaw[1], Scott A. Martin[3], Bridget A. Vincent[1], Katelyn Lanctot[1], M. Rebecca Bolt[4], Richard A. Seigel[2], Christopher L. Parkinson[1]

[1]University of Central Florida, Orlando, FL, USA, [2]Towson University, Towson, MD, USA, [3]The Ohio State University, Columbus, OH, USA, [4]Integrated Mission Support Services, Kennedy Space Center, FL, USA

Stopped dead in their tracks: The impact of railways on Testudine movement and behavior

Habitat fragmentation is one of the leading causes of biodiversity decline and most commonly results from urbanization and construction of transportation infrastructure. Roads are known to negatively impact species, but railways often cause similar effects. Certain taxa are more vulnerable to railways than others due to limitations in mobility. Here we used Gopher Tortoises (*Gopherus polyphemus*) as a model system to study the impacts of railways on turtle movement and behavior. First, we used radio-telemetry to determine the frequency of railway crossings and compared this to correlated random walk (CRW) simulations. Second, we measured behavior for one hour to determine tortoise crossing ability and tested for behavioral differences associated with the familiarity of the railways using principal component analysis. Lastly, we tested trenches dug underneath the rails as a management strategy to alleviate the impact of railways on tortoises. We found that railways impacted the movement of Gopher Tortoises. Gopher Tortoises crossed the railway less often than what would be expected by unhindered movement and, during behavioral trials, no tortoise was capable of crossing the rails due to the rails being too tall. Using game cameras, we demonstrated that trenches dug underneath the rails and between the ties was an effective management strategy. For minimal financial cost, it allowed tortoise movement across the railway, maintained full rail functionality, and created an escape route for individuals that were trapped between the rails. We suggest trenches be dug to alleviate the impact of railways on turtle movement and mortality.

0129 Herp Systematics II, Sunday 16 July 2017

Christopher Raxworthy[1], Sara Ruane[2], Richard Pearson[3], Frank Burbrink[1]

[1]American Museum of Natural History, New York, USA, [2]Rutgers-Newark University, New Jersey, USA, [3]University College, London, UK

Evolutionary Radiation of the Pseudoxyrhophiine Snakes in Madagascar

Madagascar, as an ancient, isolated, and massive microcontinent, represents an ideal environment to determine the patterns and processes of evolutionary radiation. One of the most ecologically diverse and species rich endemic radiations in Madagascar are the pseudoxyrhophiine snakes, which represents about 99% of the Madagascan colubroid snake diversity. This group has a single dispersal origin into Madagascar, arriving during the Oligocene Period. Currently 82 species have been described from Madagascar, with additional cryptic diversity expected to be discovered. Here we present our preliminary findings on the phylogeny and diversification rates for this Madagascar species radiation, based on a large anchored phylogenomic data set of more 370 nuclear loci and 366 snakes, which includes most of the pseudoxyrhophiine species diversity sampled broadly across populations and species. Speciation has occurred in all major habitats and regions of the island (except for the very highest elevations), and some closely related genera show striking morphological and ecological variation. Surprisingly, throughout the Neogene, speciation rates appear to have remained largely constant for this radiation in Madagascar. Preliminary investigation of sister species provides some support for ecological speciation along environmental clines, indicating that the environmental landscape in Madagascar may play an important role in driving speciation on this microcontinent.

0163 Herp Morphology & Development, Saturday 15 July 2017

Deran Reddy

University of the Witwatersrand, Johannesburg, South Africa

A Morphogenetic Study of the Lungs of the Nile Crocodile Using Electron Microscopy

This study's purpose was to document the morphology of the Nile crocodile lung at various ages, namely 3, 6, 12 and 24 months old. All animals were euthanized and the lungs intra-tracheally instilled using 2.5% glutaraldehyde in a sodium phosphate buffer. The lungs of the animals were divided into dorsal and ventral halves with cranial, middle and caudal samples being taken from each half using systematic random sampling. These samples were processed for and viewed under a SEM. In crocodiles of all ages, the lungs were more subdivided in the cranial regions decreasing in a cranio-caudal direction with the ventral regions all being more subdivided than their dorsal counterparts. All lung regions of the 3 and 6-month age group were more subdivided than the older age groups, indicative of lungs better suited to gas exchange. Both interfaveolar pores and stereocilia were found to be in different ratios through all lungs. The interfaveolar pores (increase gas exchange efficiency) were predominant in the

cranial regions and decreased cranio-caudally. The opposite trend was observed for the stereocilia (mechano-receptors) but these structures were observed mainly in the older individuals. The basic lung design is consistently heterogeneous through all ages but the varying degrees of subdivision indicates varying lung efficiency. This couples well to the crocodile's ontogeny and ethology. The presence of stereocilia make the hypothesis of air storage viable as individuals can sense pressure (governing diving depths to prevent lung collapse) and air movement (governing movement of air to areas suited for gas exchange).

0200 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kelsey Reider, Maureen Donnelly

Florida International University, Miami, FL, USA

Wide Thermal Range and Frost Tolerance in a High-Elevation Andean Frog

Climate change is driving changes in the elevational distribution of many species. Our primary field site is in the Cordillera Vilcanota, a heavily glaciated range in Cusco Department, southern Perú, within a region of the tropical Andes where significant changes in temperature, glacier cover, and species distributions have been recorded in recent decades. Glacial runoff forms new ponds and one anuran, *Pleurodema marmoratum* (Leptodactylidae), has expanded its range 200 vertical meters to new habitat created within the last 70 years, making it among the highest recorded amphibian populations on the planet. We determined the critical thermal maximum (CT_{max}) for *P. marmoratum* from 5200-5300 masl. *Pleurodema marmoratum* has one of the highest CT_{max} (>32^{o} C) reported from the tropical Andes of Peru, with one of the widest thermal ranges of any amphibian. We also attempted to determine the CT_{min} of *P. marmoratum*, and found that this species is frost-tolerant. Our finding expands our knowledge of frost-tolerant amphibians to the widespread tropical family Leptodactylidae.

0168 ASIH STOYE ECOLOGY & ETHOLOGY I, Thursday 13 July 2017

Kelsey Reider[1], Tracie Seimon[2], Alessandro Catenazzi[3], Maureen Donnelly[1]

[1]Florida International University, Miami, FL, USA, [2]Wildlife Conservation Society, Bronx, NY, USA, [3]Southern Illinois University, Carbondale, IL, USA

Seasonality of *Bd* Prevalence and Infection Intensity in High Elevation Anuran Populations in the Cordillera Vilcanota, Perú

Climate change is driving changes in the elevational distribution of hosts and pathogens. Significant changes in temperature, glacier cover, and species distributions have been recorded in recent decades in the tropical Andes. At our primary field site in the Cordillera Vilcanota, a heavily glaciated range in southern Peru, glacial runoff forms

new ponds and two frog species, *Pleurodema marmoratum* and *Telmatobius marmoratus*, have expanded their ranges to habitat created within the last 70 years. The newly colonized ponds reach 5400 masl, making these among the highest recorded amphibian populations on the planet. The amphibian chytrid fungus, *Bd*, and chytridiomycosis, have been found in both species in the recently deglaciated zone since 2003, and a mass-mortality event affected *T. marmoratus* in 2004. In 2013 we encountered adults and juveniles of *T. marmoratus for the first time since that event*. We found a seasonal pattern of *Bd* infection in both species: prevalence and infection intensity peaked in the dry season. We also surveyed *Bd* infection in *P. marmoratum* in eight remote valleys. We found *Bd* in six of the new sites and four sites had *Bd* prevalence greater than 50%. Our study shows that *Bd* has spread in frog populations in rapidly changing habitat throughout the Cordillera Vilcanota, but anuran populations have persisted despite high *Bd* prevalence in *T. marmoratus* (27%, 95% CI 19-36%) and *P. marmoratum* (42%, 95% CI 37-49%). Additional research is necessary to understand how continued climate and environmental changes will impact amphibian health in these extreme populations.

0426 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Carolyn Reiland-Smith, Jon Moore

Florida Atlantic University, Boca Raton, Florida, USA

Seed Dispersal of Native Drupe Bearing Plants by Gopher Tortoises (*Gopherus polyphemus*)

The gopher tortoise, *Gopherus polyphemus*, is a keystone species and an ecosystem engineer based on the characteristic burrows they excavate. While burrowing, the gopher tortoise affects its surroundings by turning soil and increasing the species richness of the community, but the tortoise grazing activity may also change the abundance of plant species in their surroundings if seeds survive gut passage. The cocoplum bush, *Chrysobalanus icaco*, is a popular large-seeded shrub in South Florida and a regular find in tortoise scat. The saw palmetto, *Serenoa repens*, another large-seeded native plant found throughout Florida, is also a known food source for the gopher tortoise. As large-seeded fruits, both study species are less likely to be consumed by other frugivores compared to small-seeded fruits. When the large fruits fall after ripening, the longer they remain on the ground the greater their risk of insect depredation. These fruits may be of particular interest to reptiles because of their fragrant and colorful flesh, and gut passage may benefit their germination time through scarification. This study will investigate the germination rates and percentages of the cocoplum bush and the saw palmetto after gut passage. With this data we may be able to uncover another aspect of the gopher tortoise's keystone effect and ecosystem engineering ability through the process of plant propagation. This research has the potential to provide novel data that will be useful in management decisions; particularly

when native plant introductions are considered in relation to known gopher tortoise activity.

0431 Lightning Talks II, Friday 14 July 2017

Carolyn Reiland-Smith, David Lucien, Jon Moore

Florida Atlantic University, Boca Raton, Florida, USA

Gigantic *Gopherus* Gastroliths

Many species of vertebrates ingest gastroliths and a variety of motivations for the behavior include endoparasite removal, stomach cleaning, food grinding, and calcium supplementation. Gravid gopher tortoises, *Gopherus polyphemus*, have been found with significantly more ingested gastroliths than non-gravid adult females. There is also evidence supporting gastrolith ingestion by juvenile tortoises. This behavior may provide a supplemental source for calcium intake which would be vital during both eggshell formation and juvenile growth stages. The study site in Jupiter Florida has procured a great variety of gastroliths found through opportunistic sampling of scat during a subsequent study, and ongoing projects that have collected numerous radiographs showing gravid and non-gravid tortoises with gastroliths. One extraordinary sample was collected on site that included an 11.5cm Eastern cotton tail (*Silvilagus floridanus*) femur which had passed intact through a resident gopher tortoise. Many other unique gastroliths have been collected, including another bone fragment with a length of 8.5cm and many large shells and rocks that have been opportunistically ingested by the resident population's tortoises. This data set presentation is a call for additional research into the incredibly large items these tortoises can apparently pass without incident.

0296 NIA Contributed/Fish Ecology, Friday 14 July 2017

Roberto Reis[1], Edson Pereira[1], Mario de Pinna[2], Alexandre Clistenes[3]

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An Enigmatic New Hypoptopomatinae Catfish from a Relictual Area in Northeastern Brazil

During fish surveys conducted in 2005 and 2007 in the Chapada Diamantina, southern Bahia state, northeastern Brazil, an enigmatic new loricariid catfish has been revealed. Initial external analyses suggested an uncertain position among the clade Neoplecostominae + Hypoptopomatinae, as some characters appeared to be intermediary between the two subfamilies. The inclusion of the new taxon in an ongoing phylogenetic analysis of the Neoplecostominae, using various

Hypoptopomatinae and members of the other loricariid subfamilies as outgroups, placed it unequivocally as a representative of one of the earliest splits within the Hypoptopomatinae, as sister-group to most other taxa in that subfamily. Traditional taxonomic methods were used to clear and stain specimens, study the anatomy and external morphology, and to include it in a phylogenetic framework. The new taxon should thus be recognized as a new genus and species of the subfamily Hypoptopomatinae, diagnosed from remaining members of the subfamily by the lateral ethmoid presenting a large exposed area bearing odontodes in the posterior rim of the nostril, the possession of one pair of enlarged plates in front of the nostril, and small fleshy lobes with slightly hyperthrophied odontodes on the lateral margins of the head. The phylogenetic position and narrowly endemic distribution of the new taxon suggest that it is a relictual element, much like the trichomycterid subfamily Copionodontinae, also restricted to the Chapada Diamantina.

0739 ASIH STOYE ECOLOGY & ETHOLOGY II, Thursday 13 July 2017

Travis Richards[1], Tracey Sutton[2], David Wells[1]

[1]Texas A&M University at Galveston, Galveston, TX, USA, [2]Nova Southeastern University, Halmos College of Natural Sciences and Oceanography, Dania Beach, FL, USA

Spatial and temporal patterns of distribution and relative abundance of meso- and bathypelagic micronekton in the northern Gulf of Mexico

The deep pelagic ocean represents the largest biome on earth yet despite its enormous volume remains the most understudied marine ecosystem. Micronekton, a key component of deep pelagic communities, are extremely abundant, contribute to vertical carbon flux through vertical migration, and have been shown to be important dietary components of higher trophic level consumers. The Deepwater Horizon oil spill, which released hydrocarbons into the deep-pelagic environment of the Gulf of Mexico (GoM), revealed a paucity of information regarding the distribution and abundance of meso- and bathypelagic micronektonic fishes. Using catch data collected during four oceanographic cruises in 2015-2016, we describe the distribution and abundance of model meso- and bathypelagic micronekton fishes in the northern Gulf of Mexico. In total 42,684 fishes were collected from 82 tows of a 10-m2 MOCNESS midwater trawl which sampled specific stratified depths from the surface to 1500 m. The four most abundant vertically migrating taxa were selected as model species and included *Sigmops elongatus*, *Ceratoscopelus warmingii*, *Argyropelecus aculeatus*, and *Lampanyctus alatus* which collectively represented 5% of all fishes collected. Model non-vertically migrating taxa included *Cyclothone pallida*, *Cyclothone obscura*, *Sternoptyx diaphana* and *Argyropelecus hemigymnus* which represented 36.5% of all fishes collected. By describing and contrasting the distribution and relative abundance of vertically migrating and non-migrating micronekton this project will provide information critical to understanding ecosystem functioning in the deep pelagic realm of the GoM and provide insight into the level of resiliency of its communities in the face of large-scale perturbations.

0914 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Tracy Rittenhouse[1], Susan Walls[2], Katie Beilfuss[3], Rochelle Renken[4]

[1]University of Connecticut, Storrs, CT, USA, [2]USGS-ARMI, Gainesville, FL, USA, [3]Wisconsin Wetlands Association, Madison, WI, USA, [4]Missouri Department of Conservation, Columbia, MO, USA

Questions that Matter: Conducting Research that Managers Will Use

Conservation is currently working to close the research-implementation gap. Under the traditional model, scientists share their knowledge by publishing papers. One benefit is that a publication can be used today or re-found in the future. Ray Semlitsch produced a notable legacy in the literature (>200 publications) and successfully wrote papers for managers (e.g., Semlitsch 2000 in JWM). Yet, scientists who conduct conservation research intend to first produce quality research that will subsequently inform conservation actions. Publication is not the end point but rather the paper must then generate on-the-ground conservation actions. The question I address here is how does a scientist conduct research that managers will use? I argue that a scientist can assist in closing the research-implementation gap with changes at both the beginning and the end of the scientific process. But first, I discount the notion that managers do not read the literature. My experiences have repeatedly confirmed that managers search the literature to find novel solutions and when they need to identify a scientist who could help create solutions. Ray's success came from asking the right questions. To ask the right question, an audience or user group should be identified before the project is designed. A known user group will also improve the end of the process, the published paper, as the paper will more naturally include the details needed for implementation. In this way, science that is used by managers is co-produced by the scientist and the user, and thus there is no gap to fill.

0276 Herp Reproduction & Life History I, Thursday 13 July 2017

Jesus Rivas

New Mexico Highlands University, Las Vegas, New Mexico, USA

Exploring the Life of an Extinct Giant Snake Using a Current Pretty Big Snake: What Studying Anacondas Can Tell Us About Titanoboa

Studying the life of extinct species is fraught with challenges since paleontological evidence can only tell us so much about an extinct species. However, when the extinct species has a very close living relative that also uses the same ecological niche, we have an unprecedented opportunity to explore the life of extinct species. Extinct Boidae, *Titanoboa cerrejonensis*, is the largest snake that ever lived. It was an aquatic predator that

lived in what is currently Colombia, 58-60 million years ago. So far as we can tell its life history and ecology was very similar to that of current day anacondas. In this contribution I used data from a long term study involving hundreds of Green anacondas (*Eunectes murinus*) to make inferences about aspects of Titanoboa's natural history that perhaps will not easily be available studying the fossil record. Drawing parallels with anaconda's biology I estimate that a non-breeding female Titanoboa weighed 925 kilos, and 1618 kg when pregnant. It started breeding at 480 cm SVL, weighing 91kg. Newborn babies of first time breeders are estimated 1.5 cm in SVL and 2.5 Lg. At 12 meters SVL its babies would have been 195 cm in SVL and 5.2 kilos. Its average meal was estimated to be 305 Kg, with a potential maximum of 1350 Kg. Although the contribution is largely speculative, it helps have a better idea of what the life of an extinct snake was like.

0235 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Pedro P. Rizzato[1], Flávio A. Bockmann[1], Eric J. Hilton[2]

[1]Universidade de São Paulo/FFCLRP, Ribeirão Preto, SP, Brazil, [2]Virginia Institute of Marine Sciences, Gloucester Point, VA, USA

'Say my name': a review of the nomenclature of the cranial bones in Polypteridae (Cladistii: Polypteriformes)

Polypteridae is a group of African freshwater fishes that includes the Bichirs (*Polypterus* spp.), and the Ropefish (*Calamoichthys calabaricus*). Ever since the discovery of the first representatives in 1801 polypterids have been of great interest to ichthyologists due to the presence of many characters that are unusual among living fishes, including several plesiomorphies, such as the presence of ganoin on the scales. Because it is hypothesized to be sister-group to all other extant actinopterygians, Polypteridae is considered to be a key group for understanding the evolution of bony fishes. However, there are striking differences in the anatomical nomenclature that is used for the group across authors, creating the need for a standardization based on robust homology statements. As a first step towards this goal, we reviewed the nomenclature of the cranial bones of polypterids from the primary anatomical accounts of the family from the early 19th century to the present day. Some bones have been consistently referred to by the same names (or variants), and sometimes the change of a specific name was simply due to the updating of an anatomical term (*e.g.* 'suprascapular' was replaced by 'extrascapular'). In other cases, however, different names are applied to the same bone due to divergent views by the authors about the identity of the element in question (*e.g.* the 'preopercular', "squamoso-preopercular" and "preopercular-supramaxillary complex" have been applied to the same element). This study provides the foundation for elucidating the numerous homology issues regarding the skull anatomy of Polypteridae.

0612 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Pedro P. Rizzato[1], Anna Pospíšilová[2], Flávio A. Bockmann[1], Eric J. Hilton[3]

[1]Universidade de São Paulo/FFCLRP, Ribeirão Preto, SP, Brazil, [2]Department of Zoology, Charles University, Prague, Czech Republic, [3]Virginia Institute of Marine Sciences, Gloucester Point, VA, USA

Ontogeny and homology of dermal bones associated with the laterosensory canal system in the skull of Polypteridae (Cladistii: Polypteriformes)

There is a long-standing dispute in the literature regarding the relationship between the laterosensory system and some dermal skull bones of fishes. Some authors advocate for a causal relationship between the formation of canals and the origin of the bones that support them, since they are often intimately connected in adults, which ultimately serves as the basis for homology statements about these elements. However, there are still few developmental data about the formation of these bones in many groups of fishes, especially those representing relatively plesiomorphic conditions of the cranial skeleton of actinopterygians. By studying a detailed and unique developmental series of the Senegal Bichir, *Polypterus senegalus*, we were able to analyze and describe the sequence of origin and formation of each of the bones associated with the laterosensory canal system. The tubular ossifications that form around the laterosensory canals comprise an additional, superficial layer of bone that interacts with the underlying ossifications in distinct ways during development. When an underlying ossification is present, the interaction produces compound bones (e.g., the dentary, angular, maxilla, and premaxilla), while when it is absent, the bone in the adult represents only the tubular ossification of the laterosensory canal (e.g., the lacrimal, postorbital, extrascapular, and the anterior-most nasals). These findings may shed light on the homology of several skull elements of basal actinopterygian lineages, especially fossils, pointing out to the need of a thorough reappraisal, including comparative ontogenetic data, of the homology of the bones of fishes associated with the laterosensory system.

0471 ASIH STOYE GENERAL ICHTHYOLOGY II, Thursday 13 July 2017

Adela Roa-Varon[1], Eric J. Hilton[1], Chenhong Li[2]

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Using Phylogenomics to Study the Interrelationships of Gadiformes

Gadiformes includes some of the most important commercially harvested fishes in the world (e.g., cods, hakes, and haddocks). Currently, different authors recognize anywhere between 11 and 14 families, about 84 genera, and more than 600 species within the group. The monophyly of the order has been supported by both morphological and molecular data, yet the relationships among families and subfamilies remain poorly understood and interpreting phylogenetic patterns has been historically

difficult. To study the higher-level relationships (i.e., above the genus level) of Gadiformes, we targeted coding DNA sequences from single-copy protein-coding genes, followed by next generation sequencing on the Illumina platform. A total of 58 species were included representing virtually all recognized families and subfamilies. Maximum likelihood analyses in both species tree and concatenation frameworks recovered a highly congruent and well-supported phylogeny at both shallow and deep levels. Most major clades obtained in prior molecular studies were validated as monophyletic. Specifically, we recovered strong support for previously problematic groups such as lotines, the inclusion of only macrouroids within Macrouridae, and the position of the enigmatic family Lyconidae (not previously sampled in molecular phylogenetic studies) as sister group to Macruronidae, among other results. Our study confirms the utility of the exon-capture approach for analyzing phylogenetic relationships at a range of evolutionary depths.

0915 Fish Biogeography & Morphology, Saturday 15 July 2017

D Ross Robertson[1], Luke Tornabene[2], Carole C Baldwin[3]

[1]Smithsonian Tropical Research Institute, Balboa, Panama, [2]University of Washington, Seattle WA, USA, [3]Smithsonian Institution, Washington, DC, USA

What do different databases indicate about Caribbean fish depth-ranges?

Public databases containing the depth-maxima and -minima of large numbers of wider-Caribbean marine fishes include Biodiversity of the Gulf of Mexico (BioGoMx), FishBase (FB), the IUCN Redlist (RL) and Shorefishes of the Greater Caribbean (SFGC). A recent study that analyzed those BioGoMx data concluded that four taxonomically distinct assemblages of fishes are associated with different depth strata between 0-300m in the Gulf of Mexico, with a strong peak in species-turnover at 60m and smaller peaks at 100m and 200m. To assess those results we analyzed species-turnover vs depth among fishes shared between BioGoMx and each of FB, RL and SFGC. While the 100m and 200m peaks were evident in all databases, the 60m peak occurred only in BioGoMx. Reef-fishes in SFGC, both all species and the subset shared with BioGoMx, showed only a (small) 100m turnover peak. Depth-ranges for individual species varied considerably among databases, clearly indicating that all databases need to rigorously reviewed before use.

0049 Amphibian Conservation IV, Sunday 16 July 2017

Donelle Robinson

City of Austin Watershed Protection Department, Austin, TX, USA

Stream Habitat Recreation for the Barton Springs Salamander

The Barton Springs Salamander, *Eurycea sosorum*, is an aquatic perennibranchiate species that inhabit the Edwards Aquifer springs known as the Barton Springs complex. It was listed as federally endangered primarily due to its small range, threats to water quality and quantity, and harm associated with the maintenance of Barton Springs Pool. The largest number of salamanders is found at Eliza Spring, although this spring was highly modified in the early 1900s. A concrete amphitheater was built around the spring pool, and the spring outflow was buried into a pipe, which destroyed the salamander stream habitat. The failing pipe can backup and create a pond-like environment in the amphitheater that impacts the remaining habitat. This pipe will be removed and the stream recreated, a process known as daylighting. The project incorporated salamander habitat requirements, including ideal water velocity and depth, substrate type, and native stream vegetation. The recreated stream will increase the amount of habitat available for the Barton Springs Salamander at Eliza Spring, allowing for more salamanders and their prey to live here and improving the resiliency of the species. The project will also improve the salamander habitat in the amphitheater by eliminating the pond-like conditions that sometimes occur.

0859 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Camila Rodriguez, Steve Johnson

University of Florida, Gainesville, Florida, USA

Interspecific Interactions Between Two Species of Invasive Lizards in an Urban Environment

Anthropogenic environments often support a diversity of non-native wildlife species. Urbanized areas of South Florida, for example, support numerous species of nonindigenous herpetofauna. However, trophic interactions among many of these species have not been investigated despite their influence on ecosystem dynamics. Our study seeks to increase understanding of the predator-prey relationship between two introduced species of lizards in an urban setting. We performed a field experiment at eight shopping plazas in Broward County, Florida, to investigate how the abundance, body condition, and survivorship of the Brown Anole (*Anolis sagrei*) would respond to reduction of its predator, the Northern Curly-tailed Lizard (*Leiocephalus carinatus*). We used Visible Implant Elastomers to individually mark brown anoles and built a Cormack-Jolly-Seber model (CJS) to estimate parameters. Additionally, multiple environmental and biotic factors such as insect density were tested in our model. Our results indicate that Brown Anole abundance and survival probability are significantly lowered by removal of the Northern Curly-tailed Lizard, whereas Brown Anole body condition was influenced only by time. Our results provide evidence for the role of the Northern Curly-tailed Lizard as a regulator of another introduced lizard in urban communities.

0879 ASIH STOYE CONSERVATION II, Friday 14 July 2017

Victoria Rodriguez, Chad W. Hargrave, Christopher P. Randle

Sam Houston State University, Huntsville, Texas, USA

Hybridization Between Two Livebearing Fish, the Endangered *Gambusia nobilis* and Introduced *Gambusia geiseri*, in Texas

Introduced species are a major cause of biodiversity loss because of predation, competition for limited resources and space, and hybridization with native taxa. Hybridization poses the greatest risk for native taxa when the non-native and native taxa are closely related. This can compromise the genetic structure of native populations and drive those taxa to extinction. Moreover, the extinction risk to native taxa by hybridization with non-native is greatest when native taxa are rare (e.g., endangered or threatened) because rare taxa often lack the genetic variation necessary mitigate ongoing hybridization events. Herein, we provide morphological and genetic evidence to suggest that the introduced Largespring Gambusia (*Gambusia geiseri*) and endangered Pecos Gambusia (*Gambusia nobilis*) are hybridizing within the San Solomon Spring complex, Reeves, Co. Texas. We inferred hybridization and gene flow from data collected on seven morphometric characters, nine meristic measurements, and five molecular markers (the mitochondrial gene Cytb; nuclear genes Rag 1, Rag 2, and RPS7; and one microsatellite) from the two species and the putative hybrid. Morphological data was analyzed using discriminant functions analysis. This analysis accurately identified three groups based on morphology (*G. nobilis*, *G. geisier* and putative hybrid) with ~99% confidence. Genetic data supported the morphology results. Several levels of genetic admixture within the population suggested extensive hybridization over several generations. Thus, the congruence between our morphological and molecular data suggest a need for an alternate conservation plan that may counteract the effects hybridization on the endangered Pecos Gambusia.

0864 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Aura S. Romero-Alemán[1], Sabas G. Sabas G. Mejía-Alvarez[1], Fredys F. Segura-Guevara[1], Angel L. Martínez-González[1], Glenys Tordecilla-Petro[2], Charles W. Olaya-Nieto[1]

[1]Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences. University of Cordoba., Lorica, Córdoba, Colombia, [2]Institución Educativa Lácides C. Bersal. Alcaldía de Lorica., Lorica, Córdoba, Colombia

Reproductive ecology of Bagre rayado *Pseudoplatystoma magdaleniatum* in the San Jorge River basin, Colombia

Reproductive ecology of Bagre rayado *Pseudoplatystoma magdaleniatum* in the San Jorge River basin, Colombia, was studied, and 178 individuals were collected between January and December 2013. Total length (TL) ranged between 32.1-113.7 (60.2 ±16.0) cm and total weight (TW) ranged between 158.0-11333.2 (1818.8 ±1970.0) grams. The gonads

were placed in Gilson solution, the Vazzoler scale was applicated and sexual proportion, sexual maturity index, spawning season, the length at first maturity, oocytes's diameter and fecundity were estimated. 110 females and 68 males were found, with sexual proportion female: male of 1.6:1, different from expected. The spawning season extends from March to October, the length at first maturity was estimated in 82.0, 61.6 and 72.4 cm TL for females, males and combined sexes, respectively, oocytes's average diameter was 83 mm and average fecundity estimated was 433040 oocytes. The results obtained in this study suggest that Bagre rayado is a rheophilous fish with synchronous gonadal development in two groups, spawning season extends from March to October, with annual spawning in the rainy season associated with water level of San Jorge River, oocytes of medium size and high fecundity, which is strongly associated to the weight of the ovaries.

0567 Herp Ecology II, Friday 14 July 2017

Jonathan Rose, Brian Halstead, Glenn Wylie, Michael Casazza

U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, CA, USA

Spatial and temporal variation in growth of the threatened giant gartersnake, *Thamnophis gigas*, in the Sacramento Valley, California

The growth rate of reptiles is highly plastic, and often varies among individuals, populations, and years in response to environmental conditions. For an imperiled species, the growth rate of individual animals is an important component of demographic models, and changes in individual growth rates may indicate population-level trends in survival and abundance. We analyzed a long-term dataset on the growth of a threatened reptile, the giant gartersnake (*Thamnophis gigas*) to characterize spatial and temporal variability in growth, and evaluate potential environmental predictors of growth. We collected data on the growth in snout-vent-length of *T. gigas* using capture-recapture data over 22 years (1995 - 2016) from eight sites distributed throughout the Sacramento Valley of California. We fit von Bertalanffy growth curves to these data, and found that male *T. gigas* grew faster and reached smaller asymptotic snout-vent-lengths than females. There was nearly equal variability in growth attributable to differences among years and among sites. From 2003 - 2016, we collected data on precipitation, temperature, and the abundance of fish and anuran prey at each site, and included these variables as predictors in growth models of *T. gigas*. We found that snake growth was positively related to the amount of precipitation that fell during the prior water year and the abundance of anurans at a site. Our results highlight the plasticity of growth in this threatened snake, and provide valuable data for future demographic modeling efforts. Results suggest that long-term, multi-population studies are needed to characterize growth patterns in reptiles.

0234 Herp Ecology III, Friday 14 July 2017

Adam Rosenblatt

Yale University, New Haven, CT, USA

What Happens to Black Caiman (*Melanosuchus niger*) When Their Prey Disappear?

Crocodilian populations across the globe are faced with myriad threats, some of which (poaching, habitat destruction, pollution) have been studied extensively. At the same time, the depletion of crocodilian prey populations due to competition with humans has received considerably less attention despite its potentially profound effects on crocodilian ecology and population dynamics. To address this knowledge gap I studied the ecology of a population of black caiman for three years in a region of Guyana experiencing a decline in fish abundance. During this time I quantified the relative proportions of different prey groups consumed by black caiman, as well as caiman movement patterns within a river system. I found that fish consumption varied across years and that cannibalism rates varied inversely with fish consumption. I also found that caiman in the river system can show very strong site fidelity year-round, and some hardly seem to move around the river at all. Together, these results suggest that black caiman in the study area may not migrate to new habitats as populations of their preferred prey decline, and that instead they may alter their feeding habits and target other prey more frequently, even their own species. Thus, declining primary prey abundance may threaten the long-term viability of some crocodilian populations.

0134 Amphibian Conservation IV, Sunday 16 July 2017

Jason Ross, Christina Feng, Michael Dreslik

Illinois Natural History Survey, Champaign, IL, USA

Evaluating Reptile and Amphibian Passage Gates using Remote Camera Traps

The Asian Carp bypass barrier in northeastern Illinois was built to prevent the invasive from entering the Great Lakes during high floods but has since resulted in habitat fragmentation. A year after the terrestrial barrier installation, wildlife passage gates were installed to facilitate movement of native organisms, including the state endangered Blanding's Turtle (*Emydoidea blandingii*). To determine the effectiveness of gates, we conducted 45 visual encounter surveys along the barrier and placed wildlife cameras on 14 of 20 gates. We found ten reptile species along the barrier and photographed nine using the gates. Common Gartersnakes (*Thamnophis sirtalis*), Northern Water Snakes (*Nerodia sipedon*), and Painted Turtles (*Chrysemys picta*) were commonly found along the barrier and were photographed using the gates frequently. Three Blanding's Turtles were found along the barrier, but none used the monitored gates. We found five amphibian species along the barrier and photographed three species using the gates. The cameras also documented abundant mammalian mesopredators, and our visual surveys found 34 depredated turtle nests. The barrier

may act as a conduit for nest predators to search along. Adult reptiles typically used gates during daylight hours whereas potential mammalian predators used gates at night. Overall, the gates were somewhat effective at facilitating movement of most reptile species present other than the Blanding's Turtles.

0503 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

David Rostal[1], Wade Carruth[1], Luke Wyrwich[2], Robert Hill[2], Brad Lock[3]

[1]*Georgia Southern University, Georgia, USA,* [2]*Zoo Atlanta, Georgia, USA,* [3]*International Reptile Conservation Foundation, Inc., Arizona, USA*

Reproductive patterns in five species of Asian turtles: *Manouria impressa, Heosemys depressa, Cuora mccordi, Cuora galbinifrons* and *Leucocephalon yuwonoi*

Asian turtle reproductive patterns vary greatly between species. Conservation efforts to breed some of these species have lacked key information. Here we present reproductive data on five different species of threatened Asiatic turtles and compare their reproductive traits: the Impressed tortoise (*Manouria impressa*), the Arakan forest turtle (*Heosemys depressa*), McCord's box turtle (*Cuora mccordi*), the Flowerback box turtle (*Cuora galbinifrons*) and the Sulawesi forest turtle (*Leucocephalon yuwonoi*). Reproductive cycles were monitored using a combination of ultrasonography and hormone analysis. All female individuals (*M. impressa*- 4, *H. depressa*- 1, *C. mccordi*- 4, *C. galbinifrons*- 4, *L. yuwonoi*- 5) were examined with ultrasound once per month for a minimum of 12 months. All five species were seasonal and reproduced at different times of the year. *Cuora mccordi* and *C. galbinifrons* hibernated during the winter and produced clutches of 1 to 2 eggs during the summer (June to August). Vitellogenesis and follicular development were primarily observed in fall prior to hibernation. *Cuora mccordi* produced multiple clutches. Both *M. impressa* and *H. depressa* produced single larger clutches of eggs but at different times of the year. *Manouria impressa* underwent vitlleogenesis and follicular growth during the fall and winter (October to March) and produced eggs in April and May. They displayed nest building characteristics like *Manouria emys. Heosemys depressa* underwent vitellogenesis and follicular growth in the summer and produced eggs in October to November. *Leucocephalon yuwonoi* displayed vitellogenesis and follicular growth during all times of year, with multiple size classes of follicle visible each month.

0248 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Betsie B. Rothermel, Ethan J. Royal

Archbold Biological Station, Venus, FL, USA

Driven by Extremes: Pond Community Structure on an Ancient Sand Ridge in Florida

Long-term studies of the fire-maintained Florida scrub ecosystem have generated deep understanding of vegetation dynamics and ecology of numerous imperiled species endemic to inland sand ridges of peninsular Florida. However, the disturbance regimes and community structure of seasonally inundated wetlands embedded in scrub have not been described, making it difficult to predict and mitigate effects of climate change or other anthropogenic threats. During a recent El Niño event, hundreds of seasonal ponds in a 2,100-ha protected scrub preserve on the Lake Wales Ridge failed to dry down. To determine community-level responses to enhanced wetland connectivity and other extreme conditions (i.e., water pH 3.3–4.7), we sampled larval anurans, fish, and macroinvertebrates in 30 ponds from April–December 2016. We used multiple linear regression to examine factors influencing species richness and relative abundance (catch-per-unit-effort in dipnets and minnow traps), with data pooled or averaged across four sampling events. In total, we detected 10 species of amphibian, three native fishes, and two non-native fishes (African Jewelfish, Walking Catfish). Despite high water levels, non-native fish invaded fewer than nine ponds. Abundances of larval hylids and ranids were affected by water chemistry and pond depth/area but not by abundance of native fish or predatory macroinvertebrates. Vertebrate richness ranged from 1–10 species and was significantly related to water chemistry, pond depth/area, and an area-weighted index of wetland proximity. Ongoing, multi-year sampling will be needed to clarify effects of hydrological variation, fire, and other disturbances on occupancy dynamics and community structure in this unique system.

0476 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

John Rowe[1], Chelsea Martin[1], David Clark[1], Carlos Valle[2], Cristina Vintimilla[2]

[1]Alma College, Alma, Michigan, USA, [2]Universidad San Francisco de Quito, Quito, Ecuador

Habitat Use and Spatial and Thermal Ecology of Two Species of Lava Lizards (*Microlophus*) on Islas Santa Cruz and San Cristóbal, Galápagos

We used radiotelemetry to study habitat use, spatial, and thermal ecology of two *Microlophus* species on Galápagos. During the warmest time of the year (February-March), use of rock faces generally declined throughout the day while during August, the use of rock faces was generally highest during midday. As measured by minimum convex polygons, males of both species occupied larger areas than did females although there were no significant species or seasonal effects. When we parceled daily distances moved into three daily time segments, males moved farther than did females in *M. indefatigabilis*. In *M. bivittatus*, neither sex nor season affected distances moved although movement increased over the course of the day. Hourly T_s was cyclic with a sharp increase occurring between 0600-0700 h, a peak (*M. indefatigabilis*) or plateau (*M.*

bivittatus) occurring during midday, with a gradual decline beginning during the late afternoon and continuing through the evening and early morning hours of the following day. Microhabitat temperature cycling indicated that lizards probably used open rock faces during the morning warming phase but used shaded microhabitats to avoid excessive midday temperatures, particularly during the warmest times of the day and during the warmest time of the year (February-March). Male *M. indefatigabilis* maintained significantly higher T_s than did females throughout the course of the day. Female *M. bivittatus* maintained higher T_s values than did males, apparently by selecting relatively warm sleep sites relative to males. However, in August, male *M. bivittatus* maintained relatively high T_s than did females especially during midday.

0669 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Freya Rowland, Raymond Semlitsch

University of Missouri, Columbia, MO, USA

The Ecological Role of Pond-Breeding Amphibians

Amphibians with complex life cycles can have substantial effects on both the aquatic and terrestrial habitats they inhabit during their larval, juvenile, and adult stages. Furthermore, it has been shown that at high densities, amphibian larvae can strongly influence nutrient cycling and serve as important prey or predators. Yet, we do not fully understand the importance of amphibians to aquatic communities compared to abiotic factors, particularly in the absence of density effects. Here we present results comparing the relative importance of bottom-up effects including light supply (low/high) and nutrients (low/high), versus top-down effects of Southern Leopard Frog tadpoles (*Lithobates sphenocephalus*; presence/absence) and larval Spotted Salamanders (*Ambystoma maculatum*; presence/absence). Tadpoles had stronger effects on multiple components of the food web (e.g., algae, Daphnia, chironomids) than light and nutrients, whereas salamanders only affected Daphnia biomass. In addition, overall zooplankton biomass was 65% higher in treatments without tadpoles. We also show that light availability and amphibian community can have significant impacts on the size-independent nutrient content of metamorphs, which has implications for aquatic-terrestrial linkages. These results provide evidence for the role of amphibians in community dynamics, including large effects on algal and invertebrate biomass, zooplankton communities, and nutrient flux between aquatic and terrestrial habitats. Furthermore, our data also support legacy effects of amphibians on the pond community. Weeks after the last amphibian metamorphosed, we could still detect changes in the food web relative to controls.

0687 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Averil Royal, Natalie Claunch, Mason DuBois, Kathleen Ivey, Elina King, Emmeleia Nix, Kiley Rucker, Tanner Shea, John Stepanek, Sunny Vansdadia, Emily Taylor

California Polytechnic State University, San Luis Obispo, California, USA

Body Size Effect on Thermal Tolerance in Certain Species of *Sceloporus*

Studies examining how physiological processes are affected as ectotherms respond to increased temperatures are crucial with the specter of global warming on the horizon. We tested the thermal tolerance of four species of *Sceloporus* lizards that vary in body sizes while exposed to normoxic (21% oxygen) and hypoxic gas (6% oxygen). In a previous study, we had observed that large *S. occidentalis* exhibited reduced thermal tolerance when exposed to hypoxic gas. The goal of this study was to examine whether body size affects thermal tolerance in additional lizard species and populations. *S. jarrovi* and *S. occidentalis* (the two larger species) exhibited a negative relationship between snout-vent length (SVL) and critical thermal maximum (CTMax) under hypoxic conditions, and *S. jarrovi* also exhibited this same relationship under normoxic conditions. In contrast, *S. virgatus* and *S. graciosus* (the two smaller species) did not exhibit negative relationships between body size and CTMax; in fact, in *S. virgatus*, there was a positive relationship between SVL and CTMax under normoxic conditions. Our study suggests that there is a significant negative relationship between body size and CTMax in large *Sceloporus* species only, and we suggest several mechanisms that could be responsible for these effects.

0064 Herp Systematics I, Sunday 16 July 2017

Sara Ruane[1], Christopher Austin[0]

[1]Rutgers University-Newark, Newark, NJ, USA, [2]Louisiana State University, Baton Rouge, LA, USA

Museum Specimens in the Age of Phylogenomics

Preserved museum specimens provide numerous data to biologists, but obtaining genetic data from formalin-fixed and fluid-preserved specimens is a challenge. Most efforts that aim to recover sequence data from such specimens are time-consuming and produce low data quality and quantity. Here we describe our work using a modified DNA extraction protocol combined with high-throughput sequencing to recover DNA from formalin-fixed and fluid-preserved snakes that were collected up to 100+ years ago; most of these species are poorly known and have no fresh tissue available for DNA sequencing. We successfully extracted DNA and sequenced 1000's of ultraconserved elements from 10 fluid-preserved snakes and included them in a phylogeny with modern samples. This phylogeny demonstrates the general use of such specimens in phylogenomic studies and provides genetic evidence for the placement of enigmatic

snakes, such as the rare Indian *Xylophis stenorhynchus*, the elusive elapid *Parapistocalamus hedigeri*, and the only known specimen of a ~50 year old *Toxicocalamus ernstmayri*. Our study illustrates the importance of museum collections in modern research, even for large-scale genetic work.

0840 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Cassandra L. Ruck[1], Nicholas J. Marra[1], Michael J. Stanhope[2], Mahmood S. Shivji[1]

[1]Save Our Seas Shark Research Center USA, Nova Southeastern University, Dania Beach, FL, USA, [2]Department of Population Medicine and Diagnostic Sciences, Cornell University, Ithaca, NY, USA

Global Population Genomics of the Great Hammerhead Shark, *Sphyrna mokarran*

The great hammerhead shark, *Sphyrna mokarran*, is a circumglobal coastal-pelagic species of high conservation concern (IUCN Red List Endangered). An earlier analysis of the mitochondrial control region in globally distributed animals uncovered two highly divergent matrilineal lineages in this species (Testerman et al. In prep.). Here we present preliminary findings of a genomic level assessment of global population dynamics of the great hammerhead shark with an analysis of nuclear single nucleotide polymorphisms (SNPs) and whole mitochondrial genomes (17,719 bp). Genotyping-by-sequencing was used to genotype SNPs across 181 individual great hammerhead sharks. Preliminary principle component analysis of the SNP data reveals at least three, distinct global populations: the Western Atlantic, the Northwest Indian Ocean, and Australia. Mitochondrial genomes were generated via a long PCR and sequenced on an Illumina MiSeq platform. Preliminary analyses of 8 whole mitochondrial genomes supports two highly divergent, matrilineal evolutionary lineages. Further analyses will investigate the complex evolutionary dynamics of the great hammerhead shark.

0908 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kiley Rucker, Adam Aslam, Natalie Claunch, Mason DuBois, Kathleen Ivey, Elina King, Emmeleia Nix, Averil Royal, Tanner Shea, John Stepanek, Sunny Vansdadia, Emily Taylor

California Polytechnic State University, San Luis Obispo, CA, USA

Testing the Effect of Blood Oxygen Carrying Capacity on Thermal Tolerance in Lizards

Despite numerous studies, the physiological mechanisms behind thermal tolerance in air-breathing organisms remain poorly studied and are a major area of interest in light of impending climate change. We tested the oxygen- and capacity-limited thermal tolerance (OCLTT) hypothesis, which states that as an organism's metabolic rate increases due to rising temperatures, it reaches a point at which its circulatory system cannot sustain its body's demand for oxygen and the animal loses coordinated muscle control. This point is deemed their critical thermal maximum (CTMax). If the OCLTT is true, then animals with induced anemia (representing reduced blood oxygen carrying capacity) should have lower CTMax than control animals. We tested how the CTMax of Western fence lizards (*Sceloporus occidentalis*) is affected by their blood oxygen carrying capacity by experimentally reducing their hematocrit by 50-60% over two days, then heating them in either normoxic air (21% oxygen) and hypoxic air (6% oxygen). Control lizards were also tested. Sex, final hematocrit, and oxygen treatment significantly affected the CTMax. Females exhibited higher CTMax than males; lizards with lower hematocrit exhibited lower CTMax; and lizards exposed to hypoxic gas had lower CTMax than those exposed to normoxic gas. We are also currently examining the effect of induced anemia on release of immature (e.g., polychromatophilic and/or mitotic) red blood cells to examine whether mature red blood cell count was related to CTMax. Understanding the physiological mechanisms responsible for the CTMax will help allow us to understand the role of thermal tolerance in animals' responses to climate change.

0510 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Friday 14 July 2017

Ariana Rupp[1], David Sever[2]

[1]University of Louisiana Lafayette, Lafayette, LA, USA, [2]Southeastern Louisiana University, Hammond, LA, USA

Junk in the Trunk: Caudal Courtship Glands Present in Plethodontid Salamanders Without Mental Glands

Salamanders in the family Plethodontidae exhibit a unique tail-straddle walk during courtship that can include the use of sexually dimorphic mental glands and caudal courtship glands. Mental glands are found in the skin of the lower jaw and caudal courtship glands are found in the skin of the dorsal base of the tail in some male plethodontids. Both are thought to increase female receptivity during courtship. While many studies focus on the variation and possible evolution of mental glands, few studies of caudal courtship glands exist and only the male morph A specimens of *Eurycea wilderae* are known to have caudal courtship glands without the presence of mental glands. This study analyzed museum specimens from genera known for absence of mental glands and used standard histological methods to determine presence or absence of caudal courtship glands. Presence of mature sperm in the Wolffian duct was also analyzed to identify sexual maturity and breeding status of males. Results show that there are caudal courtship glands present in males of species with no mental gland present, indicating the importance of these glands in courtship behavior. More data must be collected on caudal courtship glands before character optimization on a

phylogeny would be useful for studying their evolution, but our data suggest that these glands may be driving the tail straddle walk in Plethodontidae.

0619 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Amelia Russell[1], Kyle Brown[1], Michaela Lambert[2], Tracey Tuberville[3], Melissa Pilgrim[1]

[1]University of South Carolina Upstate, Spartanburg, SC, USA, [2]University of Kentucky, Lexington, KY, USA, [3]University of Georgia, Athens, GA, USA

Mercury Bioaccumulation in Florida Green Watersnakes (*Nerodia floridana*) Inhabiting Former Nuclear Cooling Reservoirs on the Savannah River Site

Anthropogenic activities have significantly increased the amount of mercury (Hg) cycling globally. Mercury can become bioavailable, accumulate in organisms, biomagnify in food webs, and can negatively impact wildlife health. Mercury contamination on the Savannah River Site (SRS) is a result of atmospheric deposition, coal combustion, and use of contaminated water from the Savannah River in nuclear reactor cooling reservoirs. Florida green watersnakes, *Nerodia floridana*, are primarily piscivorous top predators that inhabit the reservoirs and can serve as bioindicators of Hg contamination. We captured 76 snakes from three reservoirs: Pond B, Pond 2, and PAR Pond. Total mercury (THg) concentrations in watersnake tail tissue from Hg contaminated reservoirs ranged from 0.167 ppm to 2.10 ppm dry weight. Although snake THg concentrations were not significantly different among sites, we determined there was a significant relationship between snout-vent length and THg in *N. floridana*. Our work demonstrated that *N. floridana* can serve as useful bioindicators of Hg contamination in aquatic ecosystems and aid in conservation efforts.

0084 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kelsi Rutledge[1]

[1]University of California Los Angeles, Los Angeles, CA, USA, [2]University of North Carolina Wilmington, Wilmington, NC, USA

Nekton Utilization of Created and Natural Intertidal *Crassostrea virginica* Reefs

Since the 1970s, eastern oyster restoration efforts have increased. Oyster reefs provide habitat and refuge for organisms, improve water quality, and decrease erosion. Oyster restoration projects aim to construct reefs that function similarly ecologically to their natural counterpart. Therefore, post-creation monitoring of these reefs is crucial in determining their success. However, monitoring is often lacking or focused on harvest size rather than ecosystem services such as nekton utilization. This study examines

nekton utilization among created reefs compared to natural reefs in an estuary in North Carolina. The objective was to determine whether the created reefs function similarly to the natural reefs in abundance, species richness, and fish size. Through seine netting and Breder traps, reefs were sampled over a 5 month period. No significant difference was detected among reefs for nekton abundance, species richness and standard length. This is a promising result for future management, indicating the success of restoration efforts of one important ecosystem service.

0918 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Travis Ryan

Butler University, Indianapolis, IN, USA

Timing of Breeding Migrations and Metamorphosis: The Lasting Impact of Ray Semlitsch's Early Career Research

Like many ecologists, much of Ray Semlitsch's early research was field-oriented and descriptive in nature. As his career advanced, Ray incorporated complex experiments and large-scale field manipulations into his research program, and his reputation as one of his generation's most influential ecologists is based on this later research. Many of those early descriptive studies, however, have had a long-lasting impact in amphibian ecology and related fields. This presentation will analyze the literature to document the way that these early studies shaped the research of Ray and his collaborators and those working in amphibian ecology and related fields.

0062 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jung-Hwa Ryu, Jin-Koo Kim

Pukyong National University, Busan, Republic of Korea

Biogeography of Marine Fish around the Korean Peninsula

The Korean peninsula is surrounded by three seas: the Yellow Sea to the west, the Korean Strait to the south, and the East Sea (Sea of Japan) to the east. The currents between these seas, as well as paleoclimatic change, are likely to be the drivers of species diversity in Korean marine fish. To understand the current biogeography of fish species around the Korean peninsula, we measured the species composition of the marine fish community in Korean waters. Fish were collected from 16 stations around the Korean peninsula, primarily using set nets (though some gill nets were also used), four times a year from 2006 to 2013. Fish of 228 species were collected. The dominant species was *Engraulis japonicus* (81.6%), followed by *Trachurus japonicus* (9.2%) and *Sardinella zunasi*

(1.0%). The number of fish species, individuals, and species diversity (H') were highest at Gunsan in the mid-Yellow Sea, and lowest at Gwangyang in the mid-Korean Strait. Based on a Bray-Curtis similarity of 35%, the 16 stations fell into five groups, group A, comprised of three stations in the Yellow Sea; group B, comprised of two stations in the western Korean Strait; group C, comprised of two stations in Jeju Island; group D, comprised of two stations in the eastern Korean Strait and two in the southern East Sea; and group E, comprised of four stations in the mid-to northern East Sea. These groupings may have been determined by the characteristics of the sea currents or water masses.

0289 Amphibian Conservation I, Sunday 16 July 2017

Allison Sacerdote-Velat[1], Mary Beth Manjerovic[2], Rachel Santymire[2]

[1]Chicago Academy of Sciences, Chicago, IL, USA, [2]Lincoln Park Zoo, Chicago, IL, USA

Community, Health, and Stress Response of Reintroduced and Resident Amphibians to Oak Woodland Restoration

To improve oak regeneration in Illinois forested wetlands, a restoration project was implemented that creates light gaps via invasive understory removal and selective thinning of overstory trees. Restoration sites include a Wood Frog (*Lithobates sylvaticus*) reintroduction site where persistence and recruitment has been documented since 2010. To determine the impact of oak restoration on amphibian communities, we began a three-year study to examine amphibian community structure, *Batrachochytrium dendrobatidis* (*Bd*) incidence, and amphibian stress in five restoration sites and one control site along the Des Plaines River. In 2016, wood frogs expanded breeding from two ponds to four ponds. We observed a north-south gradient of low to high representation of Spring Peepers (*Pseudacris crucifer*), which are thought to be declining throughout the region. We collected 188 chytrid swabs, and 410 non-invasive stress swabs for cortisol (CORT). Of these samples, 33 tested positive for *Bd* resulting in a sample prevalence of 17.5% across sites. *Bd* was detected in four of six sites. *Bd*-positive species included Green Frogs (*Lithobates clamitans*), Bullfrogs (*Lithobates catesbeianus*), Northern Leopard Frogs (*Lithobates pipiens*), Boreal Chorus Frogs (*Pseudacris maculatum*), Spring Peepers, American Toads (*Anaxyrus americanus*), and Blue-Spotted Salamanders (*Ambystoma laterale*). *Bd* was not detected in swabs from Wood Frogs or Tiger Salamanders (*Ambystoma tigrinum*). CORT levels of each species were similar across sites, but Northern leopard frog CORT was significantly greater with positive *Bd* status. As habitat quality improves over the next two seasons, we expect increased amphibian diversity, decreases in CORT across sites, and decreased incidence of *Bd*.

0341 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Daniel Saenz[1], Toby Hibbitts[2], Cory Adams[1]

[1]*Southern Research Station, US Forest Service, Nacogdoches, Texas, USA,* [2]*Department of Wildlife and Fisheries Sciences, Biodiversity Research and Teaching Collections, Texas A&M University, College Station, Texas, USA*

The Calling Ecology of the Crawfish Frog (*Lithobates areolatus*) in Texas

The crawfish frog has suffered declines across much of its range and is currently considered for state protection in five of the twelve states where it occurs. It is a secretive species that spends most of its time in or near crawfish burrows, making it difficult to detect outside of the breeding season. During the breeding season, however, they have exceptionally loud advertisement calls that allow auditory surveys to be conducted with relative ease. Most of what is known about the biology of the crawfish frog is from studies conducted in the northern portion of their range. Our study is an attempt to learn about crawfish frog seasonal calling phenology, diel calling activity, and the exogenous factors that influence calling in the southern part of its range, the coastal prairie of Texas. We conducted auditory surveys for crawfish frogs and collected environmental data at the Attwater Prairie Chicken National Wildlife Refuge in Austin and Colorado Counties, Texas. Our analyses suggest that several abiotic factors are important predictors of crawfish frog calling activity. Breeding pond water depth, relative humidity, and rainfall have a significant positive relationship with crawfish frog calling and water temperature and wind speed are negatively associated. We suggest that crawfish frogs from the coastal prairies of Texas behave quite differently than their northern con-specifics with regard to calling phenology, daily calling activity, and possibly their relationships with abiotic factors that influence calling activity.

0872 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY II, Thursday 13 July 2017

David Saenz, Michael Markham, Kirk Winemiller, Jose Alves Gomes

Texas A&M University, College Station, Texas, USA

Effects of Melanocortin Hormones on the Electric Organ Discharge of Two Weakly Electric Fish

Gymnotiform fishes are a diverse and widely distributed order of Neotropical fish frequently studied for their ability to generate and detect electric fields. These nocturnal fish use electrolocation as a means of navigating and foraging in dark, turbid waters. The waveforms and frequencies of their electric organ discharges (EODs) have species specific properties, allowing them to signal and identify conspecifics during social interactions. We examined one mechanism regulated by adrenocorticotropic hormone (ACTH) through which some species increase the amplitude of their EOD in response to circadian rhythms and social stimuli. This is particularly interesting because amplitude changes involve the regulation of sodium channels in the membranes of electrocytes (electric cells). These ion channels are highly conserved throughout the evolutionary history of vertebrates, but may have undergone interesting adaptations in electric fishes. We tested the effects of ACTH in two species, *Brachyhypopomus bennetti* and *Sternopygus*

obtusirostris (Gymnotiformes, Hypopomidae and Sternopygidae), by injecting fish with 1 μg of ACTH per gram of body weight and recording fish EODs in a recording chamber. We also used current-clamping techniques on single electrocytes, in order to determine the effects of ACTH on membrane potentials. We found variable effects of ACTH between species that we suspect are due to the unique properties of the waveforms each species produces.

0633 LFC Multi-Stressor Effects, Friday 14 July 2017; LFC SALLY L. RICHARDSON BEST STUDENT PAPER

Andria K. Salas[1], Preston S. Wilson[1], Megan S. Ballard[1], Andrew H. Altieri[2], Timothy H. Keitt[1]

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The Role of Intermittent, Short-range Acoustic Cues on Larval Fish Settlement

The combined acoustic behavior of soniferous organisms living on coral reefs produces a soundscape that is predicted to have a role in the settlement behavior of fish larvae. However, the distance at which acoustic cues may operate to influence navigation and habitat selection is unclear given the complexities of shallow water sound propagation and uncertainties about the hearing abilities of larval fishes. Here we investigate the role of acoustic cues in settlement using an individual-based model. In the model, we use a conservative detection distance as informed by sound propagation modelling calibrated with acoustic transects. Cues are available only intermittently as informed by field data. Given the frequency-specific sound detection abilities of fishes, only a portion of the soundscape will have the frequency and amplitude characteristics to serve as potential acoustic cues, thus creating an acoustic cuescape composed of intermittent cues. We recorded the soundscapes of four coral reefs in Caribbean Panama for six weeks and predicted the sounds most likely to be used as cues by larval fishes by using knowledge of their hearing sensitivity. Using an individual-based model, we tested the relationship between the temporal characteristics of the acoustic cues and settlement success. To do this we created cue time-series that represented the temporal variability observed at the four reef sites. We found that even short range, temporally variable cues produced at a low rate improved settlement success, suggesting these cues may improve the probability of survival under a broader range of conditions than has been typically considered.

0166 Herp Ecology III, Friday 14 July 2017

Steven Salinas, Tristen Ortega, Jesús Rivas

New Mexico Highlands University, Las Vegas, New Mexico, USA

Control of Northeastern New Mexico Rivers: American Bullfrogs (*Lithobates catesbeianus*) vs. Northern Crayfish (*Orconectes virilis*) vs. Rainbow Trout (*Oncorhynchus mykiss*)

The cumulation of a multiyear study of invasive and nonnative species in river systems in Northeastern New Mexico. Invasive species are among the worst conservation problems; however, the presence of an invasive species can produce a synergistic effect on others increasing their odds of success and their impact in the environment. Continuous analysis of the diet of a population of American Bullfrogs we found it consisted of over 80% of Northern Crayfish, another invasive. Given the high proportion of crayfish in the diet of bullfrogs we hypothesize that Bullfrogs follow the Crayfish and it may first require the crayfish to get establish before they can successfully colonize a new habitat. In this study, we explore the density of bullfrogs and crayfish in locations where there are bullfrogs, trout, and crayfish, a site with both bullfrogs and crayfish but not trout, and a site where only crayfish occur. Which species has the control of the Northeastern New Mexico Rivers? In areas where Rainbow Trout of been stocked, crayfish and bullfrog populations are pushed back. In areas with bullfrog removal a 73% increase in crayfish population occurs when compared to areas with bullfrogs and crayfish. Crayfish populations with no predation have a population difference of nearly 1200% compared to areas with predation by both trout and bullfrogs.

0573 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Emily Sanchez, Christopher R. Tracy

California State University, Fullerton, Fullerton, CA, USA

Effects of Sex and Season on Thermoregulatory Activity of Common Chuckwallas, *Sauromalus ater*

Intraspecific thermoregulatory variability due to habitat, temperature availability, and seasonality have been studied extensively, but fewer studies focus on thermoregulatory variability due to sex. Sex-specific thermoregulatory strategies may affect relative fitness disproportionately, driving differences in response to environmental changes (e.g., climate change). The common chuckwalla (*Sauromalus ater*) is a great model for investigating sex differences in thermoregulation because they are sexually dimorphic in behavior; males hold territories that they actively patrol and defend. We hypothesized that male and female chuckwallas thermoregulate to the same temperatures and to the same extent, but that males spend more time thermoregulating outside of refuges, to defend territories, compared to non-territorial females. Body temperatures of free-ranging adult chuckwallas (ten of each sex) were continuously recorded from May to early July 2016, as were operative temperatures in crevices and above ground basking sites to provide context for lizard body temperatures. Preliminary analyses compared effects of month and sex on the average time chuckwallas selected body temperatures

above, below, and within their preferred temperature range (34-39˚C) in May, June, and July. Chuckwallas on average spent significantly more time above and within preferred range in July, and below temperature range in May. This reflects temporal and spatial changes in availability of suitable operative temperatures. On average, males in June spent significantly more time within and above preferred range than females, who spent significantly more time below. This may reflect different late–season reproductive priorities, with males seeking final mating opportunities aboveground, and females seeking underground nesting sites.

0273 ASIH STOYE ECOLOGY & ETHOLOGY III, Friday 14 July 2017

Jessica Sanchez, Joel Trexler

Florida International University, Miami, FL, USA

Testing alternative hypotheses for the evolution of herbivory using the Sailfin Molly (*Poecilia latipinna*)

Relative to carnivory, herbivory is thought to be an inefficient diet. But herbivory evolved from carnivorous ancestors in many metazoan groups and has been maintained alongside animal-containing diets throughout most of these lineages, suggesting that herbivory is adaptive in some circumstances. We tested two hypotheses to explain the adaptive evolution of herbivory: 1) The Heterotroph Facilitation Hypothesis, which states that herbivory is adaptive because herbivores supplement their diets with heterotrophs; and 2) the Lipid Allocation Hypothesis, which states that herbivory is adaptive because consumption of algae with high lipid concentrations is nutritionally similar to a carnivorous diet. We placed enclosure cages stocked with Sailfin Mollies (*Poecilia latipinna*) in the Everglades and manipulated the composition of colonizing epiphyton using shading and phosphorus. We then examined the effects of this varying food quality on lipid assimilation, growth and survival of juvenile *P. latipinna*. Epiphyton grown in the different conditions varied in heterotroph abundance, stoichiometry and fatty acid composition, but only fatty acid composition explained the differential survival of fishes. The abundance of algal-derived fatty acids drive fish survival, specifically eicosapentaenoic acid (EPA;$F = 6.639$, $df = 2$, $R^2adj = 0.339$, $p=.028$) and docosahexaenoic acid (DHA; $F = 5.588$, $df = 1$, $R^2adj = 0.294$, $p=0.04$). Our results do not support the Heterotroph Facilitation Hypothesis, but instead support the Lipid Allocation Hypothesis (Sanchez and Trexler 2016). These results are similar to our recent lab study, providing further support for the Lipid allocation hypothesis as a mechanism for diet evolution.

0851 General Ichthyology I, Sunday 16 July 2017

Michael Sandel[1], Andres Aguilar[2], David Neely[3], Kayla Fast[1]

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Evolution of the Coolest Hotspot: Interspecific Phylogeny of Baikal Sculpins

Ancient lakes are renowned as hotspots of freshwater biodiversity, and Siberia's Lake Baikal ranks as the oldest, deepest, and most biodiverse freshwater lake on Earth. Baikal is thus a biogeographic anomaly, standing in stark contrast to the latitudinal biodiversity gradient. Plants and invertebrates comprise the vast majority of the 1,500 Baikal endemic species, but sculpins represent the sole vertebrate radiation within the Lake. Extensive morphological variation among Baikal sculpins led to the description of twelve genera (10 endemic) and two endemic families. In order to understand the mechanisms driving adaptive radiation in Baikal, we conducted a multi-locus phylogenetic analysis including 24 described species and 3 undescribed groups. Sculpins were sampled extensively throughout Baikal and select tributaries. PCR and Sanger sequencing were used to construct DNA sequence alignments for four mitochondrial genes (ATP6, ATP8, CO1, Cytb) and multiple nuclear genes. Phylogenies inferred using multiple optimality criteria supported a monophyletic Baikal radiation, but consistently rejected the monophyly of certain Baikal endemic sculpin families and genera. A new sister taxon is identified for the Baikal radiation. We provide a novel hypothesis of interspecific relationships among Baikal sculpins that discords with best available morphological data. We recommend appropriate taxonomic changes, and discuss conservation implications as well as ongoing research in functional genomics.

0192 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Mark Sandfoss, Harvey Lillywhite

University of Florida, Gainesville, Florida, USA

Precipitation Patterns and Hydration Status of a Unique Insular Snake Population

Water is essential to survival, and thus invasion of habitats having limitations of water necessitates adaptations to maintain water balance. A unique population of Florida cottonmouth, *Agkistrodon conanti*, inhabits Seahorse Key (SHK) near coastal Levy County, Florida where they are entirely terrestrial without permanent sources of fresh water. Insofar as cottonmouths are generally associated with freshwater habitats, this insular population of snakes is likely to exhibit adaptations for living with limited resources, especially water. Our objective is to measure the hydration status in free-ranging snakes to better understand the possible stresses related to dehydration. We hypothesize that hydration status of cottonmouths on SHK will follow patterns of precipitation. We tested dehydration and drinking behavior of cottonmouth snakes inhabiting SHK from 2001–2017. Snakes were captured and tested for thirst immediately following capture. They were provided access to fresh water for at least 12 hours while we noted drinking and weighed snakes before and after. Mass gains reflected drinking

and therefore hydration status. These data were compared to satellite data for cumulative precipitation during seven days preceding capture (NASA TRMM & GPM). Preliminary results support the prediction that hydration status of cottonmouths on SHK correlates strongly with rainfall patterns, suggesting that snakes rely on periodic rainfall to remain hydrated.

0472 Lightning Talks I, Friday 14 July 2017

Inah Satiro[1], Bruno Juca-Queiroz[1], Waslley Pinheiro[1], Isabelle Arthaud[1], Thiago Basilio[2], Jones Santander-Neto[2], Vicente Faria[1]

[1]Universidade Federal do Ceará - UFC, Fortaleza, CE, Brazil, [2]Instituto Federal de Educação, Ciência e Tecnologia do Espírito Santo - IFES, Piuma, ES, Brazil

Tiger shark seasonality and structure in the southwestern equatorial Atlantic derived from fisheries data

The goal of the present study was to describe tiger shark, *Galeocerdo cuvier*, seasonality and structure along the southwestern equatorial Atlantic. This description was based on fisheries data from three independent fleets operating from northern to northeastern Brazil in coastal areas, along the continental shelf break, and over oceanic banks. Sampling occurred in multiple periods from 1999 to 2016. Tiger sharks captured in coastal areas are primarily juveniles and occur seasonally, mainly from February to April. Tiger sharks appear to separate by size across locations. Juveniles (< 200cm) are captured in coastal and at the continental shelf break. Young immature (200 to 300 cm) and adult individuals (> 300 cm) are captured from the continental shelf break to oceanic banks.

0572 Herp Genetics, Saturday 15 July 2017

Anna Savage, Matthew Lawrance, Elizabeth Abney, Katherine Mansfield

University of Central Florida, Orlando, Florida, USA

Co-Evolution of Immune Genes and Herpesviruses in Juvenile Green and Loggerhead Sea Turtles

The tumor disease fibropapillomatosis (FP) causes cutaneous benign tumors in all sea turtle species and is linked to a chelonid fibropapilloma-associated herpesvirus (CFPHV) that globally infects juvenile sea turtles. Here, we investigate the host and pathogen genetic factors influencing sea turtle FP dynamics by sequencing turtle immune genes and CFPHV genes from juvenile green turtles (*Chelonia mydas*) and loggerhead turtles (*Caretta caretta*) from Florida, USA. Immune genes of the Major Histocompatibility Complex (MHC) code for proteins that identify pathogen molecules and present them to T-cells to initiate acquired immunity. MHC genes are therefore ideal markers for measuring the genetic viability and health of populations, particularly

in the context of disease. We sequence MHC class I loci from *C. mydas* and *C. caretta* individuals with and without FP and CFPHV, as well as three genetically variable CFPHV genes, and conduct co-phylogenetic analyses to test for associations between host immune genes and viral strains. We also determine whether FP occurrence is linked to MHC variants or viral strains to better resolve the relationship between CFPHV infection and development of FP tumors. Understanding the mechanisms driving FP emergence is a necessary first step in developing the management and conservation approaches needed to mitigate this infectious disease.

0904 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Neha Savant, Matthew Palmer

Columbia University, New York, NY, USA

Genetic Structure of the Long-tailed Salamander, *Eurycea lonigcauda longicauda*

For wild species to sustain healthy populations, it is often essential for individuals to maintain sufficient dispersal and movement between habitats and populations. Maintaining connectivity across a wide variety of landscapes is especially important for amphibians, most of which are small-bodied, slow-moving, and moisture-dependent. Many studies assume that amphibian populations are inhibited by anthropogenic disturbance, but some species' distributions and movements can be influenced more by other factors. The range of the long-tailed salamander (*Eurycea longicauda lonigcauda*) is associated with physiographic provinces of the Appalachian Valley and though the species is threatened in some states, it can still be found near residential and agricultural areas. Previous studies in New Jersey suggest that this species' distribution may be highly influenced by finer scale hydrology and geology. As dispersal is difficult to study and often requires intensive, large-scale and long-term demographic studies, genetic studies can reduce the effort required to describe dispersal. Using microsatellites, I will examine the genetic structure and connectivity of long-tailed salamanders in different hydrologic landscapes: pond networks and stream networks. Genetic variation of salamanders found near ponds will be compared to variation of salamanders found near stream networks with the expectation that salamanders in stream networks will be more genetically similar due to the continuous moisture rich habitat offered by streams. Understanding how hydrology and geology can affect genetic structure will help delineate populations and can inform effective management for this threatened species.

0367 AES Conservation & Management I, Saturday 15 July 2017

Matthew Scanlon[1], Bryan Fluech[2], Christine Bedore[1]

[1]Georgia Southern University, Statesboro, GA, USA, [2]Marine Extension and Georgia Sea Grant, Brunswick, GA, USA

Evaluating elasmobranch interactions in the Georgia shrimp fishery

The Georgia shrimp fishery has seen a dramatic decrease in profit and productivity since the 1980's due to a number of economical factors. Additional, yet undocumented, pressures on this fishery include interactions between foraging sharks with trawl gear. Fishermen report that sharks frequently bite nets in an attempt to prey on netted fish, resulting in large holes in the mesh or entanglement of the animal in the gear. Further elasmobranch interactions with trawl gear occur as bycatch; shrimp trawls represent nearly 100% of elasmobranch commercial bycatch in Georgia state waters, the species composition of which is largely unstudied. Shark interactions with nets were detailed through fishery-dependent observations on commercial shrimp boats in Georgia (n=5 vessels). Number of damaged sites, location of damage on the net, estimated repair time, and tow/environmental variables (turbidity, temperature, depth, tow time, and tides) were recorded for 38 trawling events between May-November 2016. Sharks bit an average of 1.55 holes (± 0.4 SE) in the nets for every trawl. All elasmobranch bycatch was also identified and measured for each trawl day. Of twelve total species caught, three species in particular accounted for 75% of all elasmobranch bycatch (n=37 trawls): *Rhizoprionodon terraenovae* (CPUE = 2.47 ± 0.38 individuals per trawl hour ± SE), *Gymnura micrura* (CPUE =1.5 ± 0.37), and *Dasyatis sabina* (CPUE =1.17 ± 0.23). Because the fishery has decreased in size and effort over the last two decades, it is unknown if bycatch in shrimp trawls are drastically decreasing stock sizes in elasmobranch species.

0377 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Simon Scarpetta, David Ledesma

University of Texas at Austin, Austin, Texas, USA

Cranial Osteology of Extinct and Extant Gerrhonotine Lizards

Gerrhonotinae is an extant clade of anguid lizards with a rich Cenozoic fossil record in the Americas and a diverse assemblage of species that still inhabit regions of North America and much of Central America. My preliminary analysis of x-ray computer tomography (CT) scans of a previously known but unidentified Pliocene lizard specimen from the Palm Spring Formation in Anza Borrego Desert State Park in southern California indicate that it is a gerrhonotine of the genus *Elgaria* and is potentially a new species. Species belonging to the genus *Elgaria* are currently found in western and central North America, often in mesic habitats. Despite the relative familiarity of some species to biologists and paleontologists, comprehensive studies of the cranial anatomy of *Elgaria* are currently lacking. Description of the bones in the skull supplies useful data for examining morphological variation and phylogeny, and thus provides an excellent tool for any morphological study. Here, I describe the cranial anatomy of eight *Elgaria* species in addition to other gerrhonotine taxa, especially species from the genus *Gerrhonotus* and some *Mesaspis*, *Barisia*, and *Abronia*. I provide novel anatomical information for many of the almost 60 modern gerrhonotine species,

expanding the currently limited cranial osteological data available. Comprehensive cranial descriptions will supply the framework for diagnosing phylogenetic placement of fossils, in particular the Anza Borrego gerrhonotine specimen. I employ traditionally prepared skeletons as well as CT scans; the latter enables me to generate data about rare specimens of many gerrhonotine species for which no skeletal data exists.

0167 Amphibian Conservation II, Sunday 16 July 2017

Christopher Schalk[1], Carmen Montana[1], Kelsey Kralman[1], Daniel Leavitt[2]

[1]Sam Houston State University, Huntsville, TX, USA, [2]Arizona Game and Fish, Phoenix, AZ, USA

Functional distance and establishment of non-native species with complex life cycles

More than 80% of animals have complex life cycles (CLCs) and undergo distinct changes in ecology and morphology during ontogeny. The strength and type of factors regulating each life-stage may differ as an organism may occupy different niches during ontogeny. We examined the functional distance at larval and adult life-stages of two non-native anurans (Green Tree Frog [*Hyla cinerea*] and Bullfrog [*Lithobates catesbeianus*]) that have established in a Chihuahuan Desert anuran assemblage in Big Bend National Park. The larval and post-metamorphic stage of both non-native species occupied niche space outside the recipient assemblage. At the larval stage, the ability of the tadpoles to utilize permanent aquatic habitats and coexist with predatory fishes differentiated it from the majority of the native species that are restricted to temporary pools. At the post-metamorphic life stage, each species appears to have established by exploiting unoccupied niches in the recipient community. The arboreal habits of *H. cinerea* may enable it to utilize resources in microhabitats that are otherwise not used by native species as arboreal frogs are absent in this assemblage. The large body size of post-metamorphic *L. catesbeianus* may enable it to utilize larger food resources that are otherwise unavailable to the smaller-bodied natives. Both species have strong ties to permanent aquatic habitats, which suggests that their dispersal and impact will be localized to permanent aquatic sites.

0816 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Amy Schneider, Christopher Howey

Pennsylvania State University, University Park, PA, USA

Identification of Individual Timber Rattlesnakes Using Camera Trap Data

Snake biologists have typically struggled to estimate population sizes due to the secretive nature of snakes which leads to low recapture rates. Timber Rattlesnakes (*Crotalus horridus*) tend to congregate at den sites during ingress and egress throughout

the northern latitudes of the species' range. Although it may be difficult, time-consuming, or logistically unfeasible to personally monitor den sites, camera traps may be used to continuously monitor these sites throughout the day during these seasons. Further, wildlife biologists have successfully identified individuals of various species within camera trap photos using WildID software. We tested if this digital software could be used to successfully identify individual *C. horridus* in both the lab under controlled conditions and in the field while snakes were emerging from den sites. First, we brought captured *C. horridus* back to the laboratory where we photographed individual rattlesnakes in various postures. We then determined if WildID software could successfully match photos of known individuals accurately. Second, we positioned a field camera (Reconyx Hyperfire camera trap) in front of a known den site where we have captured and photographed numerous individuals. The camera trap recorded a picture every 10 seconds throughout the egress period. We then determined if WildID software could accurately identify individuals emerging from the den. If this technique works, this would allow biologists to create individual encounter histories, which could be used to estimate population sizes. We will discuss the efficacy of this technique.

0857 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Tonia S. Schwartz[1], Randy L. Klabacka[1], Dawn Reding[2], Anne M. Bronikowski[2]

[1]Auburn University, Auburn, AL, USA, [2]Iowa State University, Ames, IA, USA

Targeted sequence capture for functional population genomics of genetic networks

Studies in evolutionary biology have focused largely on either genes and gene families, or organisms and populations. However, there has been relatively little focus on the evolution of genetic networks. While the idea that genetic networks – or a group of genes that produce protein products that must interact for cellular function - may be units of evolution has become accepted, relatively few studies have assesed this hypothesis in the context of selection. The development of cost-efficient high-throughput sequencing technologies has allowed for the genomic architecture of non-model organisms to be studied, and thereby has increased feasibility for evolutionary studies involving gene networks via targeted approaches. Here we describe a procedure to conduct sequence capture for full genetic pathways in a non-model organism starting with transcriptomic data. Our data was collected from populations of the western terrestrial garter snake (*Thamnophis elegans*). We sequenced 500 genes in focal molecular pathways from 96 individuals. The resulting sequence variation data can be used to test for evidence of natural selection at the level of the pathway. Determining the most effective reference for aligning the genomic sequence data in the absence of a reference genome is an obstacle of this approach. We address this question by mapping sequences to (1) a reference transcriptome, (2) predicted exons from the transcriptome, and (3) a de-

novo assembly of the sequence captured loci. We discuss the results in the context of optimization of this procedure for molecular ecologists interested in functional divergences in genetic networks across natural populations.

0232 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Katherine E. Schweiss[1], J. Marcus Drymon[2], Toby S. Daly-Engel[3], Nicole M. Phillips[1]

[1]The University of Southern Mississippi, Hattiesburg, MS, USA, [2]University of South Alabama Dauphin Island Sea Lab, Dauphin Island, AL, USA, [3]Florida Institute of Technology, Melbourne, FL, USA

Development of environmental DNA techniques to assess habitat usage in bull sharks (*Carcharhinus leucas*)

Identifying the distribution and habitat use of elasmobranchs traditionally requires setting nets, capturing, and handling the target species to attach tags and collecting tissue biopsies for genetic analysis. Such methods are costly, time consuming, and inflict stress to both target and non-target species. Environmental DNA (eDNA) samples provide a non-invasive approach to studying elasmobranchs, eliminating the need to capture or even observe the target organism. EDNA has been used to survey freshwater and marine species using a variety of methods. In the Gulf of Mexico, Bull Sharks (*Carcharhinus leucas*) are known to use the interface between freshwater and marine systems; however, the extent to which they use the rivers feeding these systems is unknown. To investigate riverine habitat use, we established a standard protocol for collecting and filtering highly turbid coastal water samples, extracting the DNA from the filters, and amplifying a target sequence specific to *C. leucas* via polymerase chain reaction (PCR). Water samples were filtered using a two-step filtration process, testing various filter sizes in each step, and DNA was extracted from the particulate material collected on the filters. Droplet digital PCR (ddPCR) was used to detect *C. leucas* DNA in each water sample. DdPCR can identify minute amounts of target DNA present with unparalleled precision by partitioning the sample into individual droplets, conducting PCR reactions, and quantifying resultant products from each droplet. Having a reliable and consistent method of filtering and amplifying *C. leucas* eDNA will improve our knowledge of this species' distribution and habitat usage.

0412 Snake Biology I, Sunday 16 July 2017

Jacob Scribner, Matthew Kwiatkowski

Stephen F. Austin State University, Nacogdoches, Texas, USA

Facial Stripes Influence Attack Frequency on Snake Models

Dark facial markings in vertebrates can serve a variety of functions, including glare reduction, social signaling, and aposematism. Dark facial markings in the form of stripes are common in some snake groups, but little is known about their function. It has been hypothesized that they may act as either social signals to conspecifics or as warning signals to potential predators. We tested the hypothesis that facial stripes act as signals to potential predators using plasticine models. Snake models were shaped with a plaster mold using brown plasticine that most closely matched the color of some local snake species. For half of the models, facial stripes were added using black plasticine. Models were placed at regularly spaced intervals, alternating those with and without facial stripes, along a little-used trail in the Stephen F. Austin Experimental Forest in eastern Texas. In an initial test, models were left for 72 hours, retrieved, and scored for attacks when visible markings from mammals or birds were present. Models with facial stripes had visible attack marks significantly more than models without stripes ($P = 0.002$). Our results seem to contradict the hypothesis that facial stripes act as a warning to predators. However, attacks on models were not random, suggesting that models with facial stripes were targeted. Models with facial stripes may have been perceived as more of a threat and were, therefore, attacked more frequently.

0525 ASIH STOYE ECOLOGY & ETHOLOGY II, Thursday 13 July 2017

Jason D. Selwyn[1], Paolo Usseglio[2], J. Derek Hogan[1]

[1]Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA, [2]Fundacion In-Nova, Castilla la Mancha, Spain

Fine-scale microhabitat usage of a putative habitat generalist reef dwelling goby, *Coryphopterus personatus*

Variability in habitat quality influences species both at the population level as well as the individual level. At the population level, habitat quality has been found to be a primary driver of metapopulations and dispersal dynamics, affecting the frequency and strength of dispersal polymorphisms. At the individual level, habitat quality affects the growth rate and reproductive output as well as the mortality rate, amongst other processes. A wide range of characteristics of any given habitat can be thought of as being either beneficial or harmful to any given species. As such, defining habitat quality needs to be done from the perspective of the species being studied. Using structure-from-motion photogrammetry we characterize fine-scale microhabitat usage across both habitat type and topographical features to determine microhabitat usage of a coral-reef goby, *Coryphopterus personatus*. Using a zero-inflated negative binomial analytical

approach we find that both the presence of shoals and the density of individuals within shoals are significantly influenced by aspects of both habitat topography and type. Understanding the factors defining habitat quality in a habitat generalist provides an important baseline for assessing the potential effects of future habitat degradation as is predicted to occur on coral reefs. Furthermore, these findings provide the basis for future studies seeking to understand how variation in habitat quality influence both individual and population scale processes.

0381 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Alexander Semenchenko

Far Eastern Federal University, Vladivostok, Primorskiy Territory, Russia

Phylogeny of the genus *Thymallus* (graylings) using complete mtDNA

Graylings (Thymallinae) are holarctic fishes, which have widespread distribution ranges across Eurasia and North American continents. As all salmonids, these fish live in rivers with pristine and cold water and often play an important role in game fishing and aquaculture. Despite such a great popularity, there are still many unresolved questions about taxonomic validity, phylogenetic relationships and biogeography of many grayling species. The recent phylogenetic studies have resulted in molecular trees with very poor resolution. Therefore, the goal of the current study is to reconstruct the phylogeny of grayling species collected from the distant locations in Siberia and in Far Eastern regions of Russia, including the additional data from Genbank. We sequenced the whole mitochondrial genome for each individual and used the Bayesian approach to build the phylogenetic tree based on the alignment matrix with the best-fitted gene partitioning scheme. Our analysis shows that the monophyletic group with two species, *Thymallus grubii flavomaculatus* and *T. tugarinae*, from the Amur River basin represents the most ancient divergence, which occurred about 5 Ma. Its sister lineage progressively expanded from Ponto-Caspian basin and Europe. The latter monophyletic group also included the lineages of several species/subspecies collected in the Amur River basin: *T. grubii*, *T. burejensis* and *T. baicalolenensis*, indicating that the common ancestor of all grayling species used in our study had lived in that watershed. Phylogeny of grayling fishes calibrated with the molecular clock approach provides us with a new knowledge about evolution and historical biogeography of freshwater fauna.

0882 Herp Ecology I, Friday 14 July 2017

Jeffrey Seminoff[1], Lisa Komoroske[1], Peter Dutton[1], Miguel Donoso[2], Maike Heidemeyer[3], Gabriel Hoeffer[4], T. Todd Jones[5], Shaleyla Kelez[6], Garrett Lemons[7], Nelly de Paz[8], Juan Manuel Rodriguez Baron[9], Laura Sampson[10], Lucia Santos Baca[11], Joel Schumacher[1], Maria Vejar Rubio[12], Patricia Zarate[13], Alan Zavala[12], Brian Popp[14]

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Trophic Ecology of Green Sea Turtles Across the Eastern Pacific Ocean: Insights from Bulk Tissue and Compound Specific Stable Isotope Analysis

The trophic ecology of a species is among its most fundamental biological aspects. Patterns of resource use and niche width affect somatic growth and demography, and have important implications for species resilience and management. Green sea turtles (*Chelonia mydas*) are present throughout tropical to temperate marine habitats worldwide and historical paradigms suggest they are obligate herbivores in these areas with diets consisting of seagrasses and/or marine algae. In the eastern Pacific, stomach content data indicate that green turtles are opportunistic omnivores that may occupy multiple trophic levels; however, the spatial patterns of their resource use in this region are unclear. Here we use stable-carbon and -nitrogen isotope analysis of bulk epidermal tissue from 718 green turtles distributed among 16 foraging areas from the US to Chile to determine isotopic niche space. We also use compound-specific $\delta^{15}N$ analysis of amino acids of 21 turtles from seven of these sites to decipher the baseline influence on stable isotope values as well as to describe the trophic position of green turtles. Our findings support that green sea turtles are opportunistic omnivores whose diets adapt to local prey bases; our data also confirm that local isotope values are influenced by broad-scale nitrogen cycling patterns as well as local-scale anthropogenic impacts. To our knowledge, this is the largest database of stable isotope values ever assembled for a marine species. Our study underscores the value of individual and institutional collaboration across multiple countries and will hopefully provide an example for others to follow around the world.

0218 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Raymond Semlitsch[1], Susan Walls[2], Jamie Barichivich[2], Katherine O'Donnell[2]

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A Comprehensive Multi-level Approach to Preventing Amphibian Extinction

A comprehensive view of population declines and their underlying causes is necessary to reverse species loss. Historically, in many cases, a narrow view may have allowed species declines to continue, virtually undetected, for long periods of time (perhaps even decades). We suggest that extinction debt is likely responsible for numerous (perhaps most) amphibian declines and that this perspective should be incorporated into the structure of amphibian research and management. Extinction debt, originally proposed to explain changes in species richness following environmental disturbance, may also refer to the proportion of populations of an individual species that is expected to eventually be lost due to habitat change. A conservation framework to address extinction debt focuses research on threats at the individual, population, and metapopulation levels. This approach will help enhance, restore, and protect specific processes and habitats at the proper scale by directing management to the most vulnerable level and stage of a species. We illustrate this approach using Flatwoods Salamanders, *Ambystoma cingulatum* and *Ambystoma bishopi*, which occurred historically throughout the Coastal Plain of the southeastern USA but have experienced a > 85% loss of populations in recent years. Reversal of these losses is possible only if conservation and recovery efforts encompass individual, population, and metapopulation levels. We illustrate our framework by outlining actions that could be taken at each of these levels to help guide conservation and management of amphibians with complex life cycles and provide options for how to prioritize conservation actions in the face of logistical and budgetary shortfalls.

0415 AES GRUBER AWARD I, Thursday 13 July 2017

Emily Seubert[1], John Valentine[2], J. Marcus Drymon[1]

[1]*University of South Alabama, Mobile, AL, USA,* [2]*Dauphin Island Sea Lab, Dauphin Island, AL, USA*

Evaluating ecosystem resiliency through stable isotope analysis of common elasmobranchs across the northern Gulf of Mexico

Functional diversity and redundancy are important components of healthy ecosystems and can enhance ecosystem resiliency to environmental disasters. Predatory species often overlap trophic niches, thereby facilitating the ability of an ecosystem to rebound from a disturbance. Stable isotope analysis (SIA) is a non-invasive technique that can provide insight into the role of functional diversity within an ecosystem. To investigate the extent to which functional diversity of predatory species varies across the northern Gulf of Mexico, we applied SIA to tissues from common elasmobranch species in this region. Preliminary trials examined the $\delta^{13}C$ and $\delta^{15}N$ signatures of blood plasma and muscle of three common elasmobranchs from the Chandeleur Islands, Louisiana: Atlantic sharpnose shark (*Rhizoprionodon terraenovae*), blacktip shark (*Carcharhinus*

limbatus), and blacknose shark (*C. acronotus*). Across species, 휕^{15}N ranged from 13.74‰ to 15.54‰ in blood plasma and from 13.61‰ to 15.60‰ in muscle, indicating a high degree of predator functional diversity in the region. *R. terraenovae* blood plasma 휕^{15}N values were significantly higher than those values detected in the other shark species (mean ± SD, 15.10‰ ± 0.34‰), suggesting this species feeds at a higher trophic level, while *C. limbatus* and *C. acronotus* feed at similar trophic levels. With respect to carbon, a relatively narrow range of values was found (1.07‰ for blood plasma and 1.90‰ for muscle), suggesting these species occupy foodwebs with similar sources of primary production. These preliminary results indicate high predator functional diversity, as well as possible functional redundancy in this region, with further implications for ecosystem resiliency.

0784 Turtle Conservation, Saturday 15 July 2017

H Bradley Shaffer[1], Jannet Vu[3], Phil Spinks[1], Robert Thomson[2]

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The Turtle Tree of Life and how it Informs Global Conservation Priorities

During the past two decades, turtles have gone from the phylogenetically least well understood major vertebrate clade to one of, or perhaps the best resolved group. We present two phylogenetic analyses, each based on newly generated and analyzed molecular data, that provide novel views on the 220 million years of crown turtle diversity. A well resolved time tree for all families of chelonians based on a new 539-gene data set provides the backbone tree for chelonians—it is consistent with several other recent efforts, but provides a novel temporal view of living turtle diversity. A second, 15-gene analysis includes sampling for roughly 90% of the 330 species of the living turtles and tortoises, providing a comprehensive framework for species-level biogeography, diversification patterns, and conservation prioritization. We combine this species-level phylogeny with IUCN endangerment assessments to provide a first-ever map of global endangerment hotspots for turtles and tortoises that should help direct conservation efforts for the group.

0618 Herp Reproduction & Life History II, Thursday 13 July 2017

Brian Shamblin[1], Mark Dodd[2], Michelle Pate[3], DuBose Griffin[3], Matthew Godfrey[4], Michael Coyne[5], Ruth Boettcher[6], Campbell Nairn[1]

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Nest Site Fidelity of Loggerhead Turtles Characterized Through Genetic Tagging

The scale of nest site fidelity (NSF) has important implications for population connectivity and the estimation of demographic parameters in marine turtle populations. We performed genetic tagging of the US loggerhead turtle Northern Recovery Unit through subpopulation-scale clutch sampling to make preliminary inferences about the scale of NSF. A single egg was sampled from each recorded loggerhead clutch from Georgia through Maryland and assigned to an individual female via microsatellite genotyping. We analyzed 10,152 intra-seasonal nesting records representing 6,650 females nesting in 2010 – 2015. Geographic variation in NSF was apparent across the study area and was temporally stable across the six years examined. Females nesting in the vicinity of the Cape Romain National Wildlife Refuge exhibited the highest NSF detected, whereas females nesting in the immediately adjacent Grand Strand and proximal North Carolina coast had the lowest NSF. This pattern suggests that coastal geomorphology and/or freshwater outflows may provide important nesting beach selection cues or affect recruitment patterns that shape NSF behavior. From 2011 through 2015, we detected 3,493 individual females during 3,912 remigrations. The mean displacement in median nesting latitude between years was 11.2 (10.2 – 12.2) km of latitude, suggesting relatively high fidelity. These preliminary results suggest limited connectivity across rookeries such that local sources of mortality near the nesting beach may have significant consequences for the resident nesting population. Analyses of related females' nesting ranges will provide an indirect assessment of the scale of natal site fidelity required for a more complete picture of population connectivity.

0279 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Ashley Shaw[1], Doug Adams[2], Amanda Barker[3], Chris Bedore[4], Jim Gelsleichter[5], David Portnoy[3], Eric Reyier[6], Bryan Frazier[1]

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Trophic ecology and condition of sympatric hammerhead species in nursery habitats in the Southeast U.S.

The Scalloped Hammerhead, *Sphyrna lewini*, and recently described Carolina Hammerhead, *Sphyrna gilberti*, are thought to be sympatric in estuarine and nearshore nursery habitats along the southeastern U.S. coast. Despite this coastal occurrence, little is known about the trophic ecology of these two morphologically indistinguishable species. We will examine the trophic ecology and condition factor of these two genetically identified hammerhead species in nursery habitats in estuaries and near

coastal waters, using stomach content analysis and stable isotope analysis of four tissues. Analyses compare the trophic ecology of the two hammerhead species, and suggest regional differences in diet and trophic niche. In addition, the trophic ecology and condition factor of the hammerheads are compared across different nursery habitats.

0601 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Josh Sherwood, Jeff Stein

Illinois Natural History Survey, Champaign, IL, USA

Habitat and fish community changes in Champaign County, IL over the past 100 years

With data spanning over 100 years, the Fishes of Champaign County is a comprehensive, long-term investigation into the changing fish communities of east-central Illinois. The same 120 sites across the county have been sampled four times since 1928, which are compiled with data from an additional 40 sites sampled in the 1890's. Data from the surveys have produced a unique perspective into not only the fish communities of the region but changes to instream habitat. After a period of degradation, fish communities appear to be improving throughout the county, demonstrated by the return of two state-threatened species that had not been recorded since 1928. Our analysis of in-stream habitat indicates a general trend away from small streams of various substrate types towards wider, deeper streams with a more uniform substrate. Fish community data support the results, indicating a shift from typical headwater species to species that frequent streams with more stable flows and deeper streams. Long-term surveys such as this are rare and the data and analyses of these surveys can provide managers with valuable information to further restoration efforts using a historical prospective.

0542 AES GRUBER AWARD I, Thursday 13 July 2017

Chelsea Shields[1], Jim Gelsleichter[1], Bryan Frazier[2]

[1]*University of North Florida, Jacksonville, Florida, USA,* [2]*South Carolina Department of Natural Resources, South Carolina, USA*

Reproduction of the tiger shark (*Galeocerdo cuvier*) off of South Carolina

Top ocean predators, such as large sharks, have shown trends of substantial population decline over the last few decades. Due to this, it is important to understand the life history of the species to determine if the population must be managed. This study examines the reproduction of tiger sharks off South Carolina using non-lethal methods, including ultrasonography and measuring hormone levels to understand the reproductive seasonality of the species. Blood samples and biological measurements

were collected from 55 animals along the southeast U.S. coast and ultrasonography was performed on mature females when possible. Female plasma estradiol concentrations showed an increased range of concentrations at size-at-maturity (310 cm TL). This likely indicates the hormonal differences between gravid and non-gravid animals. When estradiol level was compared to month in mature animals, certain (presumed non-gravid) animals showed significant levels of estradiol (above 600pg/ml) between June and October, while others (presumed gravid) maintained lower levels of estradiol through the summer. This shows that some of the animals are carrying offspring and some are not, indicating that the reproductive cycle of this species is at least biennial, if not triennial. Mating wounds were observed on several mature female tiger sharks in October and November, showing that mating is occurring. We found no clear pattern between levels of progesterone in females and size or reproductive stage. Not enough male tiger sharks have been sampled to date to form conclusions on changes in testosterone in males.

0026 AES Conservation & Management I, Saturday 15 July 2017

David Shiffman

Simon Fraser University, Vancouver, BC, Canada

Trends in Elasmobranch Research 1985-2016: Methodolgies, Study Species, Conservation Framing, and Presenter Demographics

Here we present an analysis of how elasmobranch research has changed since the founding of the American Elasmobranch Society in 1985. Using abstracts from every past AES conference, we analyze trends in research methods used to study elasmobranchs, trends in the selection of study species, trends in the conservation framing of research projects, trends in presenter demographics, and more. We also include some predictions of where elasmobranch research may be heading.

0073 Herp Ecology I, Friday 14 July 2017

Rick Shine[1], Claire Goiran[2], Paco Bustamante[3]

[1]University of Sydney, Sydney/NSW, Australia, [2]Université de la Nouvelle-Calédonie, Noumea, New Caledonia, [3]Université de La Rochelle, La Rochelle, France

Industrial melanism in a seasnake

The classic example of industrial melanism is the increase in black colouration among peppered moths during the industrial revolution in Europe, putatively driven by selection for camouflage against predators. We describe a similar correlation – melanism in anthropogenically disturbed habitats - in a very different taxon and location and infer a very different evolutionary mechanism. Most of the turtle-headed seasnakes (*Emydocephalus annulatus*) found in polluted bays beside the city of Noumea are jet-

black, whereas melanism is rare across the rest of the species' wide range except for an isolated reef in the Great Barrier Reef that is used as a bombing range. We identify a potential selective advantage to dark colouration in these polluted sites: melanin binds trace elements, which are voided when the snake sheds its skin. More broadly, industrial melanism in vertebrates may be driven by selective pressures very different from those experienced by the peppered moth in Europe.

0262 AES Ecology II, Sunday 16 July 2017

Oliver Shipley, Jill Olin, Michael Frisk

School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, NY, USA

Environmental and biological drivers of intra- and inter-specific resource use among sympatric skates in the northwest Atlantic

Resource use and competition between marine predators support ecosystem structure and function and have large implications for resilience and diversity of global ecosystems. Understanding the environmental and biological divers of food-web structure can help inform management and conservation of marine predator species. Skates (order *Rajiformes*) are important mesopredators in benthic ecosystems worldwide, which provide important energetic linkages between lower trophic consumers and apex predators. In the last 60 years, skate populations have faced arguably the most considerable population declines of all elasmobranch species, and many are now listed as endangered, or critically endangered by the IUCN. Further life history and wider biological data is therefore required to inform management and conservation of these species. Here we used stable isotope analysis of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) to understand the environmental (e.g. temperature, depth, latitude) and biological (e.g. age, sex, and size) drivers influencing the intra- and interspecific resource use of seven common skate species in the northwestern Atlantic. We present isotope data for winter (*Leucoraja ocellata,n* = 60), thorny (*Amblyraja radiate*, *n* = 48), little (*Leucoraja erinacea*, *n* = 78), smooth (*Malacoraja senta*, *n* = 4), rosette (*Leucoraja garmani*, *n* = 5), and barndoor (*Dipturus laevis*, *n* = 15) skates, collected from National Marine Fisheries Service's (NMFS) trawl surveys between 2001 and 2002. Although historic, these data provide insight into competition and niche width of sympatric skate species and provide a comparable baseline from which to generate present day community comparisons.

0027 Lightning Talks II, Friday 14 July 2017

Dustin Siegel[1], David Sever[2], Stanley Trauth[3]

[1]Southeast Missouri State University, Cape Girardeau, MO, USA, [2]Southeastern Louisiana University, Hammond, LA, USA, [3]Arkansas State University, Jonesboro, AR, USA

The lack of nasolacrimal ducts in plethodontid salamanders

The nasolacrimal ducts drain excess products from tear production into the nasal cavity. The mass majority of terrestrial vertebrates possess nasolacrimal ducts. Recent studies concluded that nasolacrimal ducts were absent in plethodontid salamanders, but not from salamanders of every other family examined (Ambystomatidae and Salamandridae); however, only plethodontids from Plethodontinae and Spelerpinae have been examined. In the current study, we used histological preparations to survey nasolacrimal duct presence/absence from multiple representatives from all subfamilies of plethodontid salamanders (Bolitoglossinae, Hemidactyliinae, Plethodontinae, and Spelerpinae); thus, we tested the hypothesis that plethodontid salamanders lack a nasolacrimal duct.

0113 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Greg Sievert

Emporia State University, Emporia, Kansas, USA

Efficacy of Different Artificial Cover Objects in Reptile Surveys - A Long Term Study

Herpetologists commonly use cover objects in their surveys of terrestrial reptiles. It is widely assumed that the material used to create a cover object is relatively unimportant in study design; however, few studies have been conducted to validate this assumption. Differences in the numbers and types of reptiles attracted to different cover object materials have the potential to bias herpetological studies. I used arrays of cover objects to test for preferences between wood, tin, or tar paper cover objects by terrestrial reptiles. By monitoring these cover objects over five years and comparing captures of lizards and snakes to temperature data, I determined that reptiles collectively prefer tin cover object in early spring, but shift most usage to wooden cover objects in the summer. These shifts in cover object preference seem to be linked to thermoregulatory needs of the individual reptiles. Results of this study will assist herpetologists in choosing the cover object type best suited to their research objectives.

0069 ASIH STOYE GENERAL ICHTHYOLOGY III, Friday 14 July 2017

Randy Singer[1], Jon Moore[2]

[1]Florida Museum of Natural History/iDigBio, Gainesville, FL, USA, [2]Florida Atlantic University, Boca Raton, FL, USA

Finding Dories: Variation in *Parazen pacificus* (Zeiformes: Parazenidae: Parazen) with the discovery of an undocumented reproductive strategy in a deep sea fish

Parazen pacificus (Parazenidae) is a monotypic genus of zeiform fish inhabiting bathydemersal (145-500 m depth) habitats along the continental slope of the Western Central Indo-Pacific and Atlantic Oceans. Despite high sampling of suitable habitat between its known ranges, no specimens have been collected from localities in the Eastern or Central Atlantic and Eastern Pacific Oceans. This highly disjunctive distribution raised suspicion that *Parazen pacificus* is not one, but two or more species. To explore this possibility, we compared morphological characters in Atlantic populations of *Parazen pacficius* to those from the Pacific Ocean. Morphological data support at minimum one undescribed species from the Caribbean Sea. During the course of specimen examination a reproductive strategy unique to Zeiformes was discovered. In addition, this trait is the first ever of its type found in a deep-sea fish. Until recently, the reproductive ecology of *Parazen pacificus*, like most species of Zeiformes, has remained largely understudied. It is difficult to observe reproductive behavior of deep sea fishes *in situ*, but most species have been assumed to be broadcast spawners. This discovery raises more questions as to the reproductive strategies across Zeiformes, as well as in other fish taxa and warrants further exploration. In addition, high resolution video from the Caribbean Sea via the NOAA Okeanos Explorer Océano Profundo Expedition has shed light on the feeding and swimming behavior of live *Parazen in situ*.

0728 HL GRADUATE RESEARCH AWARD, Friday 14 July 2017

Shashwat Sirsi[1], Andrew R. MacLaren[1], Daniel H. Foley III[2], Michael R.J. Forstner[1]

[1]*Texas State University, Texas, USA,* [2]*Sul Ross State University, Del Rio, Texas, USA*

Comparing movement patterns and consequent management implications derived from Capture-Mark-Recapture, Telemetry, and Genetic Frameworks for the Rio Grande Cooter (*Pseudemys gorzugi*)

Freshwater turtles are among the most threatened vertebrates with ca. 42% threatened by unsustainable harvests and habitat loss. Gaining knowledge on the life-history of such threatened species is critical to enabling their management for conservation. Rio Grande Cooters (*Pseudemys gorzugi*) are a narrowly distributed and poorly-documented freshwater turtle species, restricted to the Rio Grande River and its tributaries. Habitat loss via modification to in-stream flow rates of these river systems represent a core threat to these turtles. Understanding movement patterns in such modified landscapes is important to determining population connectivity and spatial scale of management approaches. We compare the utility of three commonly used methods, Capture-Mark-Recapture (CMR), telemetry, and population genetics, in the assessment of movement rates. A raw examination of recapture locations from multi-year (2011 and 2014-2016) CMR data showed that individuals were sedentary. However, a POPAN formulation that generated a superpopulation estimate of 1019 + 241 individuals also estimated considerable probabilities (ca. 20-40%) of new entrants to the population at discrete occasions. This discrepancy provided the impetus to estimate movement in a subset of our population using telemetry. VHF transmitters coupled with GPS-enabled data

loggers have revealed novel movement data with net movements of up to ca. 36 km. Movement data from telemetry is more comparable to previously completed genetic analyses which suggest the population is homogenous, with range-wide population connectivity maintained by occasional long-range movements. Each of these methods determine varying levels of connectivity and demonstrate a need for caution in management implementations from any single approach.

0454 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

David Skelly

Yale University, New Haven, CT, USA

Evolution in the Shade: the Microgeography of Thermal Adaptation in the Wood Frog

Understanding the distribution of species confronted with environmental heterogeneity is a fundamental goal of ecologists. The role of rapid-fine scale evolution as a driver for distributional patterns is poorly known. The wood frog (*Rana sylvatica*) exhibits wide tolerance of canopy conditions within the breeding ponds it selects. Overtopping by canopy imposes profound changes in conditions within small ponds including the thermal environment. Common garden experiments reveal that traits including critical thermal maximum, thermal preference behavior, and development rate vary with canopy. Open and closed canopy ponds are often in close proximity suggesting that divergence among breeding aggregations can occur at scales easily traversed by dispersing adults. Because canopy can change on decadal time scales, our evidence suggests that trait evolution can occur rapidly at microgeographic scales. While typical models of gene flow imply that even modest levels of dispersal between ponds differing in canopy should prevent divergence in traits, we see repeated evidence that such distinctions emerge and are maintained. The wood frog system suggests a powerful ecological role for localized adaptation. Because canopy surrounding wetlands is under active or passive management by humans, our findings illustrate unintended evolutionary consequences of environmental policies intended to conserve wildlife species.

0172 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Rachel Skubel[1], Neil Hammerschlag[1], Yannis Papastamatiou[2], Jodie Rummer[3]

[1]University of Miami, Florida, USA, [2]Florida International University, Florida, USA, [3]James Cooke University, Queensland, Australia

From biochemistry to biotelemetry: An integrative framework for indicators of elasmobranch response to climate change

Elasmobranchs are a group of animals which have been subjected to major stressors including overfishing and habitat degradation, and now face the consequences of rising human carbon dioxide emissions – increased temperature and acidity, and decreased oxygen content in the oceans. Here, we systematically review the literature to assess characteristics of climate change vulnerability/resilience across (1) behavior, (2) hematology, (3) morphology, (4) cardiac and circulatory systems, (5) respiratory strategy and metabolism, (6) locomotion strategy, and (7) the nervous system. Environmental factors (biotic and abiotic habitat variability, prey, and human disturbance) are also explored with respect to their contributions to elasmobranch vulnerability and resilience to climatic change. An integrative framework to consider elasmobranch response to climate change is proposed, to contribute to the development of indicators for wide scale climate change risk assessments. We provide an overview of the state-of knowledge for the field of climate change responses of elasmobranchs, identify information gaps, and propose an integrative framework to consider elasmobranch response to climate change, to contribute to the development of indicators for wide scale climate change risk assessments.

0529 Snake Biology I, Sunday 16 July 2017

Cara Smith, Stephen Mackessy

University of Northern Colorado, Greeley, CO, USA

The Effects of Hybridization on Divergent Venom Phenotypes: Characterization of Venom from *Crotalus scutulatus scutulatus* × *C. oreganus helleri* Hybrids

Hybridization between divergent species can be analyzed to elucidate expression patterns of parental characteristics, as well as to provide information about the extent of reproductive isolation between species. A known hybrid cross between two rattlesnakes with highly divergent venom phenotypes provided the opportunity to examine occurrence of parental venom characteristics in the F1 hybrids, as well as ontogenetic shifts in the expression of these characters as the hybrids aged. The current study investigates both phenomena resulting from the hybridization of a male snake with type I degradative venom, *Crotalus oreganus helleri* (Southern Pacific Rattlesnake), and a female snake with type II neurotoxic venom, *C. scutulatus scutulatus* (Mojave Rattlesnake). SDS-PAGE, enzymology, Western blot and reversed phase HPLC (RP-HPLC) were used to characterize the venom of the *C. o. helleri* male, the *C. s. scutulatus* female and their two hybrid offspring as they aged. In general, *Crotalus o. helleri* × *C. s. scutulatus* hybrid venoms appeared to exhibit overlapping parental venom profiles, and several different enzyme activity patterns. The *C. s. scutulatus* × *C. o. helleri* hybrid male's venom profile provided the strongest evidence that type I and type II venom characteristics are expressed simultaneously in hybrid venoms, as this snake contained

distinctive characteristics of both parental species. Ultimately, the chronological analysis of this known hybrid system reveals the most distinct characteristics that can be used in determining successful hybridization between snakes that follow the type I-type II trend in rattlesnake venom composition, namely the presence of metalloprotease activity and Mojave toxin.

0122 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jaime E Smith[2], Joseph H.K. Pechmann[1], John Tupy[3]

[1]Western Carolina University, Cullowhee, NC, USA, [2]University of Southern Mississippi, Ocean Springs, MS, USA, [3]US Fish and Wildlife, Vero Beach, FL, USA

Effects of Litter Type and Algal Wafers on the Growth and Survival of Dusky Gopher Frog (*Rana sevosa*) Tadpoles

Growth and survival of *Rana sevosa* tadpoles is higher in open canopy than in closed canopy ponds. Litter substrates, which are dominated by herbaceous plant material in open canopy ponds and by pine and hardwood leaves in closed canopy ponds, may contribute to these differences. Supplemental food such as algae wafers may ameliorate any effects of substrate. We tested the effects of different combinations of the litters maidencane (*Panicum hemitomon*), juncus (*Juncus repens*), and leaves (*Pinus palustris*, *Liquidambar styraciflua*), both with and without weekly algae wafer additions, on *R. sevosa* tadpoles in outdoor tanks. Algae addition increased survival by 19%, decreased mean larval period by 25 days, increased metamorph mean snout-vent length (SVL) by 8 mm, and more than doubled metamorph mean mass. Without algae, survival averaged 53% lower for leaves alone, but with algae, survival averaged 43% lower for juncus alone, compared to other litters or litter combinations. Without algae, larval period averaged 8-23 days shorter for juncus and for juncus plus maidencane than for other litter treatments. With algae, substrate had no significant effect on larval period. Mass and SVL at metamorphosis were highest for juncus, lowest for leaves and leaves plus juncus, and intermediate for maidencane alone or combined with other substrates. *Rana sevosa* tadpoles did best overall with juncus plus maidencane and poorest overall with leaf litter and without algae addition. Use of substrates from open canopy ponds and algae wafers can improve growth and survival of *R. sevosa* tadpoles raised for translocation and population supplementation.

0189 AES GRUBER AWARD III, Friday 14 July 2017

Kelcee Smith[1], Michael Kaller[1], John Carlson[2], Dana Bethea[3], Kevin Feldheim[4], William Kelso[1], Sabrina Taylor[1]

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Southeast Regional Office, St. Petersburg, FL, USA, [4]Field Museum of Natural History, Chicago, IL, USA

Combining capture and genetic data to estimate population size of juvenile endangered Smalltooth Sawfish (*Pristis pectinata*)

A fundamental parameter in mathematical models that underpin ecological, conservation, and evolutionary theory is population size. It can be estimated as census size (N_C), i.e. the number of individuals in a population, or effective population size (N_E), which only counts individuals contributing genes to future generations. Estimating both N_C and N_E allows for a better understanding of potential demographic, environmental, and genetic risks that populations face. However, both methods are rarely used together to examine components of population size. Here, we compare N_C and N_E estimates for the juvenile segment of endangered Smalltooth Sawfish, *Pristis pectinata,* population in Southwestern Florida, U.S. Capture-mark-recapture data (2000-2015) were analyzed in program MARK to estimate N_C with recapture probabilities and apparent survival from individual capture histories, assuming a closed population. Models with time dependent capture probability and constant recapture probability estimated an N_C of 261 (SE: $4.01X10^{-5}$) and 124 (SE: $2.69X10^{-5}$) individuals during the spring/summer and fall/winter seasons, respectively. This yields an annual N_C of 385 juveniles per year in this population. To estimate N_E, tissue samples (n = 375) taken from captured individuals were genotyped at 17 microsatellite loci. Estimates of N_E included temporal, linkage disequilibrium, and sibship methods. Overall, N_C can be compared to N_E to determine effects of harvest, environmental change, or species fitness. Monitoring imperiled species in this way can facilitate recovery by revealing specific issues not evident in estimates of N_C alone.

0626 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Leo Smith[1], Chesney Buck[1], Sarah Gibson[1], Matthew Davis[2], Rene Martin[2], Matthew Girard[1]

[1]University of Kansas, Lawrence, KS, USA, [2]St. Cloud State University, St. Cloud, MN, USA

Techniques for the Improved Visualization of Vertebrate Anatomy

Following the recent discovery of fluorescence in living fishes, turtles, and amphibians, our laboratories procured the necessary equipment to explore the visual displays of these animals. Once the equipment was in the laboratory, it became clear that it had value that extended to the visualization of extant and fossil vertebrate anatomy. Previous work had highlighted the use of fluorescence in fossil vertebrates and of alizarin red autofluorescence in developmental studies of the Zebrafish. Herein, we highlight and expand on the value of alizarin red autofluorescence in comparative vertebrate anatomy. Further, we demonstrate the use of green autofluorescence with formalin-fixed soft tissues and fossilized vertebrate skeletons. Finally, we report on the use of a glycerine-gelatin matrix that allows for the temporary positioning of cleared-

and-stained vertebrates for imaging anatomical features in poses that are not possible in standard glycerine preparations. Although fluorescence microscopes can be expensive, we highlight less expensive setups that allow nearly any anatomical laboratory to take advantage of these techniques.

0753 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Shelby Smith, Devin D. Bloom

Western Michigan University, Kalamazoo, MI, USA

Evolutionary Ecology of Great Lakes alewives (*Alosa pseudoharengus*): a Population Genetic and Morphometric Analysis

Migratory animals have high dispersal ability and a propensity to colonize new areas. In some cases, migrators establish resident populations in new areas, which are subjected to rapid local adaptation. Native alewives, *Alosa pseudoharengus*, are primarily anadromous fishes occurring along the east coast of North America. Multiple native populations have also invaded inland lakes on the East Coast and become landlocked over hundreds to thousands of years. Alewives have been introduced in the Great Lakes, potentially via shipping canals or through accidental stocking. Studies comparing native landlocked populations of alewives to anadromous populations have revealed landlocked alewife populations restructured the size and composition of zooplankton communities, which subsequently drove alewife evolution. As a result, landlocked alewives have smaller gill raker spacing, gape widths, and body size compared to native anadromous populations. In this study, we used mtDNA sequencing to determine the origins of alewives in the Great Lakes and compared phenotypic traits of Great Lakes alewives with native anadromous and landlocked populations to determine the rate and patterns of morphological evolution. Our results show parallel evolution of gill raker spacing, gape width, and body size between Great Lakes and landlocked East Coast populations of alewives. We suggest that anadromy can facilitate colonization of novel geographic areas and result in rapid local adaptation.

0436 AES Ecology II, Sunday 16 July 2017

Matthew Smukall[1], Tristan Guttridge[1], Samuel Gruber[1]

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Seasonal and Ontogenetic Shifts in Movement and Trophic Position of Tiger Sharks *Galeocerdo cuvier* near Bimini, Bahamas

Tiger sharks *Galeocerdo cuvier* are presumed to fulfill important roles as apex predators across a wide range of tropical and temperate ecosystems. There has been documented

variation in their movements, habitat use, and diet, and these factors are likely affected by season, region, and ontogeny. Bimini, Bahamas provides an ideal location for assessing seasonal and ontogenetic shifts, as all age classes are abundant throughout the year. Changes in seasonal abundance, sex ratios, and size distributions were assessed with fishery-independent longline surveys. Vemco™ V16 acoustic tags were implanted in juvenile (n = 22, mean total length 118cm) and mature (n = 14, mean total length 332cm) sharks. Habitat usage, residency, and returns were monitored with 62 VR2W receivers stationed around Bimini. Long-range movement data was provided from detections on cooperative data sharing arrays and tag reporting through the National Marine Fisheries Service cooperative shark tagging program. Stable isotope analysis ($\delta^{13}C$, $\delta^{15}N$) of fin, muscle, and blood plasma samples were used to assess seasonal and ontogenetic shifts in trophic position. It is predicted movement of tiger sharks will predominately be driven by age and season. Trophic position is predicted to increase dramatically at early ages with noticeable short-term seasonal shifts. This information will provide a better understanding of the correlation between movement and trophic position for tiger sharks in this ecosystem.

0757 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Darrel E. Snyder, C. Lynn Bjork

Colorado State University Larval Fish Laboratory, Fort Collins, Colorado, USA

Larvae and Early Juveniles of Rio Grande Chub and Rio Grande Sucker

The Rio Grande Chub *Gila pandora* (RGC) and Rio Grande Sucker *Catostomus plebeius* (RGS) are medium-size fish (< 20-26 cm) native to the Rio Grande Basin (CO, NM, TX, and Mexico) and some adjacent closed basins. Both are now restricted mostly to tributary and headwater streams (and a few lakes for RGC). In Colorado, RGC is a species of special concern and RGS is endangered; in New Mexico, both are species of greatest conservation need; and in Texas, RGC are threatened. Reproductively, both are non-guarding, open-substrate lithophils, typically spawning over gravel or sand in spring or early summer. Eggs are demersal and adhesive with diameters of about 2.3-2.6 mm for RGC or (2.4-) 2.8-3.2 mm for RGS. RGC hatch as protolarvae at about 7 mm SL, complete yolk absorption at 8-9 mm, become metalarvae (have both the adult complement of principal median fin rays and pelvic-fin buds) at 11-12 mm, and become juveniles at 18-19 mm SL. Corresponding sizes for RGS are 7-9, 10-11, 15-17, and 23-25 mm SL. Recently hatched RGC have dark eyes and considerable dorsal body pigmentation, whereas recently hatched RGS have lighter eyes and no body pigmentation. Snout-to-vent (preanal) length is 66-73% SL for RGC larvae and 74-83% SL for RGS. Myomere counts to the posterior margin of the vent (preanal), after (postanal), and total are 27-31 + 11-15 = 41-44 for RGC and 31-37 + 7-11 = 41-45 for RGS.

0109 LFC Multi-Stressor Effects, Friday 14 July 2017

Jacob Snyder, Christopher Murray, Hannes Baumann

University of Connecticut, Avery Point, Groton, CT, USA

Maternal effects on offspring CO_2 sensitivity in a coastal marine fish

Many marine fish employ maternal provisioning as a strategy to better prepare offspring for changing environmental conditions. Whether maternal provisioning influences the sensitivity of fish early life stages to elevated CO2 conditions has yet to be determined. We reared offspring batches derived from five female Atlantic silversides (*Menidia menidia*) under contrasting CO2 conditions from fertilization to 16 days post hatch and quantified six response traits, including growth and survival. For most traits, we found strongly divergent responses (expressed as log-transformed response ratios, lnRR) between batches, and subsequently used fatty acid (FA) profiles of the unfertilized eggs to test for associations with the observed lnRRs. Multiple FAs were positively correlated (20:1n9, 22:5n3, 15:0) with survival lnRR's while others were negatively correlated (18:3n3, 18:4n3, 22:6n3) with length lnRR's. Maternal investment has been shown to be highly important to offspring survival, and this study shows that variable egg provisioning by mothers with certain FAs may influence offspring sensitivity to high CO2 environments. Our study also suggested that ocean acidification experiments on fish early life stages need to be based on a large number of spawners in order to avoid biases due to resulting from individual maternal effects.

0709 SSAR SEIBERT ECOLOGY II, Thursday 13 July 2017

Shawn Snyder[1], William Sutton[1], Christopher Howey[2]

[1]Tennessee State University, Nashville, TN, USA, [2]The Pennsylvania State University, University Park, PA, USA

Differentiation in Basking Habitat between Yellow and Black Morph Timber Rattlesnakes

Timber rattlesnakes (*Crotalus horridus*) have two distinct morphotypes across their range: a black morph and a yellow morph. If both morphs prefer to maintain similar preferred body temperatures, then black morphs may have a thermal advantage due to their increased melanin. If this is the case, then do yellow morphs use basking habitat that is more open? During 2016, we measured the preferred body temperature of snakes in the lab. We also radio-located 12 *C. horridus* (4 yellow morphs, 8 black morphs) between 6 June - 20 July in central Pennsylvania. Canopy closure was measured over top of basking rattlesnakes with a spherical densiometer and hemispherical photography. Further, we were able to measure the total incident solar radiation that reached each basking location based on hemispherical photographs within Gap Light Analyzer software. There was no difference in canopy closure between morphotypes or sex using either canopy measures. However, total incident solar radiation that each snake received did differ between morphotypes. These results suggest that although canopy openness does not differ between morph basking habitats, yellow morphs use sites that have more

open canopy that overlaps with the path of the sun; thus, permitting more incident solar radiation. We will discuss preferred body temperatures of snakes in the lab and field-active body temperatures of snakes. Further, these results suggest that yellow morph rattlesnakes might be able to behaviorally adapt to live in the colder northern part of their range by altering their habitat use.

0047 Fish Systematics, Saturday 15 July 2017

Young Sun Song, Jin-Koo Kim

Pukyong National University, Busan, Republic of Korea

Cryptic Diversity of Hagfishes (Family Myxinidae) collected from Korea, Japan, Vietnam and Argentina

There are currently six recognized genera and 81 recognized species of hagfishes (Family Myxinidae). Most hagfish taxa have been described based on morphological data. Although hagfish have relatively simple bodies, providing limited morphological information, this is often sufficient to differentiate between hagfish species. In recent years, many new species have been reported and new classifications have been established using a molecular perspective to review phylogenetic relationships. However, it is difficult to clarify the relationships between hagfish genera because of their similar morphology and the comparative paucity of specimens. Hagfishes were recently collected from several countries (Korea, Japan, Vietnam and Argentina) and we analyzed their morphology and genetics (mtDNA COI and cytb sequences). Molecular results showed the existence of at least four cryptic species with distinct phylogenetic positions. *Eptatretus* sp. A from Korea, *Eptatretus* sp. B from Japan, *Eptatretus* sp. C from Vietnam, and *Notomyxine* sp. from Argentina were similar to *Eptatretus burgeri* (d=0.083), *Eptatretus okinoseanus* (d=0.026~0.031), *Eptatretus fernholmi* (d=0.052), and *Notomyxine tridentiger* (d=0.068~0.071), respectively. These four cryptic species were significantly distinct from other congeneric species based on morphological characteristics such as total cusps, slime pores, etc. Therefore, we suggest here the existence of four cryptic species of hagfishes, and further discuss their evolutionary history.

0365 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Kelsey Spencer[1], Daniel Abel[1], Derek Crane[1], Neil Hammerschlag[2], Erin Burge[1], Caroline Collatos[1], Matt Larsen[1]

[1]Coastal Carolina University, Conway, SC, USA, [2]University of Miami, Miami, FL, USA

Coastal Shark Movements near Fishing Piers along the NE Coast of South Carolina: Early Results

Perceived increases in shark attacks/bites in the summer of 2015 focused attention on shark movements along beaches of the region and, more specifically, around fishing piers. Knowledge of shark movements around fishing piers has been strictly anecdotal. We implanted acoustic telemeters in pier-associated sharks to answer questions regarding the site fidelity of sharks to fishing piers in Northeastern South Carolina. Vemco V9-69 kHz transmitters were surgically implanted in 12 sharks [Blacktip (*Carcharhinus limbatus*, n = 4), Finetooth (*Carcharhinus isodon,* n = 2), Blacknose (*Carcharhinus acronotus*, n = 4), Tiger (*Galeocerdo cuvier,* n = 1), and Sandbar (*Carcharhinus plumbeus*, n = 1)] from July 14th through November 3rd, 2016. Three piers and two nearshore locations recorded 5,589 detections from July 25th, 2016 to January 5th, 2017. Three heterospecific individuals (Finetooth, Blacknose, and Blacktip), encompassed 96.3% of all detections. Site fidelity indices (number of days detected at piers / number of days detected) for the heterospecific individuals were 0.265, 0.025, and 0.463, respectively, indicating minimal site fidelity. A general linear model (GLM) revealed detection events (two detections within a 30-minute period) varied significantly ($p = 0.018$) with the interaction between bi-weekly catch per unit effort (CPUE) of potential prey caught on the piers and moon phase. Modeling results using standard selection criteria (BIC) indicated diel cycle, prey CPUE, and lunar percent illumination together best explained variation in presence/absence at piers. Results from the models demonstrate that the presence of sharks is dependent upon prey, which respond to moon phase among other factors.

0277 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY II, Thursday 13 July 2017

McKayla Spencer, C. M. Gienger

Austin Peay State University, Clarksville, TN, USA

Comparative Energetics and Responses to Feeding of Copperhead and Cottonmouth Snakes (*Agkistrodon*)

The breakdown of food and absorption of nutrients after feeding can be energetically costly for animals. Differences in response to feeding have been attributed to many factors such as temperature, foraging mode, and body shape. Habitat ecology has been less explored and differences in ecological attributes could lead to differences in important behaviors and physiological ecological interactions. We chose to compare post-feeding responses between two similar species with differing use of habitat; copperheads (*Agkistrodon contortrix*; a terrestrial species) and cottonmouths (*Agkistrodon piscivorus*; a semi-aquatic species). To make these comparisons we measured pre- and post-feeding metabolic rates (at 20, 25, and 30°C) and body temperature (T_b) selection by digesting snakes. Following the consumption of rodent meals, specific dynamic action (SDA) was affected by temperature but did not differ between species. Post-feeding, *A. contortrix* did not change their thermal behavior but *A. piscivorus* selected 5-6°C warmer temperatures. After feeding, *A. contortrix* had a longer duration of elevated metabolic rate at 25°C than at 30°C and selected a post-feeding temperature of 26°C. *A. piscivorus*

had a longer duration of elevated metabolism following feeding at 30°C than at 25°C and selected a post-feeding temperature of 29°C. Overall, both species selected post-feeding temperatures that appear to physiologically result in a longer duration of elevated metabolic rate which may maximize net energy intake of a meal. The differences in the selected post-feeding temperatures between the species that results in physiological response differences is most likely a factor related to their differing use of habitat.

0676 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Zachary Sperstad[1], Peter Berendzen[1], Andrew Simons[2], Jonathan Armbruster[3], Emily Lemmon[4], Alan Lemmon[4]

[1]The University of Northern Iowa, Cedar Falls, Iowa, USA, [2]The University of Minnesota, St. Paul, Minnesota, USA, [3]Auburn University, Auburn, Alabama, USA, [4]Florida State University, Tallahassee, Florida, USA

Phylogenomics of Catostomidae

Catostomidae is a freshwater fish family within Cypriniformes, restricted to North America and Asia. This group contains about 78 species, which are hypothesized to have evolved from a single tetraploid ancestor. Phylogenetic reconstruction of the relationships within this family have been burdened by tetraploidy, therefore molecular systematics of this group have been largely restricted to mitochondrial gene regions. These studies have resulted in several conflicting hypotheses of the relationships among catostomids. The objective of this study is to generate a molecular hypothesis of the relationships within this group using a genomics approach with consideration of tetraploidy. An ultraconserved element dataset was generated using anchored hybrid enrichment. This dataset contains 179 loci, totaling 277,092 base pairs, for 43 catostomids and 11 outgroup species. All loci for the catostomids were phased for four alleles to account for tetraploidy. Phylogenies were reconstructed using species tree and maximum likelihood methods. To estimate the relative age of nodes, time-calibrated phylogenies were generated using fossil calibration. Preliminary results will be presented.

0321 Amphibian Behavior, Friday 14 July 2017

Laura Springer[1], Cory Adams[2], Toby Hibbitts[3], Matt Kwiatkowski[1], Dan Saenz[2]

[1]Stephen F. Austin State University, Nacogdoches, Texas, USA, [2]Wildlife Habitat and Silviculture Laboratory, Southern Research Station, USDA Forest Service, Nacogdoches, Texas, USA, [3]Texas A&M University, College Station, Texas, USA

Home Range and Activity Patterns in the Southern Crawfish Frog

The crawfish frog, *Rana areolata*, has suffered declines across much of its range, primarily due to habitat loss, and is a candidate for protection in five of the states where it occurs. This species is a prairie specialist and prairies are one of the most rapidly disappearing landscapes in North America. Prairies in Texas have suffered a decline of 90%, with most of the loss occurring on the coastal prairie. In the northern part of their range, crawfish frogs are known to utilize crayfish burrows for shelter most of the year, but leave their burrow during the breeding season to travel to breeding ponds. We investigated movement patterns and burrow use of the crawfish frog in the southern part of their range where little is known about their biology. We tracked 24 crawfish frogs at the Attwater Prairie Chicken National Wildlife Refuge in southeast Texas from March 2015 to May 2016. We tracked 11 frogs back to burrows from their breeding ponds. Frogs traveled between 63 to 624 meters back to a burrow, for an average 315 meters. To monitor activity patterns of frogs at the burrows, we placed game cameras on five burrows. Frogs spent 75% of their time aboveground at the entrance of the burrow (69% of nocturnal activity, 81% of diurnal activity). These data suggest access to crayfish burrows in prairie habitat is key to the conservation of this species in Texas.

0514 Lizard Ecology, Sunday 16 July 2017

Ariel Steele, Daniel Warner

Auburn University, Auburn, AL, USA

The Effect of Incubation Temperature on Sex and Morphology in a Lizard

The developmental environment plays a pivotal role in shaping phenotypes and fitness of all organisms. Perhaps the most enigmatic example of environmental effects is the influence of developmental temperature on an individual's sex, a phenomenon known as temperature-dependent sex determination (TSD). The first description of TSD was based on a study conducted 50 years ago on an African lizard (*Agama agama*). Although novel at this time of publication, this landmark study consisted of low sample sizes and provided a poor description of the sex-determining reaction norm in this species. Our goal was to revisit this work and better characterize the pattern of TSD in *A. agama.* In addition, we aimed to quantify the effects of constant and fluctuating incubation temperatures on a variety of fitness-relevant traits of offspring. Eggs were obtained from an invasive population of *A. agama* in Miami, FL, and randomly assigned to one of nine incubation treatments: six constant temperature treatments and three fluctuating treatments that mimic field conditions. We then measured hatchling morphology (snout-vent length, head size, mass), growth, and sprint performance as indicators of fitness. Size measurements were continuously taken every six weeks to determine the ontogenetic timing of sexual dimorphism and to determine if sexual dimorphism is influenced by incubation temperature. Preliminary data suggest that warm incubation temperatures produce mostly female offspring. This ongoing research will provide a critical evaluation of the long-term effects of developmental temperature on fitness-relevant traits, and provide insights into the adaptive significance of TSD.

0179 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

David Steen[1], Dawn Kelly[0]

[1]Auburn University, Auburn, AL, USA, [2]N/A, N/A, USA

A Cottonmouth and a Copperhead Engaged in Interspecific Combat in the Wild

Copperheads (*Agkistrodon contortrix*) and Cottonmouths (*A. piscivorus*) are relatively common viperid snakes occurring throughout the eastern and central United States. The two species are unlikely to encounter each other regularly, as Copperheads are associated with terrestrial habitats while Cottonmouths generally inhabit wetlands; thus, we know little about how the two species interact. In September 2016 both snakes were observed together outside Snowball, Arkansas and their behavior was recorded for approximately three minutes and forty seconds. The snakes' behavior in the video closely matches the stereotypical combat behavior demonstrated by males within the *Agkistrodon* genus and some other snake groups. We believe the video documents for the first time combat between two different snake species.

0174 Turtle Conservation, Saturday 15 July 2017

David Steen[1], Orin Robinson[0]

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Estimating Freshwater Turtle Mortality Rates and Population Declines Following Hook Ingestion

Freshwater turtle populations are susceptible to declines following small increases in the mortality of adults, making it essential to identify and understand potential threats. Recent research has used x-ray technology to reveal that freshwater turtles ingest fish hooks associated with recreational angling; this is concerning because hook ingestion is a known source of additive mortality for sea turtles. We used a Bayesian-modeling framework, observed rates of freshwater turtle hook ingestion, and information from sea turtles to estimate there is a 1.2–11% chance that individual freshwater turtles of several species ingest fish hooks and consequently die. We then used our results and previously published life- history data for several species to demonstrate that currently observed rates of fish hook ingestion by freshwater turtles are likely sufficient to cause population declines. We believe we have identified fish hook ingestion as a serious yet generally overlooked threat to the viability of freshwater turtle populations.

0184 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Friday 14 July 2017

John Stepanek[1], Natalie Claunch[1], Julius Frazier[1], Ignacio Moore[2], Ben Vernasco[2], Camilo Escallón[2], Emily Taylor[1]

[1]California Polytechnic State University, San Luis Obispo, CA, USA, [2]Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

Corticosterone-Induced Color Change in Southern Pacific Rattlesnakes (*Crotalus helleri*)

Metachrosis, or color change, in reptiles has been of interest to herpetologists for a long time. Some species use it for thermoregulation or crypsis, but in many species the function and physiological mechanisms of metachrosis remain unknown. Anecdotes from herpetologists claim that some species, including rattlesnakes, undergo metachrosis when captured and placed in bags or buckets. A possible explanation for this color change is the release of their primary stress hormone, corticosterone. In this study, we implanted twenty-six wild Southern Pacific rattlesnakes (*Crotalus helleri*) intra-coelomically with either corticosterone or sham silastic implants. At 0 weeks (pre-implant), 2 weeks, and 4 weeks post-implant, the snakes were recaptured, bled, and photographed under standardized lighting in a curtained box. We used Adobe Photoshop to quantify light value of the dark and light bands of the snakes' tails and examined the relationship of these variables to baseline corticosterone levels. In addition, at 4 weeks post-implant, we assessed color change resulting from elevation of corticosterone from baseline levels after one hour of acute confinement stress. We found that baseline and acutely elevated corticosterone, regardless of implant treatment, were positively correlated with the lightness value of the light bands, but had no relationship with that of the dark bands. This ultimately led to increased contrast between the light and dark bands in snakes with higher corticosterone. This study is the first to quantify the relationship between corticosterone and color change in snakes, suggesting that hormones might mediate color change in response to stressors.

0086 AES Ecology II, Sunday 16 July 2017

Joshua Stewart[1], Christoph Rohner[2], Alessandro Ponzo[3], Daniel Fernando[4], Kerstin Forsberg[5], Brice Semmens[0]

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Trophic overlap in mobulid rays: insights from stable isotope analysis

Mobulid rays, a group of closely related filter feeders, are threatened globally by bycatch and targeted fisheries. Their habitat use and feeding ecology is not well studied, and most efforts have focused on temporally limited stomach content analysis or inferences from tagging data. Previous studies demonstrate a variety of different diving behaviors across species, which researchers have interpreted as evidence of disparate foraging

strategies. However, few studies have examined feeding habitats and diets of multiple mobulid species from a single location, and it is unclear if the proposed differences in diving and inferred foraging behavior are examples of interspecific variability or regional adaptations to food availability. We used stable isotope data from mobulids landed in fisheries to examine the feeding ecology of five species at three sites in the Indo-Pacific. Bayesian mixing models and analyses of isotopic niche areas demonstrated dietary overlap between sympatric mobulid species at all of our study sites. The degree of overlap may be inversely related to productivity, which is contrary to prevailing theories of niche overlap. Isotope data from two tissues allowed us to examine diet stability of *Manta birostris* and *Mobula tarapacana* in the Philippines, and we found evidence of diet switching in *M. birostris*. Our findings highlight challenges to bycatch mitigation measures for mobulid species, and may explain the multi-species mobulid bycatch that occurs in a variety of fisheries around the world.

0909 Amphibian Behavior, Friday 14 July 2017

Meghan Still, Amanda Lea, Hans Hofmann, Michael Ryan

University of Texas Austin, Austin, Texas, USA

The Role of Chemical Cues during Courtship in Túngara Frogs, *Physalaemus pustulosus*

Chemo-sensation is among the least well-understood sensory modalities in anurans (frogs and toads). While vocalizations can mediate competitive interactions amongst males, chemicals (such as steroid hormones) leached in the water by calling males may also contain information that neighboring males within a chorus (an aggregation of males advertising for mates) can use to assess opponents during social interactions such as aggressive contests. To understand the influence of multimodal signaling displays on male courtship, we collected behavioral and physiological measurements from male túngara frogs (*Engystomops* = *Physalaemus pustulosus*) before, during, and after social stimulation. To permit repeated, non-invasive presentation of experimental stimuli and water borne hormone collection, we developed a unique testing chamber that allows for acoustic and chemical stimuli to be presented in isolation and in combination without directly handling the frog. Results demonstrate that the greatest calling effort and endocrine response (corticosterone and testosterone) occurs in response to the combined (acoustic + chemical) stimulus. Thus, an intriguing implication is that water, laden with peptide and hormonal secretions of neighbors, may act as a social cue that interacts with other social stimuli to influence aggressive interactions among chorusing males. Additional research is required to help elucidate the relative importance and ubiquity of chemical cues during male advertisement across anurans.

0590 Fish Conservation I, Sunday 16 July 2017

Andrew Stites, Joshua Sherwood, Jeremy Tiemann, Michael Dreslik

Illinois Natural History Survey, Champaign, IL, USA

Assessing the Distribution of Iowa Darters (*Etheostoma exile*) in Streams of Northern Illinois

Species distribution models are good tools for predicting the possible range of species that are rare or difficult to effectively sample for. Populations of the state-listed Iowa Darter (*Etheostoma exile*) have been declining in Illinois for more than a century. However, recent observations in headwater streams of northern Illinois with no previous records of Iowa Darters revealed the need to update its known distribution. We used MaxEnt, generalized linear, and random forest models, along with targetted field surveys, to estimate the historical and current distribution of Iowa Darters in Illinois. Our model of the historical distribution in Illinois estimates Iowa Darters were sporadically distributed in northeastern Illinois, focused in the Chicago metro and suburban region. Using the current distribution model, we selected and sampled 30 potential sites divided evenly between having low, medium, and high probabilities of Iowa Darter occurrence. We found nine new Iowa Darter localities during the surveys. We revised the distribution model with the findings and found the range of Iowa Darters in Illinois has substantially decreased from its historical range. However, areas of suitable habitat still exist and remain unsampled. Sampling and monitoring of these areas could guide potential conservation efforts and lead to additional populations.

0373 ASIH STOYE CONSERVATION II, Friday 14 July 2017

Joshua Stonecipher, Rebecca Blanton

Austin Peay State University, Clarksville, TN, USA

Conservation status and population genetic structure of the Smallscale Darter, *Nothonotus microlepidus*

The Smallscale Darter, *Nothonotus microlepidus,* occurs in four tributaries (Little, Harpeth, Red, and Stones rivers) to the middle and lower Cumberland River system in Tennessee and Kentucky. These tributaries are separated by the large-river mainstem of the Cumberland River, which lacks habitat typical of *N. microlepidus*. Because *N. microlepidus* is small-bodied, benthic, and lacks a gas bladder, large-river habitat conditions may limit dispersal and restrict gene flow among tributaries. Additionally, *N. microlepidus* has been petitioned for federal listing, but insufficient information is available to evaluate listing criteria. Therefore, the objective of this study was to assess the conservation status of *N. microlepidus* by documenting its current distribution and range-wide patterns of genetic diversity. We surveyed 20 historical localities to determine presence, and at two localities from each river system, the Jolly-Seber mark recapture method was used to estimate population size. Genetic structure was evaluated using twelve microsatellite loci examined for 30 individuals from two localities from each river system. *N. microlepidus* was present at 16 of 20 sampled localities. The Harpeth River had the largest population size estimates. The Stones River contained 3 of the 4 localities at which the focal species was not detected and showed a trend of lower population sizes and habitat

quality, indicating that populations in this system may be particularly vulnerable. Efforts to genotype all individuals and estimate the effects of distance, intervening mainstem habitats, and barriers such as dams on genetic structure are ongoing.

0205 General Ichthyology I, Sunday 16 July 2017

Carla Stout, Jonathan Armbruster

Auburn University, Auburn, AL, USA

Molecular systematics of *Notropis* and related shiners (Cypriniformes: Leuciscidae)

North American shiners represent one of the most taxonomically turbid clades of freshwater fishes due to the large number of taxa coupled with conserved morphologies. Species were moved between genera and subgenera until the community decided to lump all of the taxa into one genus, *Notropis*, which at one time held at least 213 described species. Despite advances that began to separate *Notropis* into other genera, such as *Cyprinella*, *Luxilus*, *Lythrurus*, and *Pimephales*, *Notropis* remained as a taxonomic repository for many shiners of uncertain placement. Recent advances in sequencing technologies have provided the opportunity to re-examine the shiner clade using phylogenomic markers. Using a fish probe kit from the NSF-funded FishLife project, we sequenced 89 species representing 15 shiner genera, which resulted in a dataset with 1004 loci and 286,445 base pairs. Despite the large dataset, only 32,466 bp (11.33% were phylogenetically informative). In our maximum likelihood tree, 78% of nodes are 100% bootstrap supported. Unsurprisingly, *Notropis* is recovered as nonmonophyletic. Other nonmonophyletic genera include *Hudsonius*, *Pteronotropis*, *Luxilus*, and *Alburnops*. *Cyprinella* is monophyletic only if *Cyprinella callistia* is excluded. Taxonomic revisions we propose are: elevation of *Hydrophlox*, expansion of species included in *Miniellus*, movement of *Hudsonius cummingsae* to *Pteronotropis*, resurrection of the genera *Coccotis*, *Paranotropis*, and *Chriope*, movement of *Notropis dorsalis* to *Ericymba*, and a new genus description for *Notropis scepticus*.

0190 Amphibian Conservation I, Sunday 16 July 2017

Miranda Strasburg, Michelle Boone

Miami University, Oxford, OH, USA

Examining the Role of Pesticide Exposure on Parasite Infections in Amphibians

Parasitic infection rates are rising across wildlife taxa for reasons that are not clear, which is increasing the importance of understanding how anthropogenic environmental stressors, like pesticides, alter host-parasite interactions. Because of their complex life cycle and aquatic origin, trematode parasites, like *Ribeiroia ondatrae* and *Echinostoma*

trivolvis, and their hosts are at increased risk to pesticide exposure, which accumulate in aquatic systems through runoff, drift, and direct application. Trematodes negatively affect their host by altering behavior and development and can lead to mortality. Pesticides can influence these infections by affecting the host and the parasite through direct mortality, immunosuppression, or behavioral changes; these impacts may be asymmetrical so that either hosts or parasites could be more vulnerable to contamination. I tested the impact of environmentally relevant concentrations of two commonly used pesticides, *Bacillus thuringiensis israelensis* (Bti) and atrazine, on the likelihood of trematode infections in the northern leopard frog (*Lithobates pipiens*) and the Blanchard's cricket frog (*Acris crepitans blanchardi*). I hypothesized that pesticides would alter trematode infection rates through pesticide-mediated immunosuppression and behavioral changes in the host. Monitoring changes in host behavior after pesticide and parasite exposure, quantifying infection prevalence, and determining survival rates allowed us to determine if these pesticides affect amphibian-parasite dynamics. Preliminary results suggest that pesticides do not influence the effects of trematodes on these species. This complex system highlights the importance of understanding the influence of pesticide exposure on hosts and parasites as both may be distinctly impacted by exposure making overall outcomes difficult to predict.

0734 Snake Biology I, Sunday 16 July 2017

Jeffrey Streicher[1], John Wiens[0]

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Phylogenomic Analysis of More than 4000 Nuclear Loci Resolves a Difficult Branch of Squamate Reptile Phylogeny

Squamate reptiles (lizards and snakes) are one of the most diverse living groups of vertebrates with more than 9000 species. Despite considerable efforts to resolve higher-level relationships among major squamate lineages, some branches have remained difficult to resolve with strong support. These include relationships within a clade commonly referred to as Toxicofera (snakes, anguimorph lizards, and iguanian lizards), and the placement of snakes. The existence of Toxicofera itself has also been debated (as opposed to the traditional, basal placement of Iguania as sister to all other squamates). Here we used targeted sequence capture to obtain more than 4000 ultraconserved elements (UCEs) from 37 squamate taxa including representatives from all major extant groups. We sequenced an average of 2739 UCEs from each taxon and analyzed datasets including up to 1,530,015 nucleotides (from 4178 UCEs total). Data were analyzed using multiple analytical methods that included concatenated likelihood analysis and two major species-tree methods (ASTRAL and NJst). We found that UCE-inferred phylogenies of higher-level squamate relationships were largely congruent with previous molecular estimates (made from much smaller datasets), and showed overwhelming evidence against the basal placement of Iguania. We recovered strong support for a sister relationship between iguanian and anguimorph lizards across all

analyses, with snakes strongly supported as the sister group of these two clades. Thus, UCEs strongly resolve the difficult placement of snakes within squamates.

0498 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jeffrey Streicher[1], Jack Davies[2], Natalie Cooper[1]

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Amphibian Type Specimen Georeferencing and its Implications for IUCN Red List Classifications

We are currently in the midst of a 6th mass extinction. Species' extinction rates are 1,000-10,000 times higher than background rates, and these rates are predicted to increase as human activities and global change continue to intensify. If we want to prevent further extinctions, we need to know which species to conserve and where to conserve them. Unfortunately, these efforts may be hampered by inaccuracies in our knowledge of species geographic ranges. The International Union for Conservation of Nature (IUCN) Red List is widely used for assessing the conservation priority of species. The list is arranged by species and each account includes "species range" maps estimated by a panel of experts. These maps serve two purposes: (1) they are used to determine where species occur so that conservation areas can be prioritized, and what kinds of risks species may face in these areas; and (2) they are used to determine the range size of species, a factor that is incorporated into Red List extinction risk categories. Thus the accuracy of these maps is vital to conservation efforts. For some groups of vertebrates, however, these maps may contain inaccuracies due to poorly understood taxonomy of the species in question. One such group, which contains many imperilled species, is amphibians. Amphibian species that are widespread or have been described on the basis of few specimens are particularly likely to contain distributional inaccuracies. We compared georeferenced type localities (2000+ specimens) with IUCN spatial data to assess the accuracy of this crucial conservation resource.

0856 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Friday 14 July 2017

Jason Strickland[1], Miguel Borja[2], Andrew Mason[1], Darin Rokyta[3], Christopher Parkinson[1]

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Venom evolution in Mojave Rattlesnakes, *Crotalus scutulatus*

Trait evolution can occur through changes in gene sequence via mutations that alter protein structure/function and through regulatory changes that alter gene expression

and relative proportion of proteins in the phenotype. It is hypothesized that changes in expression can occur on shorter time scales and will contribute more to variation among populations within a species. To understand the relative role of these mechanisms, we focused on snake venom in Mojave Rattlesnakes, *Crotalus scutulatus*, due to high intraspecific variability documented in their venom. We collected venom and tissue from 120 *C. scutulatus* from throughout their range, determined venom type using reversed-phase high-performance liquid chromatography, and sequenced the mitochondrial gene ND4 to estimate phylogeographic structure in the species. Using these data, we selected and sequenced the venom gland transcriptome (mRNA) and proteome (venom proteins) of 21 *C. scutulatus* from two populations that diverged ~2 mya. Within each population, animals of three venom types (hemorrhagic, neurotoxic, and "hybrid") were included. We estimated and compared gene sequence divergence and differential expression of orthologous transcripts to identify instances of nonsynonymous change and altered expression, respectively, among venom types and populations. Neurotoxic individuals from the two populations differed in the proportion of Mojave Toxin and myotoxins whereas hemorrhagic populations differed in the C-type lectins present. Among populations there were nonsynonymous mutations in several toxins including Mojave Toxin. Within populations, relative expression was different among individuals. Local adaptation is present but it is not solely driven by changes in expression in *C. scutulatus*.

0268 AES Life History, Sunday 16 July 2017

Kristine Stump[1], David Die[2], John McManus[2], Tristan Guttridge[1], Samuel Gruber[1]

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Using a Long-Term Mark-Recapture Dataset to Investigate Effects of Habitat Loss on Survival Probability of Juvenile Lemon Sharks

Many shark species use nursery areas, increasing the probability of juvenile survival. The availability of suitable nursery habitat may be a limiting factor for some shark populations. The mangrove-fringed lagoons and creeks in Bimini, Bahamas serve as nurseries of the lemon shark (*Negaprion brevirostris*). Since 1997, one nursery has been subjected to large-scale anthropogenic disturbances, including dredging, mangrove deforestation and wetlands-filling. Using the Program MARK, we employed a long-term mark-recapture dataset to analyze models of recapture (p) and survival (Φ) probability of age 0, 1 and 2 lemon sharks in two adjacent Bimini nurseries. We first tested models in which recapture probabilities could vary with combinations of age, nursery and time, and found p varied with age. This model was subsequently used for the p component in a suite of candidate models for Φ, which differed in how survival could vary with major construction events (e.g., habitat alteration). Model selection based on Akaike's Information Criteria indicated that mangrove deforestation negatively affected probability of survival in juvenile lemon sharks, and young-of-the-year (YOY), in

particular. Model estimates of ΦYOY for the year of major disturbance are at or below published Leslie matrix approximations for population stability. These estimates suggest that in such years, anthropogenic effects may reduce the ability of the nursery to provide ample recruits to the adult population. Habitat loss is likely a significant threat to lemon shark populations. Future management scenarios and land-use planning should consider multiple life stages, including neonates and juveniles.

0306 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jenny Sutherland[1], David Mifsud[2], Maegan Stapleton[2], Amber Stedman[1], Edward Roseman[3], James Boase[4], Andrew Briggs[4], Justin Chiotti[4], Katherine Greenwald[1]

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Use of eDNA and Occupancy Modeling to Predict the Presence of Mudpuppies (*Necturus maculosus*) Along the St. Clair-Detroit River System

The mudpuppy (*Necturus maculosus*) is an elusive, fully aquatic salamander with a range that spans the Great Lakes region. Although this species was once abundant throughout its range, evidence suggests that there have been widespread declines because of habitat loss and modification, pollution, lampricide use, and over collection. Land use practices along the St. Clair-Detroit River System (SCDRS) have altered habitat, but information on the status of mudpuppies along the SCDRS is lacking. In an effort to remove the St. Clair and Detroit Rivers as an Area of Concern some sites have undergone restoration and now provide suitable mudpuppy habitat. Mudpuppies are important indicators of good habitat quality and could be a gauge for restoration success. Mudpuppy occurrence was quantified at these sites, along with other sites along the SCDRS, using minnow trap and setline records. These data were then used in an occupancy model which predicts detection probability and occupancy. Additionally, we are investigating the utility of environmental DNA (eDNA) to aid future monitoring efforts at these locations. Environmental DNA could be a useful tool for monitoring because it is non-invasive and requires minimal fieldwork. We used eDNA sampling and quantitative PCR (qPCR) to determine mudpuppy presence at restored and unrestored locations and compared the results to trapping records. Results from this work will help document the occurrence of mudpuppies in the system and help prioritize management of mudpuppies on a local and range-wide scale, resulting in more successful conservation of this ecologically important species.

0628 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Emma Sutton, Anna Savage, Kate Mansfield, Matthew Lawrance

University of Central Florida, Florida, USA

A comprehensive approach to surveillance, epidemiology and genetic analyses of Chelonid Fibropapilloma-associated Herpesvirus in marine turtles

Of the seven extant marine turtle species, all are imperiled. The status of marine turtles is important when considering diseases that influence the survival of reduced populations. Fibropapillomatosis (FP) is a tumor disease of marine turtles that, while benign, can impact hosts by obstructing feeding and locomotion. The putative etiological agent of FP is Chelonid Fibropapilloma-associated Herpesvirus (CFPHV). The association between FP and CFPHV presence is not absolute, as CFPHV has been found within healthy turtles. This raises the question as to what factors may be important to the onset of FP, including variation in virus genetics. Previous research was stymied by small or narrowly focused sampling. We leveraged one of the strongest available sample sets of marine turtles, collected over three decades from Indian River Lagoon, Florida. Our sampling is comprehensive, incorporating hundreds of samples from both healthy and diseased turtles, from multiple tissue types including blood and skin, across multiple sampling seasons and from two species of marine turtle (*Chelonia mydas* and *Caretta caretta*). CFPHV was detected utilizing quantitative PCR, allowing for estimation of viral load as a proxy for disease intensity. From positive samples, we reconstructed the phylogenetic patterns of virus evolution using three viral loci (polymerase, capsid maturation protease, glycoprotein B), and utilized Bayes Factor testing to determine the robustness of putative phylogenetic trees. These results have utility in future efforts in explaining host coevolution as well as patterns of selection and differentiation on viral strains found across tissue and time.

0649 Fish Ecology I, Sunday 16 July 2017

Tracey Sutton[1], Jon Moore[2], April Cook[1], Andrea Bernard[1], Kevin Boswell[3], Ron Eytan[4], Kim Finnegan[1], Christopher Kenaley[5], Lacey Malarky[6], Ted Pietsch[7], Nina Pruzinsky[1], Mahmood Shivji[1], Max Weber[4], R. David Wells[4], Danté Fenolio[8]

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The Epi-to-Bathypelagic Ichthyofauna of the Gulf of Mexico: Recent Surveys Reveal Exceptional Diversity and Endemism, with 180 New Species Records

An ongoing research program has investigated the ichthyofaunal structure and dynamics of the oceanic northern Gulf of Mexico (GoM), from the surface to 1500 m depth. Prior to 2011 there was no inventory of the GoM bathypelagial (>1000 m depth) and that of the mesopelagial (200-1000 m) was largely limited to the eastern GoM. Extensive sampling and analysis since that time has revealed an exceptionally speciose

oceanic fish assemblage with inherent pelagic endemicity. Of the 794 fish species identified to date, 180 are new records for the GoM, including one newly described and 21 putative undescribed species. This increases the total fish species number for the entire GoM marine ecosystem by over 10%. Over half of all known fish species in the GoM use the oceanic habitat for part or all of their lives. The GoM now ranks among the most-speciose oceanic ichthyofaunal assemblages known in the World Ocean. This ranking likely results from: 1) the ecotonal nature of the oceanic GoM (low-latitude input, winter cooling); 2) high (non-limiting) oxygen at depth; 3) substantial use of pelagic habitat by juvenile deep-demersal and coastal fishes; 4) sampling intensity (the GoM stands as the world's most-studied bathypelagic system); and 5) the integration of morphological and genetic methodology used to increase taxonomic accuracy and precision. Despite extensive sampling, the species accumulation curve has not reached asymptote; more species will likely be recorded with more sampling.

0834 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

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Landscape-Scale Snake Monitoring Studies: Work Hard or Work Smart?

Snakes represent an important and often maligned component of terrestrial and aquatic ecosystems. The often secretive activity patterns and cryptic coloration of snakes make it difficult to derive estimates abundance and population density for many species. In addition, local abundance and or detection rates may be so low that construction of accurate abundance/occupancy estimates is often impossible. Sampling methods for snakes are quite limited unless drift-fence arrays equipped with large box traps are employed. To this end, we acquired a series of snake occurrence/occupancy datasets from a variety of study sites throughout the southeastern United States (15 total snake occurrence datasets) to answer questions of sampling effort and approaches. We assembled all occurrence data into yearly presence/absence datasets for each snake species/species complex sampled. After correcting for landscape-scale habitat patterns, we evaluated a series of sampling and site-specific covariates that may potentially impact detection rates. Our analyses revealed that detection rates differ based on species evaluated and trap methodology employed. Collectively, our results are important for designing landscape-scale snake monitoring studies and determining the amount of sampling effort and techniques necessary for detecting both common and rare snake species.

0718 Amphibian Conservation IV, Sunday 16 July 2017

William Sutton[1], Michael Osborne[2], Jeff Bailey[3], Thomas Pauley[4]

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Impacts of Stream Disturbances on an Appalachian Stream Salamander Assemblage

Globally, amphibians are threatened by a variety of stressors, including landscape destruction and landuse change, emerging pathogens, aquatic pollution, and global climate change. Salamanders in the family Plethodontidae represent the only amphibian family where species lack lungs and rely completely on cutaneous respiration. These adaptations increase the vulnerability of these organisms to ecological disturbance, which makes them keen indicators of ecological condition. We evaluated the impacts of stream disturbance on stream salamander assemblage at 45 streams in West Virginia over a two-year period. We used a combination of transect and quadrat surveys to survey and capture salamanders. We used both multivariate approaches and N-mixture models to evaluate impacts of stream disturbances. We captured 463 adult salamanders and 1,535 larval salamanders representing 9 species throughout the study period. We found that salamanders in the genus *Desmognathus* had lowest abundance in degraded streams and reached greatest abundance in highest quality streams. The most commonly captured species, which included larval Northern and Southern Two-lined Salamanders (*Eurycea bislineata* and *E. cirrigera*), tended to reach greatest abundance at sites with intermediate disturbance levels. A variety of detection-level covariates impacted abundance estimates and included ecoregion of study site, date of survey, and survey technique. Collectively, agricultural and mountaintop-removal mining operations appear to be the greatest threat to salamanders in streams throughout the study region. Our study defines the greatest threats to stream salamanders throughout the state and also provides an additional evaluation of using salamanders as indicators of aquatic biological condition.

0019 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Meredith Swartwout, J. D. Willson

University of Arkansas, Fayetteville, AR, USA

Disentangling Mechanisms of Decline for Litter Lizards at La Selva Biological Station, Costa Rica

In recent decades, increasing evidence has linked climate change to global lizard declines. The effects of climate change are complex, with both direct (e.g. disruption of thermal biology) and indirect components (e.g. changes in habitat structure and food webs) predicted to affect lizard populations. I conducted a pilot experiment to examine some of the indirect effects on lizards at La Selva, a lowland tropical rainforest site in Costa Rica where lizard populations have declined. I manipulated leaf litter depth and precipitation in forest plots, and measured densities of ants and other invertebrates that

may be predators or prey of leaf litter lizards. Because ants are important predators of lizard eggs, I also monitored ant recruitment and 12-hr bait mass loss at bait stations as a metric of ant predation levels across treatments. Ant densities were highest in control plots, and were positively correlated with bait mass loss ($p < 0.05$). Invertebrate densities followed the same general trend as ant densities, with both being lowest in irrigated and litter removal plots, which had the shallowest leaf litter. During the study, I encountered the most lizards on litter control plots. Preliminary results suggest that lizards may be selecting for a moderate or high leaf litter depth because of a tradeoff between prey availability and predation pressure. In future studies, I will validate the results presented here, evaluate how litter depth affects ant predation on lizard eggs, and construct models that evaluate sensitivity of population dynamics to indirect effects of climate change.

0180 Herp Biogeography & Phylogeography II, Sunday 16 July 2017

Samuel Sweet

U C Santa Barbara, Santa Barbara, CA, USA

Drought and Terrestrial Plethodontids: Rediscovery of *Batrachoseps minor*

Mystery has surrounded the conservation status of the Least Slender Salamander (*Batrachoseps minor*) since its description in 2001. Regarded as common during the early 1970s in its limited distribution in the Santa Lucia Range of San Luis Obispo County, California, only three individuals were found in the 35 year interval 1976-2011 despite multiple attempts, some by the original collectors. Numbers found of the apparently microsympatric *B. nigriventris* remained roughly consistent in this interval. Current literature suggests that *B. minor* may have suffered a catastrophic population decline, with overcollecting or chytridiomycosis at its root, and a recent petition to USFWS seeks listing as Threatened. Beginning in 2011, field work has rediscovered *B. minor* at most of the historic sites, and at 6 new sites as well, augmenting its known range by about one third. True microsympatry with *B. nigriventris* occurs, but is rare; instead, *B. minor* is a habitat specialist favoring steep, heavily-shaded NE-facing slopes at moderate (not high) elevations, with limited leaf litter, shallow soils and exposed bedrock, usually with very dense stands of poison oak (*Toxicodendron diversilobum*, >15 stems/m^2). These patches are steeper, darker, rockier, and with shallower soils than sites favored by *B. nigriventris*, and additionally are inaccessible to individuals reactive to poison oak. Recent collectors have tended to avoid these sites, probably explaining the gap in records. The recent CBD listing petition is rife with errors - objectively, it is hard to imagine a species that would profit less from federal listing.

0778 AES GRUBER AWARD IV, Friday 14 July 2017

John Swenson, Karen Crow

San Francisco State University, San Francisco, CA, USA

How the Devil Ray got its horns: The molecular evolution and development of the Myliobatid body plan

Batoids (skates and rays) are a diverse clade of cartilaginous fishes comprising over 550 recognized species. Sometimes called "flat sharks", their dorso-ventrally flattened bodies and anteriorly elongated pectoral fins distinguish batoids from sharks, while variations on this body plan differentiate batoid taxa from one another. Most batoids live a benthic lifestyle and generally exhibit round flexible pectoral fins that are used for both feeding and locomotion. In contrast, pelagic batoids of the family Myliobatidae have evolved diamond-shaped pectoral fins that are used solely for locomotion and an extra pair of anterior fins called cephalic lobes, which are used for feeding. Though the functional benefits associated with the unique myliobatid fin morphologies have been documented, little is known about the underlying genetic mechanisms associated with their evolution and development. Using RNA-Sequencing, we have examined gene expression among eight distinct fin domains in the cownose ray (*Rhinoptera bonasus)*, a derived pelagic myliobatid, at two different stages of early development. Our comparative transcriptomics approach has revealed both ancestral and novel gene expression pathways in the fins of cownose ray embryos, suggesting that the myliobatid body plan evolved by layering novel gene expression pathways on top of those that give rise to the ancestral batoid body plan.

0804 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

John Swenson, Karen Crow

San Francisco State University, San Francisco, CA, USA

How the Devil Ray got its horns: developmental staging of Myliobatid embryos

Devil rays and their relatives of the family Myliobatidae (manta rays, cownose rays, bat rays) are pelagic batoids that swim using a derived mode of locomotion termed ‘oscillatory swimming'. Morphological adaptations associated with the oscillatory swimming mode include distal elongation, a high aspect ratio, stiffened fin rays, and cephalic lobes, all of which are established prior to birth and may be observed in neonates. How and when, specifically, these features are established during gestation remains unknown, as no study to-date has described early development in any myliobatid taxon. By working with commercial fishermen, we collected embryos from a representative myliobatid species, the cownose ray, during early development. These specimens have revealed hitherto unknown aspects of myliobatid development, including cephalic lobes that develop as pectoral fin attachments, completely separate from the head, and pectoral fins that project outward from the body before the primary cartilage "zips up" to the gill arch. We conclude that the basic myliobatid body plan is

established within the first 1-2 months of gestation following a period during which development proceeds in a unique and often counterintuitive fashion.

0421 AES Trophic Ecology/Physiology, Friday 14 July 2017

Brendan Talwar[1], Ian Bouyoucos[1], Jake Brownscombe[3], Cory Suski[4], Steven Cooke[3], John Mandelman[2], Edward Brooks[1]

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Comparative behavioral and physiological response to longline capture

The behavioral response to longline capture in fishes is poorly understood although it may be tightly linked with the magnitude of the physiological stress response, and, ultimately, may contribute to stress-induced mortality. We employed accelerometers, video cameras, and hook timers to analyze the behavioral response of wild subtropical fishes to experimental longline capture across varied capture durations, temperatures, and depths. We also sought to relate behavioral responses to the magnitude of physiological responses for longline-caught sharks. We found significant differences in fight intensity values across capture durations and species as well as between ventilation modes in sharks, with ram ventilators and blacktips *Carcharhinus limbatus* in particular emerging as those demonstrating the most pronounced fighting behavior. We found no effect of fish size or capture temperature on fight intensity values. In addition, we found evidence of behavioral responses influencing the magnitude of physiological responses. Our results suggest that the behavioral and physiological response to longline capture is species-specific and highly variable and may be linked to distinct evolutionary traits, providing a frame of reference for vulnerability and risk assessments.

0196 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Milton Tan[1], Jonathan Armbruster[2]

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Diagnosing Effects of Systematic Error and Phylogenetic Signal in Phylogenomics: A Case Study on the Order Cypriniformes

Although phylogenomics can help systematists overcome sampling error from limited data, conflict can arise due to systematic error (e.g. long branch attraction, base compositional heterogeneity, saturation), low phylogenetic signal, and from model choice (e.g. concatenation vs. coalescent-based analysis). Recently, the relationships of the Order Cypriniformes were clarified by use of anchored hybrid enrichment, however conflict arose with respect to relationships of *Gyrinocheilus*, Catostomidae, and Cobitoidei to *Paedocypris* and the remaining cyprinoids. It is possible that systematic

error confounds phylogenetic inference in this analysis. To assess this, we explore the sensitivity of phylogenomic analyses to systematic error by subsampling loci with respect to sources of noise and comparing their resulting trees to those from random permutations of loci, performing taxon exclusion experiments with concatenation analyses to assess the effect of long-branch attraction, and performed gene genealogy interrogation (GGI) to assess the effect of low phylogenetic signal in coalescent-based analysis. Many of the relationships of Cypriniformes are well supported across all analyses, even those on datasets with higher levels of noise, including the relationship of *Paedocypris* as sister to Cyprinoidei. Coalescent-based analyses and concatenation analyses generally differed on whether or not *Gyrinocheilus*, Catostomidae, and Cobitoidei were recovered as monophyletic. Exclusion of long-branched taxa in concatenation analysis and GGI-based coalescent-based analysis converged on a monophyly of this group, supporting the hypothesis these groups form a clade, and highlighting the effect of long-branch attraction, the anomaly zone, or both.

0374 AES Genetics, Systematics, & Biogeography, Sunday 16 July 2017

Milton Tan[1], Al Dove[2], Tim Read[1]

[1]Emory University, Atlanta, GA, USA, [2]Georgia Aquarium, Atlanta, GA, USA

A New and Improved Genome Assembly of the Whale Shark (*Rhincodon typus*) and Comparative Genomics of Positive Selection

The genome sequence of the whale shark can be used to understand the evolution of its extreme body size, as a resource for conservation genomics of this species, and as a comparative resource in vertebrate genomics given the limited number of chondrichthyan genomes available. Previously, the whale shark genome was assembled using only short read sequences. We report on a new genome assembly based on *de novo* assembly of long-read PacBio sequences and polishing using Illumina sequences. Compared to our previous assembly, the new assembly is improved by multiple metrics, including having a higher contiguity, with orders of magnitude fewer contigs and orders of magnitude longer assembled fragments (N50), and higher conserved gene completeness (BUSCO2). The conserved gene completeness also compares favorably with other chondrichthyan genome and transcriptomes available. We also report on a new gene annotation informed by transcriptome sequences and protein homology. Finally, we perform genome-wide comparative genomic analysis to detect protein-coding genes under positive selection within the whale shark genome, and tested for a shift in positive selection associated with the evolution of gigantism in the whale shark.

0752 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kevin Tang, Hayley Schroeder, Rand Daboul

University of Michigan-Flint, MI, USA

Phylogenetic Relationships of Rabbitfishes (Teleostei: Siganidae)

The family Siganidae is a widespread group of marine fishes found in the Indo-Pacific Ocean and Mediterranean Sea, where they are typically occur in association with coral reefs. Of the 28 rabbitfish species, 24 were examined in this analysis. Additional acanthomorph species were used as outgroup taxa. Sequence data from mitochondrial (12S, 16S, ATPase 8/6, cytochrome b, cytochrome c oxidase I) and nuclear (histone 3, recombination activating gene 1, and tmo-4c4) genes were used for analysis. The results of these analyses found support for the monophyly of the family. Their evolutionary relationships, and how they might affect the classification and taxonomy of Siganidae, will be discussed.

0654 ASIH STOYE GENERAL HERPETOLOGY, Thursday 13 July 2017

Rebecca Tarvin[1], Cecilia Borghese[1], Wiebke Sachs[2], Juan Santos[3], Lauren O'Connell[4], David Cannatella[1], Adron Harris[1], Harold Zakon[1]

[1]University of Texas at Austin, Austin, TX, USA, [2]Universität Konstanz, Konstanz, Baden-Württemberg, Germany, [3]St John's University, Queens, NY, USA, [4]Harvard University, Cambridge, MA, USA

Evolution of Resistance to Epibatidine, a Potent and Toxic Analgesic Alkaloid, In Dendrobatid Poison Frogs

Poison frogs sequester hundreds of chemicals from their diet for anti-predator defenses. These amphibians must resist the effects of the bioaccumulation of these toxic chemicals or risk self-intoxication. Some alkaloids sequestered by poison frogs affect important nervous system proteins known as ion channels; resistance to such alkaloids often evolves via genetic changes in ion channels where alkaloids bind. Among these compounds is epibatidine, an analgesic alkaloid 200x more potent than morphine. Despite its therapeutic potential, epibatidine was never developed as a drug because it proved to be lethal at very low doses. Given epibatidine's potency, how have poison frogs evolved resistance to its bioaccumulation? We sequenced a nicotinic acetylcholine receptor (nAChR), the target of epibatidine, across Dendrobatidae. Using comparative phylogenetics we identified four amino acid replacements in two defended clades, *Epipedobates* and *Ameerega,* the only clades known to wield epibatidine. One replacement evolved convergently in both clades, but the other three replacements differ between groups. We tested whether the replacements provided resistance or altered nAChR function with *in vitro* electrophysiological assays. We found that two replacements provide resistance to epibatidine but at a cost of decreased sensitivity to acetylcholine. The other replacements improve nAChR sensitivity to acetylcholine, suggesting that they may have arisen after resistance evolved to fine-tune nAChR function. Both *Epipedobates* and *Ameerega* are relatively young lineages among poison frogs (<15 MYA) and appear to be diversifying rapidly; we hypothesize that the evolution of resistance to potent toxins among defended lineages could play a part in facilitating their diversification.

0099 General Herpetology, Sunday 16 July 2017

Samuel Tegge[1], Steve Huskey[1], Michael Smith[1], Christopher Anderson[2], Kenneth Barnett[3], Emily Hamilton[1], Kathryn Laslie[1]

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The Behavioral Context and Mechanism of Biotremors in the Veiled Chameleon, *Chamaeleo calyptratus*

Communication, which is ubiquitous and diverse among all living organisms, is utilized to intra- and interspecifically transmit information via numerous mechanisms in myriad behavioral contexts. Vibratory communication, including biotremors, has convergently evolved in numerous animal groups, including insects, spiders, fishes, mammals, and was recently discovered in veiled chameleons. Using the veiled chameleon, *Chamaeleo calyptratus*, we have (1) determined some of the behavioral contexts in which biotremors are employed, and (2) investigated the mechanism by which they are produced. Behavioral data was collected during conspecific and individual trials. Throughout male-to-male behavioral trials, video recordings documented subtle head twitches while accelerometer data correlated twitches with the production of biotremors ranging from 50 – 100 Hz, with a mean pulse dominant frequency of 86 Hz. During individual trials, an experimental shaker, attached to a dowel with a free-moving chameleon perched on it, was employed to replicate conspecific biotremors through the production of artificial pulses. Chameleon movement rates while walking across the dowel were significantly reduced in response to pulses of 50 and 150 Hz (N=5; Wilcoxon signed-rank test; *$P<0.05$), which are similar in frequency to conspecific biotremor production. Muscular and biotremor data were gathered simultaneously during vibration production. During intra-and intersexual interactions, surgically implanted electrodes recorded muscle electrical activity via electromyography (EMG), accelerometers detected the production of biotremors, and videography documented all behaviors associated with the vibrations. EMG data was then correlated with the accelerometer data to implicate the muscles responsible for the production of biotremors.

0607 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Panupong Thammachoti[1], Utpal Smart[1], Amir Hamidy[2], Irvan Sidik[2], Nia Kurniawan[3], Eric Smith[1]

[1]The University of Texas at Arlington, Arlington, TX, USA, [2]Indonesian Institute of Science, Cibinong, Indonesia, [3]Brawijaya University, Malang, Indonesia

Molecular Systematics, Species Delimitation and Divergence Time Estimates of The Common Sun Skinks (Scincidae: *Eutropis multifasciata* [Kuhl, 1820]) from Java and Sumatra

The Common Sun Skinks, *Eutropis multifasciata* are a widely distributed terrestrial scincid that ranges across the Indian subcontinent, Indochina, the Sunda shelf and Papua New Guinea. Originally described as multiple species and later synonymized to *E. multifasciata,* the taxonomy of this species, based exclusively on morphology, has been controversial. Several studies have investigated the molecular systematics of the genus, but the geographic sampling of *E. multifasciata* has been inadequate since samples from the type locality of West Java were absent. We thus set out to construct the first molecular phylogeny of *E. multifasciata* that employs sampling from the type locality and other hitherto unsampled areas of Java and Sumatra. To this end, we used a multilocus dataset comprising of two nuclear (NGFB and R35) and two mitochondrial (16S and ND4) loci, utilising supermatrix and coalescent phylogenetic approaches. To address the taxonomy, we also clarified species boundaries in the complex using Bayesian species delimitation methods. Finally, to shed light on the evolutionary origins of this species complex, we also performed divergence time analysis using a combination of molecular rates and calibration points based on the geological history of Sundaland. Our results recover multiple geographic clades within the Sumatran and Javan *E. multifasciata*. Our species delimitation analysis corroborates these populations as distinct species. Diversification within Sundaland was most likely driven by geographic changes in sea-level and habitat as well as global glacial events of the early Pliocene.

0624 Lizard Ecology, Sunday 16 July 2017

Christopher Thawley, Jason Kolbe

University of Rhode Island, Kingston, RI, USA

Effects of Artificial Light at Night on Reproduction in Brown Anoles (*Anolis sagrei*)

Environments are changing rapidly due to human activity, and these changes have important costs and consequences for affected organisms. As human-impacted environments increase, artificial light at night (ALAN), an evolutionarily-novel stressor, affects many ecosystems and species worldwide. ALAN can impact physiological function, survival, and reproduction, yet this aspect of global change remains understudied, especially in reptiles. Anoles are adapted to specific photic environments and some species, such as the brown anole (*Anolis sagrei*), thrive in human-impacted habitats including cities where ALAN is prevalent. Previous research shows that photoperiod may drive reproduction in brown anoles and that lighting alters nocturnal activity in anoles, suggesting that ALAN may serve as a novel stressor and could impact reproduction in this species. We captured brown anoles at the beginning of the breeding season from remnant forest habitat in southern Florida and exposed them to natural light cycles or artificial light at night in the lab. We quantified impacts of ALAN on

growth, body condition, and stress (plasma levels of corticosterone) in reproductive lizards. We also assessed ALAN's impacts on initiation of reproduction, inter-clutch interval, and reproductive investment. As the human populations grows and urban areas expand, artificial lighting is likely to impact many organismal traits, including reproduction, in a variety of organisms.

0188 Herp Morphology & Development, Saturday 15 July 2017

Christopher Thigpen, Stanley Trauth

Arkansas State University, State University, AR, USA

Comparative Serous Gland Histology and Histochemistry in the Skin of North American Hylid and Ranid Frogs

The histology and histochemistry of serous glands of *Hyla chrysoscelis*, *H. cinerea*, *Rana palustris* and *R. sphenocephalus* are described, herein, for the first time. Light microscopy protocols using the stains hematoxylin counterstained with eosin, periodic acid Schiff counterstained with alcian blue, and Pollak trichome were used for examination of glands. The glands are merocrine, externally secreting and composed of a syncytium of secretory cells surrounding a central lumen bordered superficially by melanophores. Serous gland numbers and widths were compared within individuals and between species within a genus to test for differences between skin region and species with and without conspicuous coloration. Significant differences in serous gland size and number were found between regions within individuals and between species. These results suggest that concealed conspicuous coloration found in *H. chrysoscelis* and *L. palustris* is aposematic.

0662 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Dustin Thomas, Brook Fluker

Arkansas State University, Jonesboro, AR, USA

Analysis of body shape variation among restricted and widespread populations of the Southern Redbelly Dace, *Chrosomus erythrogaster*

The Southern Redbelly Dace (*Chrosomus erythrogaster*) has a widespread distribution throughout most of the eastern United States, with several disjunct populations in midwestern states and in the lower Mississippi River drainage. Of particular interest are potentially isolated populations on Crowley's Ridge in Arkansas and the Bluff Hills in Mississippi. Currently, it is unclear whether these populations share connections with larger core populations in the nearby Ozark and Eastern highlands, or represent isolated populations on these "upland islands" within the Gulf Coastal Plain. This study used geometric morphometric techniques to evaluate body shape differences among *C.*

erythrogaster from loess habitats of Crowley's Ridge and the Bluff Hills of Mississippi. In order to determine variation in body shape, focal populations were compared to populations from the Ozark and Eastern highlands, as well as populations from the Ohio, Green, and Rock River drainages. A Southwestern population was also included in the study for further comparisons. Preliminary analyses revealed variation in body shape across the geographic range, and the populations of interest seem to be showing patterns of intermediate body depth compared to other populations. In conjunction with an ongoing population genetic study, results from this study will provide valuable information about the distinctiveness of potentially isolated populations in Arkansas and Mississippi.

0545 SSAR SEIBERT ECOLOGY III, Friday 14 July 2017

Samantha Thomas

Western Kentucky University, Bowling Green, Kentucky, USA

Landscape Genetics of California Tiger Salamanders: Inferences from multiple methods

Landscape genetics is a rapidly growing field of study that compares patterns of gene flow among populations with habitat heterogeneity across a landscape to infer the interaction between dispersal of individuals and their physical environment. Empirical data generated from a landscape genetics study can be implemented for conservation and management purposes, making the field increasing popular. However, concerns have arisen that the field is expanding faster than the analytic framework that supports it. Multiple methods for generating estimates of the association among habitat types and dispersal (i.e., least-cost paths and resistance surfaces) have been proposed, and there is a debate as to which statistical methods are best for examining the genetic structure on a landscape. We use an integrated empirical- and expert-opinion-based strategy to generate a landscape resistance surface for the California Tiger salamander (CTS), *Ambystoma californiense*, which is a species of conservation concern. We utilize several alternative analysis methods (e.g., CCA, BIMR, GESTE and partial Mantel tests) to look for agreement among methods describing the relationship of landscape features and genetic variation. Our analysis revealed variation among methods for describing genetic structure in this CTS metapopulation, but all methods indicated the presence of genetic structure, to some extent, across the landscape. This empirical data set provides both a perspective on habitat management for the CTS and on the suitability of several novel analysis strategies for landscape genetics.

0020 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY I, Thursday 13 July 2017

Michelle E. Thompson, Maureen A. Donnelly

Florida International University, Miami, FL, USA

Thermal Quality Influences Habitat Use of Two Anole Species

Over the past several decades, human transformation of natural landscapes has become unprecedented in intensity and spatial scale and forest habitats and animal communities within forests are among the most highly impacted, globally. Forest destruction has been repeatedly documented as a driver of biodiversity loss. However, little is known about how animal communities respond when altered landscapes are abandoned and left to regenerate into secondary forests. To evaluate support for thermal quality as a mechanism driving reptile species distributions during secondary forest succession, we measured operative temperatures and occupancy in three successional forest stages (pasture, secondary forest, and old growth forest) for two anole species (*Norops humilis* and *Norops limifrons*). We then measured thermal preference in laboratory experiments and used operative temperature and temperature preference measurements to determine how thermal quality of habitat changes over the course of secondary forest succession and if occupancy varies as a function of thermal quality. We found that thermal quality was lowest in pasture because of a large frequency of temperatures above the thermal preference range. However, in low thermal quality pasture sites, riparian habitats provided a thermal refuge for species. Our results support thermal quality as a mechanism for reptile species distributions in altered landscapes and highlight the importance of the maintenance of riparian corridors.

0600 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Milinda Thompson[1], Tracy Langkilde[2], Christopher R. Tracy[1]

[1]*California State University Fullerton, Fullerton, CA, USA,* [2]*The Pennsylvania State University, State College, PA, USA*

Effect of Water Restriction on Corticosterone in the Herbivorous Lizard, *Dipsosaurus dorsalis*

Arid environments and their unpredictable rainfall events are a potential source of physiological stress because animals, like desert iguanas (*Dipsosaurus dorsalis*), must maintain water balance when the potential for evaporative water loss is high and water availability is limited. The stress hormone, corticosterone (CORT) could activate physiological systems to minimize the impact of dehydration to homeostasis. We predicted that CORT levels in populations of *D. dorsalis* from habitats with access to water from irrigated landscaping would have significantly lower CORT levels than lizards from a population with only natural precipitation. Thus, we measured hematocrit, as an indication of dehydration, and baseline CORT levels of two urban populations of *D. dorsalis*, one with access to water only from precipitation ("natural"), and one with access to irrigated landscaping, in Rancho Mirage, CA during the driest portion of their active season. Hematocrit levels from the "natural" site were significantly higher than those from the irrigated site. However, there were no

significant differences in baseline CORT between populations, even though, for a given hematocrit level, lizards without access to irrigation had higher baseline CORT levels than those with access to irrigation. While *D. dorsalis* from the "natural" site were dehydrated, our predictions about CORT were not supported. Dehydration may influence the acute stress response as well, so further analysis of *D. dorsalis* behavior and stress levels upon acute stress is needed to evaluate the entirety of their physiological stress responses to water restriction.

0034 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Friday 14 July 2017

Jessica L. Tingle, Timothy E. Higham

University of California, Riverside, CA, USA

Morphological Correlates of Locomotor Specialization in Vipers

Ecomorphological studies of terrestrial vertebrates typically focus on limbed species despite the ecological diversity of some limbless taxa, particularly snakes. A few studies have uncovered body shape differences between arboreal and terrestrial snakes, but these generally considered few morphological characters and/or included few species. Additionally, they were limited by the available phylogenies and statistical methods. Using a recently published phylogeny that includes 79% of extant viper species, we tested whether arboreal or sidewinding specialists differ in body shape from terrestrial generalists. We took several measurements from museum specimens: snout-vent length (SVL); width and circumference at 25%, 50%, and 75% of SVL; tail length; head length and width; and number of pre-caudal vertebrae. We then calculated an elongation ratio by dividing the total length of the animal by the largest of the three width measurements and relative tail length by dividing tail length by SVL. We used phylogenetic PCA to determine whether arboreal or sidewinding species generally occupy different regions of morphospace than terrestrial generalists. We found that arboreal species differ from terrestrial species in overall body shape, with relatively longer tails, higher elongation, and lateral compression. While sidewinding species did not differ from terrestrial generalists in their average body shape, they occupied much less of the morphospace, perhaps as the result of ecological or functional constraint.

0383 AES GRUBER AWARD II, Thursday 13 July 2017

Thomas C. TinHan[1], J. Marcus Drymon[2], Brett Falterman[3], Gregory W. Stunz[4], Matthew J. Ajemian[5], John A. Mohan[1], Eric R. Hoffmayer[6], William B. Driggers III[6], Jennifer A. McKinney[3], R. J. David Wells[1]

[1]Texas A&M University at Galveston, Galveston, Texas, USA, [2]University of South Alabama, Mobile, Alabama, USA, [3]Louisiana Department of Wildlife & Fisheries, Baton Rouge, Louisiana, USA, [4]Harte Research Institute for Gulf of Mexico Studies and Department of Life Sciences, Texas A&M University – Corpus Christi, Corpus Christi,

Texas, USA, [5]Harbor Branch Oceanographic Institute, Florida Atlantic University, Fort Pierce, Florida, USA, [6]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, Mississippi, USA

Space Use and Habitat Preferences of Scalloped Hammerheads in the Northern Gulf of Mexico

The Scalloped Hammerhead (*Sphyrna lewini*) is a circumglobally distributed species common in coastal habitats ranging from temperate to tropical waters. Within the Gulf of Mexico (GoM), coastal and continental shelf waters are considered to be essential habitat for various life stages of *S. lewini*. However, there is limited information regarding individual patterns of movement and space use of *S. lewini* in the GoM, and those factors influencing habitat preference. From March 2013-November 2015, 38 *S. lewini* (102-220 cm fork length) were equipped with Smart Position or Temperature (SPOT) transmitting tags in the northern GoM. Mean squared distances from centers of activity and linearity indices calculated for individual tracks indicated the majority (53%) of sharks exhibited site fidelity to home ranges dispersed across the continental shelf and slope habitats within the GoM. Individual variation was observed in home range size, with core use areas (50% kernel density estimates) of 33.5 ± 95.6 km^2 (median ± IQR). Here we discuss the distribution and movement patterns of *S. lewini* in the northern GoM, and the results of generalized additive models and preference indices investigating the role of environmental variables (e.g. bathymetry, temperature, chlorophyll-a) in driving patterns of space use. These results may be used in the assessment of spatially or temporally explicit management strategies aimed at mitigating bycatch mortality of this species in the northern GoM.

0072 Herp Ecology II, Friday 14 July 2017

Brian Todd, Justin Nowakowski

UC Davis, Davis, CA, USA

Meta-Analysis of Telemetry Studies Reveals Surprising Patterns of Home Range Scaling in Snakes

Home ranges increase in size with an animal's body size and subsequent energy needs. Mate searching can also drive an animal's space use, usually resulting in males having larger home ranges than females in most well-studied vertebrate groups. The extent to which these patterns apply generally to snakes remains untested, but a growing number of radio-telemetry studies in recent decades makes possible broad scale analyses for the first time. We obtained data on snake home ranges from nearly 100 published radio-telemetry studies, theses, and unpublished reports to examine which factors shape home range size in snakes. As expected, home range size increased with body size of species, but the rate of this increase was much lower than that known for endotherms, possibly owing to the greater energy efficiency provided by ectothermy. On average, males also had larger home ranges than did females, with this relative difference paralleling that of body size between the sexes. After controlling for sexual size dimorphism, however, the

extent to which males had larger home ranges than females was positively correlated with mean annual temperature and net primary productivity at study sites, suggesting, perhaps, that males are able to undertake more extensive mate-searching as energy becomes more plentiful in an area. Our results show that, although home range scaling in snakes is qualitatively similar to that of many other vertebrates, ectothermy and energy availability at a given site result in surprising macroecological and ecological patterns of space use scaling in snakes.

0227 AES Reproduction, Sunday 16 July 2017

Taketeru Tomita, Ryo Nozu, Masaru Nakamura, Keiichi Sato

Okinawa Churashima Foundation, Motobu, Okinawa, Japan

Oxygen-diffusion capacity of the white shark uterus: Oxygen delivery to an embryo without a placenta

One of the mysteries of shark viviparity is how embryos acquire oxygen from their mother without a placental connection. It has been assumed that embryonic respiration in the viviparous shark mainly depends on oxygen from the uterine wall, although this hypothesis has not been tested quantitatively. Morphological observations and measurements of the uterine wall of the white shark (*Carcharodon carcharias*) provided the first quantitative evidence in support of the ability of the uterus to supply ample oxygen to the embryo of viviparous elasmobranchs. The uterine surface of the white shark is characterized by (1) uterine lamellae developed perpendicular to the uterine wall, (2) uterine lamellae folded in an accordion-like fashion, and (3) numerous micro-ridges developed on the lamellar surface. Because of these modifications, the surface area is increased 55-fold in comparison with that in species having smooth uterine surfaces, and the total surface area of a uterus was c.a. 20 m^2. Histological observations showed that the gas-diffusion barrier of the uterine wall is approximately 12 μm. Using these values, the oxygen-diffusion capacity of 1 cm^2 of the uterine wall of the white shark was estimated to be 59.5 nmol $\cdot min^{-1} \cdot torr^{-1}$. This value is 250-400 times greater than that observed in other viviparous sharks (*Squalus* spp.) and is comparable to that of fish gills.

0691 Herp Environment, Saturday 15 July 2017

Brian Tornabene[1], Andrew Blaustein[2], Cheryl Briggs[3], Jason Rohr[4], Jason Hoverman[1]

[1]Purdue University, West Lafayette, IN, USA, [2]Oregon State University, Corvalis, OR, USA, [3]University of California, Santa Barbara, Santa Barbara, CA, USA, [4]University of South Florida, Tampa, FL, USA, [5]University of Colorado at Boulder, Boulder, CO, USA

Assessing the Influence of Spatial and Environmental Factors on Ranavirus Epidemiology in a California Amphibian Assemblage

A fundamental goal of disease ecology is to determine the spatial and environmental processes driving disease dynamics. Ranaviruses are emerging pathogens of amphibians, yet few studies have conducted comprehensive field surveys to assess potential drivers of disease dynamics on the landscape. Using field surveillance data, model selection, and multimodel inference, we examined the factors underlying patterns in site-level ranavirus presence and individual-level ranavirus infection in an amphibian assemblage in the East Bay region of California. Multiple spatial, abiotic, and biotic variables influenced patterns in ranavirus epidemiology. Wetlands in closer proximity to ranavirus-positive wetlands had a higher probability of ranavirus presence and infection suggesting that adult amphibians could play an important role in moving ranavirus between nearby ponds. We also found that ranavirus presence and infection were greater in wetlands with greater density indicating that transmission is density-dependent. Additionally, the probability of ranavirus presence and infection were higher in wetlands with greater total species richness and vertebrate richness, respectively, which provides evidence for an amplification effect. We also found several factors that were only associated with individual-level infections. Contrary to previous findings, bullfrogs reduced the risk of infection suggesting that they may function as dilution hosts. Collectively, our study demonstrates that an array of spatial and environmental factors can influence ranavirus epidemiology. Further investigations of these factors will help broaden our understanding of ranaviral disease dynamics in amphibian assemblages and wetland communities.

0860 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Ruben Tovar[1], Paul Gignac[2], Ron Bonett[1]

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Diffusible Iodine-based Contrast-enhanced Computed Tomography (diceCT), a novel approach to the comparative anatomy of degenerate neural structures; examples from the central Texas *Eurycea*

The paedomorphic *Eurycea* salamander clade of Central Texas exemplifes a continuum of morphological characteristics associated with aquatic-subterranean living: the surface-dwelling Texas salamander (*E. neotenes*) exhibits typical optic anatomy and acuity; the intermediate Comal blind salamander (*E. tridentifera*) maintains reduced but non-functional eyes; and the obligate subterranean Texas blind salamander (*E. rathbuni*) has an incompletely developed optic system. Together this genus represents a transformation series of karst phenotypes and a potentially exemplar system for using comparative approaches to understanding vertebrate ocular evolution in the face of relaxed selective pressures. More than a century ago Eigenman described ocular histology in *E. rathbuni* adults as a focal troglodyte; yet, neither the extent of optic-nerve persistence in this taxon nor among its congeners has since been documented. In this study we employed gross and micro-scale imaging techniques to elucidate features of *Eurycea* optic anatomy with a particular interest in the central nervous system.

Specimens from aforementioned taxa were fixed with 100% EtOH, contrast-enhanced with alcoholic iodine (I_2E), micro-CT scanned, and digital reconstructed using 3D rendering software for comparison to histological sections. Here we report on the 3D, internal soft-tissue systems of the eye in each taxon, documenting habitat-specific configurations of optic musculature and neuroanatomy for the first time—including for *E. rathbuni,* which surprisingly appears to retain complete bilateral optic nerves even though it lacks the mid-line decussations associated with an optic chiasm.

0031 Lightning Talks II, Friday 14 July 2017

Stan Trauth[1], Dustin Siegel[2], Steve Godley[3], Zachary Adcock[4], Roy McDiarmid[5]

[1]Arkansas State University, State University, AR, USA, [2]Southeast Missouri State University, Cape Girardeau, MO, USA, [3]Cardno ENTRIX, Riverview, FL, USA, [4]University of South Florida, Tampa, FL, USA, [5]National Museum of Natural History, Washington, DC, USA

Testicular Histology and Spermatogenic Stages in the Everglades Dwarf Siren, *Pseudobranchus axanthus belli* (Caudata: Sirenidae), from South-central Florida

We examined the testicular histology of 32 adult male Everglades Dwarf Sirens (*Pseudobranchus axanthus belli*) collected at Rainey Slough (Glades County), Florida, during 1974-75 and 1981. The salamanders were returned to the lab at the University of South Florida, euthanized in a dilute chloretone solution, fixed in 10% formalin, and deposited into the herpetological collection at the university. In 1982, the testes and attached kidneys were removed, measured, and massed by SET and JSG and prepared for light microscopy using routine histological techniques by SET. The Rainey Slough samples of *P. axanthus belli* are currently deposited at the Smithsonian Institution National Museum of Natural History. The process of spermatogenesis was evident throughout all regions of the testes and appeared to occur year-round. The testes contain numerous, spherical-to-oblong testicular lobules that vary greatly in size. Unlike all other salamanders, which exhibit cystic spermatogenesis along with a caudo-cephalic wave of maturing cell types (leading to spatial and temporal segregation of germ cells), spermatogenesis in *P. axanthus* lacks testicular cysts. Instead, the testicular lobules possess an assortment of different spermatogenic stages.

0659 Herp Genetics, Saturday 15 July 2017

Alexa Trujillo[1], Matthew Lawrance[1], Kiernan Oknefski[1], Richard Seigel[2], Anna Savage[1]

[1]University of Central Florida, Orlando, FL, USA, [2]Towson University, Towson, MD, USA

Evolutionary Dynamics of an Expressed Class II MHC Gene in Ranid Frog Populations Impacted by Emerging Infectious Diseases

A major cause of global amphibian declines is disease caused by infectious pathogens such as the fungus *Batrachochytrium dendrobatidis* (Bd) and the virus Ranavirus (Rv). Disease susceptibility and host immunogenetics are linked across a wide range of vertebrate animals. However, in amphibians, the relationship between host genetics and host susceptibility to disease is not well known for most taxa. Major histocompatibility complex (MHC) genes encode cell surface proteins that bind to and display pathogen antigens for T-cell recognition, and are therefore essential for generating acquired immune responses. In this study, we use amplicon sequencing to characterize an expressed class II MHC gene within and among populations of multiple North American ranid frog species. We also use quantitative polymerase chain reaction (qPCR) to measure prevalence and intensity of Bd and Rv for each individual. Subsequently, we test for significant associations between MHC genotype and the presence and intensity of Bd and Rv infection. To parse the roles of selection and demography in driving MHC evolution, we also sequence mitochondrial loci ND1 and ND2 across individuals as a metric of neutral population genetic diversity. Finally, we reconstruct a Bayesian genealogy of all recovered MHC alleles to assess trans-species polymorphism and lineage- and site-specific evidence of positive selection. Our study provides enhanced understanding of the link between adaptation to disease and MHC genotypes in North American amphibians, which can ultimately improve conservation and management efforts to prevent future declines.

0282 Herp Biogeography & Phylogeography I, Sunday 16 July 2017

Derek Tucker[1], Jack Sites, Jr.[2], Tomas Hrbek[3], Adam Leache[13], Nelsy Rocío Pinto-Sánchez[4], R. Alexander Pyron[5], Miguel Rodrigues[6], Omar Torres-Carvajal[7], Giuseppe Gagliardi Urrutia[8], Pablo Venegas[9], Laurie Vitt[10], Fernanda Werneck[12], Guarino Colli[11]

[1]University of West Florida, Pensacola, FL, USA, [2]Brigham Young University, Provo, UT, USA, [3]Universidade Federal do Amazonas, Manaus, Brazil, [4]Universidad de los Andes, Bogotá, Colombia, [5]The George Washington University, Washington, D.C., USA, [6]Universidade de São Paulo, São Paulo, Brazil, [7]Pontificia Universidad Católica del Ecuador, Quito, Ecuador, [8]Instituto de Investigaciones de la Amazonia Peruana, Iquitos, Peru, [9]Centro de Ornitología y Biodiversidad, Lima, Peru, [10]University of Oklahoma, Norman, OK, USA, [11]Universidade de Brasília, Brasília, Brazil, [12]Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil, [13]University of Washington, Seattle, WA, USA

Species Boundaries and Phylogeography of the Widespread Giant Ameiva (*Ameiva ameiva*: Teiidae)

There has been a myriad of hypotheses put forth to explain the extreme biodiversity in the South American tropics. The Giant Ameiva (*Ameiva ameiva*) has an extremely large geographic distribution naturally occurring in much of South America east of the Andes

as far south as northern Argentina. A lack of genetic data has resulted in taxonomic disagreement surrounding subspecies designations and species delimitation and its huge distribution across five major biomes suggests a complex phylogeographic history. We aim to generate the first rangewide genetic dataset for the *A. ameiva* complex to be used in combination with morphology to discover unique evolutionary lineages within the group and propose hypotheses about the origins of these lineages. Our complete alignment of the mitochondrial gene ND2 included 1,119 bp of DNA for 357 samples and recovered six well-supported clades. An examination of species boundaries using the GMYC model was supported by discriminant analysis of principal components and showed that *A. ameiva* may consist of up to six species, with mitochondrial divergences among these lineages ranging from 4.7–12.8%. Expectations of the riverine barrier hypothesis are not observed across much of the distribution, however, phylogeographic structure and divergence time estimates demonstrate that marine incursions or the presence of a large lake 'Lago Amazonas' that covered much of the Amazon basin may have played a role shaping genetic patterns. We have also generated a large SNP dataset for 280 individuals and are currently analyzing these data for comparison to the mtDNA.

0517 ASIH STOYE GENERAL ICHTHYOLOGY I, Thursday 13 July 2017

A.J. Turner, Fernando Aldo, Prosanta Chakrabarty

Louisiana State University, Baton Rouge, LA, USA

Range-wide genetic and morphological variation in the sailfin molly, *Poecilia latipinna*

The sailfin molly, *Poecilia latipinna*, is part of the subgenus *Mollienesia* (Cyprinodontiformes: Poeciliidae) that diversified 1.1 – 4.0 Mya in Central America and expanded northward into Mexico and the Southeastern United States. Out of the 26 species within *Mollienesia*, *P. latipinna* has the northernmost distribution, which spans continuously from Mexico to Florida and reaches as far north as South Carolina. Across their wide distribution, sailfin mollies can be found in a variety of fresh and brackish water habitats. Living in such a variety of habitats has been known to facilitate phenotypic differences between populations, however, studies of this nature focused almost exclusively on variation at the local or regional scale, and the general patterns and drivers for this variation are unknown. The goal of this study was to test whether ecological or geographic barriers influence the morphological and genetic structure of *P. latipinna* throughout the species' entire range. Geometric morphometrics were used to identify morphological variation between different habitat types (e.g., freshwater streams and estuarine salt marshes) to explore if disjunct populations showed morphological convergence in similar environments. Genetic data were obtained to identify population structure throughout the range of *P. latipinna*, which provided further insights into the role that both geology and ecology played in shaping variation within this widely-distributed species.

0060 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Peter Uetz[1], Paul Freed[2], Jiří Hošek[3]

[1]Virginia Commonwealth University, Richmond, VA, USA, [2]The Reptile Photo Database, Scotts Mills, OR, USA, [3]Reptarium, Ostrava, Czech Republic

The Reptile Database: new developments

The Reptile Database (http://www.reptile-database.org) was founded in 1996 as EMBL Reptile Database and has evolved into a major online resource for systematic herpetology (for a brief history see Uetz 2016, *Herp. Rev*. 47: 330). Currently (March 2017) the database lists 10,520 species and 2,474 subspecies, although these numbers change almost daily. All species have distribution information and their original citations, with a total of 41,524 literature records of which 25,179 were linked to web sites where they can be obtained (many at the Biodiversity Heritage Library and other public sites). At the time of this writing, 3,373 species had diagnoses, 4,316 had etymologies, 10,208 had type localities (many with coordinates that are mapped to Google maps online), and 10,386 had type information (i.e. museum specimens). Currently the database receives ~ 35,000 visits and ~200,000 page views a month. This spring we exceeded 10,000 user-submitted photos representing 3,800 species. We also expect to make available maps to most reptile species world-wide this year. The database has enough data to make it useful for research projects, e.g. macro-ecology, species identification, or large-scale phylogenetics projects. Examples of ongoing research are presented.

0244 Fish Biogeography & Morphology, Saturday 15 July 2017

Peter Unmack[1], Mark Adams[2], Christine Thacker[3]

[1]University of Canberra, ACT, Australia, [2]South Australian Museum, SA, Australia, [3]LA County Museum, CA, USA

Hemi-clonal unisexual carp gudgeons (Eleotridae: *Hypseleotris*): systematic clarification of species boundaries and various hybrid lineages in southeastern Australia

Carp gudgeons (Eleotridae: *Hypseleotris*) are the most abundant, widespread and biodiverse freshwater fishes in southeastern Australia, but the unacknowledged presence of multiple cryptic species and hemi-clonal unisexual lineages severely taints all research on this cornerstone group. Our goal is to help correct past taxonomic shortcomings and supply a valid framework for future study, by giving researchers a true picture of the group's biodiversity plus the means to accurately identify all sexual and unisexual forms in this key group. We used three genetic datasets including allozymes (52 loci), mtDNA (cytochrome b) and ddRADSeq (>10,000 SNP loci) to examine species and lineages across their entire range in southeastern Australia where most habitats contain 2-4 sympatric species and additional hemi-clonal lineages. One

key finding was a single sexual population of Lake's carp gudgeon which is of critical conservation and research concern as every other population examined of Lake's carp gudgeon are F1 hemi-clonal hybrids. For more details all about this group you'll have to come and see my talk!

0243 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Peter Unmack[1], Mark Adams[2], Dean Gilligan[3], Andrzej Kilian[4]

[1]University of Canberra, ACT, Australia, [2]South Australian Museum, SA, Australia, [3]DPI Fisheries NSW, NSW, Australia, [4]Diversity Arrays Technology, ACT, Australia

Are specific populations of key threatened Murray-Darling Basin fishes native or introduced?

Many Murray-Darling Basin (MDB) freshwater fishes have experienced extreme declines, with around a quarter of the freshwater fishes threatened with extinction. Here we target three native fishes that were once widespread across the MDB, but today have all had significant declines (Purple Spotted Gudgeon, Olive Perchlet and Darling Hardyhead). Remnant populations are extremely geographically limited, with some recently discovered populations occurring outside of the perceived natural range of the species. Existing genetic data have been unable to clarify whether these populations are endemic or translocated. Recovery actions for remnant populations are consequently very difficult to prioritise. We are now applying genetic data from thousands of loci from next generation double digest RAD sequencing, coupled with comprehensive sampling from all potential source populations. Together this should unequivocally distinguish the native status of each population. It will also provide key information regarding each population's genetic diversity, divergence between populations and whether any loci appear to be related to potential local adaptations. These results can then be used to guide reintroduction efforts and conservation strategies.

0022 Herp Morphology & Development, Saturday 15 July 2017

Nicole Valenzuela, Srihari Radhakrishnan, Robert Literman

Iowa State Institution, Ames, IA, USA

Sexually dimorphic DNA methylation of sex-determining genes in TSD painted turtle hatchlings and their historic methylation revealed by genome-wide analyses

DNA methylation alters gene expression but not DNA sequence, mediates phenotypic plasticity, and depends on genomic CpG distribution. Temperature-dependent sex determination (TSD) epitomizes phenotypic plasticity. Yet, how extensive is the link between DNA methylation and TSD remains unclear. Here we test for broad differences

in genome-wide DNA methylation between male and female hatchling gonads of the painted turtle *Chrysemys picta* (TSD) using Methyl DNA Immunoprecipitation sequencing (MeDIP-seq), to identify differentially methylated candidates for future study, including genes involved in vertebrate gonadal development and other potential mediators of TSD sex-specific development (genes of the epigenetic machinery, hormonal pathways, sensing responses). We also examine the genome-wide nCpG distribution in painted turtles, compare it other vertebrates, and test for historic methylation in genes regulating vertebrate sex determination/differentiation. We discuss our finding of sexually dimorphic DNA methylation in turtle gonads, its potential mediators and implications for the regulation of thermosensitive transcription in TSD vertebrates. Sexually dimorphic methylation of sex-determining genes in TSD turtle hatchlings and their historic methylation revealed by genome-wide analyses.

0671 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Maria C. Vallejo-Pareja[1], Juan D. Daza[1], Jessica A. Maisano[2], Monte L. Thies[1]

[1]Sam Houston State University, Huntsville, Texas, USA, [2]The University of Texas at Austin, Jackson School of Geosciences, Austin, Texas, USA

Consequences of Miniaturization in the Cranial Osteology of Lizards and Snakes

Miniaturization, the development of extreme body size, has evolved in at least 24 families within Squamata. In miniaturized skulls (~ 15 mm skull length or less), the space between the otic capsules is minimal. Given the large number of miniaturized groups, a general review of this evolutionary process and its consequences in the squamate skull is warranted. In this review, we assemble morphological changes previously attributed to miniaturization, together with new observations. General cranial features of miniaturized squamates include: 1) The relative increase in size of the neurocranium and its positioning at the same level as the dermatocranium; 2) the occipital condyle located at the posterior-most position of the skull; 3) the closure or reduction of the post-temporal fenestra; 4) the proportional expansion of the otic capsules; 5) elongation of the skull, with a 1:1 proportion between the snout and parietal units; 6) widening of the snout; and 7) short and stout paroccipital processes. Although a combination of these features is common among small squamates, at extreme miniaturization some groups exhibit morphological disparities. For example, small chameleons (*Brookesia minima*) have a short and anteroposteriorly compressed snout, resulting in a shortened skull, while small geckos have long (*Sphaerodactylus ariasae*) or shortened (*Chatogekko amazonicus*) snouts. Furthermore, while the majority of miniaturized squamates undergo closure of the post-temporal fenestra, in dwarf chameleons this opening remains open and proportionally large. Although miniaturization might also produce many convergent features among squamates (e.g., fossorial reptiles), in some groups (e.g., Chameleons) it results in distinctive morphologies.

0447 LFC Contributed III, Saturday 15 July 2017

Cindy van Damme[1], Niels Hintzen[1], Frank Kleissen[2], Loes Bolle[1], Matthias Kloppmann[3], Richard Nash[4]

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Improving Larvae Survey Indices: A case study of North Sea Herring

Recruitment is one of the major drivers of fish stock dynamics. Getting a correct perception of recruitment is therefore essential for fisheries management. Its prediction still is one of the most difficult aspects in fish stock dynamics to forecast, even if dedicated surveys are in place to sample larvae or juveniles. In the case of North Sea herring (*Clupea harengus*) there is a larvae survey (IHLS) for estimating the Spawning Stock Biomass and a later larvae survey (IBTS-MIK) for estimating recruitment. Once considered as a very good predictor of herring recruitment, in recent years the MIK index has become a poorer forecaster because the samples collected do not cover the offspring of the entire North Sea stock: only the autumn spawning component is sampled while the later winter spawning component is ignored. The mismatch is in that the IHLS gives an estimate of the whole North Sea stock, whereas the MIK recruitment index does not. A solution is to use a combination of larval drift modelling with data from the IHLS and including data from the MIK that was not previously used for estimating the recruitment index, along with simulation modelling to test if changes in survey design and the estimation procedures can provide more realistic estimates of SSB and recruitment. These simulations can also investigate whether it is advantageous to implement a new survey to estimate recruitment of the winter spawning component and thus, in combination with the standard MIK index, provide a recruitment index for the whole stock.

0783 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Robin Van Meter, Rose Adelizzi

Washington College, Chestertown, MD, USA

Pesticide and Fertilizer Effects on Corticosterone Production in Juvenile Amphibians

Agrochemicals, primarily pesticides and fertilizers, are used regularly to control damaging crop organisms and to increase crop productivity and yield. Their widespread use throughout agriculturally intensive landscapes makes these chemicals a risk factor for non-target organisms, both during and after application. Given the long-distance movement of amphibians to and from breeding ponds, often through croplands, exposure and susceptibility to agrochemicals is highly probable. In an effort

to close our knowledge gaps on the combined effects of pesticides and fertilizers on terrestrial phase amphibians, this study was designed to explore bioaccumulation and stress response in Southern leopard frogs (*Rana sphenocephala*). Juvenile frogs were exposed to three agrochemicals in a factorial design including atrazine, alachlor and urea, 2 herbicides and a fertilizer, respectively, at the labeled application rate on natural soils for 8-hours. Following chemical exposure, all frogs were transferred into clean bowls filled with 150mL distilled water for 1 hour to measure stress response. Frogs were extracted as whole-body homogenates for pesticide analysis using GC-MS and water samples processed for corticosterone (stress hormone) production using Caymen Chemical ELISA kits. The mixture containing all 3 agrochemicals resulted in significantly greater corticosterone production (ANOVA p=0.002) indicating an elevated stress response among exposed frogs. Amphibians are most active during the same time of year that crops are grown and harvested, therefore gaining knowledge on the short- and long-term impacts of agrochemicals on terrestrial amphibians is essential for improved conservation efforts.

0814 AES Behavior, Sunday 16 July 2017

Jeremy Vaudo[1], Heidi Dewar[2], Michael Byrne[1], Bradley Wetherbee[3], Mahmood Shivji[1]

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Coupling of horizontal and vertical movements of shortfin mako sharks (*Isurus oxyrinchus*) in the eastern North Pacific Ocean

The pelagic environment represents a three-dimensional landscape, however, shark movement studies often focus on only two dimensions (i.e., horizontal movements). Combining data sets on horizontal movements with vertical movements provides a much more detailed view of movement behaviors and habitat use. The shortfin mako shark (*Isurus oxyrinchus*) is a wide ranging species found in temperate and tropical waters worldwide. Although horizontal and vertical movements of this species have been examined at various scales, there has been little work uniting these movements. To investigate the relationship between horizontal and vertical movements of juvenile mako sharks in the eastern North Pacific Ocean, 35 mako sharks (114 - 245 cm FL) were double-tagged with Pop-up Archival and Transmitting (PAT) and Smart Position or Temperature Transmitting (SPOT) tags within the Southern California Bight between 2003 and 2008. We examined the depth distributions of these individuals after their horizontal movements were first classified into one of two behavioral modes (area-restricted movements or transiting) using a switching state-space model. During the transiting mode, proportion of daytime spent shallower than 10 m was relatively consistent (~57%) regardless of the thermal characteristics of the water column. Except for in the coolest water columns, mako sharks spent less time shallower than 10m while displaying area-restricted movements, possibly related to foraging.

0258 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Diego Vaz, Eric Hilton

Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA

Title: Morphological Variation of the Swimbladder of Toadfishes (Percomorphacea: Batrachoidiformes)

Batrachoidiformes, the Toadfishes, comprises 82 species of bottom-dwelling fishes that live in temperate and tropical coastal areas of all oceans around the world. These fishes are capable of a wide variety of vocalizations that are used for mating and nest defense. The sound is produced by sonic muscles attached to the swimbladders. The swimbladders of Batrachoidiformes are unique, being formed by two lobes. Previous studies proposed that a heart-shaped swimbladder is a synapomorphy of Batrachoidiformes, although there has yet to be a survey of this character across the diversity of Toadfishes. Morphological variation in this organ was examined through manual dissection of specimens of 34 species (in 16 genera) were examined, broadly representing the four currently accepted subfamilies of Batrachoidiformes. The level of separation between the lobes is variable among subfamilies: the lobes of the swimbladder of Thalassophryine, Batrachoidinae and Porichthyinae are separated anteriorly, but fused posteriorly. Species of Halophryinae share an almost complete separation of the lobes, with the left and right connected only by a small trunk in the postero-ventral surface of the swimbladder. Unlike all other subfamilies, which have rounded anterior edges of the lobes of the swimbladder, these lobes were found to be angular in representatives of Porichthyinae. Sexual dimorphism of the size of the swimbladder is present, with males usually having larger swimbladders than females. The sexual dimorphism, however, is not reflected in the degree of separation between lobes or in the shape of anterior edges of swimbladder.

0254 ASIH STOYE GENERAL ICHTHYOLOGY III, Friday 14 July 2017

Diego Vaz[1], Eric Hilton[1], Adam Summers[2]

[1]*Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA,* [2]*Friday Harbor Laboratories, University of Washington, Friday Harbor, WA, USA*

Title: The Intermuscular Bones and Ligaments of Batrachoidiformes (Percomorphacea: Teleostei)

Intermuscular bones are ossifications that develop directly in the myosepta and generally are associated with series of ligaments. Intermuscular bones are categorized into three main series: epineurals (dorsal to the horizontal septum); epicentrals (in the horizontal septum); and epipleurals (ventral to the horizontal septum).

Batrachoidiformes, the Toadfishes, is a monophyletic group of bottom-dwelling fishes described as having only the epineural series, in which the first epineural is enlarged and articulates with the cleithrum. Although the arrangement of the first epineural has been proposed as a synapomorphy of Batrachoidiformes, variation in the intermuscular complex across different species of toadfishes is unknown. Additionally, the interrelationships among species of Batrachoidiformes and its relationship to other percomorph fishes are unclear. To assess variation in this skeletal complex, representatives of the four sub-families of Batrachoidiformes were examined using CT-scans and cleared-and-stained specimens, with the goal of identifying characters that may be phylogenetically informative. The unique morphology of the first epineural was found in all examined species of Batrachoidiformes and seems unique among fishes. The second epineural (en2) in Halophryinae originates on the second neural spine; in Thalassophryinae, en2 articulates with the first neural spine; and in Batrachoidinae, en2 is is reduced. In Porichthyinae, the second and third epineurals are absent. Epicentrals, not reported previously in Batrachoidiformes, were found as both ligament (in all species) and bone (only in *Barchatus, Chatrabus*, *Colletteichthys*, *Halobatrachus*, *Perulibatrachus* and *Riekertia*). The implication of these characters for reconstructing the phylogenetic relationships within Batrachoidiformes will be discussed.

0221 LFC Contributed I, Friday 14 July 2017; LFC SALLY L. RICHARDSON BEST STUDENT PAPER

Sebastian Velez, Jon Moore

Florida Atlantic University, Boca Raton, Florida, USA

Larval and Juvenile Population Dynamics of Families Lutjanidae and Serranidae in the Gulf of Mexico, with Respect to the Loop Current and other Hydrographic Features

The Gulf of Mexico (GoM) is a dynamic environment with a variety of hydrographic features and oceanographic processes taking place. These features include; the Loop Current, cyclonic and anticyclonic eddies, and the Mississippi River Plume, all of which are important drivers of the biological processes in the GoM. Identifying the role these features play in the transportation of larval and juvenile nearshore species to offshore environments is vital to resource managers. This information would allow managers to account for future changes to the environment and the effect large scale disturbances could have on economically important fish species. The long term larval and juvenile population dynamics of families Lutjanidae (snappers) and Serranidae (groupers) have been of great interest from a biological and economic perspective. These families represent many of the large predators found in reef ecosystems and are some of the most valuable fisheries in the GoM. Using data collected after the Deepwater Horizon Oil Spill (DWH) via the NOAA Natural Resource Damage Assessment in 2011 as well as from cruises conducted by the Deep Pelagic Nekton Dynamics of the Gulf of Mexico Consortium (www.DEEPENDConsortium.org) from 2015-2017. In comparing these two

datasets we hope to identify the potential effects the DWH Spill had on these fishes and the role these oceanographic features play on their population dynamics.

0903 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Joaquin Villamil[1], Luciano J. Avila[2], Mariana Morando[2], Raul Manyero[1], Jack W. Sites, Jr.[3], Arley Camargo[4]

[1]Univ. de la Republica, Montevideo, Uruguay, [2]Centro Nacional Patagonico, Puerto Madryn, Chubut, Argentina, [3]Univ. de la Republica, Montevideo, Uruguay, [4]Brigham Young Univ., Provo, Utah, USA, [5]Univ. de la Republica, Rivera, Uruguay

Species limits and divergence times of lizards of the *Liolaemus wiegmannii* complex (Duméril & Bibron 1837) (Squamata: Liolaemidae)

Liolaemus wiegmannii together with 11 other species is part of the *wiegmannii* group, a clade of mainly arenicolous lizards whose monophyly is strongly supported. It is a species with wide distribution over several provinces of the center, center-south and northwestern of Argentina, as well as a great part of the coastal belt of southwestern and south of Uruguay. However, numerous authors have suggested that it could be a species complex. Here, we test the hypothesis of multiple species within *L. wiegmannii* and estimate the divergence times between independent lineages. We analyzed sequences of the cytochrome b gene and two nuclear loci (KIF24 and PRLR) with a Bayesian inference approach based on the multi-species coalescent. We infer species delimitation with Beast 2 STACEY, and the divergence times with the Beast 1.8 starBeast tool. The results support the hypothesis that *L. wiegmannii* includes at least four candidate species whose divergences would have begun in the early Pleistocene. The first split separated the complex into a sand-dune lineage, distributed in central-southern Argentina and Uruguay, and another present in no-dune habitats of northwestern Argentina. Thus, the early speciation of the complex may have been influenced by the expansion of the sand dunes in the Pampa and northern Patagonia during the last great Patagonian glaciation (approximately 1 million years ago).

0794 General Herpetology, Sunday 16 July 2017

Andrea Villamizar-Gomez, William Keitt, Zachary Adcock, Dittmar Hahn, Michael Forstner

Texas State University, TX, USA

Prevalence of chytrid fungus (*Batrachochytrium dendrobatidis*) in the Jollyville Plateau Salamanders (*Eurycea tonkawae*) and its correlation with microhabitat

Batrachochytrium dendrobatidis (*Bd*), is a fungus that causes chytridiomycosis on infected amphibians, and has been implicated as a potential causative agent in some amphibian population declines. This study is a multi-year evaluation of prevalence of *Bd* in a population of salamanders, *Eurycea tonkawae*, in Central Texas across. We visited 7 sampling sites monthly (2013 - 2016) and evaluated possible relationships among microhabitat data and water chemistry measurements including temperature, pH, dissolved oxygen, turbidity, and conductivity to seasonal and site prevalence of *Bd* for more than 700 samples. Each salamander swab was assessed for the presence of the pathogen using a Taqman quantitative real-time PCR (*q*PCR) assay. Over the period the highest overall prevalence was 46% in 2013 and the lowest prevalence was 14% in 2014. It remains unknown if *Bd* has a harmful impact on this population of salamanders. Further monitoring of pathogen detection and the state of the population remain key components to determining how, or if, *Bd* affects the salamander population.

0430 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Friday 14 July 2017

Kirill Vinnikov, Kathleen Cole

University of Hawaii at Manoa, Honolulu, HI, USA

Exon Capture Sequencing of Amphidromous Gobies from the Genus Stenogobius (Teleostei: Gobiiformes)

Amphidromous gobies from the genus *Stenogobius* represent an extremely widespread group of Indo-Pacific fishes, which occur in almost every coastal freshwater stream of South-East Africa, South and South-East Asia and of most Central Pacific islands, including Hawaii. An amphidromous life cycle means that individuals live and reproduce in a freshwater environment during their adult stage. Larvae upon hatching passively drift to the ocean for a marine pelagic larval period, before returning to a freshwater stream and transforming into adult. It is still not clear whether marine larvae of *Stenogobius* species can disperse widely between the islands and archipelagos during a single life cycle, or whether they stay close to their natal streams. The goal of the current study is to investigate the population structure of *Stenogobius* species on selected Central Pacific Islands by using the exon capture sequencing approach. Here we provide our preliminary results on the population structure of *Stenogobius* and describe our experimental pipeline, which allows us to obtain a large amount of sequencing data for numerous coding regions, from hundreds of individuals. The pipeline consists of three steps: 1) transcriptome sequencing and annotation; 2) bait development and exon capture; and 3) exon sequencing with the following alignment of orthologs. The resulting dataset with >2,500 exons for 135 individuals provides the amount of necessary information for recovering fine scale population genetic structure, including genes under selection, and for estimating the larval dispersal pathways between islands of the Central Pacific.

0287 AES Ecology II, Sunday 16 July 2017

Liz Vinyard[1], Wally Bubley[1], Gorka Sancho[2], Bryan Frazier[1]

[1]*South Carolina Department of Natural Resources, Charleston, South Carolina, USA,* [2]*The University of Charleston, South Carolina, Charleston, South Carolina, USA*

Diet of the Finetooth Shark, *Carcharhinus isodon*, in coastal waters of the western North Atlantic Ocean

Diet and trophic interactions are becoming more important to understand ecological roles of organisms which can aid in current management decisions or future management approaches, such as ecosystem based methods. While the Finetooth Shark, *Carcharhinus isodon*, is one of the most abundant shark species in estuarine and nearshore waters in South Carolina, dietary information in the western North Atlantic (WNA) is limited to descriptive studies. This study provides the first quantitative diet study of the WNA Finetooth population using stomach content and stable isotope analysis to evaluate prey importance, trophic level, and to assess ontogenetic overlap. Stomach contents (n = 230) confirmed a teleost diet for all age categories (YOY, 99.8% Index of Relative Importance (IRI), juveniles, 99.8% IRI; adults, 99.9% IRI) with Atlantic Menhaden, *Brevoortia tyrannus,* as the most important prey species. Stable isotope analyses (n = 58) indicated juveniles had a significantly greater reliance on pelagic carbon sources while adults had significantly higher nitrogen ratios indicative of higher trophic level feeding. While dietary overlap between age categories was observed, each category maintained unique isotopic niche space. Juveniles had the smallest combined percentage of dietary niche overlap while adults had the largest. Even with a highly specialized diet, Finetooth Sharks display ontogenetic dietary shifts which have the potential to be driven by habitat usage and suggest the possibility of resource partitioning by age.

0714 Turtle Behavior, Friday 14 July 2017

Richard C. Vogt[1], Camila R. Ferrara[0]

[1]*Insituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil,* [2]*Wildlife Conservation International Brazil, Manaus, Amazonas, Brazil*

Underwater Vocalizations in Freshwater Turtles and Seaturtles may be used for Management and Documenting Presence and Abundance Data

We have been documenting underwater vocalizations in both freshwater and marine turtles in nature for the last several years. We use the term vocalizations in that we now have video recordings of turtles vocalizing underwater and simultaneous muscle movements on the inferior posterior cephalic region suggesting the sounds are being produced in the buccal cavity. Although our most extensive work has been with one freshwater species, the Giant South American River Turtle (*Podocnemis expansa*) in the Brazilian Amazon Basin we have also documented vocalizations in many other freshwater species from both suborders in North and South America, Mexico, Australia

and China, as well as all species of seaturtles. The propagation of low frequency sound underwater is an excellent media for long distance communication. We were able to call adult female *P. expansa* from one nesting beach congregation to another 4 km away by conducting underwater playback experiments using the vocalizations they emit when they are ascending the beach to nest. Now that we have verified that some marine turtles are vocalizing underwater during an arribada, we plan to use underwater speakers playing back the vocalizations of the arribada to call turtles into less concentrated nesting areas on the same beach to disperse the nesting activities; now the nests are concentrated in only a 5 km stretch of the 25 km beach in Escobilla, resulting in the loss of 100,000s of eggs due to females destroying nests during their digging of their own nest.

0040 ASIH STOYE CONSERVATION III, Friday 14 July 2017

Anthony W. Waddle, Jef R. Jaeger, Frank van Breukelen

University of Nevada, Las Vegas, Las Vegas, Nevada, USA

Emerging Infectious Disease and the Decline of the Imperiled Relict Leopard Frog

Chytridiomycosis is an emerging infectious disease of amphibians caused by the aquatic fungal pathogen, *Batrachochytrium dendrobatidis* (*Bd*). This pathogen has spread to every continent where amphibians occur, and has been linked to hundreds of species declines and many well-documented extinctions. Prior research into the thermal tolerance of *Bd* suggested that this invasive fungus may not be a threat in hot, arid regions. Recent contradictory evidence, however, prompted us to investigate the occurrence and impact of *Bd* in a frog species of conservation concern in the Mojave Desert. The relict leopard frog was historically more widespread, but now only exists naturally in thermal springs in two general areas in southern Nevada where high water temperatures may provide refuge from *Bd*. We sampled and detected *Bd* within the historical range of the relict leopard frog and in one population of the species. We subsequently performed *Bd* exposure studies to determine the susceptibility of this frog to chytridiomycosis. Our early efforts, using *Bd* strains isolated during die-offs of other anuran species in California, suggested that the pathogen might not be a substantial threat to the relict leopard frog. Our more recent efforts, however, show that *Bd* isolated from southern Nevada, including an isolate from a relict leopard frog, and *Bd* isolated from captive exotic amphibians increased mortality in the species. Our future research will borrow from the creativity of other *Bd* researchers in an effort to provide solutions to the management challenges for the relict leopard frog.

0290 Amphibian Conservation I, Sunday 16 July 2017

Hardin Waddle[1], Michael Adams[2], Daniel Calhoun[3], Robert Fisher[4], Evan Grant[5], Daniel Grear[6], Brian Halstead[7], Blake Hossack[8], Jeffery Lorch[6], Erin Muths[9], Susan Walls[10], LeAnn White[6]

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A National Survey for *Batrachochytrium salamandrivorans* (Bsal) in the United States

Disease is one of many threats to amphibian populations worldwide. The emerging chytrid fungal pathogen *Batrachochytrium salamandrivorans* (Bsal) has caused widespread mortality among salamander species in Europe. Because of the high endemic diversity of salamander species in the U.S., Bsal has the potential to deal a major blow to global salamander diversity if it is introduced and becomes established here. Out of concern for the risk that Bsal poses to U.S. amphibians should it become established, the U.S. Geological Survey conducted a national survey for Bsal in 2016 and 2017. Our objective was to detect Bsal if it was present in wild populations of salamanders. We swabbed the skin of amphibians and used molecular methods (real time PCR diagnostic assay) to detect Bsal and *B. dendrobatidis* (Bd). We primarily sampled newts (*Notophthalmus* spp. and *Taricha* spp.) as they are widespread and abundant salamanders known to be susceptible to Bsal, but 39 other species including anurans were also sampled. Nearly 10,000 samples were collected from more than 390 sites representing 177 counties across 34 states. Whenever possible, a sufficient sample was collected at each site to ensure that Bsal would have been detected with 90% probability, even at a prevalence of 10% within the population. The results of this national survey provide information on the distribution of Bd and Bsal in the U.S. that can be used to update and refine risk assessments for these fungal pathogens.

0169 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brian Waldron[1], Shawn Kuchta[2], Cari Hickerson[1], Maggie Hantak[2], Carl Anthony[1]

[1]John Carroll University, University Heights, OH, USA, [2]Ohio University, Athens, OH, USA

Genetic Analysis of Distinct Lineages of *Plethodon cinereus* at a Secondary Contact Zone in Northeast Ohio

Contact zones between species, subspecies, or potentially diverging lineages offer important insights into the processes that maintain reproductive isolation. *Plethodon*

cinereus, a highly abundant and wide-ranging terrestrial salamander found in the northeast United States and Canada, provides an excellent model system for studying secondary contact zones. Using mtDNA, six distinct clades have been identified across the range of *Plethodon cinereus*. Populations of two such clades, the Ohio (OH) clade, which dispersed through central Ohio following receding glaciers of the Last Glacial Maximum, and the Pennsylvania (PA) clade, which dispersed through Pennsylvania and then west through northern Ohio, can be found approximately 9.4 km apart in Lorain County, Ohio. I collected tissue samples at 25 sites along an approximate north-south transect following the Black River between two populations with known clade assignment (OH-north and PA-south clades). Ten microsatellite loci and restriction-fragment length polymorphisms of mtDNA were examined to characterize the genetic structure of the contact zone between and surrounding the known populations. Twenty-three sites contained only members of the PA clade and only two sites contained a mixture of members of both the OH and PA clades. Population structure from microsatellite data analyzed suggests either 2 or 6 genetic clusters, although given the available data, it is not clear if these clusters correspond to clade membership. My results suggest that the contact zone extends northward toward Lake Erie or west of the present sampling area and should be further sampled to test gene flow and genetic clines between these two clades.

0469 AES Trophic Ecology/Physiology, Friday 14 July 2017

Cathy Walsh[1], Jess Restivo[1], Timothy Polk[2], Hannah Reid[3], Carl Luer[1]

[1]Mote Marine Laboratory, Sarasota, FL, USA, [2]University of South Florida Sarasota-Manatee, Sarasota, FL, USA, [3]University of Tampa, Tampa, FL, USA

Preliminary Studies to Transform Elasmobranch Immune Cells into a Continuous Cell Line

Research in our laboratory has demonstrated that 72-96 hr cultures of immune cells derived from shark epigonal organs secrete compounds into the surrounding culture medium that will kill human tumor cells *in vitro* by inducing apoptosis (programmed cell death) via a mechanism that preferentially targets cancer cells compared to normal cells. Studies are underway to transform elasmobranch immune cells into a continuous cell line, with the goal of generating tumor cell inhibitory compounds from cells in culture. These efforts represent the first application of hybridoma technology with elasmobranch cells and explore the feasibility of co-culturing allogeneic populations of immune cells to stimulate cell transformation via polyethylene glycol (PEG)-mediated cell fusion. Methodology gained from preliminary studies using peripheral blood leukocytes from Atlantic stingrays (*Dasyatis sabina*) has been applied to epigonal cells isolated from bonnethead sharks (*Sphyrna tiburo*), where one allogeneic population of cells stained with green fluorescing dye and the other stained with red fluorescing dye were co-cultured. The interaction between populations of stained cells was examined by fluorescent microscopy and cell cycling was analyzed using cell flow cytometry. Analyses of stained cell mixtures were performed before and after PEG treatment, with

PEG treatment resulting in an increase in cells whose fluorescent properties were consistent with a fused cell population. Cell cycle profiles demonstrated the persistence of replicating cells (S-phase) for up to 4 weeks in the mixed cells/fused cells treated with PEG, with a decline in replicating cells in the absence of PEG.

0345 General Ichthyology I, Sunday 16 July 2017

Brandon Waltz[1], Fernando Alda[2], Prosanta Chakrabarty[2], James Albert[1]

[1]*University of Louisiana at Lafayette, Lafayette, LA, USA,* [2]*Louisiana State University, Baton Rouge, LA, USA*

Addressing the Achilles Heel of Biodiversity: UCEs Indicate Cryptic Speciation in the Neotropical Electric Fish *Eigenmannia macrops*

Understanding biodiversity is fundamental to elucidating the relationships of life on Earth and understanding evolutionary patterns and processes. Evolutionary analyses and reliable measures of species richness depend on accurate alpha taxonomy; therefore, it is necessary to understand the nature of variation as the basis for correct species delimitation. However, the vast majority of species have been described based solely on morphology, leaving out a key source of variation and leading to the "Achilles heel" of biodiversity: undocumented cryptic diversity. Metapopulations face a variety of evolutionary processes contributing to lineage divergence and independence, including processes traditional morphological practices would be unable to recognize. Environmental conditions may exert strong stabilizing selection on aspects of morphology, resulting in maintenance of similar morphology throughout and after speciation. Additionally, and likely alongside stabilizing selection, the diversification of non-visual mating cues can result in undetected diversity. *Eigenmannia macrops* is a freshwater fish present in abundance throughout three large Neotropical river basins and possesses a weakly-electric signal used for non-visual communicative, reproductive, and foraging behaviors, making *E. macrops* an excellent candidate species to assess cryptic diversity. Furthermore, preliminary genetic analyses suggest the presence of undocumented diversity within the nominal taxon *E. macrops*. Here we present a case study examining the evolutionary patterns associated with cryptic speciation. Utilizing 101 samples from across the Amazon, Orinoco, and Essequibo basins, we examine the evolutionary history of *Eigenmannia macrops* using next generation target enrichment methods coupled with Bayesian species delimitation and validation methods.

0025 LFC Nutrition, Friday 14 July 2017

Jian Wang, Wen-Xiong Wang

The Hong Kong University of Science and Technology, Hong Kong, Hong Kong

Understanding the role of rotifer in micro-element nutrition to marine fish larvae

Rotifer has been widely used as the mouth-open diet for many marine fish larvae, whereas its role on micro-element nutrition has been seldom investigated. In present study, bioaccessibility of micro-elements in rotifer (enriched or non-enriched) was evaluated through an in vitro fractional method. Radio-tracer technique was adopted to study the specific micro-element (i.e., Zn and Fe) and macro-element (i.e., C) transfer from rotifer (enriched or non-enriched) to two different staged marine medaka larvae (*Oryzias melastigma*). The results showed that enrich rotifer with green algae (*Nannochloropsis gaditana*) can significant ($p<0.05$) increase Co, Mn and Fe content in rotifer and retained more micro-elements in the non-skeleton fraction (bioaccessible fraction). Fe assimilation efficiency (AE) by fish was significantly increased (ca. 1 fold) when fed with enriched rotifer. The digestive ability of madaka larvae increased from 5 dph to 25 dph, which in lined with the increased AE of C (ca. 1 fold). However, only a slight increase of both Fe and Zn AE proceeded over this period. The overall study suggested high bioaccessibility of micro-elements in rotifers and stressed importance of algae enrichment in the enhancement of larval fish micro-element nutrition (especially Fe). The assimilation of micro-elements by larval fish was unlikely limited by their digestive abilities, but the presence of certain bioavailable elemental species mattered.

0360 ASIH STOYE CONSERVATION II, Friday 14 July 2017

Brooke Washburn, Mollie Cashner, Rebecca Blanton

Austin Peay State University, Clarksville, Tennessee, USA

Islands in the stream, is that what we are: assessing the spatial scale of genetic diversity in the endangered Tuxedo Darter, *Etheostoma lemniscatum*

The federally endangered Tuxedo Darter, *Etheostoma lemniscatum*, occupies a 38.6 km reach of the Big South Fork Cumberland River where it is associated with shallow, slow-moving water with large substrate, generally located near riffles. This habitat is patchily distributed and separated by long sections (>1 km) of deep pools that are thought to be unsuitable for the species. Given intrinsic features of the species, which suggest it may have limited dispersal potential, we examined whether optimal habitat patches are functionally islands (or metapopulations), resulting from restricted gene flow. Fin clips were taken from *E. lemniscatum* collected while snorkeling. A total of 232 individuals were observed; of these, 165 individuals were captured and fin clipped from 18 distinct habitat patches encompassing its range. Sixteen variable microsatellite loci were identified and optimized for PCR amplification. A subset of individuals (n=72) from 15 habitat patches have been genotyped. Preliminary results show weak, but significant (F_{ST}=0.012), genetic structure among populations upstream and downstream of an 11 km disjunction in their distribution and overall higher allelic diversity from the upstream reach (downstream: N_a=4.06; upstream: N_a=4.88). These results suggest long distances or reaches with unsuitable habitat may limit gene flow. The lower bound of the N_e estimate indicates the overall breeding population could be as low as 376 individuals; higher than the last census estimate (N_c) of 300 individuals. Efforts to genotype the remaining

individuals at all loci to further elucidate genetic structure among sample localities are ongoing.

0392 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Dennis Wasko, Stephan Bullard

Hillyer College, University of Hartford, West Hartford, CT, USA

Analysis of Mass-Media Reported Venomous Snakebites in the U.S., 2011-2013

A common perception exists in some cases that in the United States, most venomous snakebites are "illegitimate," resulting from victims' deliberate interaction with snakes (such as attempting to move or kill the animal). While many studies have addressed snakebite epidemiology, victim demography, and clinical presentation, there is relatively little quantitative information available regarding the conditions under which bites actually occur. We compiled a dataset of snakebites occurring in the U.S. between 2011 and 2013, as reported by popular news outlets. A total of 332 reported snakebites were recorded, 307 occurring under natural circumstances and 25 under captive-care conditions. Most victims were adult males, and the majority of cases were considered "legitimate", usually resulting from accidentally stepping on or putting the hands near a snake. Sex was significantly associated with bite legitimacy, with males being more likely to intentionally interact with venomous snakes. While bias in popular-media snakebite reporting is likely and some results should be interpreted with caution, we consider this a useful complementary methodology. Across the United States, "legitimate" bites from unseen snakes appear to be the norm.

0802 Herp Reproduction & Life History II, Thursday 13 July 2017

Andrew R. Wastell, Stephen P. Mackessy

University of Northern Colorado, Greeley, CO, USA

Desert Massasauga Rattlesnakes in Colorado

Massasauga Rattlesnakes (*Sistrurus catenatus*) are threatened over much of their historic range and occur from SE Canada to SE Arizona. Desert Massasauga Rattlesnakes (*S. c. edwardsii*) in southeastern Colorado were studied over a ten year period. Mark–recapture data for 770 snakes indicated a population size of >3,500 snakes in an area of approximately 4,800 ha. Field growth rates and size class frequency distributions showed that average snake age was 3 yr; 4 yr old snakes were frequently encountered, but less than 4% were 5 yr or older, suggesting low survivorship beyond this age. Conversely, initial growth was rapid; snakes grew an average of 0.57 mm/day in their first full year. Desert Massasaugas mated in fall and spring, producing 2–7 (mean 3.3) young in late August-September, and reproduction appeared to be biennial. Desert

Massasaugas showed maternal attendance for at least 5 days post-parturition, and neonate dispersal corresponded with the first shed. Desert Massasaugas used rodent burrows as hibernacula, and within 50 m of Desert Massasauga hibernacula, eight snake, five anuran, and two turtle species use the same area for hibernation. Stable hibernation conditions are the primary resources attracting a diverse assemblage of species to this area, which serves as a critically important winter refuge for numerous species and supports the largest known population of Desert Massasaugas. This population is considered stable at present; however, because of rapidly changing climatic conditions, habitat loss and degradation, anthropogenic disturbance, and shifts in prey abundance, it may become threatened in the near future.

0713 LFC Nutrition, Friday 14 July 2017

Ken Webb, Lee Fuiman

University of Texas at Austin, Port Aransas, TX, USA

Tissue DHA Content of Red Drum (*Sciaenops ocellatus*) Larvae is Affected by Factors Other than Maternal Egg DHA Concentration

Previous research on red drum larvae in our lab has shown that the ability of red drum larvae to accumulate docosahexaenoic acid (DHA) in their tissues is affected by the level of DHA present in the egg. Research into the mechanisms underlying this "metabolic programming" have shown that while egg DHA content is a strong determinant, there are other factors involved. In the current experiment, we performed growout studies using eggs from two broodstock groups fed dissimilar diet regimes producing eggs of similar DHA content. While one group performed as expected with larval DHA accumulation predicted by egg DHA level the other group did not perform as expected. In order to examine these differences, eggs and larval tissues were analyzed using a number of approaches. First, eggs and larval tissues were analyzed for total fatty acid content. In order to better understand how the eggs differed, they were additionally analyzed for differences in neutral and polar metabolic compounds using mass spectrometry (LC-MS/MS) and magnetic resonance spectroscopy (MRS). Finally, the RNA profile of eggs and larval tissue was examined via tag based RNA-Seq (TagSeq) in order to examine differences in key metabolic markers.

0467 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY II, Thursday 13 July 2017

Denita Weeks, Matthew Parris

University of Memphis, Memphis, TN, USA

Immunity is Skin Deep: Considering Microbial Pesticides as a Disease Mitigation Strategy for Chytridiomycosis

Chytridiomycosis is an infectious amphibian disease caused by the pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*). *Bd* attaches to keratin on the dermis, invades skin cells, and may lead to pathogenesis in susceptible individuals. However, susceptibility differs within and among species. While this is due to many factors, the skin microbiome is a large contributor to disease resistance. Amphibians form symbiotic relationships with environmental microbes on the skin surface, some of which produce antifungal agents effective against *Bd.* Interestingly, many agricultural biopesticides utilize the common soil-dwelling bacteria, *Bacillus thuringiensis.* These bacteria are also known to produce antifungal metabolites and volatile organic compounds that inhibit growth of fungal plant pathogens. Through agricultural use, these bacteria increase in environmental abundance and provide opportunity for amphibian exposure. Additionally, *Bacillus* spp. appear in amphibian skin microflora, some of which inhibit *Bd*. Yet, *B. thuringiensis* has never been considered as a biological control agent for *Bd*. In vitro exposure to *B. thuringiensis* subsp. *kurstaki* significantly inhibited growth of *Bd*. We have also assessed the potential for *B. thuringiensis* colonization on *Lithobates sphenocephalus* and the subsequent effects on *Bd* susceptibility. Furthermore, while the bacteria alone may be beneficial, the toxicity of commercial formulations has been scarcely tested on amphibians. We found that eggs and premetamorphic tadpoles of *L. sphenocephalus* are sensitive to high doses of one commercial formulation. However, prometamorphic tadpoles and adults do not experience mortality. Ongoing research will assess the utility of these biopesticides in the microbial immunity of amphibians.

0747 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Nicholas Wegner[1], Laura Schwebel[1], John Hyde[1]

[1]NOAA Fisheries, La Jolla, CA, USA, [2]University of San Diego, San Diego, CA, USA

Reduced swimming and metabolic fitness of aquaculture-reared California Yellowtail (*Seriola dorsalis*) in comparison to wild-caught fish

Aspects of swimming and metabolic physiology were measured in aquaculture-reared California Yellowtail (*Seriola dorsalis*) in comparison to wild-caught individuals in order to examine potential reductions in health and fitness associated with captive rearing, and to help identify areas for targeted improvement in *Seriola* aquaculture. Incremental swimming velocity trials using a swim tunnel respirometer showed that aquaculture-reared yellowtail had a significantly slower mean maximum sustainable swimming speed (U_{crit}) (4.16±0.62 BL s^{-1}) in comparison to that of wild-caught fish (4.80±0.52 BL s^{-1}). In addition, metabolic ($\dot{M}O_2$) measurements at varying swimming speeds allowed for estimation of standard metabolic rate, which was significantly higher in aquaculture-reared yellowtail (7.36±2.28 vs. 3.97±1.62 mgO_2 kg^{-1} min^{-1}). Aquaculture fish also had a reduced aerobic scope (9.16±3.40 mgO_2 kg^{-1} min^{-1}) in comparison to wild-caught yellowtail (15.77±5.78 mgO_2 kg^{-1} min^{-1}), which likely contributed to their reduced capacity for fast sustainable swimming. Reduced physical fitness is commonplace in aquaculture-reared fishes, and the examination of wild-caught yellowtail in this study provides baseline metrics that can be used to gauge the health and fitness of future *S.*

dorsalis production. In particular, the lower standard metabolic rate and higher aerobic scope of wild-caught fish represent desirable metabolic characteristics that if achievable in aquaculture through better-rearing practices should allow for more efficient and potentially faster growth. At a minimum, a 50% reduction in standard metabolic rate (to that observed for wild-caught yellowtail) would result in increased feed conversion efficiencies and substantial cost savings for aquaculture operations.

0755 SSAR SEIBERT ECOLOGY III, Friday 14 July 2017

Chava Weitzman[1], Sarah Snyder[3], Franziska Sandmeier[2], C. Richard Tracy[1]

[1]University of Nevada, Reno, Reno, Nevada, USA, [2]Colorado State University, Pueblo, Pueblo, Colorado, USA, [3]Bard College at Simon's Rock, Great Barrington, Massachusetts, USA

Co-infection Does Not Predict Disease in *Gopherus* Tortoises

In disease ecology, the host immune system interacts with environmental conditions and pathogens to determine the manifestation of disease. Pathogens can also interact inside a host to facilitate or inhibit other pathogens' growth, and pathogens interact with different hosts in different ways, allowing individuals to be carriers of pathogens that can cause harm to others. We investigated co-infection patterns of two *Mycoplasma* pathogens (*M. agassizii* and *M. testudineum*) and the association of infection with clinical signs of disease in four congeneric tortoise host species (*Gopherus*) in the United States to detect differences in infection risk and disease dynamics. By examining frequencies of infection and co-infection for each host species, we found that Mojave desert tortoises (*G. agassizii*) were more likely to have detectable amounts of one or both pathogens than other tortoise species. In some species, but not all, the presence of each pathogen influenced the infection intensity of the other. These two *Mycoplasma* pathogens interact differently within, and with, different hosts. Neither infection nor co-infection was associated with clinical signs of disease. Experimental inoculation studies, as well as recurrent resampling of wild individuals, would help further to decipher disease dynamics in this system.

0871 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Allison Welch, Amber Ruby, Emily Beam

College of Charleston, Charleston, SC, USA

Salinity Tolerance Across Life Stages in Southern Toads, *Anaxyrus terrestris*: Transitions and Carryover Effects

Salinization of freshwater ecosystems is an emerging environmental concern, as rising sea level, intensified storm surge, road deicing salts, and land use changes can contribute to increased salinity in freshwater habitats. Elevated salinity can increase the demands of osmoregulation in freshwater organisms, and amphibians are particularly at risk due to their semi-aquatic life cycle and permeable skin. Tolerance to environmental challenges may vary across the life cycle, with individual- and population-level impacts dependent on the timing of exposure relative to the timing of vulnerability. Further, environmental challenges experienced early in development may alter performance during later stages, through acclimatization, compensatory effects, or cumulative effects. We assessed salinity tolerance of embryos, tadpoles, newly metamorphosed juveniles, and adults of the southern toad, *Anaxyrus terrestris*. Among these life stages, embryos were the most sensitive to salinity, while both terrestrial stages were able to withstand moderately elevated salinities without dehydrating. We also tested for carryover effects of salinity exposure during embryonic development, and found that elevated salinity during the embryo stage resulted in reduced performance during the subsequent larval stage. Our results suggest that elevated salinity is most likely to affect population dynamics when experienced during embryonic development, when even transient exposure to elevated salinity can be detrimental. Further, the difference in tolerance between tadpoles and newly metamorphosed individuals suggests that salinity tolerance increases before or during the metamorphic transition. Finally, this study demonstrates that tolerance to elevated salinity may be overestimated unless carryover effects are considered.

0874 Lightning Talks II, Friday 14 July 2017

Allison Welch, Jessica Hinson, Sylvia Davila, Wendy Cory

College of Charleston, Charleston, SC, USA

Shining a Light on Prozac's Effects on Amphibians: Fluoxetine and its UV Phototransformation Products Reduce Growth and Activity of Toad Tadpoles

Pharmaceutical pollution is an emerging environmental concern, with a wide variety of medications appearing in surface waters around the world. In the environment, UV radiation can cause many pharmaceuticals to transform into related molecules, which may be more toxic than the original compound. Despite increasing attention to the effects of various pharmaceuticals on aquatic life, very little is known about the ecotoxicology of these pharmaceuticals' transformation products. This study examined the effects of the widely-prescribed antidepressant fluoxetine (Prozac) and its transformation products on amphibian larvae. Throughout larval development, tadpoles of the southern toad (*Anaxyrus terrestris*) were exposed either to untransformed fluoxetine or to fluoxetine that had undergone UV phototransformation. Tadpoles experienced similar growth reduction in the two treatments, even though the total concentration of fluoxetine and its transformation products was lower in the phototransformed treatment. This result suggests that tadpole growth was more strongly affected by the transformation products than by fluoxetine itself. By contrast,

tadpoles exposed to untransformed fluoxetine showed a more dramatic reduction in activity than did those in the phototransformed treatment, suggesting that the effects on activity were mostly attributable to fluoxetine rather than its transformation products. Because UV phototransformation of fluoxetine results in compounds that may be more harmful than fluoxetine itself, levels of these transformation products, as well as fluoxetine, should be monitored in the environment. More generally, when evaluating the risks posed by pharmaceuticals in the environment, their phototransformation products must also be considered.

0388 Fish Systematics, Saturday 15 July 2017

Stuart Welsh[1], Dean Jerry[2], Damien Burrows[2], Meaghan Rourke[3]

[1]West Virginia University, Morgantown, WV, USA, [2]James Cook University, Townsville, QLD, Australia, [3]NSW Dept. of Primary Industries, Narrandera, NSW, Australia

A New Species of Eel-tailed Catfish from New South Wales, Australia

A new species of *Tandanus* is described based on specimens from four river drainages (Bellinger, Macleay, Hastings, and Manning rivers) of the mid-northern coast of New South Wales, Australia. Previously, three species were recognized in the genus *Tandanus*; *T. tropicanus* of the wet tropics region of northeast Queensland, *T. tandanus* of the Murray-Darling drainage and coastal streams of central-southern Queensland and New South Wales, and *T. bostocki* of southwestern Western Australia. The new species is distinguished from all congeners by a combination of the following morphologic characters: a high count of rays in the continuous caudodorsal and anal fins (range 153-169, mode 159), a high count of gill rakers on the first arch (range 35-39, mode 36), and strongly-recurved posterior serrae of the pectoral fin spine. Additionally, results from previously-conducted genetic studies corroborate morphologic and taxonomic distinctness of the new species.

0209 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Saturday 15 July 2017

Kevin Weng[1], Gen Del Raye[2], Dan Crear[1]

[1]Virginia Institute of Marine Science, Gloucester Point VA, USA, [2]University of Hawaii, Honolulu, HI, USA

How Do You Know When a Shark is in Love? It's all in the Heart (Rate)

Heart rate, the rhythm of animal life, is one of the most important biological rates. It may also offer a proxy for metabolic rate, and provide clues to the ecological activities of species that are difficult to observe (such as elasmobranchs). We used a recently developed implantable ECG tag (Star-Oddi, Iceland) in captive sandbar sharks and

cobia. The tag measures electrical signals with external electrodes and performs on-board processing to determine heart rate. High noise and error may be introduced by nearby non-cardiac muscles and other electrical activity, so the heart rate measurements can be erroneous. To provide an independent measure of heart rate we also used an ultrasound machine to image the heart directly. The ECG tag performs well in cobia but is very difficult to use in sandbar sharks, due to the different morphology of the cardiac region in elasmobranchs.

0593 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Steven Werman

Colorado Mesa University, Grand Junction, CO, USA

Aspects of the Cephalic Anatomy of the Bushmaster (*Lachesis)* with Phylogenetic Considerations

The cephalic soft tissue anatomy of the Bushmaster (*Lachesis)* is described from dissection and previously published studies. Osteological features are included where appropriate. This assessment of anatomy is based primarily on myology, but nerves and cephalic circulatory structures are included where observed. Comparisons are made to the anatomy of other New World pitviper genera where known. A phylogentic assessment is developed to determine if there is support for existing phylogenetic hypotheses based on molecular or other types of data sets.

0237 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Samantha Wesnak[1], Todd Pierson[2], Jennifer Deitloff[1]

[1]Lock Haven University, Lock Haven, PA, USA, [2]University of Tennessee, Knoxville, TN, USA

Mating Behaviors of *Eurycea wilderae*

Mating behaviors between many organisms include mate-guarding, where a male aggressively defends a female. These behaviors vary among and within a species. In *Eurycea wilderae*, there are two morphs, referred to as Morph A and Morph wilderae. Morph A has a larger temporal musculature on the lateral side of the head, while Morph wilderae has a smaller head, longer cirri, and a mental hedonic gland. We hypothesized that, due to these differences, there would be a significant difference between these males' behaviors. We tested this hypothesis using courtship, mate-guarding, and y-maze trials. The courtship and mate-guarding trials were used to observe the mating behaviors between the two morphs along with aggressive behaviors and Y-mazes were used to test seeking behavior. From statistical analysis of the courtship and mate-

guarding trials, we concluded that there was no significant behavioral difference between Morph A and Morph wilderae; however only Morph A individuals performed aggressive behaviors during mate-guarding trials. From Y maze trials, we found there was no significant differences between the morphs' seeking behaviors. From this experiment, we found that though there was no statistical difference in mate-guarding behaviors between these morphs, we think that since only Morph A performed mate-guarding behaviors, there is some evidence that these morphs display differences in their reproductive behaviors. This data was consistent with studies done using *Eurycea aquatica*, which have large temporal musculature and display mate-guarding behaviors; however, more work must be done to determine the extent of these behaviors in Morph A of *E. wilderae*.

0604 Lizard Conservation, Saturday 15 July 2017

Michael Westphal[1], Alex Filazzola[2], Amanda Liczner[2], Taylor Noble[2], Deborah Woolett-Smith[3], Christopher Lortie[2]

[1]US Bureau of Land Management, Marina, California, USA, [2]York University, Toronto, Ontario, Canada, [3]Working Dogs for Conservation, Three Forks, Montana, USA

Nonrandom association of blunt-nosed leopard lizards (*Gambelia sila*) with California jointfir (*Ephedra californica*) in a high-elevation refugium

Gambelia sila is endemic to the newly-described San Joaquin Desert of central California. Due to loss of over 90% of its habitat and the threat of further habitat loss due to climate change, the need to identify components that provide a resilient landscape for the species is urgent. We investigated use of a perennial shrub, *Ephedra californica*, by *G. sila*. Using trap cameras, scat-detecting dogs, and radiotelemetry, we found compelling evidence for an ecological association between *G. sila* and *E. californica*. We also investigated the resilience of *E. californica* to environmental change using historical photography, experimental plantings, and removal of whole shrubs. We found individual *E. californica* shrubs to be exceptionally long lived (>50yrs) and individual shrubs readily resprouted following complete destruction of surface foliage by fire and direct removal. We conclude that *E. californica* may be an important target for restoration of robust habitat for *G. sila*.

0759 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Michael Westphal[1], Michael Izumiyama[2], Ken Oda[3], Kristine Lesyna[3], Steven Morey[4], Karen Crow[2]

[1]US Bureau of Land Management, Marina, California, USA, [2]San Francisco State University, San Francisco, California, USA, [3]California Dept. of Fish and Wildlife, Monterey, California, USA, [4]US Fish and Wildlife Service, Portland, Oregon, USA

Geographic variation in life history characteristics of the calico surfperch, *Amphistichus koelzi*

An ongoing comparative study focusing on life history traits among the three species in the genus *Amphistichus* (*A. argenteus, A. rhodoterus, A. koelzi*) suggests a delay in timing of reproduction in *A. rhodoterus* relative to the other two species. Because the data for *A. rhodoterus* came from samples far to the north of the other two species, it is unclear whether observed differences are due to interspecific variation or simple latitudinal variation arising from plasticity in life history attributes. We assessed variation in timing of reproduction as a function of embryo size at a set date in samples of *A. koelzi* gathered from the length of its range along the California coast. We found some evidence for latitudinal variation in *A. koelzi* but conclude that *A. rhodoterus* is nonetheless more divergent than would be expected under simple plasticity.

0526 ASIH STOYE GENERAL ICHTHYOLOGY II, Thursday 13 July 2017

Courtney Weyand, Kyle Piller

Southeastern Louisiana University, Hammond, Louisiana, USA

Phylogeography of the Rosyside Dace, *Clinostomus funduloides* (Teleostei:Cyprinidae)

The genus *Clinostomus* is an understudied genus of fishes in the family Cyprinidae. *Clinostomus* has a large geographic range occupying much of eastern North America. Currently, two species are recognized within the genus: *C. funduloides* and *C. elongatus*. A previous morphological study identified multiple subspecies within *C. funduloides* and later, one additional undescribed taxon was proposed (Smoky Dace). Given the broad distribution and disjunct geographic range of this genus, a phylogenetic assessment of *Clinostomus* is needed to further resolve the taxonomic diversity within this genus. In particular, we focused on assessing diversity within the Rosyside Dace (*C. funduloides*). Multiple tissue samples of *C. funduloides* were obtained across the range. Both mitochondrial and nuclear DNA sequence data were obtained and the data was analyzed using Bayesian phylogenetic methods to investigate the diversity and phylogenetic relationship within the species. Here we present the first comprehensive molecular phylogenetic hypothesis for *C. funduloides* using multiple unlinked loci. Using a multilocus approach, our results recovered several divergent clades within the species and exhibits substantial sequence divergences between clades, which may be indicative of move diversity within genus *Clinostomus*.

0012 AES GRUBER AWARD IV, Friday 14 July 2017

John Whalen, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

A multibiomarker analysis of pollutant effects on Atlantic stingray populations in Florida's St. Johns River

The goal of this study was to examine the potential health effects of organochlorine (OC) and polycyclic aromatic hydrocarbon (PAH) exposure on Atlantic stingray (*Dasyatis sabina*) populations in Florida's St. Johns River (SJR). Special emphasis was placed on identifying OC- and/or PAH-related effects in stingrays from areas of the lower (LSJR) and middle (MSJR) basins that have been shown to possess elevated levels of these compounds, as well as characterizing baseline levels of pollutant exposure in the LSJR shipping channel, which may be subjected to dredging in the near future, potentially resuspending and redistributing contaminated sediments and increasing pollutant-associated effects. To accomplish this, we measured OC and PAH biomarker levels in stingrays collected from contaminated and reference sites. Data was analyzed using the Integrated Biomarker Response (IBR), which synthesizes data from multiple biomarkers, allowing for a comparison of samples by site. The data suggested that biomarker values from the SJR were variable, with elevated levels from Lake Jesup, intermediate levels from Lake Monroe and the LSJR, and low levels from Lake George. Biomarker levels from the LSJR were low compared to reference estuaries. This indicates that residing in portions of the MSJR is detrimental to stingray health, but residing in the LSJR is not. Data also suggested that individuals from Lake Monroe experienced reduced contaminant input over time, while the opposite was indicated for Lake Jesup. This study has developed a baseline for biomarker levels in the LSJR, allowing for the identification of dredging-induced changes to the system.

0605 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jim Wharton[1], Sandra Elvin[2], Debborah Luke[2]

[1]*Seattle Aquarium, Seattle, WA, USA,* [2]*Association of Zoos and Aquariums, Silver Spring, MD, USA*

Unified Conservation Messaging for Zoos and Aquariums

The Association of Zoos and Aquariums (AZA) is a nonprofit organization dedicated to the advancement of zoos and aquariums in the areas of conservation, animal welfare, education, science, and recreation. Saving Animals from Extinction (SAFE) is an AZA conservation initiative with a mission to combine the power of 183+ million annual visitors with the resources and collective expertise of AZA members and partners to save animals threatened with extinction. AZA has chosen 10 signature species (or complexes) to lead this new initiative. For each species, AZA institutions are working with conservation partners to develop collaborative, 3-year Conservation Action Plans (CAPs) built on existing conservation plans for the species. The CAP for sharks and rays includes seven conservation projects—public engagement, sustainable products, community-based conservation, multimedia, policy, research, and responsible animal management—each led by a coordinator from an accredited AZA institution. This poster will share some of the early work of the public engagement project. This work includes:

developing a team of collaborators from AZA institutions and their partners, an informal baseline survey of AZA institutions to understand existing messaging around shark and ray conservation, and a collaborative process to develop a set of consensus shark and ray conservation messages and actions that may be shared and amplified through the exhibits and programming in over 200 accredited zoos and aquariums. Additional background and details on other shark and ray CAP projects will be shared, with opportunities for engagement by AES members.

0083 Fish Conservation I, Sunday 16 July 2017

Justine Whitaker[1], Amy Brower[1], Margaret Hunter[2], Alexis Janosik[1]

[1]University of West Florida, Pensacola, Florida, USA, [2]US Geological Survey, Wetland and Aquatic Research Center, Gainesville, Florida, USA

Retracing the phylogeographic structure of the lionfish (*Pterois volitans* and *P. miles*) invasion: a two marker approach that elucidates hidden diversity.

To examine population connectivity in the invasive range of lionfish (*Pterois volitans* and *P. miles*), published *P. volitans* d-loop sequences were compiled with newly sequenced lionfish (n=145). Lionfish tissue samples were collected from across their invasive range from Jacksonville (n=37), Bahamas (n=20) and Key Largo (n=30), to newly sampled locations, including Pensacola (n=23), St. Petersburg (n=20) and Trinidad and Tobago (n=15). Targeted regions for amplification included two mitochondrial genes: d-loop (control region) and the cytochrome oxidase I (COI). Based on the d-loop sequences, all samples were identified as *P. volitans* and none corresponded to *P. miles*. However, based on the COI sequences, one sample from the Bahamas corresponded to *P. miles*. This is the first known record of *P. miles* in the Bahamas and it would have been overlooked without inclusion of the COI marker, suggesting that previous studies using the d-loop alone may have overlooked the presence of *P. miles*. Additionally, rare haplotype H03, found in the northern region of the invasive range, was identified in one sample from Trinidad and Tobago, which may be evidence of a secondary introduction. Haplotype composition and genetic diversities confirmed lower genetic diversity in the invasive than the native range, and indicated differentiation between the northern and southern region within the invasive range. This study suggests employing multiple markers, with a specific focus on identification of *P. volitans, P. miles*, and potential hybrids, is necessary to gain further insight into the highly successful invasion of lionfish.

0584 Lightning Talks I, Friday 14 July 2017

Mary White

Southeastern Louisiana University, Hammond, LA, USA

Venom Proteins, Genomics and Predicted Sequences

Do crocodilians have venom proteins? It's hard to imagine. However a search of Genbank turns up the predicted sequence for alligator "*A. superbus* venom factor 1-like mRNA." This predicted sequence corresponds to one of the two alternative versions of the crocodilian Complement C3 genes. Co-option and the perils of predicted sequences will be discussed.

0154 SSAR SEIBERT ECOLOGY III, Friday 14 July 2017

Nicole White[1], Betsie Rothermel[3], Kelly Zamudio[4], Tracey Tuberville[2]

[1]Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA, USA, [2]Savannah River Ecology Lab, University of Georgia, Aiken, SC, USA, [3]Archbold Biological Station, Venus, FL, USA, [4]Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY, USA

Male Size Drives Siring Success in the Gopher Tortoise (*Gopherus polyphemus*)

Male size can be a determining factor in siring success. Strains on populations such as changes to density may interact with existing reproductive biases allowing advantaged individuals to dominate mating opportunities, skew rates of siring success and lower effective population sizes and genetic diversity. The Gopher Tortoise (*Gopherus polyphemus*) has experienced range-wide population declines due to habitat loss and fragmentation, resulting in changes to natural population densities. We evaluated the rate of multiple paternity and the effects of male size on likelihood of siring offspring and how many offspring a sire in a high-density (~6/ha) population of gopher tortoises at Archbold Biological Station in Florida. We collected a total of 29 nests in 2015 and 2016 and incubated the eggs through hatching. Using previously-developed microsatellite markers, we genotyped all hatchlings (n = 220) and most potential dams and sires in the population (n = 101). We used programs CERVUS and COLONY to assign each hatchling to the most likely dam and sire. We observed multiple paternity in 24% of clutches, within range of previously reported rates. We used a zero-inflated Poisson model to evaluate the effect of size on probability of siring and number of offspring sired. Larger males were significantly more likely to sire offspring than smaller males. Additionally, size was positively correlated with number of offspring sired though this trend was not significant. Understanding factors influencing reproduction of this declining species may be important for developing management strategies under high-density scenarios caused by habitat loss or translocations.

0522 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Howard Whiteman[1], Alycia Lackey[1], Michael Moore[2], Jacqueline Doyle[3], Nicole Gerlanc[4], Ashley Hagan[1]

[1]Murray State University, Murray, KY, USA, [2]Case Western Reserve University, Cleveland, OH, USA, [3]Towson State University, Towson, MD, USA, [4]Eunice Kennedy Shriver National Institute of Child Health & Human Development, Bethesda, MD, USA

Understanding the Evolution of Alternative Life Histories Using Long-term Population Monitoring

Understanding the evolution of phenotypic variation in response to environmental change is a fundamental question in evolutionary ecology that has consequences for the production and maintenance of biodiversity. Some salamanders facultatively express two adult morphotypes, terrestrial metamorphs and aquatic paedomorphs, in response to environmental variation experienced as larvae. Size-structured populations create demographic variation such that early larval cohorts inhibit the development of later cohorts via cannibalism and competition, subsequently influencing morph production and fitness. We parameterized Structural Equation Models using 27 years of population data for Arizona Tiger Salamanders (*Ambystoma mavortium nebulosum*), to investigate how larval growth, inter-cohort interactions, and other environmental parameters influence this polyphenism. Because previous results suggested that most paedomorphs in this population were smaller as larvae than those becoming metamorphs, and because paedomorph dispersal is limited, we predicted that paedomorphs would exhibit increased reproductive effort to mitigate the fitness costs associated with smaller sizes and reduced dispersal. We also predicted that fitness of both morphs would be mediated by inter-cohort interactions such that adults from early cohorts would mature at larger sizes and older ages than later ones. We found that the two morphs ultimately reach equivalent fitness, on average, but through different paths. Paedomorphs tend to reproduce earlier, while metamorphs have longer life spans. These tradeoffs, however, depend on cohort position, which tends to impact the fitness of paedomorphs more than metamorphs, perhaps because inter-cohort interactions continue after maturity within ponds. Thus, inter-cohort interactions provide spatiotemporal variation that helps maintain alternative life histories.

0578 Amphibian Conservation II, Sunday 16 July 2017

Steven Whitfield[1], Jacob Kerby[2], Juan Abarca[3], Gilbert Alvarado[4]

[1]Zoo Miami, Miami, FL, USA, [2]University of South Dakota, Vermillion, SD, USA, [3]Centro de Investigación en Estructuras Microscópicas, Universidad de Costa Rica, San Pedro, Costa Rica, [4]Faculdade de Medicina, Veterinária e Zootecnia, Universidade de São Paulo, Sao Paolo, Brazil

Ecology and Conservation of Relict Amphibian Populations in Costa Rica

The emergence of the amphibian chytrid fungus (*Batrachochytrium dendrobatidis* "Bd") has been linked to mass mortality events, rapid population declines, and widespread

extirpations of amphibians in the Neotropics. In Costa Rica, dozens of amphibian species were presumed extinct following the emergence of Bd, yet in the past decade many of these species have been rediscovered in relict populations in small parts of their historic range. Here, we overview the ecology and conservation of several relict and recovering amphibian populations in Costa Rica. We distinguish among species persisting within environmental refugia (*Craugastor ranoides*, *Craugastor taurus*) within climates hypothesized to be intolerable to Bd, and species that persist within habitat suitable to Bd (*Lithobates vibicarius*, *Incilius holdridgei*, *Agalychnis lemur*, *Agalychnis annae*). We distinguish among species that are persisting at low population sizes (*Incilius holdrigei*, *Craugastor taurus*) and species that appear to be recovering and recolonizing their former ranges (i.e., *Lithobates vibicarius*). We show that rates of infection by Bd are highly variable among species, and among sites. Ranavirus - which is not typically given high conservation interest in Central America, is present at most sites occupied by relict populations. While some relict populations occur within relatively pristine areas and protected reserves, other relict populations occur outside of protected areas or occur in highly disturbed environments. We discuss integrative conservation strategies to protect relict populations, both in Costa Rica and around the world.

0177 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

K.H. Wild, C.M. Gienger

Center of Excellence for Field Biology, Department of Biology, Austin Peay State University, Clarksville, TN, USA

Between-year Repeatability of Locomotor Performance of Eastern Fence Lizards (*Sceloporus undulatus*)

Locomotor ability is a common metric used to assess whole-animal performance, and the ability to effectively traverse the environment plays an important role in individual fitness. The repeatability of phenotypic traits across time has been used to understand the heritability of performance traits, such as speed and endurance. Generally, it is expected that selection will remove variation and thus decrease heritability and repeatability of a phenotype. More precisely, selection will typically result in reduced additive genetic variation. *Sceloporus undulatus* is a sexually dimorphic forest lizard that is relatively common throughout the eastern United States. To assess the repeatability of locomotor performance, individuals were captured and raced in 2014 and again in 2015. Locomotor performance was highly and significantly repeatable across years (maximum sprint speed, $r = 0.74$, $p < 0.01$; 2-meter run, $r = 0.47$, $p = 0.01$). Our results are noteworthy due to the difficulty of capturing the same individuals over the course of consecutive study seasons, and to our knowledge is the first study to observe individual between-year repeatability in performance of free-ranging *Sceloporus undulatus*.

0611 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Alex Will, Julie Cobb, Zachary Gellner, David Rostal

Georgia Southern University, Georgia Southern University, USA

Endocrine influence on signalling in the Central Bearded Dragon (*Pogona vitticeps*)

The Central Bearded Dragon exhibits many types of behavioural signals from arm waves to head bobs. Males will also display a colour signal in the form of a darkened "Beard" which exhibits physiological colour change. This study examined the effects of two hormones, testosterone and corticosterone, on the time spent performing each signal along with colour expression. A captive group of nine adult male and four adult female lizards were used. Trials were randomised. Two lizards were placed into an enclosure and separated by an opaque barrier. They were given 24 hours to acclimate to the new enclosure. After 24 hrs the barrier was removed and they were allowed to interact for 1 hour. The interaction was recorded using a video camera and direct observation for signalling behaviours. An Ethogram of behaviours was developed and frequency plus duration of behaviours was recorded. Blood samples were taken from the caudal vein before and immediately after trials, and colour expression was recorded immediately after blood draws using a digital camera and a spectrophotometer. Blood samples were assayed by ELISA to determine hormone concentration. Testosterone and corticosterone levels will be correlated with beard colour changes and behaviour duration and frequency.

0720 Lizard Conservation, Saturday 15 July 2017

Dean Williams, Amanda Hale, Ashley Wall, Daniella Biffi

Texas Christian University, Fort Worth, TX, USA

Conservation genetics of Texas horned lizards (*Phrynosoma cornutum*)

The Texas horned lizard (*Phrynosoma cornutum*) has experienced declines in the state of Texas due to habitat loss and the introduction of invasive red fire ants (*Solenopsis invicta*). We conducted a statewide population genetics study to aid in future reintroduction and captive breeding initiatives in the state. We used 11 nuclear microsatellite loci and the mitochondrial d-loop to genotype 707 individuals. Bayesian clustering indicated the presence of three population clusters that correspond to 1) South Texas Plains and Coastal Prairie ecosystems, 2) High Plains, Rolling Plains, Edwards Plateau, and Pecos ecoregions, and 3) Chihuahua Desert ecoregion. Genetic diversity is high in protected areas but is significantly lower in populations that occur in small towns. Towns act as islands, isolating lizards from surrounding populations, resulting in low genetic diversity and low effective population size (Ne). A detailed study within a small town revealed restricted home ranges (usually within a town block), rare movement across roads, and significant genetic structuring on either side of major roads suggesting these roads serve as barriers to gene flow. Although data on local adaptation

are currently lacking, we suggest the correspondence between genetic structure and major ecoregions warrants a cautionary approach to translocation and captive breeding strategies. Captive-bred Texas horned lizards should only be repatriated to their region of origin and translocations should only occur within the three major genetic clusters. Lizards located in small towns should not be used in captive breeding programs or in translocations due to their lower genetic diversity.

0256 Fish Ecology II, Sunday 16 July 2017

Stuart Willis[1], Christopher Hollenbeck[1], Jon Puritz[2], John Gold[1], David Portnoy[1]

[1]Texas A&M University-Corpus Christi, Corpus Christi, TX, USA, [2]University of Rhode Island, Kingston, RI, USA

Dispersal is limited by distance and depth in young-of-the-year, deep-water snappers (Lutjanidae) in the U.S. Caribbean as revealed by ddRAD population genomics

Genetic diversity and relatedness were surveyed in consecutive cohorts of young-of the-year recruits (age 0-1) of three, deep-water snapper species (*Lutjanus vivanus*, *L. buccanella*, and *Rhomoplites aurorubrens*), sampled from ten sites along the west coast of Puerto Rico. These species, especially *L. vivanus*, support important fisheries in U.S. waters of the Caribbean Sea. Individuals were genotyped at >2,100 single nucleotide polymorphisms (SNPs) contained in >1,000 haplotyped contigs (loci). The results indicate spatiotemporal variation in patterns of genetic diversity in recruits for all three species. Differences in within-sample genetic diversity and elevated relatedness were observed in samples of silk snapper from two marine protected areas (MPAs). The two MPAs, an island and an ocean bank, are separated from the coastal shelf by deeper water (>100 m) and results suggest these sites have partially decoupled recruitment processes relative to shelf sites. Spatial autocorrelation was observed on spatial scales of less than 20 km in silk snapper, and less than 15 km in the other two species, likely indicating common sources for settling recruits at these small spatial scales. This would suggest that recruitment along the west coast of Puerto Rico originates from multiple, semi-independent units of spawners whose contribution to individual sites varies in space and time. We suggest that management of these resources protect spawning adults distributed across the entire western shelf rather than in a few specific areas.

0253 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Stuart Willis[1], David Saenz[2], Gang Wang[2], Christopher Hollenbeck[1], James Cai[2], David Portnoy[1], Kirk Winemiller[2]

[1]Texas A&M University-Corpus Christi, Corpus Christi, TX, USA, [2]Texas A&M University-College Station, College Station, TX, USA

RNA-seq analysis to decipher mechanisms of osmoregulatory adaptation to divergent physicochemical conditions and its role in diversification of Amazon fishes

Despite considerable study of osmoregulatory mechanisms in fishes, little is known about how populations adapt to new osmotic regimes. Consequently, the types of constraints that will impair the ability of freshwater fishes to respond to novel physicochemical challenges, including those resulting from climate change, remain uncertain. In the Amazon most meta-population lineages are closely associated with distinct physicochemical environments, so-called white, clear and black waters, that differentially challenge fish osmoregulatory physiology. However, closely-related lineages often show complementary distributions in different water types, suggesting that adaptation to novel osmotic regimes and the transition between habitats are diversifying forces. Nonetheless, the observation that most species are not broadly tolerant of multiple water types, a necessary intermediate stage for expansion to new habitats, implies costs to plasticity such that osmoregulatory strategies across environments are often mutually exclusive. Lineages with populations adapted to different water types, or with plastic and non-plastic populations, provide ideal study systems for understanding this process; however, a prerequisite is clear delimitation of lineage boundaries and population structure. One group of Amazonian fishes for which these data are available is the tucunarés, or peacock bass cichlids, of the genus *Cichla*. Two lineages, *C. orinocensis* and *C. ocellaris 'monoculus'*, exhibit populations in both heterogeneous and homogeneous blackwater regions, with the latter populations being phylogeographically derived. Here, we present results of an RNA-seq analysis of gill tissue from the offspring of wild *C. oc. 'monoculus'* exposed to white and black water conditions in the laboratory.

0665 Lightning Talks II, Friday 14 July 2017

John Willson[1], Shannon Pittman[2]

[1]*University of Arkansas, Fayetteville, AR, USA,* [2]*Davidson College, Davidson, NC, USA*

A Novel Approach to Estimating Density of Burmese Pythons in Everglades National Park

The Burmese python has rapidly become one of the most high profile invasive species in North America. Despite growing evidence that pythons are having dramatic effects on native wildlife in South Florida and numerous attempts to develop and refine capture methods for pythons, efforts to manage or eradiate pythons are hampered by lack of an accurate estimate of python density or population size. Here we use a novel simulation-based technique to estimate density of Burmese pythons in Everglades National Park. Specifically, we combine behavioral observations of snake road crossing behavior (crossing speed) and simulation-based analysis of spatial movement patterns derived from radiotelemetry to estimate the probability of detecting pythons as they cross roads.

We then use data on detection probability to translate python encounter rates during systematic road surveys to density, without relying on mark-recapture. The density estimates we provide fill a critical knowledge gap in understanding python impacts, control, and spread.

0441 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Hannah Wilson[1], Erika Nowak[1], Dustin Wood[2]

[1]Northern Arizona University, Flagstaff, AZ, USA, [2]U.S. Geological Survey, San Diego, CA, USA

Unusual Reproductive Events in *Thamnophis rufipunctatus*

In the fall of 2013, Northern Arizona University paired one female ("46") *Thamnophis rufipunctatus* with two male siblings in order to determine the possibility of breeding this threatened species in captivity. All the snakes were from the same litter from a wild-caught female. The following summer, 2014, 46 gave birth to six inbred offspring. All offspring were kept together as they were thought to be too small and young to be sexually mature. After nearly one year (in 2015), one of the female offspring ("Big Red") was observed mating with one of her siblings. She was removed immediately. In summer 2016, both 46 and Big Red began developing embryos. Both snakes aborted the partially-, or under-developed litters close to the expected birth date, and 46 was confirmed to have an oviduct infection at the time. Genetic samples from all of the 2014 litter and the failed 2016 litters were used for sibship and paternity analyses to investigate the possibilities of multiple paternity, long term sperm storage and/or parthenogenesis. 46's ability to become pregnant two years after being with a male, and the possibility of multiple paternity in the first litter provide novel observations of reproductive abilities in a federally threatened reptile. This information can be used to inform future decisions in captive breeding programs with *T. rufipunctatus.*

0527 Fish Ecology II, Sunday 16 July 2017

Kirk Winemiller[1], Pitagoras Piana[2], Eduardo Cunha[3], Angelo Agostinho[3], Luiz Gomes[3]

[1]Texas A&M University, College Station, TX, USA, [2]Universidade Estadual do Oeste do Paraná, Toledo, PR, Brazil, [3]Universidade Estadual de Maringá, Maringá, PR, Brazil

Using Fish Functional Traits for Individual-based Modeling to Simulate Food-web Dynamics in River-floodplain Systems

A major challenge for predicting ecosystem dynamics is the fact that species respond differently to environmental variation. Species with different life history strategies respond to environmental variation in ways not captured by food-web models that focus solely on networks of consumer-resource interactions. I will describe development of a

spatially explicit, individual-based model that simulates hydrology and food-web dynamics in the last undammed stretch of the Upper Paraná River, Brazil, a system that has extensive empirical data needed to support model construction, calibration and testing. The model accepts landscape and hydrologic data and simulates fish populations based on functional traits and constraints identified by a periodic table of niches. Our ultimate goal is to create individual-based models for other river floodplain systems for which there is less empirical data but pressing needs to assess current and future human impacts, such as large hydroelectric dams and water diversions, on fish biodiversity, fisheries productivity and other important ecosystem services.

0657 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Leann Winn, Brooke Flammang

New Jersey Institute of Technology, Newark, NJ, USA

Investigating the Fluid Dynamics of Chondrichthyan Egg Cases

Chondrichthyan development within an egg case may take multiple years before hatching. During the development of the embryo, flow is required through the egg case to move oxygenated water and metabolic wastes in and out of the egg case. In the egg cases of some skates and chimaeroids the embryo actively pumps water through the case by undulating its tail; however, some catsharks (*Apristurus* and *Parmaturus*) do not actively ventilate their egg cases and the water within the case is passively pumped through by hydrodynamic forces. The relationship between permeability, functional morphology, and fluid dynamics of egg cases are yet to be fully understood and are poorly represented in the literature. Here we show basic flow models pertaining to the effects of morphology and environmental factors on fluid dynamics surrounding egg cases. Using 3D printed models of egg cases and volumetric flow analyses, we established a previously unknown metric of flow probabilities based on morphological properties. Findings from this work contribute to the understanding of the effective relationship between an organism and its environment.

0910 AES Ecology I, Sunday 16 July 2017

Brent Winner

Florida Fish and Wildlife Research Institute, Saint Petersburg, FL, USA

A Multi-decadal Analysis of Distribution, Relative Abundance, and Habitat Utilization of the Cownose Ray, (*Rhinoptera bonasus*), in the southeastern United States

Cownose rays inhabit coastal waters from Chesapeake Bay through Brazil including much of the Gulf of Mexico. In some regions, their durophagous feeding strategy and schooling behavior result in bioturbation and depletion of economically-important

shellfish beds. Subsequently, exploitation of cownose ray populations for bait and human consumption have increased to ameliorate these perceived negative impacts to shellfish fisheries. State or federal regulations on the harvest of cownose rays are currently lacking, so there is a critical need for ecological and abundance data, to support assessment and management. We summarize 27 years of standardized fisheries-independent monitoring data collected within eight estuaries along Florida's Atlantic and Gulf coasts. Samples were collected using a stratified-random multi-gear sampling design. From 1990 through 2016, 99,000 net hauls collected 19,051 cownose rays, ranging in size from 200 to 1,031 mm disc width. Cownose rays were collected year-round, suggesting that not all cownose rays undergo long distance winter migrations in Florida. Peak abundance generally occurred during spring/summer months, with reduced abundance in northern estuaries during winter. Juvenile recruitment typically occurred during spring and early summer, with some latitudinal variation among Gulf estuaries. Young-of-the-year rays were rarely collected in Florida's Atlantic coast estuaries. Cownose rays were widely distributed throughout most estuaries over a variety of habitats, temperatures (13.8 - 37.1 °C), and salinities (2.2 - 42.9 ppt). Long-term trends in relative abundance varied among Florida's Gulf estuaries, with generally stable or slightly declining abundance since 2000, although cownose ray abundance was typically low along the Florida Atlantic coast.

0439 AES Conservation & Management I, Saturday 15 July 2017

Sabine Wintner[1], Sven Kerwath[3]

[1]KZN Sharks Board MCoE, Umhlanga Rocks, South Africa, [2]Biomedical Resource Unit, University of KwaZulu-Natal, Durban, South Africa, [3]Department of Agriculture, Forestry and Fisheries, Rogge Bay, South Africa, [4]Department of Agriculture, Forestry and Fisheries, Rondebosch, South Africa, [5]Department of Animal Sciences, Stellenbosch University, Stellenbosch, South Africa

Cold Fins, murky Waters and the Moon: What Affects Shark Catches in the Bather Protection Program of KwaZulu-Natal, South Africa?

The influence of environmental variables on shark catch in bather protection program along the South African East Coast was investigated for eleven commonly caught species (*Carcharhinus limbatus*, *C. obscurus*, *C. brachyurus*, *C. plumbeus*, *C. brevipinna*, *C. leucas*, *Carcharodon carcharias*, *Carcharias taurus*, *Sphyrna lewini*, *S. zygaena*, *Galeocerdo cuvier*). Data for the period 1986-1994 were analysed using General Additive Models and General Additive Mixed Models. The influence of temporal and spatial factors, respectively, was considered and removed within a standardisation procedure to investigate and predict the influence of lunar cycle, sea surface temperature (SST) and water visibility on daily catch. The catches of *C. taurus* and *C. brevipinna* were significantly affected by all three factors. All other species' catches were affected by at least one of the three factors. The results suggest that measurable, predictable relationships exist between environmental conditions and presence and consequently

catch of shark species in this fishery. Understanding these relationships could be useful to mitigate against unwanted catch and to further reduce risk for bathers.

0433 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Friday 14 July 2017

Nicole Witzel, Ali Taheri, William Sutton

Tennessee State University, Nashville, Tennessee, USA

Detecting the Presence and Abundance of Streamside Salamanders (*Ambystoma barbouri*) in Middle Tennessee Using Environmental DNA

Amphibians represent the vertebrate taxa that has experienced the greatest declines globally. Declines tend to occur in species with geographically-isolated and/or fragmented populations. This is specifically true for the Streamside Salamander (*Ambystoma barbouri*), an Ambystomatid salamander that occurs in Middle Tennessee. This species is active during winter and spring months when it emerges to breed in low-order, ephemeral streams. As these animals are cryptic and only surface-active for several months, they can be difficult to detect using traditional survey methods. Surveys that target environmental DNA (eDNA) in the form of DNA sloughed into their aquatic environment could provide an effective method for detecting the presence of this species. Water samples were collected in 50 meter stretches of 17 streams across the *A. barbouri* range once per month for 4 months (December - April 2017). Stream segments were searched for all life-stages of salamanders using rock-turning and visual surveys. We used real-time PCR to quantify DNA amounts using an *A. barbouri* species-specific primer. We used Generalized Linear Mixed Models to evaluate relationships between adult, larval, and egg counts and biomass at each site and evaluated the change in eDNA amounts across the active season of *A. barbouri*. Primary outputs from this study include a replicable eDNA approach to identify *A. barbouri* populations in Tennessee and sampling guidelines for appropriate times to collect eDNA survey data for *A. barbouri*. This information will provide a method which can be used by wildlife agencies to further the knowledge and conservation of this species.

0647 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Nicole Witzel, Ali Taheri, William Sutton

Tennessee State University, Nashville, Tennessee, USA

Development of an Environmental DNA Protocol to Detect and Quantify Streamside Salamanders (*Ambystoma barbouri*) in Low-order Streams of Middle Tennessee

The Streamside Salamander (*Ambystoma barbouri*) is an Ambystomatid salamander that occurs in Middle Tennessee where it is geographically isolated from other populations. This salamander species is active during the winter and spring months when it emerges to breed in low-order, ephemeral streams. As these animals are cryptic and only surface-active for several months, they can be difficult to detect using traditional survey methods. Surveys that target environmental DNA (eDNA) sloughed into their aquatic environment provide a potentially effective method for detecting the presence of this species. However, before this method can be used, it is essential to develop species-specific genetic primers that will correctly target key segments of DNA. The initial objective of this study is to identify a primer that is specific to and will successfully amplify only the DNA of *A. barbouri* without amplifying DNA of congeners. Primers were selected by choosing *A. barbouri* cytochrome B mitochondrial DNA segments with base pairs that differed from *A. texanum*, a closely related sibling species. These primers were used to amplify *A. barbouri* DNA and tested for specificity among other Ambystomatid congeners in Tennessee. Following initial tests of specificity, we used this data to develop a probe to conduct quantitative PCR to evaluate the quantity of environmental DNA in stream water samples. The long-term goal of this study is to provide a replicable eDNA approach to identify *A. barbouri* populations in Tennessee. This information will provide a method which can be used to further the knowledge and conservation of the species.

0100 Herp Genetics, Saturday 15 July 2017

Jared Wood[1], Stephanie Dowell[2], Todd Campbell[3], Robert Page[4]

[1]Southwestern Adventist University, Keene, TX, USA, [2]U.S. Fish & Wildlife Service, Lamar, PA, USA, [3]University of Tampa, Tampa, FL, USA, [4]Texas A&M University-TX, USA

Insights into the Introduction Histories and Population Genetic Dynamics of the Nile Monitor (*Varanus niloticus*) and the Argentine Black-and-White Tegu (*Salvator merianae*) in Florida

Invasive species are a leading cause of the ongoing biodiversity crisis because they frequently disrupt community function. Florida is prone to invasion by reptiles due to its climate, frequency of disturbance, and exotic pet industry. Two of the largest invasive lizards in Florida are the Nile monitor (*Varanus niloticus*) and the Argentine black-and-white tegu (*Salvator merianae*). Currently, there are self-perpetuating populations of these species in more than one region of Florida; however, little is known about the histories of these populations or the degree to which they are connected by gene flow. To address these issues, we used microsatellites to investigate genetic diversity and intra-specific gene flow between *V. niloticus* and *S. merianae* populations in Homestead, Cape Coral, and West Palm Beach (*V. niloticus*) and Hillsborough and Miami-Dade Counties (*S. merianae*). Our results show that there is limited genetic diversity in all of these populations and that there is not gene flow among regions in *V. niloticus*. However, we did find evidence for limited admixture in *S. merianae*. Use of

approximate Bayesian computation (ABC) suggested that all three *V. niloticus* populations resulted from separate introduction events. Conversely, in *S. merianae*, ABC suggested that the Hillsborough and Miami-Dade populations are most likely derived from a population that was not sampled. Our results indicate that wildlife managers should treat each population of *V. niloticus* and *S. merianae* as an independent management unit, and that managers should follow up on sightings of both species--even in areas where there are not documented populations.

0506 ASIH STOYE ECOLOGY & ETHOLOGY II, Thursday 13 July 2017

Matthew S. Woodstock, Christopher A. Blanar, Tracey T. Sutton

Nova Southeastern University, Dania Beach, FL, USA

A Comparison of the Parasite Fauna and Trophic Ecology of Vertically Migrating and Non-migrating Mesopelagic Fishes in the Northern Gulf of Mexico

Mesopelagic (open ocean, 200-1000 m daytime depth) fishes are important consumers of zooplankton and are prey of oceanic predators. Two dominant mesopelagic fish families, Myctophidae and Sternoptychidae, occupy a similar daytime depth, but different nighttime depths. Myctophids undertake diel vertical migrations, while the sternoptychid genus *Sternoptyx* does not. The relationship between parasites and gut contents provides insights into ecological processes occurring within assemblages, as prey items are often vectors for parasites. This study examined the differences between the prey contents and parasite fauna of these two contrasting families in the Gulf of Mexico. Results showed that the non-migrating *Sternoptyx* fed upon a broader range of taxa than myctophids and appeared to transition from a zooplanktivorous to a micronektonivorous feeding style with increasing size. Calanoid copepods were the primary prey item observed in all size classes of the vertically migrating myctophids, but their ration increased with body size. In both families, parasites were more abundant among higher size classes. The more diverse feeding predators, *Sternoptyx* sp., harbored a lesser diversity of parasites than the more selective feeding predator. These data will be used to enhance models aimed at understanding ecosystem structure and population connectivity of oceanic ecosystems.

0326 NIA Contributed/Fish Ecology, Friday 14 July 2017

Kirsten Work

Stetson University, DeLand, FL, USA

From Snapper to Darters: Video Surveys of 26 Florida Springs

Florida springs are highly prized as "aquatic gems", both for their clear water and their biotic assemblages. However, most Florida springs are threatened by reductions in

water quantity and quality and by invasions of exotic species. Despite this confluence of appreciation and threat, very few studies have been published on fish assemblages in Florida springs, although certainly data on spring fish exist in targeted studies by state and federal agencies. To create a broad-scale picture of Florida spring fish assemblages, albeit a coarse one, I surveyed fish assemblages in 26 springs along the Suwannee River, the Santa Fe River, and the St. Johns River. For each survey, I traversed the spring run with a GoPro camera mounted underwater near the front of a kayak. I also stopped at up to five sites along the spring run, depending upon its length, to film fish with two GoPro cameras mounted on tripods in shallow water on either bank. I analyzed the videos for presence/absence of fish species, for rough prevalence (the proportion video segments that contained each species), and for rough density (the maximum number of individuals of each species observed in one frame) and I analyzed these data with hierarchical cluster analysis. Many springs clustered based on proximity and morphology; for example, most of the Suwannee springs, which tended to be dominated by algae, were more similar to each other than to springs with less algae and/or abundant macrophytes.

0474 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Elijah Wostl, Eric Smith

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New Species and Phylogeographic Relationships of Sunda Shelf *Philautus* (Anura: Rhacophoridae)

Between 2012 and 2016, we conducted a series of large-scale herpetological surveys of the highlands of Java and Sumatra, the most intensive effort at documenting the herpetological diversity of these islands to date. From material collected during these surveys, we used a combination of morphological, molecular, and bioacoustic data to describe several new species of frogs in the genus *Philautus* and generate a nearly comprehensive phylogenetic analysis of the genus on the Sunda Shelf. We also use complete mitochondrial genomes to explore the phylogeographic relationships of the genus on the islands of Borneo, Java, and Sumatra and estimate when each island was colonized. We find that the genus is taxonomically underrepresented on Java and Sumatra. Moreover, the diversity of the genus on each respective island is largely composed of previously unrecognized monophyletic radiations. We also uncover a unique phylogeographic relationship between the islands of Java and Borneo.

0789 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Ian Wright, Travis LaDuc

University of Texas at Austin, Austin, TX, USA

Diet of the Spot-tailed Earless Lizard, *Holbrookia lacerata*

Diet composition is an important indicator of habitat use and can be of tremendous value to conservation efforts. Unfortunately, diet breadth, composition, and preference are not always known, especially for rare or threatened taxa. Such is the case for the spot-tailed earless lizard, *Holbrookia lacerata*; a species of greatest conservation need in Texas. As this species is near-threatened and encounters are no longer common in the field, we utilized historical collections to describe its diet. We dissected 129 *H. lacerata* specimens collected from across Texas and northern Mexico over the last 110 years and identified their stomach contents as well as recorded volumetric data for each prey item. The diet of this lizard is dominated by grasshoppers (40% relative volume), followed by beetles (16% relative volume), spiders (14% relative volume), and 10 other arthropod orders. There is little sexual or ontogenetic variation in this diet makeup, however juveniles tended to eat higher proportions of very small-bodied arthropod groups than adult lizards. The results of these stomach dissections indicate that *H. lacerata* is a generalist and an opportunistic forager; focusing on large-bodied grasshopper prey, but taking smaller meals when other arthropods are encountered. These results deepen our understanding of habitat utilization in spot-tailed earless lizards and may help aid conservation efforts in the recovery of this species.

0655 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jessica L. Wright[1], Juan D. Daza[1], Miguel T. Rodrigues[2], Tony Gamble[3], Aaron M. Bauer[4]

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Skull variation in pug-nosed gecko *Chatogekko amazonicus* (Gekkota: Sphaerodactylidae)

The monotypic genus *Chatogekko* was recognized only six years ago to include South American forms that exhibit extreme snout reduction. *Chatogekko amazonicus* is widely distributed in the Northeast of South America, including Venezuela, Guyana, Suriname, French Guiana, Brazil, and possibly Bolivia. Previous molecular studies have indicated that *C. amazonicus* includes several multiple species-level lineages (at least five), but previous attempts to diagnose such groups have been ineffective. Here we study the skull anatomy of specimens throughout its distributional range to provide a basis for distinguishing these species. Besides extreme morphological changes associated with the species complex, such as an elongation of the premaxillary ascending process separating entirely the nasals, posterior displacement of the osseous naris approaching the frontal, development of deep choanal grooves in the palatine. Specimens from the Northeast of Brazil, Guyana, and Surinam differ from other localities in having a very broad ascending nasal process and in lacking the squamosal bone. The premaxilla ascending nasal process and the nasal shape shows tremendous variation, which might be influencing disparity in the snout across groups; for instance, specimens from central-northern parts of the amazon basin have a narrow projection on the premaxilla while

some southern and central tend to have a notched ascending nasal process (M-shaped). More material needs to be examined to corroborate these patterns and continuous data is being taking to quantify differences in the snout, which might have some ecomorphological significance to understand the diversification of *C. amazonicus* in South America.

0576 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Chi-Shiun Wu, Jun-Jie Ma, Chang-Ye Yang

Chinese Culture University, Taipei, Taiwan

Does Salinity Experienced during Embryonic Development Affect Survival and Metamorphosis of Taiwanese Tadpoles Living in Coastal Areas?

The effects of salinity on amphibian physiology and ecology has drawn more attention in recent decades. Salinity conditions experienced early in development have immediate effects and potentially lasting consequences throughout ontogeny in amphibians. We conducted two experiments. In Experiment I, we reared embryos of *Fejervarya limnocharis* in freshwater, 3ppt, 6ppt, and 9ppt to access the salt tolerance of embryos. In Experiment II, we assigned tadpoles hatching from different salinities (freshwater, 3ppt, and 6ppt) to freshwater, 3ppt, and 6ppt (3x3=9 treatments) and measured survival, metamorphic traits, and post-metamorphic morphology of tadpoles, to test if salinity experienced during embryonic development influences survival and metamorphosis of tadpoles. Results showed that high salinity decreased hatching success but salinity experienced during embryonic development did not influence survival and post-metamorphic morphology of tadpoles. However, tadpoles expressed different patterns in metamorphic traits under the same salinity treatments if they experienced different salinities during embryonic development. Under 6ppt, time to metamorphosis of tadpoles experiencing 3ppt during embryonic development was shorter than that of tadpoles experiencing freshwater and 6ppt during embryonic development, but size at metamorphosis did not vary among these treatments with different initial salinities. This result suggests a medium salinity experienced during embryonic development helps tadpoles to adapt to higher salinity afterwards. In addition, tadpoles experiencing high salinity during embryonic development metamorphosed later and at a smaller body size when exposed to high salinity. Together, our results indicate that salinity condition experienced early in development is critical because it influences metamorphic trait of tadpoles under salinity stress.

0754 Reptile Conservation, Sunday 16 July 2017

Amy Yackel Adams[1], Bjorn Lardner[2], Adam Knox[3], Julie Savidge[2], Robert Reed[1]

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Evaluating searcher fatigue and taxon-bias during nocturnal visual encounter surveys for reptiles on Saipan, Commonwealth of the Northern Mariana Islands, USA

Visual encounter surveying is a standard animal inventory method, modifications of which (e.g., distance sampling and repeated count surveys) are used for modeling population density. However, a variety of factors may confound visual survey results. We evaluated a group of observers for signs of fatigue and for individual biases in what taxa (lizards and small mammals) they detected in 4 hours following twilight. Detections of sleeping (diurnal) Emerald Tree Skinks, *Lamprolepis smaragdina*, exhibited a small but significant decline as the evening progressed; a pattern consistent with searcher fatigue (tiredness and/or loss of concentration). Surprisingly, detections of sleeping (diurnal) Green Anoles, *Anolis carolinensis*, increased significantly as the evening progressed. Detections of nocturnal geckos (several species pooled) showed a weak and non-significant declining trend. Small mammal sightings (rats, shrews, and mice) declined significantly over the course of an evening, suggesting an effect of their circadian rhythm on top of any surveyor fatigue. Observers were biased in taxa detected, with particularly strong differences among persons in the ratio of Emerald Tree Skinks to Green Anoles that they spotted. Yet, across the four analyzed taxonomic classes, the skills of some observers appeared to be consistently above average; others consistently below average. We conclude that neither short-term nor long-term observer fatigue is of concern for visual searches, but that differences among observers may hamper efforts to statistically evaluate survey results.

0213 Fish Reproduction & Development, Saturday 15 July 2017

Alora Yarbrough, Karen Martin

Pepperdine University, Malibu, California, USA

Effects of Increased Air and Water Temperatures on the Embryonic Development of the California Grunion

As the earth's atmosphere becomes warmer, more organisms are being affected at varying stages of their life history. *Leuresthes tenuis* is a beach spawning silverside that is endemic to the Pacific Coast of North America from Point Conception, CA to Punta Abreojos, Mexico. *L. tenuis* may be uniquely affected by climate change due to their unusual embryonic development occurring in a terrestrial environment rather than a marine one. To examine the effects of embryonic development of *L. tenuis* under temperature stress, we examined the effects of exposure to high temperatures for only a portion of the day coupled with a rest period of a lower temperature overnight. Little has been done to compare the incubation of *L. tenuis* in water versus air, so we also describe the developmental differences observed between eggs incubated in sand versus seawater. Eggs were incubated in either sand or water in three temperature conditions of constant 20°C, constant 30□C, and alternating 30°C for eight hours and 20°C for sixteen hours resulting in a mean temperature of ~23□C. The eggs were examined under

a microscope daily, hatching success testing began at 6 days post fertilization and hatchling length was measured. The eggs incubated in water showed more frequent deformities, slower embryonic development, lower hatching success, and shorter hatchling length than those incubated in sand across all temperature treatments. Future studies should focus on the factors behind what causes the developmental deficiencies in eggs incubated in water.

0207 AES Conservation & Management II, Saturday 15 July 2017

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Understanding the U.S. Endangered Species Act and Examining Trends in Elasmobranch Petitions and Listings

The purpose of the U.S. Endangered Species Act (ESA) is to conserve threatened and endangered species and their ecosystems. Currently, there are over 2,300 species listed under the ESA. Each of these species have met the criteria for listing under Section 4(a)(1) of the ESA and are considered to be endangered or threatened as defined by the ESA. Recently, the National Marine Fisheries Service has seen an influx of petitions to list various elasmobranch species under the ESA. Since 2010, we have received 24 elasmobranch petitions covering 56 species, including 33 species that are found solely outside of U.S. waters and 23 species that may occur within U.S. jurisdiction. Prior to 2010, we received only 2 petitions (in 1999 and 2009) requesting the listing of elasmobranch species. Currently, a total of 23 elasmobranch species (includes distinct population segments) are either listed or proposed for listing under the ESA. The listing process under the ESA, including the criteria for listing, is often misunderstood and sometimes conflated with other organizations' criteria for listing species (including the International Union for the Conservation of Nature's Red List and the Convention on International Trade in Endangered Species). Therefore, we will provide an overview of the ESA listing process, describe key factors considered in making listing determinations, and summarize specific case studies of recent elasmobranch petitions and their outcomes.

0387 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Saturday 15 July 2017

Melissa Youngquist[2], Michelle Boone[1]

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Understanding species distributions: the effects of landscape composition, configuration, and scale

Species distributions are a function of the availability of suitable habitat and an individual's ability to disperse to and colonize suitable habitat patches. These factors depend on the composition and configuration of land cover types across the landscape. Equally important to our understanding of species distributions is the scale at which patterns of occupancy are described. We investigated the influence of habitat and dispersal on Blanchard's cricket frog (*Acris blanchardi*) distribution in Ohio, USA, at two spatial scales. First, we assessed which land cover types were predictive of presence and population genetic structure at a small spatial scale (county-wide). Second, we used habitat suitability models to assess if the same factors affecting presence at small scales were predictive at a larger spatial scale (state-wide); we then used logistic regressions to evaluate whether habitat suitability or landscape connectivity were most predictive of cricket frog presence across Ohio. We found that land cover is moderately predictive of cricket frog presence at all scales and that highways limit gene flow. When comparing models of cricket frog presence, we found that habitat suitability, not landscape connectivity, best explains cricket frog distribution. Our results show that cricket frog distribution is primarily a factor of habitat availability and is not limited by dispersal in the Ohio landscape. Assessing the relative importance of habitat suitability versus landscape connectivity is vital for effective species management because it can help direct conservation effort towards the most important factors affecting species distributions in a given area.

0408 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Melissa Youngquist[1], Sue Eggert[2], Anthony D'Amato[3], Brian Palik[2], Robert Slesak[1]

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Potential effects of emerald ash borer invasion on wetland community composition

Forested wetlands provide vital habitat to a range of taxa and yet, they are one of the most threatened habitat types in North America. In the Great Lakes Regions, black ash wetlands are at risk from invasion by emerald ash borer (EAB; *Agrilus planipennis*); widespread infestation by EAB will dramatically alter the physical environment within and around these wetlands, with consequences for the biotic community. However, to date, relatively little is known about the aquatic community within these habitats. Our objectives were to 1) characterize the amphibian community within black ash wetlands and 2) to understand how amphibians might respond to EAB invasion. Using calls surveys and quantitative larval sampling, we documented the amphibian community within black ash wetlands across northeastern Minnesota; we also sampled amphibians

within experimental ash plots that were clear-cut to mimic EAB die-offs. We found six species of anurans within the study area; however only three anuran and one salamander species used the ephemeral pools within ash stands for breeding. There was no difference in larval amphibian composition between in-tact ash stands or clear-cuts. Taxon richness was positively correlated with pond hydroperiod and area. Our results suggest that, on a small spatial and temporal scale, aquatic communities may be resistant to EAB invasion.

0056 Fish Biogeography & Morphology, Saturday 15 July 2017

Hyo Jae Yu, Jin-Koo Kim

Pukyong National University, Busan, Republic of Korea

Clarifying the Effects of a Sister Species and Dispersal of Ichthyoplankton on the Population Genetic Structure of Goldeye Rockfish, *Sebastes thompsoni* (Pisces, Sebastidae)

Sebastes thompsoni is an important component of the commercial rockfish catch in the northwest Pacific Ocean. This species is most closely related to *Sebastes joyneri*, based on both morphology and genetics. To clarify the population genetic structure of Korean *S. thompsoni* and its relationship with *S. joyneri*, we analyzed a mitochondrial DNA (mtDNA) control region and eleven polymorphic microsatellite DNA (msDNA) loci of 215 *S. thompsoni* and 48 *S. joyneri* specimens collected from Korean waters. *S. joyneri* individuals were clearly distinguished from *S. thompsoni* by the mtDNA control region and msDNA results. Analysis of mtDNA revealed no distinct subpopulations within *S. thompsoni*. The msDNA results, in contrast, showed two distinct subpopulations of *S. thompsoni*: one distributed along the entire coast of Korea, and the other restricted to the Dok-do Island and Wangdolcho Reef off its coast, in the East Sea. One factor that may limit gene flow between subpopulations is the early dispersal of this species in the East Sea, where the circulating Tsushima warm current may inhibit transport to other locations. In this study, *S. thompsoni* larvae and juveniles were mainly observed near the coast, where their dispersal is restricted by various ocean current patterns (e.g., upwellings, eddies). Our results indicate that the two subpopulations of Korean *S. thompsoni* may be differentiated primarily by the characteristics of local marine environments and consequent effects on the dispersal of larvae and juveniles, rather than by hybridization between *S. thompsoni* and *S. joyneri*.

0057 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Hyo Jae Yu, Jin-Koo Kim

Pukyong National University, Busan, Republic of Korea

Is the Family Sebastidae (Pisces, Scorpaenoidei) Monophyletic According to Molecular Data?

In 1994, Ishida first proposed the new family Sebastidae (eight genera: *Sebastes*, *Sebastiscus*, *Hozukius*, *Helicolenus*, *Adelosebastes*, *Sebastolobus*, *Trachyscorpia* and *Plectrogenium*), which, based on myological and osteological characteristics, is clearly distinct from other families in the suborder Scorpaenoidei. Due to their fairly recent speciation, species groups within this family exhibit few or only minute morphological differences, rendering their phylogenetic relationships potentially confusing. Also, Ishida's (1994) new classification has not yet been broadly accepted. This study aims to clarify Sebastidae phylogeny using genetic data to test whether this family is a reciprocal monophyletic group and, if so, to determine which genera it includes. Here, two mitochondrial (mt) DNA sequences (1002 bp of cytochrome b and 559 bp of 16S rRNA) and two nuclear (n) DNA sequences (655 bp of RAG2 and 956 bp of RNF213) from 29 species in six genera in the family Sebastidae (excluding *Trachyscorpia* and *Plectrogenium*), as well as 27 outgroups, collected from the northern Pacific Ocean, were used to confirm the interrelationships among Sebastidae taxa. Bayesian inferences based on mtDNA and nDNA produced similar phylogenies, suggesting that the family Sebastidae is monophyletic. Furthermore, the basal position of *Sebastolobus* within Sebastidae as revealed by molecular phylogeny was highly consistent with the previous morphology-based tree. However, because some researchers recognize *Sebastolobus* as a separate family (Sebastolobidae, sensu Nakabo, 2013), more diverse sampling and additional data are required to resolve the problem.

0694 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Joshua Zacharias, Robert Cerrato, Michael Frisk

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Habitat Preference and Spatial Interactions of the NW Atlantic Skate Complex

The seven resident northwest Atlantic species of skates; barndoor (*Dipturus laevis*), clearnose (*Raja eglanteria*), little (*Leucoraja erinacea*), rosette (*L. garmani*), smooth (*Malacoraja senta*), thorny (*Amblyraja radiata*) and winter (*L. ocellata*) possess life history traits that make them vulnerable to overexploitation, such as slow growth, late maturation and low fecundity. The various species occupy overlapping habitats and often migrate long distances throughout the year. While their ecological role as benthic marine generalists and common geographic ranges are known, wider habitat use of these species is poorly defined. The goal of this study was to examine habitat preference and overlapping space use between the seven species of skate in the northwest Atlantic. National Marine Fisheries Service (NMFS) bottom trawl survey data from 1963-2009 was analyzed to assess conspecific and interspecific spatial overlap for all seven species. Within a species, we focused on measures of aggregation within the surveyed area as well as within the sampled fish distributions with emphasis upon temporal and abundance variation. We found evidence of population density based range expansion/retraction in several species. Our interspecies analysis focused upon indexes of collocation between each possible combination of species pairs. The highest index values, indicating a higher degree of spatial overlap, were found amongst sympatric

species pairs. These results highlight spatial preference amongst skate species and a possible reference point to aid management in understanding population movement and exploitation vulnerability.

0385 Fish Behavior, Saturday 15 July 2017

Nathaniel Zbasnik, Steve Huskey

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The Impact of Invasive Lionfish, *Pterois volitans*, on the Feeding Performance of Endemic Spotted Scorpionfish, *Scorpaena plumieri*

In 1985, *Pterois volitans*, red lionfish, were introduced off the coast of Florida. Without natural predators, they have rapidly reproduced while negatively impacting native populations and ecosystems. The impacts lionfish have on Atlantic and Caribbean ecosystems, specifically their reproduction and utilization of resources, have been well studied. Here, the presence of lionfish was assessed for its influence on the feeding success of an endemic family member, the spotted scorpionfish, *Scorpaena plumieri*. Wild-caught individuals were transported to the lab where we employed three experimental treatments: isolated, intraspecific competition, and interspecific competition. Isolated scorpionfish were maintained in individual tanks during feeding trials and were used to establish baseline feeding performance. During intraspecific and interspecific trials, a scorpionfish was housed with either another scorpionfish or a lionfish. Several key-feeding kinematic variables (e.g. timings, durations, excursion distances, and angles), as well as negative buccal pressure, were recorded and analyzed with high-speed videography and a Millar pressure catheter, respectively, for all six scorpionfish across all treatments. We also quantified the overall success (i.e. prey-capture rate) of scorpionfish feeding with competitors present and absent. Preliminary data suggest lionfish directly impact the feeding success of spotted scorpionfish. Scorpionfish are forced to modulate their feeding behavior and performance to be competitive in the presence of lionfish. While the impact of lionfish on endemic fishes is overwhelmingly negative, their impact on a family member, with whom they overlap greatly ecologically, is likely even more significant.

0319 Fish Ecology II, Sunday 16 July 2017

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Beta Diversity of Stream Fish Assemblages: Partitioning Variation Between Spatial and Environmental Factors

Studies that analyze the structure of assemblages across spatial scales, in order to determine generalizable patterns, can be used to guide efforts that allocate resources meant to conserve regional biodiversity. Beta diversity can shed light on the underlying factors that drive variation of assemblage structure including spatial and environmental influences. We examined fish beta diversity in southeastern Oklahoma by sampling 65 wade-able stream reaches and measuring 30 environmental factors at each sampling location. Variation of fish assemblage structure was partitioned between environmental and spatial predictors using RDA. Species turnover was separated into its two additive components of spatial turnover and nestedness to determine which of these two accounted for the most turnover across the drainage. Spatial and environmental factors combined accounted for 25.5% of fish beta diversity. Environmental factors alone accounted for 20.1%, while spatial factors alone only accounted for 3.5% of the variation. Nine environmental factors were significantly related to fish beta diversity: 1) elevation; 2) stream order; 3) stream width; 4) percent riffle habitat; 5) water temperature; 6) conductivity; 7) turbidity; 8) gravel substrate; and 9) current speed. Overall species turnover was driven mostly by spatial turnover rather than nestedness. This pattern was found to be the same across multiple spatial scales (entire drainage, sub-drainage, mainstem) and despite several techniques used to extract turnover coefficients. These results suggest that fish assemblages-particularly in headwater streams-are structured by environmental filtering and that these assemblages tend to be compositionally distinct, rather than being nested derivatives of one another.

0884 Herp Ecology II, Friday 14 July 2017

Amanda J. Zellmer[1], Gregory B. Pauly[2]

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Citizen Science Elucidates Urban Habitat Usage by *Batrachoseps* Salamanders

Urban environments are often associated with a loss of biodiversity due to widespread habitat modifications. Yet many organisms including some amphibians and reptiles continue to make use of urban habitats, from large city parks down to even the smallest gardens and backyards. Studying habitat use within urban environments however is a challenge because of limited access to private property. Using a combination of field surveys and data from the RASCals citizen science project, we document the presence of two species of salamanders, *Batrachoseps nigriventris* and *Batrachoseps major*, in urban habitat across Los Angeles. The presence of these species throughout the city raises the question of whether these are isolated remnant populations of *Batrachoseps* or if urbanization has instead resulted in an expansion into newly created habitats where irrigation has led to year-round availability of moist soil in a historically seasonally dry landscape. We test these hypotheses using fine-scale species distribution models by comparing the role of natural versus urban environmental variables in the distributions of these salamanders. Our results illustrate the importance of all urban green spaces and demonstrate a need to manage and conserve urban habitat regardless of habitat size.

Further, our results highlight the utility of citizen science projects for studying urban species.

0524 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES SYMPOSIUM – APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Casey Zender, James Gelsleichter

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Exploration of Plasma Indicators for Predicting Post-Release Mortality in the Blacktip Shark (*Carcharhinus limbatus*)

Catch-and-release fishing as well as the release of fisheries by-catch are often regarded as sustainable fishing approaches. However, recent studies have shown that a higher degree of post-release mortality may be occurring in sharks captured and released in these fisheries than previously expected. To determine the amount of capture-related mortality, previous studies have used electronic tagging and measurement of blood-borne secondary indictors including pH, concentrations of lactate, and dissolved CO_2. These methods may not be the best fit, as electronic tagging can be costly, and some secondary stress markers may consistently correlate with post-release mortality. For this reason, there has been a call for study of new indicators. To partially address this call, this study examined if plasma concentrations of malondialdehyde (MDA), a by-product of lipid peroxidation (LPO), and 8-hydroxy-2'-deoxyguanosine (8-OHdG), an indicator of DNA oxidation, were useful as indicators of capture stress and post-release mortality in blacktip sharks. LPO and DNA oxidation are the processes in which lipids and DNA respectively are damaged during oxidative stress, which can occur during capture. We measured plasma levels of MDA and 8-OHdG in blacktip sharks that were collected for a prior capture stress study, and compared these values to data obtained using more traditional forms of stress assessment, including electronic tagging and secondary stress indicators. Preliminary data suggests that levels of MDA may not be closely correlated with the expression of traditional indicators, although additional testing is needed. Development of new indicators are imperative to provide new mortality data for fisheries management.

0761 Herp Morphology & Development, Saturday 15 July 2017

Mingna V. Zhuang[1], Anthony P. Russell[2], Heather A. Jamniczky[2], Timothy E. Higham[1]

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Evolution of the gecko ankle in relation to the acquisition of frictional adhesion: A geometric morphometric analysis of the mesotarsal joint

Among terrestrial vertebrates, foot morphology and locomotor function are closely associated. A prominent example of this is the pedally-based adhesive system of geckos. Although the integumentary aspects of this complex are well-studied, its skeletal elements are not. The mesotarsal ankle joint of limbed squamates, situated between the astragalocalcaneum and fourth distal tarsal, is complex and governs the patterns of foot motion during propulsion. Among geckos, pad-bearing taxa have different limb and ankle kinematics from ancestrally padless forms, and we predicted that such kinematic differences are reflected in skeletal anatomy. To explore whether evolutionary changes in the morphology of the ankle joint have accompanied the acquisition of adhesive function, we obtained 3D micro CT images of the hind foot of 28 genera of the Gekkonidae and six outgroups. Our sample represents seven origins of the adhesive apparatus. We used 3D geometric morphometrics and phylogenetic comparative methods to compare shape variation in the ankle joint among ancestrally padless and pad-bearing lineages. Preliminary results suggest that the ankle joint of pad-bearing lineages differs from that of ancestrally padless lineages in having a shallower astragalocalcaneal groove and a shorter ventral peg on the fourth distal tarsal. This is suggestive that flexion and rotation of the crus about the foot are decoupled in pad-bearing lineages. Our results have important implications for the function of the adhesive system and gecko locomotion, and also provide evidence relating to how superficial and deep anatomy change in parallel in association with function.