Abstract Book

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Abstracts for the 2014
Joint Meeting of Ichthyologists and Herpetologists

AES – American Elasmobranch Society
ASIH – American Society of Ichthyologists and Herpetologists
HL – Herpetologists' League
SSAR – Society for the Study of Amphibians and Reptiles

Chattanooga, Tennessee
31 July – 3 August 2014

Edited by
Martha L. Crump
8 May 2014

0499 Herp Behavior, Banquet Room I, Saturday 2 August 2014

Andrea Acevedo, Matt Lovern, Stanley Fox

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Effects of Testosterone and Dihydrotestosterone on Coloration and Behavior of Male Hatchling Collared Lizards C*rotaphytus collaris*

Male secondary sexual characteristics are often tightly associated with androgens such as testosterone. Male hatchling collared lizards present conspicuous dorsolateral orange bars early in life, which disappear when adult coloration appears. We tested if testosterone (T) or its metabolite, dihydrotestosterone (DHT), or both, increases the intensity of orange coloration and aggressive behavior in hatchlings. We collected 35 male hatchlings in August of 2012 and 2013 and implanted them with T, DHT, or silicone blank (control). We measured androgen concentrations, orange coloration, and aggression 30 days after implantation. For hatchlings with T and DHT implants, T levels and aggression scores were significantly higher in the treatment groups compared to control groups. DHT however, was significantly higher only in the treatment group for hatchlings with DHT implants. For DHT implanted hatchlings, orange saturation, an index of its intensity, significantly increased with DHT. For T implanted lizards, no significant correlations were found between T or DHT and saturation. For hatchlings with implants (pooled), we found a positive but non-significant relationship between saturation and aggression. Aggression increased with higher levels of both androgens for hatchlings with T and DHT implants, but was statistically significant only between aggression and DHT in DHT implanted lizards. Androgens and coloration were also measured for wild hatchlings at the Sooner Lake dam (Pawnee Co., Oklahoma) from 2011 to 2013. In these, saturation showed a positive but non-significant relationship with DHT. Collectively, our results suggest that orange coloration and aggression in hatchling males depend more on DHT than on T.

0199 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Cory Adams, Daniel Saenz

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Effects of Chinese Tallow Leaf Litter on Overwintering Larval Anurans

Chinese tallow (*Triadica sebifera*), an exotic invasive deciduous tree species, is expanding its range and becoming more abundant where it occurs. This is particularly relevant to amphibian conservation considering that this tree species tends to invade wetlands and has been shown to reduce the survival of aquatic amphibians. At relatively low

concentrations, Chinese tallow leaf litter kills anuran eggs and larvae by reducing the dissolved oxygen and lowering the pH of water. The lethal effect of Chinese tallow leaf litter is short lived and concentrated soon after leaf fall, typically December through February in the Gulf Coastal states. We were interested in determining how sub-lethal levels of Chinese tallow leaf litter effects the behavior of overwintering anuran larvae. *Lithobates catesbieanus* and *L. clamitans* are two frog species that commonly overwinter as aquatic larvae and extensively overlap in range with invasive Chinese tallow, which may expose them to the harmful effects of the leaf litter. We conducted experiments where we exposed tadpoles to four different concentrations of tallow leaf litter and recorded water chemistry and air gulping behavior. As tallow concentration increased, dissolved oxygen and pH decreased. Both anuran species responded similarly, where tadpoles swam to the water's surface to air gulp at a significantly higher rate in the treatments with greater tallow concentration. Such changes in behavior induced by Chinese tallow could have consequences on tadpole foraging efficiency and predator avoidance.

0523 Herp Development, Morphology & Histology, Banquet Room H, Sunday 3 August 2014

Dean Adams

Iowa State University, Ames, Iowa, USA

Elevated Rates of Morphological Evolution in Montane Endemic Species of *Plethodon* Salamanders

Understanding the pace of evolution is important for discerning how biological diversity is generated and maintained. Rates of phenotypic evolution are sometimes affected by differences in habitats and ecological regime, and elevated evolutionary rates can be found in species facing ecological shifts, novel environments, or species invading new habitats. In the southern Appalachian mountains, *Plethodon* salamanders exhibit a distinct elevational trend, where montane species restricted to high-elevation localities are replaced at lower elevations by more widespread species. These montane species also display unique climatic tolerances, suggesting that they are physiologically specialized to their high-elevational niche. As such, it may be expected that rates of phenotypic evolution are higher in montane species as compared to more widespread species in the genus. In this study, I compared rates of morphological evolution between montane and lowland *Plethodon* species for several ecologically-relevant anatomical traits. Using various linear distance measurements I found that the rate of phenotypic evolution was higher in montane species for all seven traits examined. Further, head shape was found to evolve at a faster rate in montane endemic species as compared to lowland species for members of the *P. cinereus* species complex. These results are

consistent with the hypothesis that montane species rapidly adapt to their specialized ecological niche, and corroborate prior work showing an association between ecological shifts and rates of phenotypic evolution.

0644 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Ginny Adams[1], Casey Cox[1], Reid Adams[1], Lindsey Lewis[2], Jeff Quinn[3]

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Should We Explore Passage Opportunities for American Eel *(Anguilla rostrata)* in the Ouachita River Basin, Arkansas?

The American eel is a facultative catadromous fish that can undergo an extensive upstream migration into inland riverine habitat. Recently, American eels have experienced declines from historical population sizes in parts of their range. Multiple causes for the decline have been hypothesized, including barriers to migration. A majority of previous and ongoing research focuses on Atlantic river systems, while limited data exist for rivers discharging into the Gulf of Mexico. In particular, few data exist for the Ouachita River Basin. Our objective was to describe demographics of American eels in the Ouachita, Caddo, and Little Missouri rivers. From June 2011 through June 2013, twenty main channel sites and three sites directly downstream of dams in tailwaters were sampled in the Ouachita Basin by standardized boat electrofishing. Mean total length was 395 mm (236 - 763 mm). Mean CPUE was 27 eels/hour with a range of 0 to 78 eels/hour. Differences in total length and CPUE were observed between main channel and tailwater sites. Eels collected in tailwaters were significantly smaller than eels collected from main channel sites, and greatest CPUE was observed in tailwaters. Potentially, small eels collected directly below dams were attempting upstream migration but were impeded by barriers. These observations suggest opportunities to facilitate eel passage should be explored.

0539 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

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Seven Years of Monitoring the Reproductive Ecology of Alligator Gar in the Fourche LaFave River System, Arkansas

Better knowledge of where, when, and how alligator gar, *Atractosteus spatula,* spawn and factors influencing reproductive success will aid understanding of population declines and inform managers involved in recovering populations. Starting in 2007, we have continuously monitored reproduction at a floodplain tributary site on a yearly basis. Spawning is associated with flooding of the lower Fourche LaFave River caused by high water on the Arkansas River during spring/early summer when channel water temperatures have warmed to at least the low to mid 20°'s (Celsius). Adults leave the river channel and swim upstream in floodplain tributaries during the ascending limb of the flood and spawn over a short period of time (< 24 hrs) in flooded herbaceous vegetation (e.g., *Carex lupulina*) in proximity to tributary channels. A banner year for data collection through the fall juvenile stage occurred in 2007 when flooding extended into July. In other years, we have observed no spawning attempts, presumably due to lack of flooding or de-coupled flooding/temperature regimes, and instances where eggs were spawned, but immediately desiccated due to receding water levels. We highlight data collected during 2013 when we further observed spawning and recruitment to at least the late larval stage.

0616 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Mickey Agha[1], Jeffrey E. Lovich[2], Joshua R. Ennen[3], Benjamin Augustine[1], Terence Arundel[2], Mason Murphy[1], Dave Delaney[7], Jessica Briggs[7], Kathie Meyer[2], Curtis Bjurlin[4], Meaghan Austin[2], Sheila Madrak[5], Laura Tennant[2], Steven J. Price[1]

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Variation in Agassiz's Desert Tortoise (*Gopherus agassizii*) Survivorship Along a Wilderness to Industrial Disturbance Gradient

With the recent increase in utility-scale wind energy development, researchers have become increasingly concerned about the response of wildlife and conservation of critical habitat. To understand the impacts of wind energy facilities post-construction (maintenance and operation phase) on wildlife, we examined activity center, survivorship and potential predation on a population of desert tortoises (*Gopherus agassizii*) at a wind energy facility in southern California. Using a Cormack-Jolly-Seber model, we tested the hypotheses (*i*) that desert tortoises within the wind energy facility post-construction would be affected by anthropogenic features and operation, and would therefore have lower estimates of long-term apparent survival relative to nearby tortoises in proximity to a designated wilderness area and (*ii*) that individual activity areas would be significantly higher within the boundaries of the energy facility potentially due to altered resource availability. Over the span of 17 years there were 227 tortoise capture events of 54 different individuals, we found that activity areas varied greatly along the disturbance gradient. The top ranked apparent survival model included habitat type (area with proximity to wilderness or footprint of wind facility) effects. Model averaged overall apparent survival was 0.96 (CI: 0.941 - 0.991) for industrial landscape tortoises, while wildland tortoises apparent survival was 0.93 (CI: 0.901 - 0.958). High annual overall survival during 17 years suggests that the adult population has not declined considerably since the first year of study (1997).

0212 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Mickey Agha[1], Mason Murphy[1], Jeffrey Lovich[2], Joshua Ennen[3], Christian Oldham[1], Kathie Meyer[2], Curtis Bjurlin[6], Meaghan Austin[2], Sheila Madrak[4], Caleb Loughran[5], Laura Tennant[2], Steven Price[1]

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Research Activities and Winter Precipitation Influence Voiding Behavior in Agassiz's Desert Tortoise (*Gopherus agassizii*)

There is little information available on how research activities might cause stress responses in wildlife, especially responses of threatened species such as the desert tortoise (*Gopherus agassizii*). We studied the effects of repeated research handling of a population at a wind energy generation facility for 7 study years between 2000 and 2013. Using a generalized linear mixed-effects model we assessed the effects of both research manipulation and abiotic conditions on probability of stress induced voiding behavior. Of 1008 total capture events, voiding was recorded on 83 occasions in 42 different individuals. The top six models predicting voiding behavior included variables handling time, precipitation, gender, number of times captured, identification, and year. Our top models indicated that increases in handling time led to significantly higher probabilities of voiding for juveniles, females, and males. Similarly, increases in precipitation resulted in significantly higher probabilities of voiding for juveniles and females, but not for males. Tortoise capture frequency was negatively correlated with voiding occurrence.

0599 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Bonnie Ahr, Michael Farris, Christopher Lowe

California State University Long Beach, Long Beach, CA, USA

Hierarchical Habitat Selection and Utilization of White Croaker (*Genyonemus lineatus*) in the Los Angeles and Long Beach Harbor and the Development of Predictive Habitat Use Models

White croaker (*Genyonemus lineatus*) are a commonly caught and consumed species by subsistence fishers off local fishing piers near the Los Angeles and Long Beach Harbor.

They are a sentinel fish species for contamination due to their direct interaction with contaminated sediments through benthic foraging behavior, therefore determining which habitats white croaker select may be indicative of where these fish are acquiring contaminants. Habitat use and selection was determined using fine-scale fish movement data from actively tracked fish coupled with environmental and biotic data for the LA-LB harbor. Mixed effects models were also used to determine which factors influenced white croaker activity space, rate of movement, and tortuosity. Variables used included depth, dredging vs non-dredged, sediment grain size, potential prey density (polychaete density), sediment total organic carbon, substratum type, temperature, time of day, and harbor region. White croaker exhibited hierarchical habitat selection in which the primary drivers included areas of high sediment total organic carbon (4.8-8.1%), high polychaete density (406-700 individuals/0.1m^2), and non-dredged areas. Secondary drivers included depth, small grain size (below 23.5 μm), and substrata consisting of clay and silt. Several factors contributed to the best candidate models; however, time of day and depth were important parameters in all final models. Knowledge of which habitats are preferred by white croaker will aid in sediment remediation efforts aimed at reducing contaminant tissue concentrations of white croaker within the harbor. Additionally, white croaker habitat preferences can be used to predict the species' spatial response to changing environmental conditions in the harbor.

0380 NIA, Banquet Room F, Sunday 3 August 2014

James Albert[1], Donald Schoolmaster[2], Scott Duke-Sylvester[1]

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A Spatially-explicit Neutral Model Predicts Accumulation of Early Branching, Species-poor Clades Towards the Geographic Periphery

Macroevolutionary theory predicts highly imbalanced phylogenetic trees, with many species-poor clades and few species-rich clades, even under neutral conditions with no differences in per-species rates of speciation and extinction. Real phylogenies also show an unexpectedly high number of phylogenetically basal (early branching, species-poor) clades located towards the geographic periphery and phylogenetically nested clades located towards the geographic center. Further, macroecological data in most biotas show power-function-like relationships in species-range frequency distributions, with many geographically restricted species (endemics) and few widespread species. However, current theory does not provide a mechanistic connection between these patterns of species-richness, phylogenetic position and geographic location. Here we present results of a novel parametric biogeographic method called SEAMLESS that simulates neutral diversification on a spatially-explicit landscape using three

parameters; barrier addition resulting in vicariant speciation, barrier movement resulting in species range-expansion or dispersal, and a minimum viable area threshold resulting in extinction. SEAMLESS differs from DIVA and Lagrange in tracing clade diversification in a continuous space, rather than among discrete areas of endemism. SEAMLESS also differs from macroevolutionary approaches (e.g. GeoSSE) that study species range-evolution on trees. SEAMLESS predicts many observed biogeographic and phylogenetic patterns. 1. Power function-like relationships between species-richness and cladal-diversity. 2. Power function-like species-range frequency distributions. 3. Gradual accumulation of log-lineages through time. 3. Accumulation of species diversity towards the center of the domain, and of early-branching, species-poor clades towards the periphery. SEAMLESS also demonstrates that vicariance-only diversification results in global extinction; i.e. dispersal is necessary to maintain diversity.

0533 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Kaitlin Allen[1], Robert Powell[2]

[1]*Villanova University, Villanova, PA, USA,* [2]*Avila University, Kansas City, MO, USA*

Thermal Biology and Microhabitat Use in Puerto Rican Eyespot Geckos (*Sphaerodactylus macrolepis*)

The thermal environment of ectotherms affects every aspect of life history. Many ectotherms employ some form of behavioral thermoregulation to maintain body temperatures within an optimal range. Because of small body sizes, geckos in the genus *Sphaerodactylus* presumably are thermoconformers. However, small size also renders them extremely susceptible to overheating and desiccation. We used a thermal gradient in the lab to find the preferred temperature of *S. macrolepis* and thermal imaging and data loggers to explore their thermal ecology and microhabitat selection in the field. Our data suggest that all available microhabitats are outside the preferred temperature range during the hottest times of day. The layer of leaf litter closest to the substrate in dense shade had the highest humidity and lowest, most stable temperatures. However, geckos frequently ranged into a nearby grassy field where temperatures and humidity were sub-optimal. Although geckos quickly conform to microhabitat temperatures, they appear to adjust activity periods to coincide with most optimal environmental temperatures.

0761 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Abdulaziz Alqahtani

King Khalid University, Bisha/Aseer, Saudi Arabia

Biological Aspect of *Bufo tihamicus* in Aseer Region, South West of Saudi Arabia

Bufo tihamicus is an endemic species, average size (43-71mm). large toads and dry skin, The presence of horns conical protrusion on the outside (back) to the heel bone in the legs. And tubers metatarsophalangeal large, dry and heavily keratinized. The adult color in the environment light gray to brown. A huge head is broad and short. Tubercle heel, instep, toes and hand are often dark brown edges, and ventral parts poacher. Tadpole is small and dark brown color. The geographic distribution of *Bufo tihamicus* on Tehama area, along the south-west side of Saudi Arabia along the Red Sea coast of the region of Jizan, to the north of Aleeth. The current study has been registered Toad Tehama spread in several locations of the south-west of Saudia, where the toad was recorded in fifteen locations, including thirteen new sites of Tehama area. *Bufo tihamicus* environments areas near the red sea and extended to the interior places, a territory of the flat nature sand consist of deposits and the remnants of dust and with cracks and fissures because of the valleys many of unloading quick and flowing generally east to the Red Sea near the beach and the pools and ponds in some locations and be semi-permanent and sometimes throughout the year, and spread environments agricultural land on the valley. Active at night, breeding seasons for toad follows the seasons of rains.

0734 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

James Anderson[1], Luisa Queiroz[2], Kim Holland[3]

[1]Department of Biology, University of Hawai'i at Manoa, Honolulu, Hawai'i, USA, [2]Laboratório de Oceanografia Pesqueira, Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brazil, [3]School of Ocean and Earth Science and Technology, University of Hawai'i at Manoa, Honolulu, Hawai'i, USA

Perception and Discrimination of Magnetic Fields in Sandbar (*Carcharhinus plumbeus*) and Scalloped Hammerhead (*Sphyrna lewini*) Sharks

It is well documented that a diverse number of species across a broad range of taxa gain positional information and navigate using the earth's magnetic field. Yet empirical data regarding such capabilities in elasmobranch fishes is remarkably scant, with questions arising over the exact nature of the perceived stimulus. Thus questions regarding if, and how sharks perceive magnetic fields remain unanswered. Here we present some preliminary information from ongoing behavioral studies investigating the ability of two

shark species to perceive and discriminate magnetic fields. Captive sharks (n=11) were used in two separate studies. Sharks were conditioned through pairing activation of a magnetic stimulus with presentation of food over a target, or by pairing activation of an auditory stimulus with the presentation of food over an electromagnetic target. The conditioned response (CR) in both studies requires sharks to swim to the target in anticipation of reward (food). In study 2, sharks were requires to demonstrate a conditioned response and also choose the correct target to receive the reward. Sharks in study 1 demonstrated a strong response to the magnetic stimulus, making significantly more approaches to the target ($P<0.01$) during stimulus activation (S+) than before or after activation (S-). Data from study 2 indicates sharks are able to distinguish between magnetically active (S+) and inactive (S-) targets to receive a food reward. These data demonstrate that sharks of different species and life history can detect and use magnetic stimuli in search behavior, supporting hypotheses that sharks navigate using geomagnetic fields.

0228 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Jeffry Anderson, Robert Page

College of St. Benedict & St. John's University, Minnesota, USA

Genetic Resource Development in the Red-backed Salamander (*Plethodon cinereus*)

Red-backed salamanders (*Plethodon cinereus*) have long-served as an important model organism in ecology, evolution, and behavior. Over the past decade, microsatellites have been increasingly used in this species to address a variety of questions in population, behavioral, and conservation genetics. However, despite the publication of ~ 20 microsatellite loci, the average number of loci used in studies of *P. cinereus* is ~ six—a value that falls well below the number of loci used in comparable studies on other taxa. One reason for this limited genomic sampling depth is that many markers are informative in some locales, but not others due to the red-backed salamander's large geographic range and limited dispersal abilities. Nevertheless, these features of red-backed salamander biology (*i.e.,* large range and limited dispersal) present exciting research questions in molecular ecology, such as: (1) how much geographic variation is there in territoriality and breeding system dynamics? (2) How much geographic variation is there in dispersal behavior? And, (3) can we identify molecular markers that correlate with geographically variable traits of adaptive significance? To facilitate answering such questions, we used 454 pyrosequencing to generate a genomic shotgun sequence library that contains 283,830 reads corresponding to > 0.11 gb. We then scanned this library and identified 5430 fragments that contained microsatellites, of which 1790 had sufficient flanking regions for primer design. We will present the fruits

of our efforts to mine this library, with the goal of stimulating discussion on how to maximize its impact on the plethodontid salamander community.

0238 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Kaite Anderson

Towson University, Towson, Maryland, USA

Impacts of Human Recreation and Hydroelectric Flow Regime on Basking Behavior in Northern Map Turtles, *Graptemys geographica*

Habitat loss and modification are a threat to riverine turtles worldwide. Northern Map turtles, *Graptemys geographica*, are a state endangered species in Maryland where they are found only on the Lower Susquehanna River and its tributaries. Human recreation and water level fluctuations surrounding the Conowingo Hydrolectric Dam limit basking behavior in this population. As ectotherms, turtles rely heavily on basking to thermoregulate; decreased basking activity has the potential to negatively affect the success of individuals, and in turn, the success of the population. Spotting scope surveys were conducted to quantify the effects of 1) human recreation and 2) loss of basking habitat due to rising water via the hydroelectric dam on basking behavior. While motor-powered vessels were often ignored, turtles were most likely to abandon basking sites for slow-moving vessels like kayaks, which provided the most frequent source of disturbance. Boat traffic followed seasonal patterns with peaks during critical stages in the Map Turtle lifecycle, such as nesting season and spermatogenesis. Additionally, hourly disruptions in basking substrate use where observed as water levels rose; the majority of basking sites became submerged for hours at a time on a daily basis. Low flow rates had no significant effect on basking activity, while high flow rates, in combination with tide level, did negatively affect basking behavior. Artificial basking platforms are currently being tested as a possible mitigation measure.

0240 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Kaite Anderson, Nathan Byer, Ryan McGehee, Teal Richards-Dimitrie

Towson University, Towson, Maryland, USA

A New System For Marking Hatchling Turtles Using Visible Implant Elastomer (VIE)

The study of hatchling turtles can provide invaluable information on the survival rates, ecology, and population dynamics of the often poorly-understood early life history of

turtles. Numerous techniques have been applied to marking hatchling turtles; however, many of these marking techniques require shell or limb modification and may not remain visible as the turtle ages. A widely-used technique known as Visible Implant Elastomer, which involves injecting a small amount of fluorescent dye just below the skin of the organism, has been used on hatchling turtles with some success. Many of these marking systems apply multiple colors of elastomer to the legs, toe webbing, and tail. The majority of these techniques designate cohort marks for groups of hatchlings, rather than individual numbers. We expanded on existing methods by adapting the Ernst et al. (1974) marking system to fit the plastron of the turtle, giving each hatchling an individual mark number. The technique has been successfully applied to 101 hatchling Northern Map Turtles (*Graptemys geographica)* and five hatchling bog turtles (*Glyptemys muhlenbergii)* during 2012 and 2013. Recaptures of marked hatchlings have already provided valuable information about survival, habitat use, and growth rates of individuals. This marking method provides an inexpensive and potentially long-lasting technique for marking and tracking hatchling and sub-adult turtles.

0255 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Matthew Anderson[1], Stanley Fox[2]

[1]*Broward College, Pembroke Pines, FL, USA,* [2]*Oklahoma State University, Stillwater, OK, USA*

The Effects of Tail Autotomy on Behavior, Mating Strategies, and Territorial Quality in the Lizard *Uta stansburiana*

Our study was a field-based effort to monitor and document changes in marked individuals of the lizard *Uta stansburiana* following tail autotomy. We tested to determine if tail loss: 1) changes behavior of either sex in the field, or 2) leads to decreases in survivorship, territory size, or territory quality. We documented changes in territorial and foraging behavior, territory size, overlaps and quality, movements, mating strategies, and survivorship of *Uta stansburiana* following tail autotomy. Males responded to territorial intruders more aggressively than females, but tail loss did not affect intensity of aggression in either sex. Tailless males adopted more cryptic, less conspicuous behavior and moved more than tailed males; tailless males increased the size of their home ranges while tailed males decreased theirs. Tailless females increased foraging rate, potentially offsetting the burdens of tail regeneration during the energetically demanding reproductive season. Tail loss negatively impacted survivorship in both sexes. When looking at territory quality, tailless males displayed a pattern consistent with a switch from territoriality to a sneaker strategy. Post-autotomy females signaled lowered social status, fought less, and made the best of a bad situation.

As predicted, tail loss did not alter female territory size or overlaps. Overall, clear sexual differences in the behavioral strategies of *Uta stansburiana* following tail autotomy were observed. By addressing a single adaptation, tail autotomy, and examining its costs, this study elucidated the sexually disparate effects of tail autotomy on territoriality, behavior, and mating strategy in *Uta stansburiana*.

0406 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Thomas Anderson, Raymond Semlitsch

University of Missouri, Columbia, MO, USA

Multiple Predator Effects and Habitat Complexity Alter a Larval Salamander Intraguild Predation Module.

Intraguild predation (IGP) and multiple predator effects (MPE) each can have large effects on population dynamics and community structure. Environmental variables often interact with both of these processes, such that the outcome of IGP and MPEs vary under different abiotic constraints including increased habitat heterogeneity. We tested whether multiple predator effects influenced an IGP module within experimental pond communities, and examined whether increasing habitat complexity modified the outcome of IGP and MPEs. We additively combined central newts, mosquitofish, and aeshnid dragonflies in six combinations with larval ringed (*Ambystoma annulatum*) and spotted (*A. maculatum*) salamanders, the latter two of which form an intraguild predator-prey relationship, respectively. Size at metamorphosis of *A. annulatum* was smallest without predators and with mosquitofish compared to all other predator combinations, whereas their survival was highest in the same two treatments. Increased habitat complexity had minimal effects on size or survival of *A. annulatum*. Predator treatment, habitat complexity, and the survival of *A. annulatum* exhibited a significant three-way interaction that influenced size and survival of *A. maculatum*. Survival of *A. annulatum* and *A. maculatum* were negatively correlated, indicative of a release from IGP, but the effect varied by top predator treatment. Increased habitat complexity also modified the effect of each predator, and in some cases eliminated the negative relationship between salamanders. Overall, our results indicate that multiple predator effects and habitat complexity can influence an intraguild predation module by altering the survival of the intraguild predator, with subsequent cascading effects on the survival of the intraguild prey.

0676 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Zane Anderson, Robert B. Gillespie, Mark A. Jordan

Indiana University-Purdue University, Fort Wayne, IN, USA

Population Genomics of Creek Chubs (*Semotilus atromaculatus*) in Channelized Agricultural Streams

The transformation of headwater streams to assist in draining excess water from agricultural fields is associated with increased variation in flow rate, simplified in-stream habitats and reduced water quality. The creek chub (*Semotiuls atromaculatus*) is an abundant species inhabiting these altered environments that appears to be tolerant to disturbance. Prior work using neutral genetic markers has suggested that genetic variation is associated with contrasting stream habitats. To further understand possible evolutionary responses to the ecological effects of stream channelization, we analyzed genetic variation using amplified fragment length polymorphism (AFLP) loci. We screened 116 fish sampled from streams within the St. Joseph River watershed: one in northeastern Indiana and one in southern Michigan with land cover dominated by agriculture, and a third in southern Michigan that is less disturbed and runs through a forested game reserve. Whole genomic DNA was fragmented using EcoR1 and MseI restriction enzymes and subsequently amplified with four pairs of selective primers. A total of 638 AFLP loci were genotyped and 75% were found to be polymorphic. Creek chubs from agricultural streams showed equal or higher levels of polymorphism and heterozygosity than those the stream with less disturbance but there was no population structure detected in the dataset. These results corroborate those from the same populations using microsatellite loci and suggest that gene flow may be higher in channelized streams. An analysis of outlier loci to test for possible differential selection among streams will also be presented.

0435 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Paul Andreadis

Denison University, Granville, Ohio, USA

The Academic Phylogeny of Gordon Burghardt

History, both ontogenetic and phylogenetic, is a frequent theme of Gordon Burghardt's research. To properly set the historical stage for the symposium, I review the 'phylogeny' of his doctoral lineage. The clade originates in Germany with **Wilhelm Wundt** (M.D. 1856). Father of experimental psychology, Wundt supervised an astonishing 186 doctoral theses of students from across Europe, including the Briton **Edward Titchener**

(Ph.D. 1892). A major dispersal event is recorded in Titchener's transAtlantic move to Cornell. His student **Edwin Boring** (Ph.D. 1914) was a noted psychological historian and administrator. An important evolutionary transition over this time was the divorce of psychology and philosophy: while 1/3 of Wundt's students were in philosophy, Boring presided over the separation of the Harvard psychology and philosophy departments. Boring's student **William Prentice** (Ph.D. 1942) was also a successful administrator (retiring as president of Wheaton College), but both Boring and Prentice continued to support experimental psychology. An important mutation is seen in the studies of non-human animals pursued by Prentice's student at Johns Hopkins, **Eckhard Hess** (Ph.D. 1948). Burghardt received his doctorate at Chicago in 1966 under Hess's tutelage. Attributes of the entire Wundt-Burghardt lineage include a dedication to the scientific study of mental phenomena, an experimental approach, and an interest in sensory and perceptual processes. A noteworthy Burghardtian apomorphy is reflected in the number of his students who continue to study reptiles. I conclude with a question and a concern for future students eager to study reptile behavior and psychology: who will guide them?

0752 SSAR SEIBERT CONSERVATION AWARD, Banquet Room J, Friday 1 August 2014

Nicole F. Angeli[1], Ian Lundgren[2], Clayton Pollock[2], Zandy Hillis-Starr[2], Lee A. Fitzgerald[1]

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Occupancy, Density, and Dispersal of a Critically Endangered Lizard on a Small Island

The critically endangered St. Croix Ground Lizard (*Ameiva polops*) was extirpated from mainland St. Croix due to mongoose and rat predation. To establish a new population, fifty-seven animals were translocated to offshore Buck Island in 2008. With the goal of estimating the current size and extent of the population, we made visual counts of unmarked animals by multiple observers at an array of sites throughout Buck Island. The 61 observation sites covered 12% of the island, and were surveyed 3 times between March and May 2013. We used count data and habitat variables to estimate island-wide occupancy and to draw correlations among habitat variables and abundance. By May 2013, *A. polops* occupied 59% of the entire island. Over five years, the population increased at least four-fold from 57 to 940-1802. Models showed lizard abundance was correlated with temperature and habitat structure. We suggest that future translocations

of *A. polops* to other locations is feasible and would be a worthwhile conservation and restoration strategy for this species.

0162 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Whitney Anthonysamy[1], Sarah Wylie[1], Michael Dreslik[1], Mark Davis[1], Marlis Douglas[2], Michael Douglas[2], Christopher Phillips[1]

[1]*Illinois Natural History Survey, Champaign, IL, USA,* [2]*University of Arkansas, Fayetteville, AR, USA*

Genetic Assessment of an Eastern Massasauga (*Sistrurus catenatus*) Population in Illinois

In Illinois, the Eastern Massasauga Rattlesnake (*Sistrurus catenatus*) has suffered a drastic decline and currently only has 1-4 known populations remaining. We have established a long-term monitoring program for the population at Carlyle Lake in Clinton County, and have a continuous time series going back to 1999 (approximately 15 years). One of the remaining gaps is to improve our understanding of the genetic population structure and molecular ecology. We used microsatellite DNA markers to genotype 94 Eastern Massasauga Rattlesnake collected across three time periods (2002, 2007, and 2012) from South Shore State Park (SSSP). We report on 1) within-population diversity (e.g., allele frequencies, observed heterozygosity), 2) estimates of effective population size (Ne), 3) evidence for bottlenecks, and 4) levels of migration for each temporal population. Levels of heterozygosity were moderate and remained stable over time but a number of rare alleles previously detected in 2002 and 2007 were undetected in 2012. Levels of migration were high from one temporal population to another but estimates of Ne were low and evidence for a recent population bottleneck (e.g., heterozygosity excess) was detected within time periods. Further, the gradual loss of rare alleles prior to a decrease in heterozygosity is consistent with predictions of genetic drift in small populations. This ongoing study will provide a firmer understanding of the genetic status of the Carlyle Lake population to further refine conservation strategies within the region, state, and range of the Eastern Massasauga Rattlesnake.

0376 NIA, Banquet Room F, Sunday 3 August 2014

Caroline Arantes[1], Kirk Winemiller[1], Miguel Petrere[3], Leandro Castello[2], Carlos Freitas[4]

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Influence of Deforestation on Fisheries in the Amazon Floodplains

In floodplains, fish populations are dependent upon forests for food resources, spawning and rearing habitat, and protection from predators. However, the influence of forest cover on fish production remains undocumented despite the attention garnered by estimates of deforestation within the Amazon. Our study aims to reveal potential impacts of forest cover on fishery yields in floodplains of the lower Amazon. We conducted field research during the flood season to assess fish populations in 126 habitats across 17 lake systems along a gradient of impacts to the floodplain (from the most degraded forest to the most pristine). Fishes were sampled using gillnets of varying mesh sizes in order to capture a broad range fish species and sizes harvested in regional fisheries. For each sampled lake system, we quantified floodplain vegetation cover using GIS. We analyzed abundance (biomass catch-per-unit effort, CPUE) patterns of fish species and trophic guilds in relation to percent forest cover of local watersheds. Positive relationships were found between CPUE and forest cover for lake systems ($F = 7.27$; $p = 0.018$; $n = 17$) and habitat types ($F = 5.21$; $p = 0.024$; $n = 126$). The median CPUE for herbivorous fishes was 1.8 times higher in pristine areas than in deforested areas. This ongoing research highlights the need to study impacts of land use, including deforestation, on fish ecology and fishery yields in the Amazon. Future analyses of fish assemblage structure, food web ecology, and local fishing activities will be integrated to explore relationships between ecological and social factors.

0695 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

Edith Arenas Rios[3], Nora Irbargüengoytía[2], Norma Manríquez[4], Fausto Méndez[1]

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Male Reproductive Cycles in Lizards

Lizards are one of the most conspicuous, diverse and widely distributed groups of reptiles. Part of its success is due to the diversification in reproduction. Reproductive

cycles represent a good way to understand the success acquiring different strategies. In particular, males exhibit reproductive diversity since timing of gametogenesis (precopulatory, mixed and postcopulatory); even when most of the lizards reproduce during spring-summer, some viviparous species present associated (synchronous) patterns, in which males and females exhibit the maximum activity in fall or dissociated (asynchronous), with maximum activity of males in summer and females until fall. Dissociated cycles also involve sperm storage in the female reproductive tract. Incipient evidences suggest that sperm maturation must include temperatures lower than preferred to achieve the cytoplasmic drop. Reproductive cycles of lizards are commonly based on the sacrifice of many individuals; nevertheless different factors have conduced to lizard extinction. Therefore the sacrifice of any organism must be fully justified as many issues have been resolved and are available different non-invasive techniques to determine basic information of reproductive cycles.

0117 AES Behavior, Banquet Room E, Thursday 31 July 2014

Csilla Ari

University of South Florida, Tampa, Florida, USA, Manta Pacific Research Foundation, Kona, Hawaii, USA, Foundation for the Oceans of Future, Budapest, Hungary

Rapid and Long-term Coloration Changes of Manta Rays (genus *Manta*)

Changes of body coloration have not been described in manta rays (genus *Manta*) so far, therefore their natural body coloration is used to distinguish species and their ventral spot markings are used to identify individuals worldwide in order to estimate their population size or seasonal migration. This report describes the first evidence of rapid and long term coloration changes of manta rays based on observations of captive individuals. Rapid body coloration changes were observed most intensely on the dorsal surface and on the head, which occurred within minutes prior to feeding and during intense social interactions. Long term coloration changes were documented on the side of the head, the inner side of the cephalic lobes, the pectoral fin margin of ventral side, and spot markings on the gill slits which appeared within 9 months, most likely during maturation. This observational study confirms the ability of manta rays to rapidly change body coloration during exposure to certain environmental stimuli, as well as that some coloration patterns of manta rays are not as stable over longer periods of time as it has been assumed previously. Understanding the dynamics of these coloration changes is essential for accurate species and individual identification and to perhaps gain insight into more advanced forms of communication.

0294 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Csilla Ari[1,2], Dominic D`Agostino[1]

[1]*University of South Florida, Tampa, USA,* [2]*Foundation for the Oceans of the Future, Budapest, Hungary*

Contingency Checking and Self-Directed Behaviors in Giant Manta Rays: Do Fish Have Self-Awareness?

Elaborate cognitive skills arose independently in different taxonomic groups. Self-recognition is conventionally identified by the understanding that one's own mirror reflection does not represent another individual but oneself, which has never been proven in any fish species so far. Manta rays have high encephalization quotient similarly to those species that passed the mirror self recognition test and possess the largest brain of all fish species, therefore mirror exposure experiments were conducted on two captive giant manta rays to document their response to their mirror image. The present study shows evidence for manta rays contingency checking and self-directed behavior when exposed to a mirror, which are prerequisites of self-awareness, while these behaviors have been taken as evidence of self-recognition in apes. We conclude that manta rays are likely the first fish species described to exhibit self awareness which implies their ability to higher order brain function, sophisticated cognitive and social skills.

0453 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Jonathan Armbruster, Carla Stout, Malorie Hayes

Auburn University, Auburn, AL, USA

An Empirical Test for Convergence and Social Mimicry Using African Barbs (Cypriniformes)

Evidence for convergence is often just based on overall similarity as interpreted by human eyes. A critical test is developed to assess convergence in shape using geometric morphometrics. Overlap in shape space indicates similarity, and phylogenetic regression on shape demonstrates whether or not the similarity is due to evolutionary history. If evolutionary history is eliminated via a homogeneity test for phylogenetic signal, convergence is the cause of the similarity. This method was tested on a group of cyprinid fishes from the Dja River of Cameroon. Two species, '*Barbus*' *aspilus* and '*B.*' *guirali* are very similar in shape and color and appear to school together. Phylogenetic analysis of the mitochondrial cytochrome *b* gene suggests that they are not sister taxa, and there is no phylogenetic signal when the phylogeny is overlaid on shape space. The

convergence between the two is likely due to a variety of factors including social mimicry to increase the benefit of the herd effect, crypsis and predator avoidance in open water, increased protection of '*B.*' *aspilus* because '*B.*' *guirali* has a protective dorsal spine, and potentially increased predator avoidance because of the extensive network of lateral line neuromasts on the head of '*B.*' *aspilus*.

0603 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Rachel Arnold

University of Washington, Seattle, WA, USA

Evolutionary Relationships of the Enigmatic Anglerfishes (Teleostei: Lophiiformes): Can Nuclear DNA Provide Resolution for Conflicting Morphological and Mitochondrial Phylogenies?

Anglerfishes, order Lophiiformes, are a morphologically diverse group of teleost fishes found worldwide from tropical near-shore habitats to the deep ocean. Previous studies examining evolutionary relationships within the Lophiiformes using morphological and mitochondrial data are incongruent, especially within the deep-sea ceratioid anglerfishes. To test these novel relationships, concatenated nuclear and mitochondrial loci were subjected to maximum likelihood and Bayesian analysis. The loci were further analyzed using a species tree approach that accounts for heterogeneity among gene trees. As reported in the mitogenomic study, the genus *Lasiognathus* belongs within the family Oneirodidae rather than the Thaumatichthyidae. The Melanocetidae and Diceratiidae form a sister relationship, and this assemblage formed the sister to the Himantolophidae. However, many other relationships within the deep-sea anglers are incongruent with both the morphological and mitogenome studies, including the primitive placement of the family Linophrynidae within the Ceratioidei. In addition, novel relationships within the Antennarioidei are recovered, requiring the reclassification of the families Antennariidae, Brachionichthyidae, Lophichthyidae, and Tetrabrachiidae.

0683 Fish Ecology, Banquet Room G, Friday 1 August 2014

Viviana Astudillo-Clavijo, Hernan Lopez-Fernandez

University of Toronto and Royal Ontario Museum, Toronto, Ontario, Canada

Divergence of Locomotor Morphology in the Radiation of Neotropical Geophagine Cichlids

Adaptive radiations generally involve phenotypic diversification along one or various ecological dimensions of specialization. In fishes, the evolution of locomotor phenotypes may represent an important dimension of ecomorphological diversification given its implications for habitat use, feeding ecology, and swimming performance in general. The species rich and phenotypically diverse Neotropical cichlid tribe Geophagini offers the opportunity to investigate important dimensions of phenotypic diversification in a newly identified case of adaptive radiation. We used phylogenetic Principal Components Analysis (PCA) and models of phenotypic evolution to investigate diversification patterns of locomotor traits and to test whether locomotor diversification is consistent with an adaptive radiation in Geophagini. Species were found to exhibit a high degree of diversity in locomotor traits that appears to be related to feeding and habitat use adaptations. Most of this phenotypic diversity appeared during an early burst of phenotypic evolution, which is consistent with an adaptive radiation. Additionally, locomotor diversification was characterized by an adaptive peak in the morphologically unique and speciose Crenicichla subclade. Taken together these results confirm that the diversification of locomotor morphology represents an important dimension of phenotypic evolution during the adaptive radiation of Geophagini.

0678 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Frank Bailey[1], Vince Cobb[1], Matthew Klukowski[1], Jake Pruett[2]

[1]Middle Tennessee State U., Murfreesboro, TN, USA, [2]Indiana State University, Terre Haute, IN, USA

Sexually Dimorphic Corticosterone Responses to an Acute Stressor in Cottonmouths (*Agkistrodon piscivorus*)

The sexes may differ in their stress responses because of different selective pressures. In a previous study we showed that mere human proximity elicited only a weak elevation of plasma corticosterone levels in cottonmouths. Here we tested the effects of more intense acute stressors (e.g., confinement for 2 hr, 4 hr, or a repeated bleed). In particular, we tested for sex differences in both corticosterone and leukocyte responses. We also tested three common predictions: (1) since one of the major functions of corticosterone is to mobilize energy stores, baseline corticosterone levels should be

elevated in individuals in poor body condition, (2) corticosterone levels should covary with the heterophil to lymphocyte ratio, and (3) baseline corticosterone levels should be positively associated with hemogregarine parasite loads, if these parasites are costly. Finally, we tested the utility of using plasma lactate levels to measure the magnitude of the acute stress response. We found that female cottonmouths have a more robust adrenocortical response than males, with more than double the corticosterone concentration at 4 hr in spite of lower baseline levels. Snakes in poorer body condition had higher baseline corticosterone levels than snakes in better condition. The effect of repeated blood sampling was especially pronounced - snakes bled both upon capture and at 2 hr had higher corticosterone levels than snakes bled only once at 2 hr or even at 4 hr. Plasma lactate was positively correlated with corticosterone levels and thus may serve as a useful measure of the acute stress response.

0779 SSAR Infrared Imaging Symposium, Banquet Room J, Sunday 3 August 2014

George S. Bakken[1], Aaron R. Krochmal[2], William B. Gerwig[2], and Travis J. LaDuc[3]

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Evolution is in the (Thermal) Eye of the Beholder: Anatomical and Ecological Influences on the Evolution of the Facial Pits of Pitvipers

The facial pits of pitvipers are unique thermosensory organs that function as part of a multispectral visual system providing pitvipers with a composite visual-thermal image. Our understanding of the behavioral utility of the facial pits is decidedly limited, with a more complete understanding of the potential behavioral roles of the facial pits hinging on a strong comprehension of both the thermal and directional sensitivity of these organs. The external anatomy of the facial pits strongly influences both their directional sensitivity (by altering exposure of the internal sensory membrane to the external environment) and thermal sensitivity (*via* the interaction of pit size and shape on pit aperture, and thus, angular resolution). External pit anatomy is known to vary markedly, but this variation has never been formally quantified nor has it been interpreted in light of its impact on facial pit optics. To these ends, we used panoramic photography and computational image analyses to document and quantify the external anatomy (*e.g.* shape, size, angular orientation, projection, and relative surface area) of the facial pits of 13 North and Central America pitviper species, providing a broad ecological and evolutionary context for the work. Our results are the first to document and quantify variability of the external facial pit anatomy, and will be interpreted in

optical, ecological and phylogenetic contexts, shedding light on both the causes and consequences of the evolution of the facial pit.

0028 Fish Systematics & Taxonomy III, Banquet Room G, Sunday 3 August 2014

Carole C. Baldwin[1], G. David Johnson[1], D. Ross Robertson[2]

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New Discoveries in the Caribbean Sea: Integrative Taxonomy Reveals Two New Species of *Liopropoma* (Serranidae: Epinephelinae: Liopropomini) from Deep Reefs off Curaçao and the Surprising Identity of an Unusual Fish Larva from the Florida Straits.

Integrative taxonomy, in which multiple disciplines are combined to address questions related to biological species diversity, is a valuable tool for identifying pelagic marine fish larvae and recognizing the existence of new fish species. Here we combine data from DNA barcoding, comparative morphology, and analysis of color patterns to identify an unusual fish larva from the Florida Straits as the pelagic larval phase of a previously undescribed species of Liopropoma sea bass from deep reefs off Curaçao, southern Caribbean. A second new species of *Liopropoma*, also from Curaçao, has the deepest depth range (182-241 m) of any known western Atlantic *Liopropoma* species. Preliminary phylogenetic data suggest that western Atlantic liopropomins (*Liopropoma* + *Bathyanthias*), are monophyletic and that *Bathyanthias* is nested within *Liopropoma*, indicating a need for further study of the generic limits of *Liopropoma*. The phylogenetic data further suggest that western Atlantic liopropomins comprise three monophyletic clades that have overlapping depth distributions but different depth maxima (3-70 m, 30-150 m, 133-241 m). The two deeper clades, but not the shallowest clade, show indications of allopatric and depth-mediated ecological speciation. Exploration of deep reefs to 300 m using a manned submersible off Curaçao is resulting in the discovery of numerous new fish species, improving regional genetic databases, and greatly enhancing understanding of deep-reef fish diversity in the Caribbean.

0104 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Timothy Baldwin[1], Yong Wang[2], Callie Schweitzer[3]

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The Influence of Forest Management Practices on Breeding Pool Accessibility, Breeding Site Selection, and Breeding Performance of Amphibians in Grundy County, Tennessee

The purpose of this project was to assess the influence that forest disturbance has on pool breeding amphibian reproductive success. This experimental study was executed using a split-split plot design to examine the effect forest treatment (main factor), distances to forest edge (split-factor), and variation in amount of light reaching the pools (split-split factor) had on amphibian breeding parameters. The forest treatments included: control with gaps (five replications), shelterwood (four replications), and an oak shelterwood (five replications). Three artificial ponds were established at each of the three distance categories (ten meters, fifty meters, and one hundred meters) in each of the forest stands. Three pools at each distance were randomly assigned to allow thirty percent, fifty percent, and eighty four percent of the light in relative to control stands to reach the pools using light screens. Artificial pools were monitored over two breeding seasons. A factorial analysis of variance was used to compare amphibian species abundance among different treatments, along the distance gradient, and between the different canopy treatments. Multiple regression was used to compare the environmental variables to amphibian species abundance. In the field experiment, larval amphibian abundance was different across treatments ($F = 4.3$, $p = 0.022$) and canopy cover arrays ($F = 3.2$, $p = 0.042$). Multiple regression showed significant relationships for both the 2010 ($R^2 = 0.211$, $p < 0.001$) and 2011 ($R^2 = 0.478$, $p < 0.001$) breeding seasons. Larval amphibian abundance was highest within the shelterwood treatments and the thirty percent canopy array.

0336 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Charles Bangley, Roger Rulifson

East Carolina University, Greenville, North Carolina, USA

Sharks in the Sound: Delineating Potential Coastal Shark Habitat Within Pamlico Sound, North Carolina

Coastal sharks often use estuarine environments as nursery habitat, making them potentially vulnerable to human activity. Pamlico Sound is part of the second-largest estuary system in the United States, but relatively little is known about its use by coastal

sharks. To identify potential shark habitat areas within the Pamlico Sound, environmental and shark catch data were taken from North Carolina Division of Marine Fisheries (NCDMF) gillnet and longline surveys covering February-December 2007-2013. A total of 7,521 gillnet and 631 longline sets captured 2,299 individual sharks representing 11 species. All sampling locations were plotted in Arc-GIS and distance to the nearest inlet and known SAV bed were determined for each station. Environmental and spatial factors potentially affecting shark abundance were interpolated and converted into raster layers covering the area of Pamlico Sound. For each species, multiple regression analysis was used to determine which of these factors most strongly correlated with abundance. These factors were run through classification and regression tree (CART) models to identify environmental "break points" between high and low catches. Areas of Pamlico Sound falling within these environmental parameters were mapped to delineate the spatial extent of potential habitat for each shark species within the estuary.

0161 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Alyssa Bangs

Arkansas Tech University, Russellville, AR, USA

Thermal Ecology of Northern Fence Lizard (*Sceloporus undulatus hyacinthinus*) Populations in Two Thermally Different Habitats

The thermal environment of a habitat has a large effect on organisms that utilize that habitat. This is especially true in ectotherms, where thermal conditions can strongly influence a wide variety of life history traits. I compared morphology, activity levels and behavior of Eastern Fence Lizard (*Sceloporus consobrinus*) populations residing in two different habitat types (rocky and forested) located in close proximity. Rocky habitats were primarily made up of boulder to gravel-sized rocks with little to no vegetation and were bordered on at least one side by water. Forest sites were primarily deciduous, with a varied understory. I found no morphological or behavioral differences between these two habitats except in microhabitat use; forested lizards utilized a wider range of microhabitats. I was also able to detect a significant difference in daily activity patterns between lizards in rocky and forested habitats. These results run counter to the current consensus that population differences are primarily the result of temperature differences, as opposed to any other environmental factors. However, the majority of similar research has focused on these traits in populations separated by elevation or latitude. I propose that environmental factors other than temperature may be partially responsible for differences found between populations separated by elevation or latitude.

0527 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Max Bangs, Marlis Douglas, Michael Douglas

University of Arkansas, Fayetteville, AR, USA

Range-wide Assessment of Hybridization and Introgression in Bluehead Sucker (*Catostomus discobolus*)

Southwestern fishes are impacted by a multitude of anthropogenic impacts, including introduced non-native species, habitat alterations, and climate change. Generating baseline data about population demographics and structure provides information necessary to develop management plans. However, if species identifications are ambiguous due to introgression, accurate assessments can be hampered. Molecular genetic approaches are generally needed to determine levels of admixture (e.g., hybridization or introgression). The Bluehead Sucker (*Catostomus discobolus*), native to the Colorado River, Upper Snake, and Bonneville basins, has experienced declines throughout its range. Hybridization with native and introduced species may further jeopardize persistence of locally adapted lineages. We tested samples phenotypically identified as either hybrid or introgressed Bluehead Sucker for admixed ancestry by sequencing several bi-allelic nuclear (nDNA) loci, two mitochondrial (mtDNA) genes and 16 microsatellite loci. We were able to not only confirm hybridization with and without introgression, but also characterize parental species involved in the admixture. Our results have important management implications and will aid in conservation planning for the species.

0215 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Santiago Barbini[1], Luis Lucifora[2], Daniel Figueroa[1]

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Using Opportunistic Records from a Recreational Fishing Magazine to Assess Population Trends of Sharks

Detecting and determining changes in the occurrence and abundance of species is prioritary for effective management of the resources and conservation of the biodiversity. In the absence of long-term monitoring data, potential population declines may be very difficult to establish. Therefore, alternative information on occurrence of

species to infer population trends is highly valued. We reviewed records of sharks (i.e. *Notorynchus cepedianus*, *Carcharias taurus*, *Galeorhinus galeus* and *Carcharhinus brachyurus*), from a recreational fishing magazine (Weekend) off northern Argentina, between 1973 and 2008, with the aim of evaluating population trends with opportunistic data sources. For each shark species, the number of occurrences per year in the magazine was registered. Our analyses were based on a non-probabilistic method (McPherson & Myers' approach) designed to determine population trends with opportunistic sighting records. In this approach we included the number of classified offering fishing guide services published per year in the magazine, as a measure of observation effort. Alike, for each species, we fitted generalized linear models with a Poisson error structure and a log link, where response variable was the number of occurrences per year, the explanatory variable was the year and the logarithm of the number of fishing guide ads was specified as an offset in each model. For both approaches, our models estimated that populations of the four shark species have suffered declines. Estimates produced by these models will help to determine the magnitude of population changes where a paucity of data prevents more precise analysis.

0642 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Sarah Barns, Matthew Klukowski

Middle Tennessee State, Murfreesboro, TN, USA

Influence of Food Restriction on Plasma Corticosterone and Innate Immunity and Blood Chemistry in the Brown African House Snake *Lamprophis fuliginosus*

The ability to tolerate the stress of extended periods of food deprivation is an evolutionarily important trait that has significant effects on survivorship in the wild. There are different physiological mechanisms by which certain species survive these periods: elevation of the stress hormone corticosterone, reduction of immune function, and reduction in reproductive activity are well documented in regards to food deprivation. These differences have been documented between species, but to our knowledge, have not been performed within a gender based context in colubrids. Thus the objectives of this project are to determine if there are any sexual differences in plasma corticosterone, or blood chemistry and to determine if innate immunity is associated with plasma CORT in the brown African house snake. This project consisted of a ten week food restriction period in which all snakes were fed ~5% of body mass every two weeks and a three week recuperation period in which all snakes were fed ad lib. Twenty six African house snakes (18 female and 8 male) were sampled. Over the duration of the 13 week project, five blood samples were collected from each snake to measure corticosterone, bacterial killing capacity (with *E. coli*), leukocytes, testosterone,

estrogen, triglyceride, and uric acid concentrations. I predict that CORT will increase over the 10 week period of food restriction and that as CORT increases, immune function will decrease but differentially between the sexes.

0481 Herp Ecology & Phylogeography, Banquet Room E, Sunday 3 August 2014

André Felipe Barreto-Lima[1], Guarino Colli[1], Sandra Maria Hartz[2]

[1]Universidade de Brasília, Brasília, Distrito Federal, Brazil, [2]Universidade do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil

Ecology Niche Overlap Between *Enyalius* Species (Squamata, Leiosaurinae): A Distribution Modelling for Neotropical Forest Lizards

Lizards in the genus *Enyalius* are restricted to South America and occur predominantly in the Atlantic Forest of eastern Brazil. Herein we use species distribution models (SDMs) to investigate the ecological determinants of their geographic distribution and patterns of niche overlap. Climatic and geographic variables exert considerable influence over the distribution of *Enyalius* spp. In general, latitude, mean diurnal temperature range, and altitude were the most important predictors of SDMs for the majority species. Precipitation of the coldest quarter and precipitation of the driest quarter were more important for *E. leechii* and *Enyalius* sp., respectively. We found no significant niche equivalency between species of *Enyalius* spp. However, background similarity tests indicated that sister species tend to be more similar than expected by chance. Whether in simpatry or allopatry, this similarity may result from a combination of abundant resources, phenotypic plasticity, and phylogenetic conservatism.

0502 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

André Felipe Barreto-Lima[1], Cristiano Campos Nogueira[1], Guarino Colli[1], Sandra Maria Hartz[2]

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Potential Distribution and Geographic Variation in the Morphology of the *Enyalius* Genus (Iguanidae; Leiosaurinae) from the Brazilian Forests

We investigate the association between morphology and environmental parameters in lizards of the genus *Enyalius*, endemic to South America. Environmental information

from each collection site was used to model the geographic distribution of the genus and determine possible associations with morphology. The potential distribution of the genus is mainly concentrated in the Atlantic Forest, suggesting that an important part of the evolutionary history of *Enyalius* is deeply linked to this biome. The most important variables in the potential distribution model were mean annual temperature, latitude and diurnal temperature range. Precipitation of coldest trimester was positively related to *Enyalius* body size. Precipitation in coldest trimester, altitude and vegetal coverage best explained the variation in body shape for the group as a whole. Latitudinal and altitudinal patterns were found for the extremities of the body as predicted by Allen's rule. However, patterns contrary to Allen's rule occurred for some parts of body. Longitude had an either direct or inverse relationship with body extremities. No pattern corresponding to Bergmann's rule was found for body size in relation the latitude or ambient temperature. Some climatic patterns were associated with shape, as demonstrated by association between the precipitation and the fourth finger length and associations between vegetal coverage and hand and body length. In conclusion, the thermal and geographic requirements can exert a greater influence over the morphological adaptation of *Enyalius* genus, explaining the differential allometric growth in an extensive geographic area along the Brazilian biomes.

0531 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Henry Bart[1], Dorothy Nyingi[2], Nathan Gichuki[3], Dorcas Sigana[3], Ray Schmidt[1]

[1]*Tulane University Biodiversity Research Institute, Belle Chasse, Louisiana, USA,* [2]*National Museums of Kenya, Nairobi, Kenya,* [3]*University of Nairobi, Nairobi, Kenya*

Molecular Phylogenetic Evidence of Unrecognized Diversity and Differing Divergence Histories Across Several Clades of Freshwater Fishes from Central and Southern Kenya

From 2010-2012, researchers, graduate and undergraduate students from the US and Kenya joined forces to sample freshwater fishes from endorheic and exorheic river basins of central and southern Kenya with support from NSF's International Research Experiences for Students (IRES) program and the US Agency for International Development's Partnership for Enhancing Expertise in Research (PEER) program. Nearly 100 localities were sampled and more than 10,000 fish specimens were collected, contributing substantially to the Ichthyology Collection of the National Museums of Kenya. Student participants also received basic training in biodiversity research and DNA sequencing methods. Here we report the results of molecular phylogenetic studies, involving nuclear and mitochondrial genetic markers, for eight clades or species complexes of fishes collected from streams across the study area (Lake Victoria, Lake

Naivasha, Ewaso Nyiro, Ewaso N'giro, Athi, Tana and Pangani basins). The species complexes and clades studied include six groups of cyprinids (*'Barbus' apleurogramma*, *'B.' kerstenii*, *'B.' paludinosus*, *Garra* spp., *Labeo* spp., *Labeobarbus* spp.) and two groups of catfishes (*Amphilius* spp. of family Amphiliidae and *Chiloglanis* spp. of family Mochokidae). Phylogenies produced for all of the groups contain more divergent lineages than the numbers of species currently recognized as valid within each group. However, divergence histories differ across the groups, both in terms of the numbers of lineages and the geographic patterns of divergence. Diversity and divergence histories for each of the groups will be discussed, and an attempt will be made to collate the histories into a general ichthyogeographic hypothesis for the region.

0783 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Michael F. Bates

National Museum, Bloemfontein 9300, South Africa

The South African Reptile Conservation Assessment Project

Data collection for the Southern African Reptile Conservation Assessment (SARCA) project was conducted mainly from 2005 to 2009. The main aim was to improve our understanding of reptile diversity and distribution in South Africa, Lesotho and Swaziland, and thereby make possible a detailed assessment of conservation status. Distribution records were obtained from a variety of sources, including 24 field surveys and an online virtual museum, and compiled into a single database. Resultant maps allowed a group of experts to conduct a revision of conservation status according to IUCN criteria. The final product is the *Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland* published in March 2014. The conservation status of 96% of the 421 indigenous species and subspecies (taxa) was assessed; some polytypic species were analysed at species level only, and six species of marginal occurrence, and one introduced species, were not assessed. Global assessments were prepared for all 190 endemic taxa (45% of total) and 82 additional taxa mainly endemic to southern Africa, but other taxa were assessed at regional scale. Two species were considered Extinct, five Critically Endangered, 10 Endangered, 21 Vulnerable, 37 Near Threatened and six Data Deficient. When threatened and Near Threatened taxa are considered together, at least 17% of all taxa are of conservation concern. This assessment was the most thorough ever undertaken in Africa, and supports global trends in the decline of, and conservation concern for, reptiles and amphibians, and models projecting significant lizard extinctions in the near future.

0329 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Andrew Battles, Kevin Aviles, Jason Kolbe

University of Rhode Island, Kingston, RI, USA

Performance Loss Does Not Deter Anoles from Using Artificial Perches.

Populations of *Anolis* lizards are successfully established in urban environments, which differ in structural aspects, among others, from natural habitats. However, urban habitats are diverse, comprising a complex matrix of natural and artificial substrates. We ask how often lizards use artificial substrates in urban areas and whether performance differs between smooth (artificial) and rough (natural) surfaces. We recorded perch use frequencies (natural vs. artificial) of *Anolis cristatellus* and *Anolis stratulus* in natural and human-disturbed (urban) sites on Guana Island in the British Virgin Islands and determined substrate roughness on a scale from 1 to 5. Lizards were found more frequently on artificial substrates than on natural ones (i.e. trunks and branches) at urban sites. Substrates in urban habitats were significantly smoother than those in natural habitats. We then tested experimentally, whether performance (i.e., maximum velocity) differed across substrates by running lizards on tracks varying in roughness and incline. Lizards sprinted faster on inclined and rough vertical tracks compared to smooth vertical tracks. This decrease in performance was particularly severe for male *A. cristatellus* because they are much heavier than female *A.cristatellus* or either sex of *A. stratulus*. Our results suggest that even though performance decreases on artificial substrates, lizards still frequently use these substrates in urban areas. Therefore, other aspects of the urban environment such as better escape opportunities or more efficient foraging may influence this choice.

0246 Reptile Genetics & Evolution, Banquet Room J, Saturday 2 August 2014

Aaron Bauer[1], Juan Daza[2], Edward Stanley[3], Philipp Wagner[1], David Grimaldi[4]

[1]Villanova University, Villanova, Pennsylvania, USA, [2]Sam Houston State University, Huntsville, Texas, USA, [3]California Academy of Sciences, San Francisco, California, USA, [4]American Museum of Natural History, New York, New York, USA

A Mid-Cretaceous Lizard Fauna in Amber from Myanmar

Mines in Kachin State, northern Myanmar, have yielded a large number of amber-preserved lizards from a critical period in the early diversification of the major extant squamate lineages. All specimens have been examined through the use of High-Resolution X-ray Computed Tomography and have been compared to a diversity of extant and extinct lizards. Several specimens are represented by isolated appendages and preserve characters permitting identification only to broad taxonomic groups (i.e.,

Gekkota, Scincomorpha, Lacertidae). A superbly preserved gekkotan skull represents the oldest skeletal remains unambiguously referable to this clade. One of the more spectacular elements of the fauna is a largely intact lacertid with a partially articulated skeleton and pyritized integument. It represents a new genus and species characterized by elongate digits and claws and differs dramatically from *Succinilacerta*, a genus represented by numerous specimens from Baltic amber from the Eocene. A possible scincomorph is preserved as an almost intact integumentary "shell" with multicarinate scales surrounding a largely complete but disarticulated skeleton including about 50% of the cranial elements, which have been digitally isolated to reconstruct the skull. A tiny skeleton preserved with only traces of skin may represent a highly plesiomorphic chameleon with a much reduced number of presacral vertebrae and a well-developed hyoid apparatus, but without the obvious lateral compression or modifications of the skull typical of extant or later fossil forms. These amber fossils reveal an ecologically and taxonomically diverse fauna and provide a unique perspective on the lizards of the mid-Cretaceous.

0548 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

David Bechler, Joseph Kirkley

Valdosta State University, Valdosta, Georgia, USA

Dorsal Coloring and Ventral Patterning in a Population of *Agkistrodon piscivorus*, the Water Moccasin

This research project examined the basic biology of the water moccasin, *Agkistrodon piscivorus*, to include color and pattern structure, in the Alapahoochee watershed, Lowndes and Echols Counties Georgia. While it is recognized that moccasins darken as they age, no definitive studies were found in the literature detailing the process. As such this presentation examines both graphically and statistically the change in dorsal color pattern that occurs with age as well as discrete patterns involving splotching, block-like patterns and white coloration on the ventral surface, which indicate underlying genetic factors. Snakes with snout vent lengths (SVL) between approximately 27 and 80 cm possessed an array of dorsal colors involving white, tan, dark brown and black. Between 80 and 87 cm most white and tan colors were lost with dark brown and black being the only remaining colors in snakes up to 120 cm. Nonparametric regression analyses provide a strong graphic representation of the process, which is confirmed by correlation analyses. Ventral color patterns show discrete relationships involving the occurrence of all white coloration and splotched patterns and block patterns involving dark pigments such that if a splotched pattern was present, then a blocked pattern was not and vice-versa regardless of SVL.

0538 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

David Bechler[1], Josh Salter[1], Brett Albanese[2]

[1]Valdosta State University, Valdosta, Georgia, USA, [2]Georgia Dept. of Natural Resources, Social Circle, Georgia, USA

The Status of the Blackbanded Sunfish and Other Species of Concern in the State of Georgia

From May 2011 to October 2013 field research was conducted to determine the status of *Ennaecanthus chaetodon*, the blackbanded sunfish, in South and southeast Georgia via sampling historic and new sites. The study also examined the status of other species of concern in Georgia (*Elassoma gilberti*, *Fundulus escambiae*, *Fundulus rubrifrons*) within the habitats sampled for *E. chaetodon*. As part of the Occupancy Modeling employed, other uncommon or difficult species (*Umbra pygmaea*, *Ennaecanthus obesus*, *Acantharcus pomotis*) to sample were also analyzed for comparative purposes. During the 2.5 year study involving the occurrence of these species of concern, an extensive drought occurred that prevented sampling in many historic sites and resulted in a reanalysis of what are actual sites of occupancy for the blackbanded sunfish as well as other species of concern. With respect to the occurrence of the *E. chaetodon*, only one historic site was confirmed as being occupied and one new site discovered. Both sites possessed reasonably robust populations. Other species studied produced a mosaic of Occupancy models in which covariates such as distance to the main river, elevation and surface area produced the strongest models based on AIC and Maximum Likelihood values.

0597 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Taylor Beckwith-Ferguson, Cassandra Owen, Kristine Kaiser

Pomona College, Claremont, CA, USA

Corticosterone Does Not Mediate Reproductive Suppression in White's Treefrog (*Litoria caerulea*)

There is currently little understanding of the physiological and behavioral mechanisms underlying amphibian declines. Previously, we investigated the potential role of anthropogenic disturbance as a chronic stressor in White's treefrog (*Litoria caerulea*). We showed that exposure to anthropogenic noise increased circulating corticosterone (CORT) levels and decreased sperm count and sperm viability, yet the mechanisms

underpinning this effect remained unclear. We completed two experiments with the aims of 1) assessing the impact of anthropogenic noise on circulating testosterone levels and chorus calling rates, and 2) measuring testosterone levels in frogs after exogenous CORT application to determine whether this hormone mediates the observed effects of chronic stress on *L. caerulea*. In the first study, frogs exposed to eight nights of anthropogenic noise had significantly higher testosterone levels and lower calling rates compared to control frogs. In the second study, frogs given exogenous CORT for eight days showed no change in sperm count and viability compared to controls, and no change in circulating testosterone was measured. Taken together, we suggest that CORT does not mediate reproductive suppression previously associated with chronic exposure to an anthropogenic noise stressor in *L. caerulea*. Thus, we come closer to elucidating the physiological basis for the ecological consequences of anthropogenic habitat disturbance.

0646 AES Behavior, Banquet Room E, Thursday 31 July 2014

Christine Bedore[1], Stephen Kajiura[2], Sönke Johnsen[1]

[1]Duke University, Durham, NC, USA, [2]Florida Atlantic University, Boca Raton, FL, USA

Bioelectric Crypsis in Cephalopods Reduces Detection by Shark Predators

The ability of cephalopods to camouflage themselves is well documented as a defense against predation. However, visual camouflage is only effective against visually-oriented predators. For example, bioelectric cues that arise from the rhythmic exposure of mucous membranes, such as gills, may make certain animals vulnerable to detection by elasmobranch predators. Thus, modulation of an organism's own bioelectric field in response to predator stimuli may decrease the risk of predation, which has been suggested for egg-encapsulated elasmobranchs that suspend their ventilatory movements in the presence of predator-simulating electric fields. We used behavioral and physiological assays to assess the freeze response in the cuttlefish, *Sepia officinalis*, and its effect on detection by sharks. *Sepia officinalis* ceased ventilation for a period of 2-37s in response to a video simulation of a looming fish predator. The freeze response resulted in a 45±17% decrease in voltage relative to the surrounding seawater (N= 15, P=0.015). Escape by jetting was also observed, and resulted in a 420±240% increase in voltage. Dipole electric fields that simulated *S. officinalis* resting, freezing, and jetting were produced with underwater electrodes in a behavioral assay to quantify the detectability by shark predators. Blacktip sharks, *Carcharhinus limbatus*, and bonnethead sharks, *Sphyrna tiburo*, responded to freeze stimuli less frequently than resting and jetting (N=534 responses; P<0.001). These results suggest the freeze response facilitates predator avoidance via reduction of sensory stimuli, including bioelectric fields, and

future work should examine the extent to which other cues are modulated during this behavior.

0077 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Anat Belasen, Timothy James

University of Michigan, Ann Arbor, MI, USA

Investigating Native Skin Mycoflora as a Potential First Line of Defense Against Amphibian Chytridiomycosis

Emerging infectious diseases (EIDs) threaten global biodiversity and public health. Predicting potential EID effects necessitates characterizing the processes underlying variation in host susceptibility. The organismal "microbiome," the community of microbial symbionts inhabiting the host's organs, such as the skin and gut, contribute significantly to this variability. New metagenomic techniques have facilitated deeper understanding of microsymbionts, as traditional culturing often produces biased samples. Bacteria are likely important in mediating host health and can enhance immunocompetence. Despite the knowledge that fungi are also abundant and interact with bacteria, mycoflora remain largely overlooked in studies of the microbiome. I am applying molecular techniques for microbial community analysis to examine the skin mycoflora of amphibians. It is well-established that bacteria can serve as a potential "first line of defense" against the widespread amphibian skin pathogen *Batrachochytrium dendrobatidis* (Bd). Mycoflora are likely important as well, as some protect against pathogens (e.g., mycorrhizae in plants), and others are "hyperparasites." Therefore, native amphibian skin fungi may help explain the enigmatic variation in Bd susceptibility among hosts. A first step in determining fungal symbiont significance in amphibian-Bd interactions is establishing the variation in mycoflora community across species and ecosystems. In this study I test the hypothesis that fungi exhibit similar patterns to bacteria, for which core species exist across amphibian hosts and ecosystems. I also examine whether the fungal species recovered specialize on amphibians.

0419 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

John Belcik, Terry Grande

Loyola University, Chicago, IL, USA

Distribution and Population Genetics of the Oriental Weatherfish (*Misgurnus anguillicaudatus*) in Illinois and Indiana Tributaries

Oriental Weatherfish (*Misgurnus anguillicaudatus*), native to South East Asia are peculiar freshwater fish belonging to the family Cobitidae (loaches). They are benthic in habitat, have the ability to breathe atmospheric air, and exhibit an unusual behavior of swimming vertically in the water column in response to changes in barometric pressure. Oriental Weatherfish appear to be successful invaders to North American waterways. Within the last century they have been sighted in freshwater systems throughout the United States, yet the source of this invasion and distribution is largely unknown. This study investigates the distribution patterns and population genetics of the Weatherfish within Illinois and Indiana waterways. Weatherfish were collected from May to September of 2013. These data were compiled with those of the DNR, USFWS, and Army Corps to provide the most up-to-date map of the current Weatherfish distribution in the Midwest. Sequence data from COI and D-Loop were compared among specimens collected from multiple sites throughout Illinois and those available on GenBank. Preliminary results from this study suggest a single introduction to the Midwest occurring before 1987, with a subsequent range expansion. This study is the first to genetically examine the introduced Midwestern Weatherfish population. Preliminary data suggest that the Midwest population is virtually genetically identical to the Weatherfish introduced into Australia in 1984. This further suggests that the Midwestern and Australian populations were derived from the same native population in Asia. This work will be expanded to include genetic comparisons with other North American populations of Weatherfish.

0299 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Mauro Belleggia[2], Daniel E. Figueroa[3], Gabriela Irusta[1], George Burgess[4], Claudia Bremec[2]

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The Diet of the Argentine Hake *Merluccius hubbsi* in Patagonian Waters

In this work the trophic ecology of the Argentine hake *Merluccius hubbsi* was investigated in the southwest Atlantic Ocean. The specimens were collected in six research cruises carried out during winter 2011, 2012 and 2013, and during summer 2012, 2013 and 2014. The study area covered a great portion of the Patagonian continental shelf between 41° to 47° S, 56 to 67° W, and from 36 to 210 m depth. The stomachs were excised and prey items were identified aboard. The frequency of occurrence of each prey, the total length of fish, mantle length of cephalopods and carapace length of lobster krill were recorded. In total, 46,588 specimens ranging from 9 to 90 cm total length were examined, from which 19,622 (42.12%) contained prey items. The Argentine hake *M. hubbsi* fed mainly on zooplankton crustaceans (73.82%) such as the euphausiid *Euphausia lucens*, the hyperiid amphipod *Themisto gaudichaudii*, and the lobster krill *Munida* spp., followed by fishes (14.78%) and cephalopods (13.34%). The gadoid *M. hubbsi* (by cannibalism), the argentine anchovy *Engraulis anchoita* and the notothenioid *Patagonotothen ramsayi* were the most consumed fishes. The cephalopods were represented mainly by the Argentine squid *Illex argentinus*. Dietary shifts related to sex, maturity stage, size, season, region and hour of the day were examined using generalize linear models (GLMs). Prey size - predator size relationships, with emphasis in cannibalism, were analyzed.

0297 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Mauro Belleggia[2], Daniel E. Figueroa[3], Ana Massa[1], George Burgess[4], Claudia Bremec[2]

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The Diets of the Spiny Dogfish Species (*Squalus acanthias, S. mitsukurii* and *S. cubensis*) From the Northern Argentinean Continental Shelf

In the southwest Atlantic Ocean inhabit three Squalidae species: *Squalus acanthias*, *S. cubensis* and *S. mitsukurii*. In spite of the diet of the former having been widely studied in Argentina and worldwide, the trophic ecology of *S. cubensis* and *S. mitsukurii* remain unknown. In this context the diets of these two species were studied based on analysis of stomach contents from specimens caught during three research cruises on the northern Argentinean continental shelf (34° S – 41° S). Prey items were identified to the lowest possible taxonomic level, counted and weighted. A total of 214 specimens of *S. cubensis* were analyzed from which 176 (82.24%) contained prey items. From 414 specimens of *S. mitsukurii* analyzed, 289 (69.80%) contained food in their stomachs. *Squalus mitsukurii* fed on fish (%IRI=54.1%), crustaceans (%IRI=25.04%) and cephalopods (%IRI=18.89%). The argentine anchovy *Engraulis anchoita*, the argentine hake *Merluccius hubbsi* and hagfishes Mixinidae were among the most important identified fishes. The euphausiids were the most consumed crustaceans, whereas *Illex argentinus*, *Loligo sanpaulensis* were the preferred cephalopods. On the other hand, the diet of *S. cubensis* was composed mostly by fishes (%IRI=84.96%), followed by crustaceans (%IRI=9.99%) and cephalopods (%IRI=1.99%). The most important prey items identified in the diet of *S. cubensis* were the same as those found in *S. mitsukurii*, but differed in proportions. The hypotheses that the diet is determined by intrinsic (total length, sex, maturity) and extrinsic factors (area, season) were tested by fitting generalized linear models (GLMs).

0469 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Ana Bello Soares[1], Helga Wiederhecker[1], Barry Sinervo[2], Guarino Colli[1]

[1]*Universidade de Brasilia, Brasília, Brazil,* [2]*University of Santa Cruz, California, USA*

Comparative Thermoregulatory Behavior of Brazilian Tortoises: Seasonal Patterns of Body Temperature and Hours of Restriction

Reptiles present two strategies of thermoregulation: thermoconformity and thermoregulation. Environment influences thermoregulation, but the nature of strategy differences (evolutionarily selected or plasticity) is poorly understood. We assessed the thermoregulatory behaviour of the Brazilian tortoises *Chelonoides carbonaria* (savanna inhabitant) and *Chelonoides denticulata* (forest inhabitant) in captivity (same temperature). If thermoregulatory behaviour is plastic, species temperatures will vary in a similar manner. Conversely, if it is evolutionarily selected, we expect species to diverge in temperature. We obtained body temperature (TB) and operative temperature (TO) instrumenting 14 *C. carbonaria*, 12 *C. denticulata* and 5 tortoise models with Hobos. We registered temperature every five minutes for six days (rainy season 3, dry season 3). We compared mean TB between species and seasons. We calculated daily hours of restricition (HR) as the summatory of minutes that TO was higher than average TB. TB differed between species (*C. carbonaria* > *C. denticulata*) (Kruskal-Wallis, H= 3114.85, df=25, p<0.005) and seasons (dry < wet) (Kruskal-Wallis H = 213.50, df = 1, p< < 0,05). HR were higher in the dry season (*C. carbonaria*, 7.45 and *C. denticulata* 7.05) than in the rainy season (*C. carbonaria*, 6.49 and *C. denticulata* 6.84). Species thermoregulated in a similar way. Differences were in accordance with species original habitat, with *C. denticulata* keeping a cooler TB. *Chelonoides denticulata* tends to behave as thermoconformer in the forest, but when submitted to a warmer novel environment it thermoregulates. The longer HR in the rainy season (breeding season) suggests that climate change might compromise *C. denticulata* reproduction.

0664 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Brent Benentt[2], Sarah Bruemmer[3], Jayne Gardiner[3], Christine Bedore[1]

[1]*Duke University, Durham, NC, USA,* [2]*Principia College, Elsah, IL, USA,* [3]*Mote Marine Laboratory, Sarasota, FL, USA*

Scaling of the Elasmobranch Electrosensory System and Effects on Behavioral Responses to Prey-simulating Electric Fields

Sharks detect changes in voltage (electric field gradient) with specialized receptors called ampullae of Lorenzini, which terminate at the skin surface in an array of pores.

Pore distribution and density differ for each elasmobranch species. Higher pore density has been hypothesized to be associated with higher resolution, similar to increasing pixels on a camera. Pore number does not change over ontogeny so larger animals may have lower resolution. Gel-filled canals that connect pores to the subdermal receptor elongate with growth, which is thought to increase sensitivity. Therefore, as a shark grows, it may lose spatial resolution capabilities, but may increase in sensitivity. We used a behavioral assay to quantify sensitivity of adult bonnethead sharks, *Sphyrna tiburo* (N=9), to weak electric fields, as well as quantify their accuracy (as a proxy for resolution) in localizing the source of the electric stimulus. Our data were compared to those published on neonate bonnethead sharks to determine if sensitivity or resolution are affected by growth. Both neonate and adult sharks demonstrated a behavioral electrosensitivity of approximately 50 nV cm^{-1}, but neonate sharks were more accurate in locating the electric stimulus than adult sharks. Our results suggest that changes in peripheral morphology over ontogeny do affect behavioral responses by reducing resolution. Although not quantified here, adult bonnethead sharks may compensate for the reduction in resolution by enlarging their electrosensory search area as the surface area of their heads increase with growth.

0129 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Amanda Bennett, Dennis Murray

Trent University, Peterborough, Ontario, Canada

Thanks Mom! Maternal Body Condition Influences Magnitude of Anti-predator Response in Tadpoles.

Tadpoles show plasticity in behaviour and morphology in response to predation risk through the detection of chemical cues that are released when predators consume fellow tadpoles. These anti-predator responses increase the likelihood of a tadpole surviving when predators are around, however, there is notable variation in both the magnitude and even the direction of anti-predator responses between tadpoles from different clutches. Maternal influence on egg size is known to alter the phenotype of offspring, with larger eggs resulting in larger offspring whose size advantage increases growth and survival. We hypothesized that variation in the magnitude of plastic responses to predation risk between clutches is at least partly due to maternal provisioning, and examined the relationship between maternal condition, offspring provisionment, and magnitude of plastic response to perceived predation risk (by dragonfly larvae: *Aeshna* spp.) in Northern leopard frogs (*Lithobates pipiens*). Female frogs in better body condition tended to lay more (clutch size) and larger (egg diameter) eggs. Tadpoles responded to predation risk by increasing relative tail depth and decreasing activity level. We found a

positive relationship between morphological effect size (the increase in relative tail depth) and maternal body condition, but no relationship between behavioural effect size (decrease in activity level) and maternal body condition. Maternal investment can therefore affect the ability of offspring to mount morphological defenses against predators. Our findings suggest that limitations imposed by maternal condition can constrain phenotypic variation and, ultimately, influence the capacity of populations to respond to environmental change.

0143 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Stephanie Benseman, Larry Allen

California State University, Northridge, CA, USA

Distribution and Growth Estimates of Young-of-the-Year Giant Sea Bass, *Stereolepis gigas*, off Southern California

Life history information on an ecologically, and once economically, important species such as the giant sea bass (*Stereolepis gigas*) is critical for the continued management of its fishery. Little is known about the life history of *S. gigas* due to the over exploitation of their fishery in the early 1900's, and depressed populations have prevented any detailed research. Legislation passed in the last 30 years has presumably helped the population begin its slow recovery, but still much remains unknown. The goal of this study is to fill in gaps in 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, and 2) estimating their growth rates based on site aggregations and collections for otoliths analysis. Spawning aggregations during the summer months yield a larval duration of approximately 30-60 days, after which settlement should start to occur. SCUBA transects with video and laser measurements can be used to estimate cohort populations and sizes in the field, and collections will allow otoliths analysis for daily growth ring assessment. A better understanding of the growth rates will allow for more accurate estimates of future populations leading to better fisheries management policies, while distribution information can be used to protect important nursery areas. The early developmental process is crucial for completing the life history of this endangered species and this study is a key component of their life history as well as forming a baseline for other polyprionids.

0726 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Peter Berendzen, Ryan Kurtz

University of Northern Iowa, Cedar Fall, Iowa, USA

Distribution, Habitat Preference, and Demographic Pattern of *Moxostoma duquesnei* (Black Redhorse) in Iowa

The black redhorse, *Moxostoma duquesnei*, is a member of the Central Highlands ichthyofuana with a widespread, disjunct distribution in the Mississippi River drainage. In Iowa it has a patchy, discontinuous distribution in rivers drainages of the northeast portion of the state, which represents the northwestern edge of its range. The black redhorse is listed in Iowa as a species of special concern due to its limited distribution within the state and lack of knowledge about the habitat preference of the species. The objective of this study is to gain a greater understanding of the ecology, distribution and demographic parameters of the population in Iowa. Multiple localities representing the majority of the distribution within the state were sampled to identify the presence or absence of *M. duquesnei*. Collections of black redhorse individuals were followed with fin clips for genetic analysis and a stream habitat assessment to define habitat preference. An ecological niche model was constructed to define a statewide probability of presence based on large-scale environmental variables. Both statistical analyses of habitat data and ecological niche model suggest that geologic factors play a primary role in determining the distribution and abundance of black redhorse in Iowa. All tissue samples were genotyped for multiple microsatellite loci. Landscape genetic analyses of genetic data in conjunction with the results of the habitat analyses were used to determine the demographic parameters of the species. Preliminary results will be presented.

0198 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Abigail Berkey[1], Marlis Douglas[2], Chrisopher Phillips[3]

[1]*University of Illinois, Champaign, IL, USA,* [2]*University of Arkansas, Fayetteville, AR, USA,* [3]*Illinois Natural History Survey, Champaign, IL, USA*

Influence of Kinship on the Social Behavior of the Four-Toed Salamander, *Hemidactylium scutatum*

Social interactions among conspecifics are instrumental in a species' spatial ecology, but can also have large impacts on its genetic structure on a micro-scale. However, the potential role of kinship in mediating the interactions of adult plethodontids is poorly

understood. Movements of individuals to and from populations are likely limited because of small body size and vulnerability to desiccation, increasing the likelihood of encounters between close relatives. These circumstances create conditions conducive to the evolution of kin recognition and kin discrimination. Kinship may mediate conspecific interactions in territorial species through kin selection, resulting in reduced aggression in encounters between closely related individuals. I staged experiments to examine the behavior of adult, female four-toed salamanders, *Hemidactylium scutatum*, when exposed to the chemosensory stimulus of conspecifics. Trials were run for each possible dyad of 17 individuals, pairing an acting individual with substrate which had been previously been used by a conspecific as bedding for seven days. During these 30 minute trials, the number of nose taps, amount of activity, and body posture of each individual were recorded. Relatedness among individuals was calculated from microsatellite DNA data and calculated as genotypic similarity between each pair. Mantel tests were used to test for associations between genetic similarity and scored behaviors. Preliminary results suggest that the role of kinship in mediating intraspecific behavior is complex and may be influenced by a number of variables.

0247 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Maxwell Bernt

University of Louisiana at Lafayette, Lafayette, LA, USA

The *Apteronotus bonapartii* Species Group (Apteronotidae: Gymnotiformes): A Widespread Phenotype Across the South American Platform

The family Apteronotidae is a diverse clade of weakly electric knifefishes, including 94 described species distributed across most of tropical South America. A majority of these species inhabit deep river channels in the Amazon and Orinoco basins where they comprise a major portion of the benthic fish biomass. Though this family exhibits a wide range of distinct morphologies, the diversity and alpha taxonomy are not well understood due to many phenotypically similar forms. Here we report observations on the *Apteronotus bonapartii* group, a putatively monophyletic clade represented by five nominal species distributed across most of the South American platform. Two of these species were described from the Amazon basin (*A. bonapartii*, *A. macrolepis*), one from the Orinoco (*A. apurensis*), and two from the La Plata (*A. ellisi*, *A. paranaensis*). Additionally, evidence for sexual dimorphism has been observed in specimens from both the Amazon and the La Plata basins. I provide a diagnosis of the *A. bonapartii* group and review the validity of all nominal species, finding unambiguous morphological support for only two distinct phenotypes. I conclude that the very similar phenotypes observed among

members of the *A. bonapartii* group in the Orinoco, Amazon and La Plata basins indicate either strong phylogenetic conservatism and/or relatively recent dispersal.

0036 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Tim Berra[1,3], David Crook[1], Dion Wedd[2]

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Use of Otolith Strontium Isotope Analysis to Determine the Salinity Histories of a Tropical Riverine Fish, the Nurseryfish *Kurtus gulliveri* (Perciformes: Kurtidae)

Although many tropical riverine fish species occur across a wide range of salinities, very little is known of the movements of most species. The nurseryfish *Kurtus gulliveri* is found in estuarine and freshwater reaches of tropical rivers in northern Australia and southern New Guinea. Nurseryfish have been recorded in salinities ranging from freshwater to seawater (salinity <0.5-36), but almost nothing is known of their movement requirements. We conducted core-to-edge transect analyses of $^{87}Sr/^{86}Sr$ in the otoliths of 40 nurseryfish collected from a tropical river in northern Australia to examine their movements across the freshwater-estuarine salinity gradient. Comparisons between water and otolith $^{87}Sr/^{86}Sr$ showed that most fish had $^{87}Sr/^{86}Sr$ values indicative of saline (salinity >4) residence during the early life history, followed by a transition into the lower freshwater reaches of the river (salinity <0.5) later in life. There were no discernible differences between the salinity histories of male and female nurseryfish. Based on these findings, we conclude that nurseryfish are marginally diadromous and that analysis of water and otolith $^{87}Sr/^{86}Sr$ is an effective method for determining the movement requirements of tropical riverine fishes.

0209 AES Ecology, Banquet Room E, Saturday 2 August 2014

Dana Bethea[1], Matthew Ajemian[2], John Carlson[1], Eric Hoffmayer[3], Johanna Imhoff[4], R. Dean Grubbs[4], Cheston Peterson[4], George Burgess[5]

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Distribution and Community Structure of Coastal Sharks in the Northeastern Gulf of Mexico

Coastal shark community structure was quantified across 10 geographic areas in the northeastern Gulf of Mexico using fishery-independent gillnet data from 2003-2011. A total of 3,205 sets were made in which 14,244 carcharhiniform sharks, primarily juveniles, were caught comprising 11 species from three families. Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*) were the most abundant species overall followed by bonnethead (*Sphyrna tiburo*) and blacktip sharks (*Carcharhinus limbatus*). Two-way crossed analysis of similarity (ANOSIM) found geographic area to significantly influence shark species-life stage assemblages while season did not. Resemblance matrices between environmental data and shark community assemblage found the two were significantly correlated with the combination of salinity and turbidity producing the highest Spearman rank correlation value. Species diversity varied by geographic area, but was generally highest in areas with the greatest amount of fresh and saltwater fluctuations. The mean size of the three most abundant species differed across geographic areas; whereas, those species in lower abundances also differed across regions, but exhibited no discernible pattern. Our results suggest geographic area is important for juvenile sharks and some areas may be considered important nursery areas for many species. Atlantic sharpnose and blacktip shark were not restricted to any specific geographic area but species such as bull (*C. leucas*), spinner (*C. brevipinna*), blacknose (*C. acronotus*), finetooth (*C. isodon*), sandbar (*C. plumbeus*) and scalloped hammerhead (*S. lewini*) sharks were only consistently captured within a single area or over a select group of areas.

0231 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Phil Bishop[1], James Lewis[2], Candace Hansen[2], Robin Moore[2], Reid Harris[3], Don Church[2], Claude Gascon[4]

[1]University of Otago, Dunedin, New Zealand, [2]Amphibian Survival Alliance, Austin, Texas, USA, [3]James Madison University, Harrisonburg, VA, USA, [4]National Fish and Wildlife Foundation, Washington, DC, USA

Resuscitating the Amphibian Conservation Action Plan (ACAP)

Finding solutions to counter amphibian declines and extinctions is one of the greatest conservation challenges of the century. The IUCN SSC Amphibian Specialist Group (ASG) is a network of 500 of the world's leading amphibians experts providing scientific guidance to enable conservation actions to be prioritized and implemented by the Amphibian Survival Alliance (ASA), a partnership of over 70 organizations committed to amphibian conservation worldwide. As the scientific advisory body of the ASA the ASG has been tasked with updating the 2006 Amphibian Conservation Action Plan (ACAP) to better reflect the current challenges. The ASG is uniquely positioned to work with the ASA to identify the current challenges to amphibian conservation, and to recommend potential solutions, having a broad membership represented across more than 40 regions from around the world. In mid-2013 the ASG initiated a number of thematic working groups designed to identify priority actions that would be executed through the Alliance with the ASA Secretariat acting as a coordinating implementation body. Each thematic working group maintains a web page (hosted on amphibians.org) aimed at sharing information and encouraging discussion around priority action. As knowledge increases and progress is made the priority actions will evolve helping to redefine the new ACAP as a living document.

0637 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Joseph Bizzarro[1], Kristin Broms[2], Miles Logsdon[1], David Ebert[3], Mary Yoklavich[4], Linda Kuhnz[5], Adam Summers[1]

[1]University of Washington, Seattle, WA, USA, [2]Colorado State University, Fort Collins, CO, USA, [3]Moss Landing Marine Laboratories, Moss Landing, CA, USA, [4]National Marine Fisheries Service, Santa Cruz, CA, USA, [5]Monterey Bay Aquarium Research Institute, Moss Landing, CA, USA

Spatial Segregation in Eastern North Pacific Skate Assemblages

Skates (Rajiformes: Rajoidei) are common mesopredators in marine benthic communities, yet the spatial associations of individual species and the structure of skate

assemblages are poorly known. Such information is of considerable importance for monitoring and management of exploited skate populations. This study investigated the spatial associations of eastern North Pacific skate assemblages in continental shelf and upper continental slope waters of California and the western Gulf of Alaska. Long–term fishery independent data were analyzed using spatial analysis techniques and regression models to determine distribution (by depth, temperature, and latitude/longitude) and relative abundance of the dominant species in each region. Submersible video data also were incorporated in California to facilitate habitat association analysis. Skate populations were highly clustered in both regions, on scales of 10s of kilometers; however, high–density regions were largely segregated among species. In general, skate densities and frequency of occurrence was substantially reduced in Alaska as compared to California. Although skates are typically believed to be restricted to soft sediment regions, *R. rhina* exhibited the strongest habitat association with mixed substrates, and *R. stellulata* catches were greatest in association with rocky reefs. In regions where species overlapped substantially in geographic and depth distribution (e.g., *R. rhina* and *B. kincaidii* in Monterey Bay, CA; *B. aleutica* and *B. interrupta* in Shelikof Strait), size segregation was evident. Spatial niche differentiation in skates appears to be more pronounced than previously reported.

0046 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

Daniel Blackburn[1], James Stewart[2]

[1]*Trinity College, Hartford, CT, USA,* [2]*East Tennessee State University, Johnson City, TN, USA*

Placental Specializations in Placentotrophic Viviparous Lizards

In most viviparous squamates, the ovulated yolk provides most nutrients for embryonic development. However, in four separate lizard clades (*Mabuya, Chalcides, Eumecia* and *Trachylepis*), females ovulate tiny yolks and provide nutrients by placental means. Species in two other lineages (Australian *Niveoscincus* and *Pseudemoia*) show moderate degrees of placentotrophy. The morphological basis for nutrient provision varies significantly among these six lineages. In an extreme case (the African skink *Trachylepis ivensi*), the developing embryo undergoes invasive implantation into the uterus to contact maternal blood vessels - a pattern previously known only in therian mammals. The diverse specializations for fetal nutrition in lizards reflect the convergent evolution of placentotrophy, as well as pre-adaptations, constraints, and heterochronic factors. The adaptive significance of placentotrophy is unclear, but recent information offers insight into its evolutionary origins and consequences.

0073 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Daniel Blackburn, Laurie Bonneau, Kristie Anderson

Trinity College, Hartford CT, USA

Placental Morphology in Viviparous North American Water Snakes (Colubridae: *Nerodia*)

This study is part of an ongoing research program on functional morphology and evolution of reptilian placentas. In viviparous squamates, such placentas maintain developing embryos in the maternal uterus through transfer of nutrients and respiratory gases. We used light and electron microscopy to study placentation in the viviparous water snake *Nerodia sipedon*. The chorioallantois and adjacent uterine lining are highly vascularized with thin epithelia, features that enhance gas exchange. The yolk sac placenta shows evidence of nutrient transfer. Scanning EM reveals elaborate networks of capillaries in fetal and maternal components of both placentas. The chorioallantoic placenta replaces the yolk sac placenta during development, reflecting growing needs for gas exchange. Remnants of earlier functions of the fetal yolk sac placenta are evident in residual yolk droplets and absorptive cells. Placentation in *Nerodia* is similar to that of other thamnophine snakes and has converged evolutionarily on viviparous lizards and mammals.

0034 Herp Systematics, Banquet Room H, Sunday 3 August 2014

David Blackburn[1], Mareike Hirschfeld[2], Mark-Oliver Rödel[1]

[1]*California Academy of Sciences, San Francisco, California, USA,* [2]*Museum für Naturkunde, Berlin, Germany*

A Complete Species-level Phylogeny of the Long-fingered Frogs (genus *Cardioglossa*, Arthroleptidae) and the Evolution of Their Coloration

Among the terrestrial frog fauna of continental sub-Saharan Africa, the genus *Cardioglossa* is remarkable for its diversity of coloration and patterns. Previous morphological studies based on external morphology resulted in several species groups, some of which were supported by evolutionary studies based on mitochondrial DNA data. However, the phylogenetic relationships among species of *Cardioglossa* remain unclear because many species were lacking from previous work and mitochondrial data alone were insufficient for resolving certain relationships. We compiled an extensive sampling of more than 150 specimens for every recognized species and all known undescribed species. Based on a mitochondrial gene phylogeny for these individuals, we

selected approx. 60 samples for sequencing of seven nuclear coding loci (BDNF, CXCR4, NCX1, POMC, RAG1, rhodopsin, and tyrosinase). Using these data, we have generated a well resolved species-level phylogeny for *Cardioglossa* that supports most previously proposed species groups. In addition, these data reveal that several sister species pairs that differ notably in coloration and pattern exhibit extremely low genetic divergences. Interestingly, these species pairs are always allopatric (either on different mountains, or on the mainland and Bioko Island). This suggests that the remarkable variety of coloration and patterns for which *Cardioglossa* is known evolves rapidly in allopatry.

0584 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

Scott Boback, Nicole Davidson, Nick Schwab, Matt Miller

Dickinson College, Carlisle, Pennsylvania, USA

Spatial Distribution of Painted Turtle (*Chrysemys picta*) Nests in an Artificial Wetland

Nest site selection is a critical feature in species with temperature dependent sex determination (TSD) because temperature not only determines sex but also significantly affects growth, development, and survival of developing embryos. However, aquatic turtles like the Painted Turtle (*Chrysemys picta*) frequently inhabit anthropogenic areas where nest site selection may be constrained. This study addresses the spatial distribution of Painted Turtle nests within an artificial wetland in south central Pennsylvania. The perimeter of a series of ponds was surveyed daily throughout the nesting season (May - July). All active turtles, nest sites, and false nests were documented with GIS. Nests were processed by recording a variety of environmental and spatial attributes including clutch size, nest depth, nest width, distance to water, slope angle, slope aspect, soil composition, and canopy cover. We recorded temperature using ibuttons deployed in the nests and we monitored for fall and spring hatchling emergence. Results indicated that actual and false nests were distributed in a linear fashion along the northern edge of the wetland predominately along a walking path and a railroad access lane. Nests at this site were characterized as relatively shallow, with low slope angles, moderate canopy coverage, and rocky soil. We suggest these characteristics influence the high variability in hatchling success at this site and reflect constraints on turtle movement imposed by an anthropogenic barrier in the form of a railroad.

0260 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Brian C. Bock[1], Vivian P. Páez[1], Gordon M. Burghardt[2], A. Stanley Rand[3]

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Life Table Matrix Projections for the Green Iguana (*Iguana iguana*): Implications for Conservation and Control

The green iguana may be the most studied of all neotropical squamate species, but few of the studies on natural populations have had a demographic focus. This is surprising, given that many populations of *Iguana iguana* are over-exploited, and that other introduced populations outside of the natural range of the species are considered threats to the native fauna and flora. Here we resurrect data that formed the basis of several previous publications on a population of *Iguana iguana* in Panama. These publications were concerned with iguana growth rates, female nesting migrations and nesting site fidelity, and hatchling dispersal and social behavior. We reanalyze these data from a demographic perspective, using a maximum likelihood modeling approach, to obtain estimates of survivorships for nesting females and juveniles. These results, combined with available information on age at first reproduction, fecundities as a function of female size, and hatching success rates, permit us to construct a life table for this population and produce projection matrices to conduct elasticity analyses. One matrix assumes a stable population size and the other assumes that the population was in gradual decline. These analyses are interpreted to propose management measures both to help over-exploited iguana populations to recover, and also to help guide efforts to control or eliminate introduced populations.

0553 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Juan Bogota-Gregory[1], William Crampton[1], Javier Maldonado[2]

[1]*University of Central Florida, Orlando, FLorida, USA,* [2]*Pontificia Universidad Javeriana, Bogota, Cundinamarca, Colombia*

Environmental Influences on Neotopical Freshwater Fish Community Structure in the Tomo River, Colombia

This study examined the influence of five hydromorphological and four physico-chemical parameters on fish community structure in the Lower Tomo River, Vichada, Colombia. 238 species of fish were sampled at twenty-one sites using beach seines, gillnets, dip-nets and baited hooks in terra firme streams, floodplain lakes, and adjacent

main river channels. Species abundances and physico-chemical data (pH, DO, conductivity, temperature) were subjected to two independent principal component analyses. Hydromorphological parameters (substrate structure, vegetation structure, margin slope, water-body type [i.e stream, lake, river]) were subjected to a "fuzzy coding" categorization, and subjected to multiple component analysis. Co-Inertia Analysis (COIA) was then used to explore relationships between: first, the species abundances matrix and the physico-chemical matrix; and, second, the species abundance matrix and the hydromorphological matrix. Sites with the highest pH values, abundant riparian vegetation, and weak currents were dominated by *Hemigrammus* sp. indet. Sites with the highest DO concentrations and no riparian vegetation were dominated by *Microschemobrycon casiquiare*. In contrast, sites with the lowest DO concentrations were dominated by*Hyphessobrycon* spp. Sites with the highest conductivity, high currents, and sandy substrate were dominated by *Plagioscion squamosissimus*. Finally, sites with the highest temperatures and muddy substrates were dominated by *Cyphocharax festivus* and *Hemigrammus analis*. The COIAs revealed a much stronger correlation between species abundances and hydromorphological site parameters than between species abundances and physico-chemical parameters.

0522 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Jason Bohenek, Lauren Eveland, William Resetarits

The University of Mississippi, University, MS, USA

The Influence of Newts (*Notophthalmus viridescens louisianensis*) on Oviposition Site Choice of Mosquitoes

Oviposition site choice (OSC) is crucial to the fitness of organisms which offer little to no parental care. There has been increasing research concerning mosquito OSC in recent years. Much of the mosquito OSC literature focuses on the avoidance of sites containing backswimmer (Notonectidae) and fish predators. However, very few studies have considered the effects of amphibian predators and no study has considered the effects of adult amphibians. Adult eastern newts (*Notophthalmus viridescens louisianensis*) have aquatic life stages that occupy a similar niche to freshwater fish. Our objective was to determine if newt predators influence mosquito OSC. We assayed mosquito oviposition in paired artificial pools, half of which contained caged newts. Each egg raft was individually collected and reared for species identification and quantification. Our results indicate that mosquito responses to newt predators are species specific. *Culex pipiens* complex showed no preference across treatments. *Culex restuans* preferentially oviposited in predator-free pools. This species specific response is consistent with similar studies conducted with predators at the field site. These findings have important

management implications for controlling mosquito populations that circumvent the negative consequences of fish introductions.

0780 SSAR Infrared Imaging Symposium, Banquet Room J, Sunday 3 August 2014

Wilmar Bolivar-Garcia[1], Marta M. Antoniazzi[2], Taran Grant[3], Carlos Jared[2]

[1]Universidad del Valle, Columbia, [2]Instituto Butantan, Sao Paulo, Brazil, [3]Universidade de Sao Paulo, Brazil

Relationship Between Pit Organ Morphology and Ecology of Central and South American Crotaline Snakes

Crotaline vipers are efficient predators with specialized morphological and physiological mechanisms that increase prey detection and capture success, including a thermo-receptive infrared (IR) receptor organ. This loreal pit organ has outer and inner chambers separated by a thin IR-receptive membrane, and an air-filled inner chamber extending posteriad via a duct opening into the anterior orbital adnexa. Past studies have focused on a small sample of North American and Asian species. The present study evaluated the relationship between pit organ morphology and the ecology, using 463 individuals of 11 species of Central and South American crotalines. Seventeen morphometric and ecological characteristics were scored, and macro- and microscopic morphology of *Crotalus durissus*, *Bothrops asper*, *Bothropoides jararaca* and *Bothriechis schlegelii* pit organs were studied by light and scanning electron microscopy. Differences were detected in relative size and shape of the pit organ, orbital opening of the inner chamber, and number of trigeminal nerve bundles innervating the pit organ. A conspicuous IR receptor organ accessory structure, composed of well-defined papillae that project from the anterior orbital adnexa, is reported for the first time. The papillae are coextensive with the pit organ inner chamber and possess the same dense innervation and vascularization and characteristic epithelial surface microstructure as the IR-receptive pit membrane, suggesting that they provide an additional IR detection surface. Finally, it was found that the facial pit opening is significantly larger in arboreal than terrestrial species, possibly because arboreal species consume more poikilothermic prey, while terrestrial species consume prey mainly endothermic prey.

0583 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Samuel Borstein[1], Matthew McGee[2]

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Mouthbrooding Does Not Constrain Craniofacial Diversity in Lake Tanganyikan Cichlids.

Mouthbrooding is a parental care strategy in fishes in which the eggs or larvae are incubated in the mouth. Mouthbrooding has been hypothesized to have a negative influence on craniofacial diversity in multiple lineages of teleost fishes. In this study, we examined the impact mouthbrooding has on the craniofacial morphology of the cichlid fishes from East Africa's Lake Tanganyika. The Lake Tanganyika cichlid radiation consists of almost 200 species. There is a deep split between clades of substrate-spawning cichlids (Lamprologini) and a clade of mouthbrooding cichlids found in the lake. We used geometric morphometric methods using the TPS family of programs to digitize landmarks on the heads of all described Lake Tanganyikan cichlids. Relative warps analysis was performed following the broken stick model to retain warp analysis that explained more variation than by chance. Three axes were retained which explained 88 percent of the total variation. Head elongation or deepening was the major axis of diversity and accounted for 60 percent of variation while Mouth angle and mouth size accounting for 16 and 12 percent of the variation respectively. Morphospace occupation was determined using the program Morphospace Disparity Analysis to examine the occupation of both mouthbrooding and non-mouthbrooding sister lineages using 10,000 bootstrapped samples to calculate the mean Euclidean pairwise distance, a common measure of morphological diversity. Results of the study revealed that mouthbrooding cichlids exhibit a significantly higher average pairwise distance than non-mouthbrooders. Our results demonstrate that mouthbrooding does not impede craniofacial diversification in mouthbrooding Tanganyikan cichlids.

0167 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

John Bourne, Stephen Richter, Amy Braccia

Eastern Kentucky University, Richmond, KY, USA

The Structure and Distribution of Stream Salamander and Macroinvertebrate Communities Across Southeastern Kentucky.

Because of stream salamanders' relatively high abundance and complex life cycles, they are important links between invertebrate and vertebrate communities and serve a critical role in transferring energy. Despite this importance little research has examined salamander community structure of aquatic ecosystems in southeastern Kentucky. The primary objective of this research was to determine community structure of stream salamander species across southeastern Kentucky and understand what factors impact their abundances and distributions. To address this, we sampled eight reference streams located in state and federal preserves across the region three times during March-June 2014. Within each stream, we sampled a 100-m transect for salamanders, macroinvertebrates, water quality, and habitat measurements, including mesohabitat types, canopy closure, stream temperature, dissolved oxygen, pH, conductivity, and streambed cover types. Salamander sampling consisted of an intensively sampled 10-m portion of stream within a 50-meter transect less intensively sampled, and a 1-m terrestrial belt transect immediately surrounding the stream. The diversity, relative abundance, and body condition of salamanders were recorded. We sampled macroinvertebrates with four replicate Surber samples in riffles that were randomly selected within a 100-m transect that encompassed the amphibian transects. Results will be discussed in the context of understanding the habitat requirements of stream salamander species and their dominant food source, macroinvertebrates, and specifically how the community structure of stream salamanders in reference quality streams varies across southeastern Kentucky. A follow-up study will focus on variation in salamander community structure between reference streams and streams impacted by mountaintop removal mining.

0417 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Luke Bower[2], Kyle Piller[1]

[1]*Southeastern Louisiana University, Hammond, LA, USA,* [2]*Texas A&M University, College Station, TX, USA*

Spatial and Temporal Resource Utilization by a Gulf Coast Stream Fish Assemblage

Niche-partitioning has presumably allowed for high species richness in stream fishes communities in the southeastern United States. It is imperative that we understand fish habitat preferences in order to better understand the role of the environment in structuring local species assemblages, yet our understanding of habitat use and natural history of many southeastern fishes remains poor. Several species are known to undergo seasonal changes in habitat position (e.g., many Cyprinidae, Centrarchidae and Percidae), but little work has been done on seasonal changes in habitat niche position for Gulf Coast stream fishes. This study examined seasonal changes in habitat preference of a stream fish assemblage in the Tickfaw River (Lake Pontchartrain Basin), southeastern Louisiana. The fish assemblage was sampled at the local scale throughout the year, and ecological data were collected for each fish specimen. Multivariate and univariate analyses were used to examine life-stage dependent habitat preferences and seasonal changes in habitat preferences. Species were found to be non-randomly distributed among habitat types, and spatial distributions of most species were strongly associated with stream flow, substrate composition, and depth. The results of this study support instream flow incremental methodology (IFIM) that has been adopted by many resource agencies worldwide for protecting streams and fish habitats.

0187 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Bonnie Bowers, Morgan Wilson, Renee Godard

Hollins University, Roanoke, VA, USA

Are Eastern Garter Snakes (*Thamnophis sirtalis*) Attracted to Alarm Substance from Fathead Minnows (*Pimephales promelas*)?

Ostariophysan fish release a chemical alarm cue from damaged skin cells which may attract secondary predators and facilitate escape. Predatory fish and aquatic beetles are attracted to this alarm substance, but it is unknown if other predators show such attraction and what role learning may play. Eastern garter snakes (*Thamnophis sirtalis*) are relatively inefficient foragers on fish; thus, sensitivity to injured fish would be

beneficial. Thirty-eight juvenile snakes maintained on a nightcrawler diet were tested to determine if fish-naïve individuals were attracted to alarm substance, and how feeding experience subsequently affected responsiveness. Fish-naïve snakes were tested for response to alarm substance, then fed either fathead minnows (alarm substance) or swordtails (no alarm substance) for five weeks, and then retested. Using methodology pioneered by Burghardt, snakes were presented with four stimuli in a counterbalanced order: a water control, as well as soak water from 1) skin-damaged fathead minnows, 2) intact fathead minnows, and 3) skin-damaged swordtails. Fish-naive snakes responded more to all three fish stimuli than to water, but did not distinguish among fish stimuli. Experienced snakes increased overall responsiveness to all fish stimuli compared to the first test but again did not distinguish among them. This increase was driven by a diet-specific response, especially in the swordtail-fed group. Thus, there does not seem to be an innate response to alarm substance in these snakes, and feeding experience did not significantly increase responsiveness to alarm substance when compared to other fish chemical cues.

0307 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Sean P. Boyle, Jacqueline D. Litzgus, David Lesbarrères

Laurentian University, Sudbury, Ontario, Canada

Knowing is Half the Battle: Using Intensive Monitoring to Identify Hotspots of Herpetofauna Mortality in a Protected Area

Reptiles and amphibians are among the most threatened taxa on local and global scales. Roads, which are the most pervasive human structure on the planet, present one of the most significant threats to herpetofauna populations. Common techniques used to mitigate these threats are exclusion fencing to minimize animal access to roads and culverts to maintain habitat permeability; however, appropriate placement of mitigation structures requires prior knowledge of animal crossing locations. Hotspot analysis allows researchers and managers to predict the probable locations where target species' will cross the road and to thus effectively plan the locations of mitigation structures. We initiated a 4-year Before-After-Control-Impact-Paired study design to evaluate the effectiveness of road mortality mitigation measures in Presqu'ile Provincial Park, Canada. The first "before-construction" year of road surveys took place in 2013 during which a high number of reptiles and amphibians were found. Multiple surveys were conducted daily in order to rigorously identify herpetofauna crossing points on the park road. Linear Ripley's K-analyses were used on GPS waypoints to identify significant hotspots for all herpetofauna. Hotspots varied spatially both within and between taxa. We identified six major hotspots along 1.2 km of road: one for turtles, three for snakes, and two for frogs. Based on our results, we developed a comprehensive mitigation

strategy. Presqu'ile Provincial Park is installing two 2m box culverts, four 0.8m culverts and 1.2 km of exclusion fencing on both sides of the road when they repave their main road in October 2014.

0452 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Krista Boysen, Robert M. Wood

Saint Louis University, Saint Louis, MO, USA

Genetic Evaluation of the Threatened Shovelnose Sturgeon, *Scaphirhynchus platorynchus*, Throughout the Mississippi River Basin and a Portion of the Missouri River Basin

Microsatellite markers have been widely used in molecular studies on *Scaphirhynchus* species. Unfortunately, these markers do not provide diagnostic species-specific discrimination. In addition to our inability to genetically distinguish *S. albus* from *S. platorynchus*, morphological identification in the southern end of the range is also problematic. This is due to pronounced similarity in many morphometric and meristic characters. This study seeks to characterize *S. platorynchus* throughout the allopatric and sympatric distributions of the endangered *S. albus*. Unique to this study is the inclusion of an increased number of loci (N=20) to determine if additional species resolution could be determined. Sympatric samples were collected from the Mississippi River in Wisconsin to New Orleans, Louisiana as well as in the middle and lower Missouri River. Allopatric samples included collections from the Cedar River, Wabash River, Arkansas River and Red River. Samples (N=417) were analyzed using the program Structure without a priori designations to determine the number of populations (ΔK). To further characterize these sturgeon standard population genetic statistics were estimated including: total alleles and unique alleles per locus, observed heterozogosity (Ho), expected heterozogosity (He), and conformance to Hardy-Weinberg Equilibrium.

0085 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Kenzie Bozeman

Southeastern Louisiana University, Hammond, LA, USA

Dermal Glands of Three-toed Amphiuma (*Amphiuma tridactylum*) and the Inhibitory Effects of Skin Secretions against the Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*)

Skin glands and associated secretions have been studied in many amphibian species and have been suggested to serve an array of functional roles, including predatory defense and defense against microbial pathogens such as the amphibian chytrid fungus, *Batrachochytrium dendrobatidis*. Similar studies are lacking for fully aquatic salamander species such as Three-toed Amphiuma (*Amphiuma tridactylum*), a large-bodied burrowing salamander endemic to southeastern United States. Like other amphibians, the skin of *A. tridactylum* seems to be heavily supplied with glands, indicated by observations of two distinct cutaneous secretory products. Based on these and previously documented observations, I hypothesize that the skin glands and consequent secretory products of *A. tridactylum* also serve functional roles associated with predatory defense and defense against the amphibian chytrid fungus. This poster presentation will provide a brief description of the observations that have led to my hypotheses, and a summary of methods that will be used to identify the distributions, concentrations, and morphologies of *A. tridactylum* dermal glands and to suggest potential functional roles of these glands and associated secretions. This poster presentation will also include any preliminary data that have been attained by the time of the presentation.

0132 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Casey Brewster

University of Arkansas, Fayetteville, AR, USA

Reintroduction of the Collared Lizard (*Crotaphytus collaris*) in Ozark-St. Francis National Forest, Arkansas

Collared lizard (*Crotaphytus collaris*) populations in Arkansas have suffered a tremendous decline in recent years. In Arkansas, the collared lizard is restricted to Ozark glades habitats, which are characterized by thin soil, herbaceous plants, exposed bedrock and xeric adapted species common to the American southwest (e.g. prickly pair cactus, tarantulas, scorpions, road runners). As glade habitats and associated ecosystems are divergent compared to the rest of Ozark landscape (e.g. pine and hardwood forests

and savannas parries), glade habitats provide added diversity at both the habitat and species level to Arkansas. As a top predator of the glade community, the collared lizard is a pivotal species to glade ecosystems, making this a critical species to restoring glade ecosystems in Arkansas. Thus, reestablishing collared lizards to restored habitat is important not only for the species itself, but also for maintaining biodiversity within the state of Arkansas as well. Mitochondrial DNA data from four established collared lizard populations in Arkansas suggests these populations are suitable as source populations for reintroduction. Seed populations (made up of an admixture of collared lizards from the four source populations) were released onto restored glade habitats in the Ozark-St. Francis National Forest. I provide preliminary data on differences between operative temperature environments, prey abundance and initial population response of reintroduced populations at three different sites.

0507 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Lauran Brewster[1], Tristan Guttridge[1], Robert Bullock[1], Samuel Gruber[1], Adrian Gleiss[2], Nicholas Whitney[3]

[1]Bimini Biological Field Station Foundation, Miami, FL, USA, [2]Hopkins Marine Station, Pacific Grove, CA, USA, [3]Mote Marine Laboratory, Sarasota, FL, USA

Accelerometery to Determine the Field Metabolic Rate of Marine Predators

The evolvement and miniaturization of bio-logging technology plays a pivotal role in elucidating the cryptic lives of animals in their natural environment. Accelerometers allow for formerly unattainable interpretation of fine-scale behaviors, addressing important questions regarding activity levels and energetic requirements. Ascertaining field metabolic rate (FMR) is essential for quantifying the impact of a species on its ecosystem and producing reliable bioenergetics models for fisheries management. Acceleration data has been collected for two free-living model species: *G. cirratum* (<90cm Total Length; n=4 dry season, n=3 wet season) and *N. brevirostris* (n=3 dry season, n=9 wet season). Preliminary analysis for *G. cirratum* data allowed us to characterize behaviours such as resting and steady swimming with fast-start swimming additionally identified for *N. brevirostris*. For *G. cirratum*, analysis showed that on average 87.70% ±1.52 (mean ±SE) and 86.73% ±3.02 of the time was spent resting during the dry and wet season respectively. *N. brevirostris* averaged 10.83% ± 1.97 and 15.74% ± 3.26 of their time resting during wet and dry seasons respectively; 89.04% ± 1.97 and 84.17% ± 3.26 steady swimming. Overall Dynamic Body Acceleration (ODBA) values for each species have been determined for different behaviours. An individual of *G. cirratum* experienced a range of values from 1.19×10^{-7}g for resting to 8.32g for fastest swimming. This ongoing study is expected to demonstrate a revolutionary technique in determining FMR in

marine predators. These field data will combine with results of ongoing respirometry experiments to correlate ODBA and MO2 to determine the FMR of these species.

0581 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Michael Britton

Florida International University, Miami, Florida, USA

Extreme Climatic Events Affecting Amphibian Egg and Larval Stages May Impact Future Metapopulation Dynamics Through Latent Effects.

In many amphibians, there are large separations between larval and adult habitats, and the stability of populations and metapopulations depends on successful dispersal between natal and adult habitats. Environmental conditions experienced at the egg and larval stages can have substantial impacts on adult organisms, known as 'latent effects'. These latent effects can impact adult size, reproductive success, and dispersal capability. Extreme climatic events can have immediate effects on amphibian behavior, reproduction, and survival, but can also impact future spatial dynamics through latent effects. The use of metapopulation models can illustrate the potential impacts of latent effects on metapopulation dynamics, and provide testable hypotheses for observational and experimental studies. The results from such a model will be presented. Under future climate change, the frequency and magnitude of extreme events are expected to increase, thus understanding the effects of extreme events on amphibian metapopulation dynamics is crucial to potentially mitigate the impact of climate change.

0763 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Ricardo Britzke[1], Jonathan Ready[2], Raquel Siccha-Ramirez[1], Claudio Oliveira[1]

[1]UNESP, Botucatu/São Paulo, Brazil, [2]UFPA, Bragança/Pará, Brazil

Phylogenetic Relationships of the Genus *Apistogramma* (Teleostei: Cichlidae) Based on Molecular Data

The genus *Apistogramma* is widely spread in South America cisandina. These are small fishes of ornamental importance, being popularly known as dwarf cichlids. Regarding the relationships between species of this genus, don't exists further analysis was carried out to date, exists only hypotheses of relationship available in aquaristic literature. The present study, molecular markers, aims to analyze the phylogenetic relationships among species of the genus. For this we amplified and sequenced the mitochondrial 16S, ND4,

COI and CytB . The sequences were edited using the program and Bioedit, aligned with the program MUSCLE and analyzed by the maximum-likehood method with the GTR model. Of 2,000 bp obtained, 955 were variable and 795 were informative in parsimony analysis. The results obtained so far support *Apistogramma* as monophyletic. The species *Apistogrammoides pucallpaensis* is grouped together with *Apistogramma*, showing that this can become a synonym *Apistogramma*. The genus *Taenicara* is the sister group of *Apistogramma*. Within the genus, we can observe the formation of 8 species groups: *A. regani* group, *A. macmasteri* group, *A. trifasciata* group, *A. steindachneri* group, *A. pertensis* group, *A. agassizii* group, *A. cacatuoides* group and *A. nijsseni* group, confirming the classification based on morphological characters. With the inclusion of representatives of the other groups, a better view of the phylogenetic relationships of the genus must be obtained.

0236 Herp Conservation I, Banquet Room F, Friday 1 August 2014

Bob Brodman

Saint Joseph's College, Rensselaer, IN, USA

The Effects of Plastics and Aquatic Herbicide Application on Jefferson Salamander Eggs and Larvae

The commercial Glyphosate-based herbicide Glyphomate41 is approved for use in wetlands and ponds because it is designed to be safer to aquatic wildlife than other formulations (such as Roundup or Vision). However toxicology studies traditionally focus on direct short-term acute toxicity effects on individual study animals and do not require tests on sub-lethal effects on fitness for EPA registration. Our previous studies in the field and in the lab using plastic aquaria suggest that these aquatic herbicides cause density-dependent changes in community structure and also alter the development, growth and behavior of salamander larvae. These effects are not as intense or negative as those observed in studies using Roundup. However there is a current controversy about using plastic in experiments because it is possible for chemical contaminants such as phthalates to leach from plastic aquaria and if so they could interact with pesticides to confound experimental results. We conducted a 2x2x2 factorial experiment on effects of herbicide, plastic, and temperature on Jefferson Salamanders (*Ambystoma jeffersonianum*) by exposing salamander eggs reared in glass and plastic containers to the aquatic glyphosate-based herbicide Glphomate41 at 16C and 18C. Herbicide and temperature had significant effects on survival of eggs. Glass and plastic containers had no effect on egg survival, but all three factors affected time of hatching. We will present results on larval development, growth, behavior, and survival through metamorphosis.

0251 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Allison Bronson, Adam Cummings, John Reiss

Humboldt State University, Arcata, California, USA

Structure of the Olfactory Epithelium in *Taricha granulosa*, the Rough-Skinned Newt

A detailed description is presented of the olfactory epithelium and associated tissues in the rough-skinned newt *Taricha granulosa*, a common salamandrid collected from Humboldt and Mendocino Counties, California, based on scanning electron microscopy and traditional histology. The olfactory organs are paired, flattened sacs, extending from the external nares anteriorly to the internal nares posteriorly. The ventrolateral contour of the main olfactory chamber has a depression carved outward from the rest of the chamber, which forms the vomeronasal organ, running longitudinally along the main olfactory chamber. The nasolachrymal duct appears beneath the skin as a small canal. The olfactory epithelium is ridged, or striped, with regions of sensory and supporting cells set in a layer of respiratory epithelial cells. In aquatic adapted individuals, the length of cilia differs between respiratory, non-sensory cells (mean =7.7 μm) and olfactory cells (mean = 11.5 μm). Terrestrial adapted individuals lack cilia on their non-sensory epithelium and have shorter sensory cilia (mean length: 9.6 μm) relative to aquatic adapted individuals. A similar aquatic-to-terrestrial transition in epithelial structure was observed in European newts (*Lissotriton*, *Triturus*) by Matthes (1926). This transition in anatomical composition between media may indicate a variation in sensitivity to chemical cues from conspecifics as *T. granulosa* move between water and land as part of their annual reproductive cycle.

0623 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; AES CARRIER AWARD

Amanda Brown, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Reproductive Endocrinology of the Finetooth Shark, *Carcharhinus isodon*

The finetooth shark, *Carcharhinus isodon*, is a small coastal shark found in Atlantic waters from South Carolina to Florida. Due to recent fishing pressures, new reproductive data is being gathered in order to reassess the status of the fishery. This provided an opportunity to examine the reproductive endocrinology of *C. isodon*, and explore how gonadal sex steroids may contribute to the regulation of reproduction. Plasma serum

concentrations of the sex steroids testosterone (T) in males and 17b-estradiol (E_2) and progesterone (P_4) in females were measured using chemiluminescent assays (CLIA). Histological sections of reproductive organs such as the testis, ovary, uterus and oviducal gland were prepared and used to characterize changes in tissue architecture and identify target cells for sex steroid action using immunocytochemistry. Plasma T concentrations in males peaked in Spring followed by a rapid decline in May prior to the mating season indicating a key role of androgens in spermatogenesis. Histological analysis of the testis confirms this pattern, demonstrating the presence of mature spermatozoa in Spring samples. In females, E_2 levels were highest in vitellogenic females and lowest in gravid, non vitellogenic females suggesting that this hormone plays a key role in yolk production and follicular development. Histological analysis shows the presence of yolk in females with high E_2 levels. Hormone data is being compared with hormone receptor localization to provide data on the role of these hormones in reproductive cycling.

0214 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Amanda Brown[1], Jim Gelsleichter[1], Bryan Frazier[2]

[1]*University of North Florida, Jacksonville, FL, USA,* [2]*South Carolina Department of Natural Resources, Charleston, SC, USA*

The Reproductive Biology of the Finetooth Shark, *Carcharhinus isodon*, in the Northwest Atlantic Ocean

The finetooth shark is a small coastal shark species found in Atlantic waters from South Carolina to Florida. This species has recently come under increased fishing pressure and has previously been designated as "overfished." New life history and reproductive biological data is required so that these populations can be properly managed. To address this issue, this study will examine the reproductive biology of Atlantic finetooth sharks. Morphological measurements of reproductive organs were obtained throughout the year to determine reproductive timing. Histological analysis was conducted on gonads of mature animals to determine reproductive stage. Plasma concentrations of the sex steroids testosterone in males and 17b-estradiol in females were also measured as these hormones are good indicators of reproductive condition. In males, testis and head epididymis width increases starting in September and peaks in late April/early May, followed by a rapid decline. Histological analysis of the testis showed the presence of mature spermatozoa in Spring samples directly prior to copulation, indicating this is the period of spermatogenesis. Plasma testosterone concentrations in males also peaked in Spring followed by a rapid decline in May corroborating histological data. In females, follicle diameter was greatest from winter-early Spring, indicating that this is the period of vitellogenesis. Estradiol levels were

highest in vitellogenic females and lowest in gravid females. Follicular diameter decreased after late Spring, suggesting that this is the period of ovulation and fertilization. Embryos were present in only non-vitellogenic females, suggesting a biennial reproductive strategy. Average litter size is 4-6 pups/litter.

0366 Herp & Ich Genomics, Banquet Room J, Sunday 3 August 2014

Rafe Brown[1], Scott Travers[1], Karen Olson[1], Carl Oliveros[1], Yong-Chao Su[1], Mike Anderson[1], Xinaguang Guo[1], Cameron Siler[2], Robert Moyle[1]

[1]University of Kansas, Lawrence, Kansas, USA, [2]University of Oklahoma, Norman, Oklahoma, USA

Ultraconserved Elements Resolve Shallow Divergences within a Complex of Cryptic Gecko Species from an Island Archipelago.

The Philippine *Gekko mindorensis* complex has been the subject of several recent systematic studies aimed at resolving the question of whether the group represents a single widespread species, two or three taxa, or possibly numerous range-restricted microendemics. Approaches using traditional morphological characters, cytogenetics, and multilocus Sanger sequence datasets have produced conflicting results and have not yet fully resolved species boundaries within this group. In this study we took a genomic approach to species delimitation by targeting ultraconserved elements, which yielded a dataset of over 1,700 complete informative gene loci, comprising a total of 1.6 million nucleotide positions, across over 30 individuals. Empirical results demonstrate some similarities with results from conventional sequencing methods—but also produced notable differences with respect to branching pattern and numbers of putative taxa delimited with strong statistical support. In this talk we will discuss approaches to analysis of UCE data in phylogeographic and species delimitation studies, and highlight related topics for consideration in the immediate future with genomic insight into shallow divergences.

0371 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Warren Brown, Robert Robins, Kenneth Krysko

University of Florida, Florida Museum of Natural History, Gainesville, FL, USA

A Novel Use of Specify Database Software for Museum Collections

We present an aggregated collection web portal developed at the Florida Museum of Natural History (FLMNH), based on Specify database software. For the first time,

Specify software's full-featured web interface for accessing specimen data is configured to search multiple collections simultaneously. We discovered that the steps to build and export a web portal in Specify may be interrupted and data from multiple collections aggregated at a database level. The process may then be resumed to produce a web portal containing the aggregated data. As Specify software's common data model for storage of collection data controls for disparities in data typing across collections, the Specify Web Portal is ideally-suited for aggregating databases of disparate collection types. Search results of an example aggregation including both fishes and herps are presented to demonstrate functionality. The FLMNH envisions the completion of a "Digital Florida" aggregated collection web portal for all FLMNH data-based natural history specimens from Florida, including fossils. This new methodology has been shared with the Specify project and collaborative efforts toward inclusion in the Specify application are ongoing.

0039 Fish Ecology I, Banquet Room F, Saturday 2 August 2014

Nancy J. Brown-Peterson, James S. Franks

University of Southern Mississippis, Ocean Springs, MS, USA

Reproductive Biology of Yellowfin Tuna, *Thunnus albacares*, in the Northern Gulf of Mexico

Yellowfin Tuna, *Thunnus albacares*, support recreational and commercial fisheries in the northern Gulf of Mexico (GOM) where they are an important component of the pelagic fish community, yet little is known of their reproductive biology in the region. Monthly samples taken in 2012, combined with samples of opportunity during summers of 2000-2011, provide information on the basic reproductive biology of the species. Length at 50% maturity for females is 97.2 cm FL; 100% of females are mature at 126 cm FL. Gonadosomatic Index (GSI) values suggest a May through September spawning season, but histological analysis showed some females were in the spawning capable and actively spawning reproductive phases in April. A majority of males were in the spawning capable phase by February, and some males (10%) remained in this phase through November. However, active spermatogenesis decreased as the spawning season progressed, with most spawning capable males in the late GE sub-phase by July. Female Yellowfin Tuna are batch spawners with asynchronous oocyte development. Spawning frequency varies from every 2 days in the early portion of the season (April-May) to once every 1.28 days by the end of the season (August-September). However, histological analysis found few examples of females able to spawn daily (i.e., 24 h POF and oocyte maturation in the same ovary). These results are similar to previous reports of Yellowfin Tuna reproduction in the eastern Pacific Ocean and Coral Sea, although GOM fish reach sexual maturity at a smaller size than those from the Coral Sea.

0058 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

Richard Bruce

Western Carolina University, Cullowhee, NC, USA

Reproductive Allometry in Three Species of Dusky Salamanders as Evidence of Life-History Symmetry in the genus *Desmognathus*

In this study I examined the tradeoff between egg size and clutch size in North Carolina populations of *D. santeetlah*, *D. ocoee*, and *D. aeneus*, with special emphasis on the latter two species. Traits evaluated included standard length, body mass, trunk volume, egg size, clutch size, and clutch volume. For *D. aeneus* and *D. ocoee*, regressions of log-transformed values of body mass and trunk volume on standard length, and trunk volume on body mass, indicated strong similarity between the species in those body proportions that ostensibly constrain female reproductive effort. In all three species bivariate linear regressions of log-transformed values of clutch dimensions on body size suggested little correlation between egg size and body size within species, although larger species had larger eggs, larger clutches, and greater clutch volumes. An apparent interspecific tradeoff between egg size and clutch size in *D. aeneus* and *D. ocoee* suggested a common pattern in the relationship between body size and reproductive effort in these species. The results provided further evidence of a high level of life-history invariance in the genus *Desmognathus*, embodied in tradeoffs, which may stem from morphological conservatism related to specializations of the musculo-skeletal system.

0735 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Andrew Buckelew, Daniel Warner

University of Alabama at Birmingham, Brmingham, Alabama, USA

Temporal Changes in Food Availability Affect Reproductive Allocation in the Lizard *Anolis sagrei.*

Females that experience nutritional stress typically have reduced energy for reproduction, which in turn can influence patterns of investment into eggs. Because nutritional conditions (e.g., prey availability) can change temporally, patterns of reproductive investment are also expected to shift accordingly across time. In this study, we raised reproductive female brown anoles (*Anolis sagrei*) under two treatments that

differed in prey availability (high versus low amounts of food), and assessed the effect on egg production and egg mass. After 15 weeks into the reproductive season, half the females in the low-prey treatment were switched to the high-prey treatment, and half the females in the high-prey treatment were switched to the low-prey treatment over the following 15 weeks. The remaining lizards remained on the same diet regime throughout the experiment. Females in the low-prey treatment produced substantially fewer eggs than those in the high-prey treatment, but egg mass was not affected. Females that were switched to the low-prey treatment rapidly decreased their egg production, whereas those moved to the high-prey treatment increased their egg production. Additional analyses will evaluate the effect of prey availability on various components of eggs (e.g., water weight, energy content, yolk steroids). Overall, these preliminary results suggest that brown anole reproduction responds rapidly to changes in environmental conditions, and that this species relies primarily on recently acquired energy for reproduction, rather than stored reserves.

0092 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Kathryn Buckley

Charles Darwin University, Northern Territory, Australia, NERP Marine Biodiversity Hub, Northern Territory, Australia, Territory Wildlife Park, Northern Territory, Australia

The Ecology of Juvenile Largetooth Sawfish *Pristis pristis* in the Adelaide River, Northern Territory, Australia: Movement Patterns and Habitat Use

The sawfishes (family Pristidae) are considered one of the most threatened groups of aquatic species, with all species assessed as Critically Endangered on the IUCN Red List. The Largetooth Sawfish *Pristis pristis* was once globally widespread across the tropics but now northern Australia represents one of the species' last remaining viable stocks. Nevertheless, this subpopulation has still undergone considerable (albeit unquantified) declines in abundance and extent of its distribution. In northern Australia, many anthropogenic activities are considered threats to Largetooth Sawfish populations, including fishing and habitat modification. Effective management of the species is hampered by a lack of knowledge of the distribution, movement patterns, habitat use and requirements, life history and threats facing their populations. This information is required to provide a scientific basis for protection of critical habitats, mitigation of impacts, and regulation of harvest regimes. We aim to support the management of Largetooth Sawfish by providing an improved ecological understanding of juvenile Largetooth Sawfish. Acoustic tracking of juvenile Largetooth Sawfish in the Adelaide River of the Northern Territory is being undertaken using both active tracking and a passive receiver array. Preliminary results for the movement patterns and habitat use of

Largetooth Sawfish are presented. Clearly identified and consistent movement patterns have been detected on larger spatial and temporal scales. On smaller spatial and temporal scales movement patterns are more variable.

0204 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Rob Bullock[2], Lauran Brewster[2], Mark Bond[3], Tristan Guttridge[4], Samuel Gruber[1]

[1]Bimini Biological Field Station Foundation, Bimini, Bahamas, [2]University of Hull, Hull, England, UK, [3]Stony Brook University, Stony Brook, New York, USA, [4]Cardiff University, Cardiff, Wales, UK

Assessing the Effects of Prey Interactions on Habitat Use Patterns and Foraging Effort in Lemon Sharks

Coastal nursery sites provide critical refuge for young sharks. Delineating how sharks use these habitats and interact with other species helps us to better understand their ecological role and develop sound marine management policy. In this ongoing study we assess the effects of distribution and abundance of prey species on lemon shark behaviour, in Bimini, Bahamas. For this study we developed a 'tag package' comprised of a CEFAS G6A tri-axial accelerometer and a Sonotronics PT4 acoustic transmitter. Tag packages are attached to the first dorsal fin of sharks. Accelerometers provide quantitative behavioural data used to identify potential foraging attempts and acoustic transmitters are used to actively track large juvenile (0.8-1.2m) and sub-adult (1.2-2.0m) lemon sharks. We surveyed the study site for potential prey communities using baited remote underwater video stations (BRUVS). Thus far 12 sharks have been tagged for periods ranging 3 to 5 days. Accelerometer and telemetry data show distinct, tidally mediated patterns in diel movements and foraging effort in lemon sharks. Relative abundance data from 150 BRUVS deployments show abundance and distribution of prey species to vary greatly within the study site. We aim to identify overlap between patterns in shark movements and foraging effort with prey availability, demonstrating the importance of predation and inter-species interactions in the daily habitat use patterns of lemon sharks. This research is supported by a grant from the Bimini Biological Field Station Foundation.

0134 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Gordon Burghardt

University of Tennessee, Knoxville, TN 37996, USA

A Serpentine Life in Science

To have one's work as scientist and teacher recognized as having had a positive impact is both satisfying and humbling; the latter because with age I increasingly appreciate where I have fallen short. It is one thing to acknowledge the truism that science is always changing, but quite another to personally experience several generations of such changes. The challenge is to adapt while remaining true to one's core approach and values, and to the organisms and questions that motivate and inspire us. I will discuss major shifts in the field of animal behavior as well as the shifts that I have made in the research I have been privileged to pursue with wonderful students and colleagues; I will also highlight the mentors that appeared almost magically at opportune moments. The remarkable growth of interest in non-avian reptile behavior over the last 50 years is extraordinarily exciting. As the next half-century opens, I hope the audience will bear with me as I offer some speculative predictions, and cautions as to what may lie ahead. It is increasingly evident that the survival of the animals we love, and the environments they inhabit are at risk, and the attitudes toward nature by the broad public must transform. Scientists of the future will need to adapt in ways that may conflict with current goals and be disconcerting, but for many, also liberating.

0634 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Jacob Burkhart[1], Christopher Shulse[2], Raymond Semlitsch[1]

[1]University of Missouri, Columbia, Missouri, USA, [2]Missouri Department of Transportation, Jefferson City, Missouri, USA

Larval Abundance as a Predicter of Total Metamorph Production for Pond-Breeding Aamphibians

Currently, there is a paucity of information on the relationship between larval abundance and metamorph production in pond-amphibian population dynamics studies. To date, research has focused solely on larval abundance or metamorph production to quantify recruitment; however, only metamorphs are recruited into the adult population and no study has linked larval abundance estimates with overall metamorph production. Furthermore, metamorph production is quantified using

complete drift-fence survey and the time and labor required for such studies limits the number of ponds that can be surveyed. As such, we seek to model the relationship between larval density and metamorph production which will allow recruitment to be more easily estimated. We surveyed eighteen wetlands across three conservation areas in central Missouri, USA over a two year period. We conducted dip-net sweeps and funnel trap surveys to generate larval densities as well as complete drift-fence surveys to obtain metamorph production for six species of pond-breeding anurans (*Bufo americanus*, *Hyla versicolor*, *Hyla chrysocelis*, *Pseudacris triseriata*, *Lithobates sphenocephalus*, and *Lithobates blairi*). During our surveys, we also collected data for slope, percent of vegetated cover, macroinvertebrate predator density, and fish density. Using generalized linear regressions with a negative binomial probability error distribution, we show that metamorph production is best estimated by larval density combined with the covariate effects of species and percent of vegetated cover. As all three covariates are easily obtained during field surveys, our model provides a method for estimating recruitment into the terrestrial population in a more time and cost effective manner.

0602 NIA STUDENT COMPETITION, Banquet Room G, Friday 1 August 2014

Michael Burns

Oregon State University, Corvallis, OR, USA

Body Shape Evolution in Characiformes

The order Characiformes is a hyperdiverse group of South American and African fishes that exhibits an unparalleled amount of variation in body shape, trophic ecology, and habitat. I sought to analyze body shape evolution of the order to characterize and quantify morphological variation and test different hypotheses about the origin of the variation. I quantified body shape through geometric morphometric analysis of radiographed specimens. I digitized 24 landmarks from the head and body of 10 adult individuals per species for 134 genera with at least two genera from each family and summarized variation through a principal components analysis. The major axis of body shape variation was elongation, with three major morpho-types being described. The first body shape morph was an elongate slender form, which is contrasted with the second morph which was a deep bodied form. The third morpho-type was an intermediate form that was slightly elongate with a more robust body. Most of the variation was between families and indicates that body shape evolution occurred early in cladogenesis. Phylogenetic comparative analysis supported a relationship between body shape and trophic ecology, indicating that phylogenetic relatedness is not completely responsible for the shared morphologies. I hypothesize that trophic ecology was a key factor promoting morphological differentiation early in cladogenesis, and

postulate that similar body shapes have evolved multiple times in independent lineages, enabling taxa to invade similar adaptive zones.

0301 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Michael Burns, Ben Frable, Brian Sidlauskas

Oregon State University, Corvallis, OR, USA

The Oregon State Ichthyology Collection: Undergraduate Training Through Digitization of an Outstanding Library of Fishes

Established in 1935, the Oregon State University Ichthyology Collection (OSIC) developed into an important resource for ichthyological research and education in the Pacific Northwest. Unfortunately, lack of space, funding and staff hindered the expansion and modernization of the collection until 2009 when we acquired NSF funding to secure, relocate, and digitize the collection. The collection now occupies a modern facility that meets fire and earthquake safety codes, features mobile compact shelving and provides archival tanks for large specimen storage. The collection houses the largest collection of Oregonian fishes in the world and substantial marine and freshwater holdings from throughout the Pacific Northwest and beyond. Of over 18,500 cataloged lots 15,000 (~81%) have been digitized and are now searchable via GBIF and FishNet2 (http://www.fishnet2.net/search.aspx?c=OS). The substantial task of computerizing the collection has allowed for undergraduate students at Oregon State University to gain hands on training in the study of biological diversity and collection science. In addition, many of the undergraduate students have experienced biological diversity by integrating the museum's collections into independent research projects. In total, the modernization of the OSIC has allowed for the training of over 15 undergraduate students. We will update the ichthyological community on the progress of the digitization, and showcase several of the undergraduate research and training projects currently underway including creation of the genetic database and a project on the body shape evolution of Pacific Northwest cyprinids.

0580 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Edward Burress, Milton Tan, Jonathan Armbruster

Auburn University, Auburn, Alabama, USA

Ecological Diversification Among Adaptive Radiations of Neotropical Cichlids

Multiple lineages of Neotropical cichlids have been hypothesized to represent adaptive radiations. However, support for these hypotheses is contentious. For example, few studies have incorporated comprehensive sampling across their transcontinental distribution and broad-scale studies involving traits explicitly linked with an adaptive value are also lacking. We were interested in whether the diversification of whole body and pharyngeal jaw shape were coupled or decoupled, and if either trait displayed rate shift increases that would be consistent with adaptive radiation. We inferred the evolutionary relationships among Neotropical cichlids by constructing a time-calibrated phylogeny using previously published sequence data for five genes (16S, ND4, cyt b, S7, and RAG2). We analyzed two variables with well-established links to ecological processes: whole body shape and lower pharyngeal jaw shape. We used landmark-based geometric morphometrics to characterize ecologically important shape variation among 530 individuals that represent 103 species. We then compared morphological disparity among major lineages (e.g., the Heroini, Cichlasomatini, and Geophagini) using principal component analysis and tested for rate shifts associated with pharyngeal jaw and whole body diversification.

0044 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Nathan Byer[1], Richard Seigel[1], Scott Smith[2]

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Threatened from the Start: Nest Success and Nesting Ecology of the Federally-Threatened Bog Turtle, *Glyptemys muhlenbergii*

Traditionally, high adult and juvenile survivorship has been considered critical for long-term population viability of turtles and other long-lived organisms. However, a lack of sufficient egg survival can make long-term population persistence unlikely regardless of adult survivorship. This consideration is particularly important for imperiled taxa in highly disturbed landscapes. The bog turtle is one of the most vulnerable freshwater turtles in North America, and has experienced sharp population declines due to habitat

loss, overcollection, and other anthropogenically-mediated factors. Bog turtle nesting ecology and reproductive characteristics were measured using radio telemetry of females and intensive nest monitoring at two sites in Maryland: one in a suburban landscape and the other in a rural, historically agricultural landscape. Nests were laid in sedge tussocks and clumps of vegetation, typically had very little overstory vegetation cover, and averaged three eggs per clutch. Nest success at the rural site was much higher than nest success at the suburban site, with much of nest failure attributable to nest predation. These results suggest that bog turtle populations may be particularly at risk to predation at early life history stages. Additional field work in the 2014 field season will be used to better assess population viability, nest success, nest selection, and reproductive characteristics of bog turtles at these sites.

0444 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Elisa Cabrera Guzmán[1], Michael Crossland[2], Richard Shine[2]

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Native Arthropods Prey on Invasive Cane Toads (*Rhinella marina*) in Tropical Australia.

Although popular wisdom suggests that cane toads (*Rhinella marina*) are invulnerable to predators within their invaded range in Australia, the impact of arthropods on toads has been ignored. We combined field observations and experimental work to better understand this topic. We found that toads in various life history stages (eggs, tadpoles, metamorphs, juveniles) are killed and consumed by a phylogenetically diverse array of aquatic, semi-aquatic, and terrestrial arthropods. Aquatic stages of toads are killed and consumed by adult spiders, adult crustaceans, larval or adult hemipterans, larval or adult water beetles, and dragonfly nymphs. Some of these predators only attack free-swimming toad hatchlings or tadpoles, not toad eggs. Metamorph toads are killed by adult ants and spiders. None of these predators showed any overt ill-effects from consuming bufadienolides. In choice experiments, dragonfly nymphs (*Pantala flavescens*) and adult fishing spiders (*Dolomedes facetus*) selectively took cane toad tadpoles at higher rates than they took simultaneously-offered native frog tadpoles (*Litoria caerulea* or *L. rothii*). Our data suggest that cane toads face high predation rates from the diverse and abundant invertebrate fauna of aquatic and riparian habitats in Australia. The invasion of cane toads can thus have direct positive effects on arthropod populations, by offering an additional food source. Hence, native vertebrates that are affected by the toads can be indirectly benefited by arthropod predation on the invader.

0466 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Elisa Cabrera Guzmán, Carmen Díaz Paniagua, Ivan Gomez Mestre

Estación Biológica de Doñana, Seville, Spain

Effect of Invasive Mosquitofish (*Gambusia holbrooki*) on the Behavior of Gravid Pygmy Newts (*Triturus pygmaeus*) from Doñana, Spain

Native pygmy newts (*Triturus pygmaeus*) coexist with invasive Eastern mosquitofish (*Gambusia holbrooki*) in water bodies at the Doñana National Park, Spain. We tested if presence of mosquitofish affects the oviposition and feeding behavior of gravid newts and egg survival. We performed an experiment in 10 L tanks containing sand and *Mentha pulegium* plants, commonly used by newts to conceal their eggs by wrapping them in their leaves. Mosquitofish were either absent, caged in clear plastic containers, or freely swimming to modulate the degree of exposure of newts to fish. Each treatment was replicated 9 to 10 times. We performed behavioral observations three times a day, offered an earthworm once a day, and recorded the number of eggs laid by the newts twice a day, for seven days. Gravid newts exposed to freely swimming mosquitofish were frequently located in the upper part of the water column (near surface) or hidden behind the plastic container. Newts with caged fish or with no fish were commonly located on the sandy bottom of the aquarium. Newts' feeding success was low in the presence of fish. Oviposition was not disrupted by the presence of fish, and most eggs were wrapped in leaves regardless of the exposure to fish. Female newts coexisting with fish laid a slightly lower mean number of eggs per day than those unexposed to fish. Predation on unwrapped eggs occurred in all treatments suggesting that newts occasionally prey on their own eggs.

0232 AES Ecology, Banquet Room E, Saturday 2 August 2014

Gregor Cailliet[1], Kenneth Goldman[2], Henry Mollet[1], Henry Mollet[3]

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The Use of Demographic Parameters to Assess the Population Size of Shark Species: A Test Case Using the White Shark (*Carcharodon carcharias*) Sub-population off Central California, USA

We explore the use of demographic parameters to assess the size of shark populations. We have chosen white sharks (*Carcharadon carcharias*) off central California because recent studies have provided usable data. White sharks are difficult to sample because they are highly migratory, move both vertically and horizontally, and tend to segregate by sex, age and size. Thus, their population or sub-population sizes are difficult to

estimate. A recent tag-recapture study used photographic identification of the trailing edge of the first dorsal fin and concluded that the central California sub-population comprises only 219 sub-adult and adult white sharks. We use a dataset from sharks observed in that study to generate an estimate of total population size using demographic modeling. Our results indicate that an all-life-stage sub-population size of >2,400 individuals in coastal California is required to account for the abundance of the 219 adults and sub-adults of white sharks estimated in the previous central California study. Our estimate concurs with those of recent state and federal panel assessments of ESA status. The true total white shark population size throughout the eastern North Pacific is likely several-fold greater than both our study and the original published estimate because they both exclude non-aggregating, or otherwise unobservable, sharks, and those that independently aggregate at other important eastern North Pacific sites. Accurately estimating total population sizes of sharks requires methodologies that account for biases introduced by sampling a limited number of sites and include all life history stages across the species' range.

0180 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Patrick Cain[1], Robert Arndt[1], Matthew Cross[2]

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Arduino is Awesome! Innovative and Easy-to-Use Hardware for Do-it-Yourself Electronic Field Equipment

Biologists often find that the equipment they use is not built to the exact specifications needed for the questions they are asking, and building customized devices can require further expertise in electrical engineering. Here, we discuss the use of a microcontroller called Arduino™ to develop electronic tools specific to one's own research. Arduino™ is an open-source prototyping platform that can send and receive information to peripherals (sensors, GPS, memory card, etc.). Here, we describe three devices that were developed using Arduino™ microcontrollers. The first is a GPS data-logger for tracking turtles. Many GPS data-loggers of this type are expensive and too large for many turtles. Furthermore, radio telemetry can influence behavior via the proximity a researcher needs to be to locate the animal, which is easily avoided with a passive data-logger. The second is a light-sensor capable of detecting the light intensity of moonlight for use in night activity studies. Common sensors for this application are commercially available, but are not usually capable of detecting light intensity of the moon. Finally, we developed a robotic lizard that can be programmed to emulate the display action patterns ("push-ups") of *Sceloporus* lizards to be used to examine male-male interactions and predation risk. These are similar to "clay model" studies, but include motion.

Arduino™ microcontrollers and sensors are relatively inexpensive, and programming/wiring are easy to learn because of its open-source nature. Many projects are made available online and include wiring, diagrams, and code, so similar projects can be adapted for one's specific need.

0508 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Courtney Calhoun, Pete Berendzen

University of Northern Iowa, Cedar Falls, IA, USA

Genome Duplication and Evolution in a Tetraploid Family of Fishes (Cypriniformes: Catostomidae)

Gene and genome duplications have long been considered to be of key importance to evolutionary innovation. Duplications play a significant role in shaping the architecture of the genome and have resulted in morphological novelty contributing to the diversification of eukaryotes. The consequence of whole genome duplications (WGD) is that they add thousands of duplicate genes and regulatory elements to the genome, which are subjected to a variety of evolutionary forces. Duplicate copies can experience a number of evolutionary fates including retention of function, loss of function, novel function, or partition of function between copies. In the evolutionary history of animals, WGD have occurred at several key points including a genome duplication event within the lineage of ray-finned fishes. Additional events have occurred within several groups of fishes including the Catostomidae, the suckers. The objective of this study is to examine the impact of WGD and subsequent genomic evolution within the Catostomidae using targeted enrichment techniques and next generation sequencing. The entire exome from seven species of suckers selected widely across the catostomid tree and one non-polyploid cypriniform were collected. These data were aligned and annotated to the zebrafish reference genome Zv9. The exomes will be characterized in reference to the zebrafish by determining the number of single nucleotide changes, structural variations, copy number variants, presence of pseudogenes, and evidence of retained function. Patterns observed in these data will be used to determine the amount of genome variation following polyploidization. Preliminary results will be presented.

0414 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

David Camak[1], Lisa Cordes[2], Kyle Piller[1]

[1]*Southeastern Louisiana University, Hammond, LA, USA,* [2]*Louisiana Department of Wildlife and Fisheries, New Orleans, LA, USA*

Assessing the Influence of Riverine Outflow on Genetic Diversity of Two Coastal Marine Fish Species

The classic idea of the marine environment is that it is an open space devoid of barriers with several species having high effective population sizes and dispersal abilities allowing for unhindered gene flow. Recent work has suggested that a variety of factors may influence gene flow in the marine environment and genetic structure occurs at large and small spatial scales. One potentially important genetic barrier for marine organisms is the influence of freshwater river outflows, which can block the lateral movements of inshore marine fishes. The impacts of the Mississippi River outflow on terrestrial/freshwater systems have been well documented, but less so for marine organisms. Red drum (*Sciaenops ocellatus*) and spotted seatrout (*Cynoscion nebulosus*) are estuarine-dependent fishes, occurring throughout the Gulf of Mexico and Atlantic basins. Although there are numerous studies investigating intrabasin and/or interbasin genetic structure in the Gulf of Mexico for these species, relatively little is known regarding microgeographic levels of genetic variation or the influence of a specific genetic barrier. The objectives of this study were to assess the effects of the Mississippi River's freshwater outflow on gene flow in red drum and spotted seatrout using multiple microsatellite loci. We also assessed whether the outflow of smaller systems in Louisiana influence gene flow to the same degree as the Mississippi River, simultaneously testing for population genetic structure along the coast of Louisiana. Results indicate that the Mississippi River represents a substantial barrier to gene flow for both species, whereas the other basins do not impede gene flow.

0402 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Sâmia M Camargo[1,2], Bruno LS Ferrette[2], Guilherme C Silva[2], Claudio Oliveira[2], Natália J Mendes[2], Miguel N Santos[3], Rui Coelho[3,4], Fausto Foresti[2], Fernando F Mendonça[1]

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Phylogeography of the Oceanic Whitetip Shark *Carcharhinusn longimanus* in the Atlantic Ocean, Using Molecular Markers

The oceanic whitetip shark *Carcharhinus longimanus* have been considered one of the most important capture species of commercial interest, which currently have strong signs of population depletion. Considering that, researches on the genetic structure of fish populations have contributed to clarify issues relating to population genetic variability, distribution, migration, taxonomy, systematic and historical events. Additionally, considering the urgent need for effective conservation plans for this species, this study aims to characterize the genetic structure of population of the oceanic whitetip shark in the Atlantic Ocean, using sequences of the mitochondrial DNA control region. A review of 100 individuals captured in localities nearby the African continent and the Brazilian coast were characterized with 658 analyzed nucleotide bases with the identification of 6 polymorphic sites forming 8 distinct haplotypes. The total nucleotide diversity was $\pi = 0.00089$ and haplotype diversity was Hd = 0.338, which are similar to the rates found in other shark species analyzed with the same markers. In the Analysis of Molecular Variance was observed a moderate population structure (FST = 0.10436) with moderate level of restriction to gene flow between the West and East Atlantic. It must be considered that this index of divergence between the sample groups do not characterize genetically distinct stocks, but for the development of conservation plans aimed to safeguarding the genetic variability of *C. longimanus* is necessary giving priority to management areas where unique haplotypes were identified, attributing high genetic diversity to these regions.

0298 General Herpetology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD GENERAL HERPETOLOGY

Lisa Cantwell, Joe Altobelli, Arthur Echternacht

University of Tennessee Knoxville, Tennessee, USA

Who's There? The Importance of Familiarity in Discrimination of Avian Calls by the Brown Anole (*Anolis sagrei*)

Many animals use auditory cues to assess the risk of predation. Historically, studies investigating antipredator behavior in lizards have focused on visual or chemical stimuli, despite the fact that most lizards have well developed auditory systems. Recent evidence suggests that lizards also use auditory cues to assess predation risk, however, little is known about the mechanisms by which they distinguish between threatening and non-threatening sounds. We conducted playback studies on brown anoles using the calls of a sympatric predator, the American kestrel (*Falco sparverius*; Falconidae), and three allopatric predators of increasingly distant phylogenetic relatedness, the Lesser kestrel (*Falco naumanni*; Falconidae), White-rumped falcon (*Polihierax insignis*; Falconidae) and the Shikra (*Accipiter badius*; Accipitridae). We found no effect of stimulus type on whether or not lizards initially responded with antipredator behavior or response time. Conversely, lizards responded with more antipredator behaviors during playback of the calls from the sympatric predator compared to the calls of allopatric predators. In addition, lizards remained alert twice as long after being exposed to sympatric predatory calls. Results from this study suggest that call familiarity may be important for lizards when distinguishing between threatening and non-threatening auditory stimuli.

0377 Conservation, Banquet Room F, Friday 1 August; ASIH STOYE AWARD CONSERVATION

Connor Capizzano[1], John Mandelman[2], William Hoffman[3], Micah Dean[3], Douglas Zemeckis[4], Jeff Kneebone[3], Marc Stettner[5], Joe Langan[1], James Sulikowski[1]

[1]University of New England, Biddeford, ME, USA, [2]John H. Prescott Marine Laboratory, New England Aquarium, Boston, MA, USA, [3]Massachusetts Division of Marine Fisheries, Annisquam River Marine Fisheries Field Station, Gloucester, MA, USA, [4]University of Massachusetts Dartmouth, School for Marine Sciences and Technology, Fairhaven, MA, USA, [5]N/A, Portsmouth, NH, USA

Estimating and Mitigating Post-Release Mortality of Atlantic Cod in the Gulf of Maine's Recreational Hook-and-Line Fishery

Recreational hook-and-line angling for Atlantic cod, *Gadus morhua*, in the Gulf of Maine (GOM) has increased over the past decade and recreational discards are approximately double the recreational landings in this region. However, the discard mortality of cod remains poorly understood, creating uncertainty in recent GOM cod stock assessments. The current project aims to examine the capture-related factors most detrimental to post-release survival of cod in the recreational hook-and-line fishery. Both sublegal and just legal cod (n = 637; 25 - 71cm) were angled using Norwegian-style jigs (48%) or baited J-hooks (52%) at depths ranging from 44.5 - 83.0m on southern Jeffreys Ledge from July - October 2013. All cod were visually inspected for injuries sustained during capture and ranked based on a condition index. A subset (n = 136) were also tagged with ultrasonic transmitters before being released into a fixed acoustic receiver array deployed to monitor survival over a 30d period. A mixed-effects logistic regression model was applied to the capture-related data to determine their effectiveness as post-release mortality predictors. Results can robustly estimate cod discard mortality and enhance survival through "best practice guides" that will be disseminated to stakeholders.

0242 AES Genetics, Genomics, & Systematics, Banquet Room E, Saturday 2 August 2014

Joao Paulo Capretz Batista da Silva, Marcelo Rodrigues de Carvalho

Instituto de Biociencias, Sao Paulo, SP, Brazil

A Reinterpretation of the Pectoral Articulation in Elasmobranchs (Chondrichthyes)

The morphology of the pectoral articular region in elasmobranchs was studied based on 154 species from 97 genera representing many orders and families. Particular attention was given to characters employed in previous higher-level morphological phylogenetic studies. Two characters of the pectoral articulation previously described in these studies as presenting non-homoplastic distributions are reported here to be more complex in variation and distribution (a separate articular condyle for the pectoral metapterygium and the presence of an articular condyle for the pectoral propterygium). These characters provide new insights concerning the higher-level relationships of elasmobranchs. This study highlights the continued importance of morphological characters for phylogenetic analyses and that certain characters employed in higher-level phylogenetic studies of elasmobranchs need to be revised.

0188 Herp Reproduction, Banquet Room I, Sunday 3 August 2014

Wade Carruth[2], Brad Lock[2], David Rostal[1]

[1]Georgia Southern University, Statesboro, GA, USA, [2]Zoo Atlanta, Atlanta, GA, USA

The Reproductive Cycle of the Guatemalan Beaded Lizard, *Heloderma charlesbogerti*

Little is known about the reproduction of helodermatid lizards. Several species are uncommon or rare and in need of the development of conservation programs and management. Reproductive information, including seasonality in behavior and physiology, is key to our ability to breed species for maintaining assurance colonies or future introductions. Most *Heloderma* reproductive data collected has been done using histological techniques, using deceased animals. No hormones have been analyzed, and individual animals have not been followed through a complete cycle. The purpose of this study was to delineate the reproductive cycle of the Guatemalan beaded lizard, *Heloderma charlesbogerti*, by monitoring seasonal steroid and calcium cycles, vitellogenesis, ovarian follicular growth, and egg production. Blood samples were collected monthly from adult lizards to determine circulating hormone levels. These hormone levels (testosterone, estradiol, and corticosterone) and calcium levels were

correlated with reproductive condition determined by ultrasonography. A distinct ovarian cycle was tracked using ultrasonography with small previtellogenic follicles appearing as early as November and vitellogenesis during May through November. Ovulatory estradiol spikes were very well defined in two females in August and November. Corticosterone levels appear to increase in gravid females, possibly due to males still being housed with females trying to lay eggs. Testosterone in male lizards peaked during August indicating that breeding should be taking place in September-October; similar to what has been observed in Mexican beaded lizards with spermatogenesis in August through October, as determined from road kill specimens from Mexico. Captive reproduction has dramatically increased by monitoring these seasonal cycles.

0337 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Cynthia Carter, Stephen Mullin

Eastern Illinois University, Charleston, Illinois, USA

Trophic Interactions in a Semiaquatic Snake Community: Insights into the Structure of a Floodplain Food Web

Food webs model the trophic interactions among species and provide a useful conceptual framework for evaluating the relationships that exist within ecological systems. The complexity of interactions within a trophic web can be influenced by the niches occupied by members of that community. The dimensions of each niche often vary as a function of the position of species within the trophic web (i.e., producer or consumer) and the life history stage (i.e., juvenile or adult). Our research examines niche variation in a semiaquatic food web, where consumers have the opportunity to acquire their food from either of two distinct habitats, aquatic or terrestrial. Of particular interest is the mudsnake (*Farancia abacura*) whose ecology is poorly understood, presumably because of their secretive nature. We used stable isotope analysis to compare the diets of mudsnakes and several syntopic snakes to determine their relative contributions to trophic dynamics and the degree of dietary overlap that exists among them. We collected tissue samples from snake species and potential prey species from Mingo National Wildlife Refuge in southeastern Missouri between September 2013 and July 2014. Samples were processed using mass spectroscopy and then analyzed using a Bayesian mixing model to determine the proportion of each snake's diet contributed by each prey taxon. We discuss our findings with respect to the niche parameters of these predatory species in floodplain habitats and consider how these parameters might change in response to shifts in community composition.

0230 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Evin Carter, Benjamin Fitzpatrick

University of Tennessee, Knoxville, Tennessee, USA

Reproductive Strategy and the Efficiency of Selection in Small Populations

Small populations can evolve rapidly under some scenarios, but these mostly drift- and mutation-driven changes are rarely expected to result in an increase in fitness. Nonetheless, there exist several remarkable examples of rapid adaptation by small populations that do not readily conform to theoretical expectations—most notably among amphibians. Most amphibian species exhibit complex life cycles and exceedingly large reproductive outputs, which increases both the number of recombination events per individual and the expected number of mutations per generation relative to standard population genetics models. Using individual-based simulations, we show that high reproductive output and low recruitment rate can act in concert to increase adaptive capacity and the efficiency of selection in small populations. However, benefits depend strongly on the number of loci affecting fitness and recombination rates among them. Our results may explain previous observations of rapid adaptation in small populations and might provide meaningful predictions regarding hybrid invasions.

0564 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Evin Carter[1], Bryan Eads[2], Matthew Farmer[2], Bruce Kingsbury[2]

[1]University of Tennessee, Knoxville, Tennessee, USA, [2]Indiana - Purdue University Fort Wayne, Fort Wayne, Indiana, USA

Demonstrating Roads as Barriers to Snakes using a Modified Random Walk: The Case of the Copperbelly

Plain-bellied Watersnakes (*Nerodia erythrogaster*) are imperiled throughout much of the Midwestern portion of their distribution—within those areas occupied by populations previously identified as Copper-bellied Watersnakes (*N. e. neglecta*). Previous studies suggest that roads could play a role in documented declines by fragmenting wetland complexes and presenting barriers to snake movements through either road mortality or an unwillingness to cross. However, no study has explicitly tested the hypothesis that copperbellies actively avoid roads. Existing methods for such an analysis may not be suitable for species having strict spatio-temporal habitat requirements or when habitats themselves are temporally dynamic. We used a modified random walk simulation to account for temporal variability in both habitat preference and availability in which

individuals can be drawn to or away from a specified point(s) or area(s) through time (e.g., hibernaculum). This is achieved via a temporally dynamic probability matrix representing a landscape. We apply this model to two years of radiotelemetry data on 29 copperbellies in an expansive, but anthropogenically-modified, landscape containing numerous wetlands. We demonstrate that snakes were significantly less likely to cross roads than expected at random under all conditions tested but that the frequency of expected road crossings still depends heavily on model parameters. We discuss theoretical motivations for various null movement models as well as implications for management of copperbellies.

0160 NIA, Banquet Room F, Sunday 3 August 2014

Tiago Pinto Carvalho

Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA

A New Miniature Species of Banjo Catfish (Siluriformes: Aspredinidae) from Lower Purus River in the Amazon Basin, Brazil

Aspredinidae is composed of 50 species distributed in 13 genera found throughout the major drainages of South America including the Magdalena, Maracaibo, Orinoco, Amazon, São Francisco, and Paraná-Paraguay. Aspredinidae has also several miniaturized species that show morphological changes related with size reduction. In a recent survey at the collection of the Instituto Nacional de Pesquisas da Amazônia (INPA, Brazil) a new small sized species of banjo catfish was found inhabiting two small stream tributaries of the lower portion of the Purus River in Brazil. This new species can be diagnosed from all other aspredinids by its reduced and unique fin-ray count. The new species has two dorsal-fin rays (I+1), four pectoral (I+3), five pelvic-fin rays, four to five anal-fin rays, and nine caudal-fin rays. This species is putatively referred to *Pseudobunocephalus* by having the anterior limit of the upper and lower jaws approximately equal and the lateral line truncated at about the level of the dorsal-fin origin. Some characters are unique within the new species compared to putative congeners such as the irregularly arranged series of tubercles in the caudal peduncle. Also, this species is the smallest (maximum 22 mm of SL); widest (cleithral width 33.5-36.9% of SL); and shallowest (head depth 9.9-11.5% of SL) member of this genus. This new species its being included in a phylogenetic analyses of the family Aspredinidae and characters related with miniaturization are being study under a phylogenetic scope.

0543 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Gary Casper[1], Julia Robson[2], Brian Halstead[3], Kristina Kroening[4], Beth Mittermaier[5]

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Wisconsin Butler's Gartersnake Populations in a Conservation Context

We present population data from eight multi-year mark-recapture studies on Butler's Gartersnake (*Thamnophis butleri*) at development sites in southeastern Wisconsin, and report on conservation planning. All sites were impacted by development during the study and were monitored through the 2011-12 drought period. Model-averaged abundances varied by year from 6 to 677, with most sites having lower abundance during drought years and following disturbance. Daily apparent survival probability during the active season at one site was 0.95 (0.94-0.97). Abundance increased post-disturbance at one site embedded in a larger undisturbed habitat matrix, and at another site where mostly forested habitat was converted to more suitable grasslands. Results from remaining sites were mixed, with most showing partial recovery post-drought and disturbance, others steadily declining. At no sites did snakes disappear, but most remain well below their pre-disturbance levels after several years. Proportion of adult gravid females varied across sites and years (30-89%, N>9), as did sex ratios (0.40-0.75), and average SVL (F:292-409mm; M:272-354mm) and weight (F:19-59g; M:13-34g). Previous genetic investigations have revealed a complex evolving system between *T. butleri* and *T. radix* in Wisconsin, with evidence for an extant ancestral clade co-existing with both species. A more recent study proposed a new genetic definition of *T. butleri* independent of morphology, biogeography or reproductive isolation. We examine how these assumptions have resulted in a purported expanded range for the species and consequent delisting, and how population and genetic data can better inform a long-term conservation plan that addresses the evolving system.

0694 Physiology & Physiological Ecology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY

Corey Cates, Daniel Warner

The University of Alabama at Birmingham, Birmingham, AL, USA

Effect of Moisture and Substrate on Egg Water Uptake and Phenotypes of Hatchling Lizards (*Anolis sagrei*)

The environmental conditions that embryos experience during development can have profound and long-lasting effects on offspring phenotypes. The hydric conditions of the incubation substrate are particularly important for reptiles with parchment-shelled eggs. Moreover, different types of substrates have different moisture holding capacities and can also affect offspring development. Although several studies demonstrate that moisture availability positively affects water uptake by eggs and hatchling body size, few studies have mimicked conditions in the field. In this study, we incubated eggs of the brown anole (*Anolis sagrei*) under four conditions that mimic natural variation in substrate type and moisture. At our study site (islands in a saltwater estuary), eggs have been found in two substrate types (sand/broken shell mixture and dark organic soil) and likely experience a broad range of hydric conditions. To quantify the effects of this environmental variation, we incubated eggs in a 2x2 factorial design using both substrate types at two water potentials (-30 and –600 kPa). By incubating *A. sagrei* eggs under these different combinations of substrate types and water potentials, our preliminary results reveal relatively rapid water uptake and long incubation periods for eggs experiencing moist conditions, particularly for eggs in sand/broken shell substrate. This ongoing research will assess how these different incubation conditions influence desiccation tolerance of hatchlings and subsequent survival. Overall, this work will demonstrate how natural environmental variation during early life stages (embryo) can have critical impacts on variation in fitness-related phenotypes of offspring.

0107 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Kristen Cecala

University of the South, Sewanee, TN, USA

Estimating the Efficacy of Alternate Conservation Scenarios for Wetland Amphibian Conservation

Amphibian population persistence requires sufficient upland and wetland habitat to complete their biphasic life histories, but current regulations fail to adequately protect upland habitat. This failure is largely due to competing interests between conservation

and landowner profits. New scenarios have been proposed to develop compromises among stakeholders by allowing for limited development within upland habitat while preserving the uplands most frequently used by amphibians. The objective of this study was to evaluate the efficacy of conservation scenarios on long-term persistence of wetland-breeding amphibians. We performed simulations relating the percent of upland habitat protected relative to the probability of persistence to 100 years assuming that individuals that would typically move into unprotected upland habitat would experience mortality. Our study concluded that alternate land uses within a terrestrial buffer could be accommodated without reducing amphibian population persistence in the future. These alternate scenarios may provide a successful compromise between conservation and landowners in the future.

0460 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Stacy L. Cecil[1], John F. Morrissey[2], Kevin A. Feldheim[3], Toby S. Daly-Engel[1]

[1]University of West Florida, Pensacola Florida, USA, [2]Sweet Briar College, Lynchburg, Virginia, USA, [3]The Field Museum, Chicago, Illinois, USA

Development and Optimization of Novel Microsatellite Loci for the Chain Catshark, *Scyliorhinus retifer*

The chain catshark, *Scyliorhinus retifer*, is a small, oviparous, shark species commonly used by humans in the aquarium trade. Abundant and relatively easy to study, *S. retifer* provides a unique opportunity to examine elasmobranch mating strategies. Whether viviparous or oviparous, most elasmobranch species show evidence of polygyandry, promiscuous mating by both sexes. Usually polygyandry is indicated by molecular studies identifying multiple paternity, which occurs when a single litter of offspring is sired by multiple males. Multiple paternity appears to have little benefit to female sharks across taxa, and speculation varies as to why they consistently endure multiple mating events. Genetic tools, such as microsatellites, have been used effectively in previous studies on sharks for describing multiple paternity as a genetic mating system. This study describes the optimization of novel, species-specific microsatellite markers for use in *S. retifer*, with potential for cross amplification to related species. Of the 34 loci tested, 19 amplified consistently and showed enough allelic polymorphism to be useful for determining multiple paternity. Because of fishing pressure and habitat loss for many elasmobranchs, understanding shark mating behaviors in species such as *S. retifer* allows for better management and conservation practices in other at risk elasmobranchs.

0340 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Chris Chabot[1], Donald Buth[2]

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Species-specific Nuclear Genetic Markers for the Detection of Hybridization Between the Grey Smoothhound (*Mustelus californicus*) and the Brown Smoothhound (*Mustelus henlei*)

Many species retain the physiological capacity to hybridize over long periods of evolutionary time. Hybridization has been reported recently for the first time within sharks and may be the reason for uncertainty regarding phylogenetic relationships within the genus *Mustelus*. Because of similar life-histories and morphologies, limited genetic divergence (both nuclear and mitochondrial DNA), and the degree of uncertainty regarding their phylogenetic relationship, 31 allozyme loci were used to determine the levels of genetic diversity for the grey smoothhound, *Mustelus californicus*, and the brown smoothhound, *M. henlei*, and to detect species-specific nuclear markers capable of determining the existence of hybridization within northeastern Pacific *Mustelus*. Tissue extracts from 26 adult *M. henlei* collected from Santa Catalina Island, CA and 17 *M. californicus* collected from Marina Del Rey, CA were subjected to starch gel electrophoresis. Gene products of the loci were resolved for both species. All 31 loci were monoallelic in *M. californicus*, whereas polymorphic loci, two diallelic and one triallelic, were resolved in *M. henlei*. Nine of the 31 loci exhibited complete allelic divergence between the two species, i.e. no shared alleles, and can serve as diagnostic markers to reveal potential hybrids.

0373 AES Genetics, Genomics, & Systematics, Banquet Room E, Saturday 2 August 2014

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Population Structure and Gene Flow in the Brown Smoothhound Shark, *Mustelus henlei*, in the Northeastern Pacific

We assessed the effects of the prominent biogeographic (Point Conception and the Peninsula of Baja California) and phylogeographic barriers (Los Angeles Region) of the northeastern Pacific on the population connectivity of the brown smoothhound shark, *Mustelus henlei* (Triakidae), using data from the mitochondrial control region and six nuclear microsatellite markers to measure gene flow among sample localities from throughout the range of the species (San Francisco Bay, CA, Santa Barbara, CA, Santa Catalina Island, CA, Punta Lobos, Baja California Sur, San Felipe, Baja California, Mexico, and Costa Rica). Mitochondrial and microsatellite data revealed significant population structure among three populations: northern (San Francisco), central (Santa Barbara, Santa Catalina, Punta Lobos, and San Felipe), and southern (Costa Rica). Patterns of long-term and contemporary migration were incongruent, with long-term migration being asymmetric and occurring in a north to south direction and a lack of significant contemporary migration observed between localities with the exception of Punta Lobos that contributed migrants to all localities within the central population. Our findings indicate that Point Conception may be restricting gene flow between the northern and central populations whereas barriers to gene flow within the central population would seem to be ineffective; additionally, a contemporary expansion of tropical *M. henlei* into subtropical and temperate waters in response to climate change may have been observed.

0394 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Chris Chabot, Holly Hawk, Larry Allen

California State University, Northridge, Northridge, CA, USA

Low Genetic Diversity and Effective Population Size in the Critically Endangered Giant Sea Bass, *Stereolepis gigas*

The giant sea bass, *Stereolepis gigas* (Polyprionidae), is a megacarnivore distributed in the northeastern Pacific from California to northern Mexico that has been overexploited by fisheries for more than a century. As a consequence of this historic exploitation, populations collapsed throughout the region resulting in the classification of the species as Critically Endangered by the IUCN. Recently, numbers of giant sea bass have been increasing within the region due primarily to the banning of the gill net fishery in California waters. To assess population structure, the impact of historic exploitation on the genetic diversity and effective population size of the species, and to detect signs of recent population expansions, individuals from throughout the northeastern Pacific (n = 61; Northern Channel Islands, CA to San Quintin, Baja California) were sequenced at the mitochondrial control region and genotyped using 12 nuclear microsatellite loci generated from next-generation sequencing. Based on these markers, a single population was detected with low mitochondrial diversity, an estimated effective population size of less than 500 individuals, with evidence of recent expansion within the region. As a single population of giant sea bass occurs throughout the northeastern Pacific and genetic diversity and effective population sizes are low, conservation measures should be reassessed by enforcement agencies in both California and Mexico to reduce the possibility of the species' extirpation from the region as a result of continued fishery pressure in Mexican waters and the incidental bycatch of juveniles in commercial and recreational fisheries in Californian waters.

0473 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Tyler Chafin[1], Whitney Anthonysamy[2], Marlis Douglas[1], Michael Douglas[1]

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Riverscape Genetics of Roundtail Chub in the Upper Colorado Basin

The native big-river fish community in the Upper Colorado River basin is comprised of minnows (Cyprinidae) and suckers (Catostomidae). Both are represented by but a few species, most of which are endemic and either threatened, endangered or considered of conservation concern. Roundtail Chub, *Gila robusta* is a species of concern and its

propagation and/or translocation is a potential tool for adaptive management. A genetic baseline would aid in making appropriate decisions regarding donor and source populations, so as to avoid the potential for outbreeding depression that can result from the intermingling of lineages. In this regard, how genetically distinct are Roundtail Chub populations from the mainstem Colorado River versus those from tributaries? These habitats differ markedly with regard to flow regimes, community composition, and historical selective pressures. Admixing local populations may break apart co-adapted gene complexes and reduce fitness in future generations – complicating recovery efforts. To consider this possibility, we evaluated genetic relationships of 450 Chub collected from mainstem and tributaries in Wyoming, Colorado, and Utah. We analyzed sequence variation across 2 mtDNA genes (842 bp) as a means of identifying genetic relationships reflecting deep history and relating these patterns with geomorphic features. Second, we examined genetic diversity across 16 fast-evolving microsatellite loci to test for contemporary connectivity and demographic independence among local populations. While small sample sizes from some sites limited statistical power, results suggest that management actions should strive to preserve local adaptations among populations and rely upon a drainage-specific focus for adaptive management.

0151 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Prosanta Chakrabarty, Caleb McMahan

Louisiana State University, Museum of Natural Science, Baton Rouge, Louisiana, USA

How Old are Cichlids?

Cichlids (Cichlidae) are well known for their diversity both in terms of their exceptional morphology and species richness but also for their notable distribution largely on former Gondwanan fragments. It is on the basis of this distribution and the pattern of their evolutionary relationships that has led some to conclude that cichlids originated on Gondwana prior to fragmentation of that ancient supercontinent. However, disparate dates for the age of cichlids and their subfamilies (viz., Cichlinae – from the Neotropics, Pseudocrenilabrinae – from Africa, Ptychochrominae - from Madagascar, and Etroplinae from India/Madagascar) have been recovered in recent years, with some finding ages far too young to support an ancient vicariant origin on Gondwana for these lineages. Here we show that these estimations are skewed by the use, or non-use, of cichlid fossils in analyses and we argue that these fossils are essential to estimating the age of the family. We also argue that other lines of evidence including the pattern of phylogenetic relationships, morphological evidence, and insights from the fossil record (e.g. modern advanced features present in morphology) should also be considered before falsifying a hypothesis of Gondwanan origin.

0153 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Prosanta Chakrabarty[1], Melanie Warren[1], Lawrence Page[2], Carole Baldwin[3]

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GenSeq: An Updated Nomenclature and Ranking for Genetic Sequences from Type and Non-type Sources

An improved and expanded nomenclature for genetic sequences is introduced that corresponds with a ranking of the reliability of the taxonomic identification of the source specimens. In the new nomenclature, genetic sequences are labeled "genseq," followed by a reliability ranking (e.g., 1 if the sequence is from a primary type), followed by the name of the genes from which the sequences were derived (e.g., genseq-1 16S, COI). The numbered suffix provides an indication of the likely reliability of taxonomic identification of the voucher. Included in this ranking system, in descending order of taxonomic reliability, are the following: sequences from primary types – "genseq-1," secondary types – "genseq-2," collection-vouchered topotypes – "genseq-3," collection-vouchered non-types – "genseq-4," and non-types that lack specimen vouchers but have photo vouchers – "genseq-5." We encourage authors to adopt the GenSeq nomenclature (note capital "G" and "S" when referring to the nomenclatural program) to provide a searchable tag (e.g., "genseq"; note lowercase "g" and "s" when referring to sequences) for genetic sequences from types and other vouchered specimens. Use of the new nomenclature and ranking system will improve integration of molecular phylogenetics and biological taxonomy and enhance the ability of researchers to assess the reliability of sequence data. We further encourage authors to update sequence information on databases such as GenBank whenever nomenclatural changes are made.

0163 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jordan Chaney[1], Rachel Hill[1], Julia Earl[3], Matthew Gray[1], Rebecca Wilkes[2], Debra Miller[2]

[1]Center for Wildlife Health, Knoxville, TN, USA, [2]University of Tennessee College of Veterinary Medicine, Knoxville, TN, USA, [3]National Institute for Mathematical and Biological Synthesis, Knoxville, TN, USA

Ranavirus Could Cause A Threatened Toad Species To Go Extinct.

Ranaviruses are known to infect and cause disease in common amphibian species such as the wood frog (*Lithobates sylvaticus*). However, there is increasing evidence that rare amphibians may also be affected negatively by this emerging pathogen. For example, Mississippi gopher frogs (*L. sevosus*) and Chinese giant salamanders (*Andrias davidianus*) are highly susceptible to ranavirus. Wild populations of the boreal toad (*Bufo boreas*) have been declining for over 20 years, and pathogens are believed to play a role. To date, no studies have been performed to explore the susceptibility of boreal toad tadpoles and metamorphs to ranavirus. Thus, we exposed boreal toad tadpoles and metamorphs to an environmentally relevant concentration (10^3 PFU/mL) of two *Frog Virus 3* (FV3)-like isolates (n = 20 tadpoles per isolate) in water and monitored survival for 28 days. Tadpoles began dying at five days post-exposure and 100% mortality and infection was documented after eight days for both isolates. Similarily during the metamorph stage, by day 5[R1] post-exposure, mortality and infection was 90% and 95% for both isolates. These results indicate that multiple life stages of the boreal toad are highly susceptible to ranavirus. Additionally, population-simulations of wood frogs exposed to ranavirus during the larval or metamorph stage, indicated extinction can occur as fast as 5 years, if exposed every year. Such models suggest that ranavirus infection can seriously impact the federally threatened boreal toad. Future pathogen surveillance and conservation planning should consider ranavirus as a threat to this species.

0385 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

Jordan Chaney[1], Patrick Reilly[2], Debra Miller[2], Rebecca Wilkes[2], Rachel Hill[1], Matthew Gray[1]

[1]University of Tennessee Center for Wildlife Health, Knoxville, TN, USA, [2]University of Tennessee College of Veterinary Medicine, Knoxville, TN, USA

Wood Frogs (*Lithobates sylvaticus*) May Function as Superspreaders of Ranavirus.

Superspreading occurs when <20% of infected individuals are responsible for >80% of transmission. High shedding or contact rates can contribute to superspreading. The

superspreading phenomenon has been identified among viruses such as HIV and SARS. Ranavirus is an emerging pathogen that has caused amphibian die-offs on five continents. Ranaviruses are known to infect and cause disease in common amphibian species such as the wood frog (*Lithobates sylvaticus*) and Cope's gray treefrog (*Hyla chrysoscelis*). It is unknown if certain amphibian species act as superspreading hosts, and thereby increase the probability of a ranavirus outbreak in an amphibian community. Given the rapid spread of ranavirus worldwide, and the rate at which these massive die-offs can occur, we hypothesized that certain species are capable of being superspreaders of ranavirus. To test this hypothesis, we exposed wood frog and gray treefrog tadpoles to an FV3-like ranavirus isolate. Thereafter, we introduced one exposed individual to ten unexposed individuals, survival was monitored for 14 days, and infection determined by qPCR. Our results showed that after five days, there was evidence that superspreading occurred in 20% of the wood frog tubs. After 14 days, superspreading was evident in all wood frog tubs. In comparison, there was no evidence of superspreading in the Cope's gray treefrog tubs. Our results suggest that the ability to transmit ranavirus differs among amphibian species. Additionally, wood frog tadpoles may amplify ranavirus in aquatic systems, and perhaps increase the likelihood of infection in other species.

0365 Conservation, Banquet Room F, Friday 1 August; ASIH STOYE AWARD CONSERVATION

Stephanie Chavez, Amanda Williard

UNC Wilmington, Wilmington, North Carolina, USA

Assessment of the Impact of Bycatch Reduction Devices on Diamondback Terrapin and Blue Crab Catch

The diamondback terrapin (*Malaclemys terrapin*) is listed as a species of special concern in North Carolina by the N.C. Wildlife Resources Commission. One of the prominent threats facing the diamondback terrapin is drowning in recreational and commercial crab pots. Small terrapins, i.e. males and juvenile terrapins, are more susceptible to being entrapped in crab pots which can cause a demographic shift in terrapin populations towards older females. Excluder devices have been shown to prevent terrapin mortality, but these devices face opposition from the fishing industry due to fears that they will decrease target species catch. The primary goal of the study was to examine the ability of bycatch reduction devices (BRD's) to exclude terrapins from crab pots without causing a reduction in blue crab catch. Forty standard commercial crab traps were modified with a four-foot tall chimney and strategically positioned in marsh areas of Bogue Sound and Masonboro Island, NC. Pots were deployed for 20 days and processed every other day during the summer of 2012 and 2013. Two dimensions of BRDs were addressed, a 2 in x

6 in and a 1.5 in x 6 in BRD. Over the course of this study, 6,077 blue crabs and 14 terrapins were captured. Only one terrapin was caught in a pot fitted with a BRD. Preliminary results show low terrapin captures and no significant difference between the total number of crabs caught in pots with BRDs versus control pots (P= 0.705; t= -0.397).

0408 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Barry Chernoff, Michelle Kraczowski, Julio Angel, Sinead Keogh, Abrial Meyer, Chloe Nash, Nicole Roman-Johnston

Wesleyan University, Middletown, CT, USA

Over the Falls: Population Differentiation of Blacknose and Longnose Dace, *Rhinichthys atratulus* and *R. cataractae,* in Connecticut

Populations of Blacknose and Longnose Dace, *Rhinichthys atratulus* and *R. cataractae*, were sampled in the Coginchaug River, Middlesex County, CT, above and below two waterfalls. Though the geologic structure is Eocene, the falls were established during the retreat from the last glacial maximum. Based upon varve chronology, this occurred between 22,500 and 21,500 years before present. Currently, both falls are approximately 10m high. One of the falls is in the mainstem of the Coginchaug River, while the other is on an independent tributary. Both falls act as a "leaky" barrier to gene flow. In this presentation, we test whether populations above and below the falls are distinct genetically. We expect, based upon the literature, that genetic diversity should be greater below the falls than above. We also investigate whether dace populations at the five localities are stable. To address these issues we resolved for *nd2* and a number of polymorphic microsatellite loci from individuals of both species. Bayesian, maximum likelihood and parsimony techniques as well as analyses of molecular variance (AMOVA) were used to test null hypotheses. The results show that there is significant differentiation above and below the falls. There are unique haplotypes and microsatellite alleles both above and below the falls. Results also show that populations are not necessarily stable but may be in serious decline.

0446 AES Morphology & Reproduction, Banquet Room E, Sunday 3 August 2014

Melisa Chierichetti[1], Lorena Scenna[1], Daniel Figueroa[1], Paola Ondarza[2], Karina Miglioranza[2], Edgardo Di Giácomo[3]

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Reproductive Biology of the Cockfish, *Callorhinchus callorynchus* (Holocephali: Callorhinchidae), in a Coastal Area off Argentina

The knowledge of reproductive parameters is needed to assess the status of the populations and to develop effective fisheries management plans. The cockfish, *Callorhinchus callorynchus*, is an oviparous species of chondrichthyans widely distributed in the Southwest Atlantic (23°-55° S). This species has come under increased fishing pressure on the Argentinean Continental Shelf (34º-55ºS), being an important resource for artisanal, commercial and recreational fisheries. However, the life-history characteristics of *C. callorynchus* have been only studied in the northern Patagonia (41º-42º S, 64-65ºW). Therefore, we investigated the reproductive biology of this species in coastal area of Argentinean Shelf (36º-37ºS) that supports a high fishing pressure on chondrichthyans. A total of 6 males (385-455 mm precaudal length, PCL) and 143 females (390-630 mm PCL) were collected from small-scale artisanal fishermen catch at depths lower than 50 m, during winter-spring from 2011 to 2013. Males had secondary sexual structures (frontal tenaculum and prepelvic claspers), which would be utilized during mating. The smallest mature female measured 410 mm PCL, whereas the largest immature one was 490 mm PCL. The length at 50% maturity in females was 465 mm, which corresponded to 74% PCL of the largest female sampled. There was no seasonal variation in average number of mature oocytes. Although the highest values of gonadosomatic and liver indices were recorded in October and November (spring), females with eggs cases in their uterus were not found in the study area, suggesting that it would be not a spawning zone for the species.

0223 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Banquet Room J, Friday 1 August 2014

Jacqueline Chivers, Craig Guyer

Auburn University, Auburn, AL, USA

Frequency and Geographic Location of Hybridization of the American Toad (*Anaxyrus americanus*), Fowler's Toad (*Anaxyrus fowleri*) and the Southern Toad (*Anaxyrus terrestris*) in Alabama Based on Morphological Traits

The American toad (*Anaxyrus americanus*), Fowler's toad (*Anaxyrus fowleri*) and the southern toad (*Anaxyrus terrestris*) hybridize, yet their frequency of hybridization is unknown in the state of Alabama. In this study we observed the frequency of hybridization among these species using morphological characteristics. We examined 1,024 preserved toads from Auburn University's Museum of Natural History and collected morphological data including body length, condition of the junction of the interorbital and postorbital crests, size of tibial warts, number of warts per dorsal dark spot, and contact of the postorbital crest with the parotoid gland for all three species. Location coordinates for each specimen were plotted on a map of Alabama to examine geographic range and areas of distribution overlap. The results showed 15.7% of *A. fowleri*, 66.4% of *A. americanus*, and 34.7% of *A. terrestris* specimens containing morphological evidence of hybridization. *Anaxyrus fowleri* had a higher frequency of hybridization with *A. terrestris* than with *A. americanus*. *Anaxyrus americanus* specimens exhibited a higher hybridization frequency with *A. terrestris* than with *A. fowleri*. *Anaxyrus terrestris* showed a higher hybridization frequency with *A. americanus* compared with *A. fowleri*. A 1.5% hybridization frequency was observed for specimens containing morphological characteristics of all three species. Morphological hybrids between *A. americanus* and *A. terrestris* occur mainly along the fall line where the species' geographic ranges meet. Morphological hybrids of *A. fowleri* occur without geographic limitations.

0659 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Kevin Chovanec

East Tennessee State University, Johnson City, TN, USA

Early Records of Fossil *Anolis* from the Oligocene and Miocene of Florida, USA

Paleokarst deposits from the Oligo-Miocene of northern Florida preserve undescribed herpetofaunal remains that fill important temporal and geographic gaps in our understanding of Cenozoic lizard evolution. Here I describe, associate, and discuss

isolated skeletal remains of *Anolis* from the Brooksville 2 (Oligocene; approximately 26-28 Ma) and Miller (Miocene; approximately 19 Ma) local faunas. The Brooksville 2 assemblage includes two species of anole. Both are abundant relative to other lizards from the site, and one is well represented by an informative suite of elements including dentaries, maxillae, frontals, prefrontals, a postorbital, and an exceptionally preserved braincase. Only a single species is known from Miller, but its presence suggests the continued occupation of extra-tropical latitudes by *Anolis* across the Oligocene/Miocene boundary. Importantly, all three fossil taxa bear little resemblance to members of the *A. carolinensis* subgroup. An alternative relationship is not proposed, highlighting the need for a better understanding of the skeletal morphology of basal mainland species. Specimens from Brooksville 2 predate the current oldest records of crown *Anolis* by 3-5 million years, and the sympatric occurrence of two congeners provides early evidence for their exceptional radiation. Anoles from both sites occur in the context of diverse squamate assemblages that are dominated by extralimital taxa. Such records complement recent studies of older, Eocene lizards by others and lend paleontological support to aspects of the Tropical Conservatism Hypothesis: lineages now confined to the tropics were present at higher latitudes when megathermal climates were more extensive.

0627 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Heather M. Christiansen[1], Nigel E. Hussey[1], Geremy Cliff[2,3], Sabine P Wintner[2,3], Sheldon F.J. Dudley[4], Aaron T. Fisk[1]

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Investigating Within and Among-individual Variation in the Trophic Ecology of the Marine Apex Predator White Shark, *Carcharodon carcharias*

Understanding a species' diet is important to elucidate its connectivity and role within food webs. Given the wide range of prey available to top predators, complex food web linkages often occur within populations confounding our understanding of their trophic roles. Moreover the occurrence of diet specialization or ecotypes within top predator species is likely common but to date has received only limited attention. White sharks (*Carcharodon carcharias*) are apex predators, with documented diet shifts with increasing size and consumption of a diverse prey base. To investigate variability in the diet of white sharks off southern Africa, we measured $\delta^{13}C$ and $\delta^{15}N$ values in tissues sampled from juvenile and sub-adult white sharks (200-300 cm total length, TL) that have defined habitat and migration patterns. Multiple tissue types with different turnover rates were

analyzed to provide insight into feeding behaviors over spatio-temporal scales. Among individual variation differed by tissue, with stable isotope values ranging by 3.2, 2.7, and 3.7‰ ($\delta^{13}C$) and 5.8, 2.2, and 3.0‰ ($\delta^{15}N$) for vertebrae, muscle, and fin tissues, respectively. Furthermore, vertebrae were sequentially sampled providing an indication of within individual changes in isotope values over ontogeny. Within individual variation was 1.0 ± 0.6‰ (range, 0.01-2.6‰) ($\delta^{13}C$) and 2.2 ± 1.0‰ (range, 0.01-4.7‰) ($\delta^{15}N$). These data indicate spatio-temporal variation in feeding behaviors (i.e., diet and habitat use) of and between individual white sharks. Data on the variable contributions of the main prey groups to juvenile/sub-adult white sharks will be presented as well as investigations of diet by sex.

0065 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

James Christiansen[1], Travis LaDuc[1], Margaret Stummer[2]

[1]Texas Memorial Museum, Austin, Texas, USA, [2]Castlerock Veterinary Clinic, Georgetown, Texas, USA

An Undescribed Shell Disease in the Yellow Mud Turtle, *Kinosternon flavescens*

Ulcerative inflammatory shell lesions have been described in several turtle species, including *Trachemys scripta* and *Pseudemys concinna*. We describe here a less inflammatory deteriorative shell condition from many individuals in a Chihuahuan Desert population of the yellow mud turtle, *Kinosternon flavescens.* While monitoring this population since 2006, we have watched the disease progress in individual turtles from a benign appearing origin to a disfiguring and potentially destructive disease. The condition begins with a scattering of enlarged pores, usually in recessed areas of the carapacal scutes, such as the winter portion of growth annulae, typically in turtles in their 6th – 11th year. Over the next two or three years, additional enlarged pores become obvious and slightly elevated rims appear around the older pores, sometimes connecting them. By the 14th year of life, after 6 or more years with the condition, the pores are no longer visible and the involved areas have become distinctly elevated and rough. Eventually portions of the elevated areas disappear, leaving exposed bone. In no instance have we observed redness, bleeding, puss, or lethargy in the involved turtle. Algae often cover the lesions throughout their development and may contribute to the condition. This disease is similar but not the same as one described in Iowa populations of *K. flavescens*.

0542 General Ichthyology II, Banquet Room G, Friday 1 August 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Todd R. Clardy, Eric J. Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Phylogenetic Systematics of the Prickleback Family Stichaeidae (Cottiformes: Zoarcoidei) Based on Morphological Data

The prickleback family Stichaeidae is a diverse group of small, elongate marine fishes distributed in intertidal and subtidal waters of the northern hemisphere. The family is one of nine in the Cottiformes suborder Zoarciodei and currently includes six subfamilies, 38 genera, and about 80 species. The systematics of Stichaeidae and their relatives remain unresolved due in part to a lack of fundamental morphological data. A systematic framework is necessary to address aspects of their biology such as the evolution their mechansosensory systems and biogeography. In this presentation, we present the results of a morphological phylogenetic analysis of Stichaeidae and their relatives. This analysis includes 60 taxa, representing 30 genera of Stichaeidae, all other zoarcoid families, several taxa from within Cottiformes, and additional, more-distant outgroup taxa. A total of 118 morphological characters from external and skeletal anatomy are included in the analysis. Analysis of this data matrix resulted in a single most-parsimonious tree of 705 steps (CI=0.184; RI=0.558). Although substantial homoplasy exists within this data matrix, Stichaeidae is not recovered as a monophyletic family, which is consistent with the results of recent molecular analyses. Only two subfamily units, Lumpeninae and Neozoarcinae, are recovered as monophyletic, and many non-stichaeid zoarcoid taxa are interspersed among "stichaeid" taxa; however, most clades are supported by only a few, homoplastic characters. This homoplasy is reflective of a general trend in Zoarciodei for reductive skeletal systems.

0433 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

David Clark[1], Caleb McMahan[1], Wilfredo Matamoros[2], Prosanta Chakrabarty[1]

[1]LSU Museum of Natural Science, Baton Rouge, LA, USA, [2]Universidad Nacional Autonoma de Mexico, Mexico City, Mexico

Intradrainage Body Shape Variation of the Tetra *Astyanax aeneus* (Characiformes: Characidae) in the Río Patuca, Honduras

The banded tetra, *Astyanax aeneus* (Characiformes: Characidae), occurs throughout Middle America from the Río Papaloapan in Mexico through Panama, including rivers along both the Atlantic and Pacific slopes. This species is common at localities

throughout its distribution, and high levels of morphological variation regarding body shape can be observed. The purpose of this project is to assess patterns of body shape variation of this tetra throughout a given river drainage. This analysis is an important step to get a better understanding of the geographic variation throughout the range of the species. The Río Patuca in the Honduran region of La Mosquitia is a large river in Middle America, and recent collection efforts throughout the entirety of this river have resulted in broad coverage of specimens of this species throughout the entire drainage. These collections will be used to examine fine-scale patterns of body shape changes relative to habitat along the entirety of the river in this morphologically variable tetra. The Río Patuca is also scheduled to undergo damning that will likely vary the landscape and alter habitat for the many species that live there.

0115 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Sharon F. Clemmensen, C. Darrin Hulsey

University of Tennessee, Knoxville, TN, USA

Morphological Convergence in Durophagous Heroine Cichlids

Trophic divergence in cichlid fish is linked to shifts in pharyngeal jaw morphology. For instance, in the Heroine cichlids of Central America, the ability to crush hard-shelled mollusks is a convergent phenotype with multiple evolutionary origins. These durophagous species often have very similar pharyngeal jaw morphologies associated with the pharyngeal jaw apparatus and some of these similarities could be due to phenotypically plastic responses to mechanical stress. We examined both bone and soft tissue differences between durophagous and non-durophagous Heroine cichlids and compared them to phenotypically plasticity morphologies induced through diet manipulations to determine the degree to which convergent morphologies in durophagous cichlids were likely due to phenotypic plasticity.

0356 Fish Systematics & Taxonomy II, Banquet Room G, Sunday 3 August 2014

Kean Clifford, Donald Stewart

SUNY Coll. Envir. Sci. & For., Syracuse, NY 13210, USA

Morphological Variation in the Bowfin (*Amia calva*), with a Review of Nominal Species: Conservation Implications

The genus *Amia* has been considered monotypic since 1896, when 12 nominal species were put in synonymy without analysis or rationale. To test that monotypy hypothesis, we analyzed morphological variation between two populations: 1) from Savannah River basin, South Carolina (~130 km W of type locality of *A. calva*), and 2) from Oswego River drainage, Central New York. We also examined all available type materials for *Amia* spp. Results revealed significant morphological differences between these populations; we reject the 118-year-old monotypy hypothesis. Several characters distinguish CNY bowfins from those in SC. 1) Relatively lower scale count across breast between pectoral-fin bases (14-20 in CNY vs. 20-26 in SC; $p<0.00001$; Mann-Whitney U-test), and between pelvic-fin bases (4-6 vs. 6-8; $p<0.01$); 2) Relatively lower lateral-line scale count (mode 65, 62-68 vs. mode 68, 66-70; $p<0.00001$); 3) Lower anal-fin ray count (mode 8, 7-9 vs. mode 10, 8-10; $p<0.00001$); 4) Lower pectoral-fin ray count (mode 16, 13-18 vs. mode 17, 15-18; $p<0.01$); 5) Less scale rows above (mode 8 vs. mode 9; $p<0.01$) and below lateral line (mode 11, 10-12 vs. mode 13, 12-15; $p<0.00001$); 6) Longer pectoral-fin length (mean 15.1 %SL vs. 13.8; $p<0.0001$; ANCOVA); 7) Narrower premaxillary tooth-row width (mean 5.8 %SL vs. 6.5; $p<0.001$); and 8) Pelvic fins extend beyond anus in CNY, but not in SC; $p<0.0001$). Resolving status of *Amia* sp. *incertae sedis* from CNY requires further evaluation of previously described species. Discovery of a second bowfin species raises new conservation concerns, given the developing bowfin caviar fishery.

0629 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR PHYSIOLOGY & MORPHOLOGY

Jonathan Clinger[1], Kevin Gribbins[2], Stanley Trauth[3], Cady Gannon[2]

[1]Austin Peay State University, Clarksville, TN, USA, [2]Wittenberg University, Springfield, OH, USA, [3]Arkansas State University, Jonesboro, AR, USA

The Ultrastructure of Spermatid Development within the Anole, *Anolis sagrei*

Most studies examining squamate sperm morphology have focused on the ultrastructure of spermatozoa, with few studies specifically detailing the developmental stages of spermiogenesis. In this study, testes of adult male Jamaican Anoles, *Anolis sagrei*, were analyzed using transmission electron microscopy to investigate the stages of

spermiogenesis in comparison with previously published spermatid development data within *Anolis carolinensis,* in order to identify if spermiogenesis is conserved within the family Polychrotidae. Spermiogenesis in *A. carolinenesis* and *A. sagrei* have similar ultrastructural features that follow the same general steps including acrosome development, nuclear condensation and elongation, and flagellar development. While much of spermiogenesis is conserved across the family Polychrotidae, there are some key morphological differences between *A. carolinenesis* and *A. sagrei*. During nuclear condensation and elongation there is less spiraling of the chromatin and during this stage of development smaller nuclear lacunae are observed within *A. sagrei* nuclei. Flagellar development also follows the typical stages found in amniotes but *A. sagrei* has a more round basal plate to its perforatorium. There are also numerous myelin figures present during acrosome granule formation, with an underdeveloped manchette, which is not observed at all in *A. carolinenesis* spermatids. Overall spermiogenesis in *A. sagrei* is similar to that of *A. carolinenesis,* with most morphological ontogenies being similar within this family and genus. Future studies will continue to focus on changes to spermatids at the early stages of spermiogenesis and more detailed analysis of the acrosomes within elongating spermatids to access their relevance in phylogenetic analysis.

0600 AES Behavior, Banquet Room E, Thursday 31 July 2014

Elizabeth Clingham[1], Judith Brown[1], Alistair Dove[2], John Tyminski[3], Robert Hueter[3]

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Observations and First Tagging of Whale Sharks off St. Helena in the South Atlantic

Much is yet unknown about the behavioural ecology and reproduction of the whale shark. An aggregation site for this species has been identified off St. Helena, a remote volcanic island in the South Atlantic Ocean about 3,100 km northwest of Cape Town, South Africa. A total of 286 whale shark sightings by government biologists, fishers and the public were recorded February 1999 - March 2014, with up to 17 sharks observed in a single sighting. Sharks ranged 4 to >10 m estimated total length and were of both sexes. Unlike other whale shark aggregations, this site comprises more females than males, with some of the larger females appearing pregnant. Mature males and juveniles of both sexes also are present. Active ram surface feeding has been observed and plankton analyses in the area reveal large numbers of fish eggs. Observations of pregnant females, possible mating and young juveniles in the area are consistent with the Mid-Ocean

Remote Pupping Hypothesis (MORPH) for this species. In January 2014, two possibly pregnant whale sharks were satellite-tagged, one with a floating SPOT5 and one with a PSAT. The SPOT5 remained attached for three weeks and revealed around-island movements and some offshore forays. The PSAT was programmed to report June 2014. With the opening of St. Helena's first airport scheduled for 2016, conservation measures to protect St. Helena's whale sharks are in development, given an expected sharp increase in ecotourism on the island.

0352 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Carl Cloyed, Perri Eason

University of Louisville, Louisville, KY, USA

Trophic Discrimination Factors and Turnover Rates of Carbon and Nitrogen Stable Isotopes in Adult Green Frogs, *Lithobates clamitans*

Stable isotope techniques are increasingly used in ecological studies of diet. Stable isotope analysis (SIA) is popular because it has advantages over traditional methods. However, several critical parameters are required to accurately use SIA. First, trophic discrimination factors (TDF), which are the difference of isotope values between resources and consumers, must be used to model the proportion of different resources in a consumer's diet. Second, turnover rates vary among tissues both within a consumer and among taxonomic groups. We conducted a controlled feeding experiment on *Lithobates clamitans* to determine TDFs and turnover rates in skin, whole blood, and bone collagen. These tissues can be obtained from many species without serious harm. We collected frogs in central Kentucky that had an average $\delta^{13}C$ of -24.8 and $\delta^{15}N$ of 4.3. In the lab they were fed a diet of 2 crickets a day, which had an average $\delta^{13}C$ of –20.4 and $\delta^{15}N$ of 4.6. Frogs were sampled on day 0 (day of capture), and days 4, 8, 16, 32, 64, 128, and 256 after being switched to the new diet. Trophic discrimination factors of carbon and nitrogen in skin were 0.1 (SD=0.374) and 2.28 (0.508), respectively. In whole blood, TDFs for carbon were 0.5 (0.476) and for nitrogen were 2.25 (0.444). Frog skin reached equilibrium on the new diet in 90 days, whole blood in 160 days, and bone collagen in 256. These three tissues together offer an excellent means to investigate anuran diets at different time frames.

0354 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Carl Cloyed, Perri Eason

University of Louisville, Louisville, KY, USA

Using Stomach Content Analysis and Stable Isotope Analysis to Describe Adult Anuran Diets

Although diet can be examined by traditional methods such as stomach content analysis or direct observation, ecological studies on diets increasingly use stable isotope analysis (SIA). SIA has several advantages, as it assesses only diet items that were absorbed into the body, incorporates diet information over various periods of time, and allows us to more easily test individuals' responses to ecological changes. In this study, we used stomach content analysis (SCA) along with SIA to determine the diets of five frog and toad species: *Lithobates catesbeianus, L. clamitans, L. sphenocephalus, Anaxyrus americanus,* and *A. fowleri*. Contrary to other studies, we found it impossible to divide prey groups the same way with both methods of diet analysis. SIA determined prey groups best by dividing them by trophic level and habitat type (terrestrial or aquatic), and between flying and non-flying carnivorous prey. In SCA, we often could not identify the trophic levels of prey items. SCA was best at determining the order and sometimes family of prey groups. Prey groups in SCA were Orthopterans, Coleopterans, ants, miscellaneous flying arthropods and miscellaneous non-flying arthropods. In SIA, we could not differentiate between flying and non-flying terrestrial, herbivorous prey, and in SCA we could not differentiate between trophic levels of flying vs. non-flying prey items. Although the two methods were not completely comparable because the prey groupings were not the same, the two methods complemented each other and offered a more comprehensive view of the anuran diets.

0320 Herp Biogeography & Phylogeography, Banquet Room J, Sunday 3 August 2014

Kerry Cobb[1], Cameron Siler[2], Arvin Diesmos[3], Rafe Brown[1]

[1]University of Kansas, Lawrence, Kansas, USA, [2]University of Oklahoma, Norman, Oklahoma, USA, [3]Philippine National Museum, Manila, The Philippines

Cryptic Diversity in a Widespread Island Archipelago Forest Frog

We utilized a multilocus phylogeny to investigate lineage divergence and population structure in the cryptic and widespread endemic Philippine frog *Platymantis corrugatus*. Recent studies of other widespread Philippine species have revealed previously

unrecognized species diversity across this archipelago. Although color pattern and adult body size vary across the range of the *P. corrugatus*, diagnostic characters have not been identified for distinguishing allopatric populations, which has complicated efforts to evaluate species boundaries. Our phylogeny, based on one mitochondrial gene and three nuclear loci, was estimated using Bayesian and maximum likelihood methods. Sampling from across the full range of this complex reveals widely divergent lineages within this taxon, suggesting the possibility of multiple undescribed species. Putative species boundaries correspond to previously observed biogeographical patterns which, have been related in other taxa to Pleistocene sea level fluctuations. Our results highlight the necessity for continued study of this region's fauna, which is imperative for adequate and informed conservation efforts.

0318 General Ichthyology, Banquet Room G, Sunday 3 August 2014

Phil Cochran[1], Scott Malotka[1], Daragh Deegan[2]

[1]Saint Mary's University of Minnesota, Winona, Minnesota, USA, [2]City of Elkhart Public Works and Utilities, Elkhart, Indiana, USA

Biology of Chestnut Lampreys (*Ichthyomyzon castaneus*) in the St. Joseph River Drainage in Northern Indiana

This study was initiated in response to concern about parasitism by lampreys on trout in the Little Elkhart River of the St. Joseph River drainage in northern Indiana. Identification of 229 lampreys collected by the City of Elkhart Public Works and Utilities during the period 1998-2012 in the St. Joseph River drainage revealed 52 American brook lampreys (*Lethenteron appendix*), one northern brook lamprey (*Ichthyomyzon fossor*), 131 adult chestnut lampreys (*I. castaneus*), four possible adult silver lampreys (*Ichthyomyzon unicuspis*), and 41 *Ichthyomyzon* ammocoetes. Electrofishing surveys in the Little Elkhart River in August 2013 indicated that attached chestnut lampreys and lamprey marks were most common on the larger fishes at each of three sites, including trout, suckers, and carp. This is consistent with the known tendency for parasitic lampreys to select larger hosts. Compared to the St. Croix River drainage in Wisconsin, trout in the Little Elkhart River and other tributaries to eastern Lake Michigan may be relatively more vulnerable to lamprey attacks because they are relatively large compared to alternative hosts, such as suckers. Management to increase abundance of redhorse or other large suckers might reduce lamprey parasitism on trout. Plots of chestnut lamprey total length versus date of capture are similar for the St. Joseph and St. Croix drainages, but both reveal substantial variability on any given date. This may be due to variability among individual streams and individual years and may also result from variability among individual lampreys in when they initiate and terminate parasitic feeding.

0311 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Michael Colley[1], Stephen Lougheed[2], Kenton Otterbein[3], Jacqueline Litzgus[1]

[1]Laurentian University, Sudbury, Ontario, Canada, [2]Queens University, Kingston, Ontario, Canada, [3]Killbear Provincial Park, Nobel, Ontario, Canada

The Impacts of Road Mortality Mitigation on the Population Ecology of *Sistrurus catenatus* in Killbear Provincial Park

Reducing road mortality is essential to reptile conservation. The Georgian Bay, Ontario population of the Eastern massasauga rattlesnake (*Sistrurus catenatus*) is designated as Threatened by COSEWIC, in part because of high road mortality. Killbear Provincial Park has taken steps to reduce reptile road mortality through construction of 4 ecopassages and barrier fencing along 3 busy park roads. Although ecopassages have been widely recommended, their effectiveness has rarely been evaluated. Our goal is to study the efficacy of fencing and ecopassages and to determine their impact on local Massasauga population viability. Park roads will be monitored twice daily on bicycles, and again at night by car to document locations of both living and dead Massasaugas. Spring, summer and fall surveys will create a subpopulation of PIT-tagged snakes. Automated PIT tag readers and trail cameras installed at each ecopassage will record snake activity. To further explore the effectiveness of the ecopassages a "willingness to utilize" experiment will be conducted. Information collected will augment the park's long-term database (1992-present), which includes mortality rates and locations of dead and live captures on roads, campgrounds and along fences. Population viability modeling will predict the demographic requirements for this species' survival, determine current status, and provide a relative estimate of the effect of road mortality on the long-term viability of Killbear's Massasauga population. Ultimately, this project will provide a template for construction of similar ecopassages in other key locations where road mortality is prevalent.

0244 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Rupert A. Collins, Emanuell Duarte Ribeiro, Valéria Nogueira Machado, Tomas Hrbek, Izeni P. Farias

Universidade Federal do Amazonas, Manaus, Amazonas, Brazil

A Preliminary Inventory of the Catfishes of the Lower Rio Nhamundá, Brazil, with the Description of a New Species of *Pseudolithoxus* Isbrücker and Werner (Siluriformes, Loricariidae)

The Rio Nhamundá is a poorly-known clearwater river draining the southern Guiana Shield of Brazil. In this study we report the findings of a preliminary ichthyological survey of the river, focusing here on catfishes (Siluriformes). We identify a total of 32 species (seven families) from the river, and include four species already known from museum collections. One suckermouth catfish species (Loricariidae, *Pseudolithoxus* sp. n.) collected on the survey we describe as new, and can be distinguished from its congeners on the basis of unique colour pattern: body with large pale spots on a dark background (versus bars in *P. kelsorum* and *P. tigris*; large dark spots on a pale background in *P. dumus*; and small white dots on a black background in *P. nicoi* and *P. anthrax*). This species represents the first *Pseudolithoxus* from the Amazon basin of Brazil. Overall, our survey results show that even rapid surveys can provide important information on Amazon fish biodiversity, providing a new species description, range extensions for many species, and additionally highlighting taxa in need of taxonomic revision and genetic study. As well as the traditional forms of data collected on biodiversity surveys (i.e. preserved specimen vouchers), our study also provides "new" types of data in the form of DNA barcodes and images of live colour pattern, information which will be invaluable in future studies addressing those difficult groups.

0392 Fish Ecology I, Banquet Room F, Saturday 2 August 2014

Michael Collyer

Western Kentucky University, Bowling Green, KY, USA

Sexual Dimorphism of a Pupfish Species in Varied Sinkhole Fish Communities

Evolutionary ecologists frequently question whether replicated ecologies inspire parallel evolutionary divergence among fish populations. Such studies often examine whether different populations or different taxa exhibit consistent differences in phenotypes between e.g., predator and anti-predator, or competitor and anti-competitor environments. Such studies do not usually consider whether males and females have

the same ecological function in different environments, or whether disparity in ecological function influences sexual dimorphism. For example, pupfishes in the genus, *Cyprinodon*, are often sexually dimorphic. Different ecological niches might influence sexual dimorphism, as males often defend breeding territories, whereas females have more errant feeding and breeding behaviors. Males tend to be more laterally compressed; females tend to be more streamlined in body shape. It has been hypothesized that strong natural selection could mitigate sexual dimorphism, especially if fish occur in saline habitats, where salinity would favor streamlining in males as well as females. We analyzed body shape in four sinkhole populations of Pecos pupfish (*C. pecosensis*) using geometric morphometric methods and phenotypic trajectory analysis. Sinkhole populations varied in salinity and co-occurring species. We found that sexual dimorphism tended to be parallel among populations, but that the amount of dimorphism was inversely related to the number of co-occurring species, more so than salinity. It appears that sexual dimorphism was exacerbated by character release, which would help explain the great morphological diversity and sexual dimorphism within *Cyprinodon*, as many species evolved in allopatry.

0778 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Timothy J. Colston, Brice P. Noonan, Colin R. Jackson

University of Mississippi, University, Mississippi, USA

Phylogenetic Analysis of Bacterial Communities in Different Regions of the Gastrointestinal Tract of *Agkistrodon piscivorus*, the Cottonmouth Snake

Vertebrates are metagenomic organisms in that they are composed not only of their own genes but also those of their associated microbial cells. The majority of these associated microorganisms are found in the gut-intestinal tract and presumably assist in processes such as energy and nutrient acquisition. Few studies have investigated the associated gut bacterial communities of non-mammalian vertebrates, and most rely on captive animals and/or fecal samples only. Here we investigate the gut bacterial community composition of a squamate reptile, the cottonmouth snake, *Agkistrodon piscivorus* through 454 pyrosequencing of the bacterial16S rRNA gene. We characterize the bacterial communities present in the small intestine, large intestine and cloaca. Sequence analysis and phylogenetic reconstruction revealed distinct bacterial communities in each gut-intestinal region. Many bacterial phylotypes present were consistent with other vertebrate gut community studies, but we also recovered unexpected phylotypes, perhaps unique to squamate reptile gut bacterial communities. No clear trends in bacterial community richness based on gut region were apparent, but there were significant differences in community composition between regions. Additionally we show the utility of using cloacal swabs as a method for sampling snake gut bacterial

communities.

0708 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Grant Connette, Raymond Semlitsch

University of Missouri, Columbia, Missouri, USA

Historic Timber Harvest Predicts Abundance but Not Genetic Diversity of a Terrestrial Salamander, *Plethodon shermani*.

Species occupancy or abundance are common metrics for assessing the health of plant and animal populations, yet conservation efforts increasingly recognize the importance of preserving the genetic diversity of organisms. Concern over the progressive loss of genetic diversity from repeated over-harvesting has led many studies to examine the genetic consequences of human resource use such as fisheries and forest management. Terrestrial salamanders are important ecological components of many forest ecosystems and may experience population declines following timber harvest which persist for decades. We combined repeated point count surveys with genetic sampling across a 4 x 5 km landscape in the Nantahala Mountains of North Carolina in order to identify the effects of historic timber harvest on current patterns of species abundance and genetic diversity. We found that abundance of both stream-breeding (*Desmognathus ocoee* and *Eurycea wilderae*) and terrestrial-breeding salamanders (*Plethodon shermani*) is positively related to forest stand age. Furthermore, the abundance of stream-breeding species was negatively related with distance from adjacent forest in young timber stands, suggesting the role of immigration in the recovery of these species. In spite of the apparent movement limitation of *P. shermani*, we found no clear effects of past timber harvest on genetic diversity. It is possible that large population sizes and relatively modest declines after timber harvest make these populations resistant to genetic bottleneck events. These results improve our understanding of the landscape ecology of terrestrial salamanders and may inform future forest management strategies.

0141 General Herpetology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD GENERAL HERPETOLOGY

Andy Connolly, Larry Martin, Stephen Hasiotis

University of Kansas, Lawrence, Kansas, USA

Positive Correlation Between Parietal Foramen Size and Latitudinal Distribution in Iguanids (Squamata: Iguanidae)

Iguanids use their parietal eye (PE) to orient themselves using the sun's polarized light; however, there is still debate whether or not the PE is also used to regulate body temperature and maintain circadian rhythms. Lizards may have used their PE for circadian rhythms by gauging daily sunlight absorption through the production of melatonin. Lizards found at or near the equator (<10 degrees latitude) are less likely to have a PE than those living more than 10 degrees from the equator. We tested the circadian rhythm hypothesis by measuring the parietal foramen (PF) size in Iguanids collected between 0 to 40 degrees latitude. We found a positive correlation of PF size relative to latitudinal distribution; some equatorial specimens did not possess a PF at all. This may result from selective pressure due to the more extreme variation of day length at high latitudes compared to low latitudes; this supports the circadian rhythm function of the PE. These results may also be important in paleontological research because the PF is preserved in the fossil record. There are several broad vertebrate groups to test this hypothesis on, including therapsids, plesiosaurs, and mosasaurs. Analyzing these animals could elucidate why some vertebrates still retain the PE, such as lizards, while others, such as mammals, eventually lost it.

0758 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Kevin W. Conway[1], Philip Hastings[2], Dae-Min Kim[1], Hector Espinosa-Perez[3], Lukas Ruber[4]

[1]Texas A&M, College Station, TX, USA, [2]SCRIPPS, La Jolla, CA, USA, [3]Instituto de Biología, UNAM, Copilco, Coyoacán, Mexico, [4]Naturhistorisches Museum der Burgergemeinde Bern, Bern, Switzerland

Is *Pherallodiscus* Briggs a Junior Synonym of *Gobiesox* Lacepède?

In his monographic treatment of the clingfishes, Briggs established the genus *Pherallodiscus* (type species *Gobiesox funebris* Gilbert) for two species of eastern Pacific clingfishes found along the coast of Mexico. The two species of *Pherallodiscus* (*P. funebris* and *P. varius*) are strikingly similar to members of the genus *Gobiesox* (differing only in the arrangement of adhesive disc papillae) and the two genera were considered by Briggs to be closely related. As part of an ongoing molecular phylogenetic investigation

of *Gobiesox* (and other New World genera of clingfishes) we have discovered a sister group relationship between *P. funebris* (type species of *Pherallodiscus*) and a clade of *Gobiesox* comprised of *G. adustus*, *G. pinniger* and *G. strumosus*. Together these four taxa form the sister group to all other species of *Gobiesox* included in our data set, suggesting that *Gobiesox* (as currently recognized) may be paraphyletic. We utilize a number of different approaches (testing of alternative hypotheses, phylogenetic networks and SAMS) to further scrutinize the phylogenetic position of *P. funebris* and present our findings.

0416 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Stephen Corn

US Geological Suvey, Aldo Leopold Wilderness Research Institute, Missoula, MT, USA

Can Amphibian Distributions Respond to Rapid Climate Change?

A primary concern about the effects of climate change is whether organisms will be able to respond by altering their distributions. This question is particularly relevant to amphibians, because most species have relatively low vagility and many life history parameters are directly tied to the physical environment. Several disparate lines of evidence suggest that montane amphibians especially may have dynamic distributions. A long-term demographic study of Columbia spotted frogs (*Rana luteiventris*) in Montana found higher survivorship in years with low winter snowpack. However, a historical reconstruction of snow conditions indicates that the magnitude of reduced snowpack in the late 20th century is unique over the last millennium. These observations raise the question of how long amphibians have occupied high-elevation habitats, with the snow data suggesting that these populations might have been established only within the last 100 years. A test of this hypothesis would provide insight into the dynamics of amphibian distributions at environmentally-determined limits and how species may respond to rapid climate change.

0110 AES Genetics, Genomics, & Systematics, Banquet Room E, Saturday 2 August 2014

Shannon Corrigan[1], Lei Yang[1], Chenhong Li[4], Nico Straube[1], Peter Last[3], Will White[3], Lindsay Marshall[6], Jason Davies[1], John Maisey[5], Michi Hofreiter[2], Gavin Naylor[1]

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The Chondrichthyan Tree of Life Project

The Chondrichthyan Tree of Life Project is a five year, multi-disciplinary, multi-institutional project funded by the U.S. National Science Foundation. Its mission is to document both extant and extinct chondrichthyan diversity and to provide an evolutionary framework for the interpretation of variation within the group. There are four components to the project (A) An up-to-date taxonomic accounting of all extant species including scientific illustrations for each species (B) An estimate of evolutionary relationships based on comparisons of DNA sequences and skeletal anatomy (C) Up-to-date range maps for all described extant species (D) CT scans for representatives of the major lineages for comparative anatomy. In pursuing the project, we have developed a targeted DNA hybridisation sequence capture protocol that allows high throughput DNA sequencing of ~ 1000 nuclear exons and their associated introns for use in phylogenetics and population genetics, technology for the interactive display of geographic range information, technology for the interactive display of comparative anatomy over the world wide web. This presentation will provide an overview of each of these components as well as present some noteworthy results that have emerged from each component of the project thus far.

0743 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Charles F. Cotton[1], R. Dean Grubbs[1], Shannon C. Rolfe[2], Austin Heil[1]

[1]Florida State University Coastal and Marine Lab, St. Teresa, FL, USA, [2]University of Central Florida, Orlando, FL, USA

Life History Characteristics of Two Common Deep-Water Dogfishes (*Squalus cubensis* and *S.* cf. *mitsukurii*) from the Northern Gulf of Mexico

More than half of all identified shark species reside in deep waters (> 200 m), yet little is known about their life histories due to low fisheries reporting and a paucity of scientific sampling in the deep ocean. In conjunction with a project to examine the ecological effects of the 2010 Deepwater Horizon oil spill (Deep-C; www.deep-c.org), sharks were collected near Desoto Canyon in the northern Gulf of Mexico using demersal longlines in depths of 191 to 2,645 m. Reproductive tracts from 162 *Squalus cubensis* and 117 *S.* cf. *mitsukurii* were collected to determine reproductive parameters (e.g. fecundity, embryonic sex ratio, size-at-maturity) and growth model parameters (e.g. theoretical asymptotic size (L_{inf}), the growth rate constant (k), age-at-maturity). Sexual maturity for males was determined by degree of clasper calcification and vas deferens coiling. Additionally, the inner and outer clasper lengths were measured. In females, maturity was determined by uterine expansion or presence of embryos. The diameter of the largest oocyte was measured to characterize the ovarian cycle and any visible embryos were counted, sexed and measured. Length-based maturity ogives will be constructed to determine sex-specific size at maturity. Fecundity and seasonality of mating was determined for each species and the relationship of maternal size to fecundity was investigated. Sharks were aged by counting growth bands deposited on the enamel caps of both dorsal finspines and growth will be modeled using multiple length-at-age models. These results will inform life history models and fisheries managers in countries currently exploiting these poorly-studied species.

0578 NIA, Banquet Room F, Sunday 3 August 2014

Cristina Cox Fernandes[1], Adília Nogueira[2], Andrew Williston[3], José Alves-Gomes[2]

[1]University of Massachusetts, Amherst, MA, USA, [2]Instituto Nacional de Pesquisas da Amazônia, Manaus, AM, Brazil, [3]Harvard University, Boston, MA, USA

Diversity of *Microsternarchus* (Gymnotiformes, Hypopomidae) from Negro River Basin

The South American hypopomid electric fish tribe Microsternarchini includes three small species from the Upper Orinoco and Negro rivers. These are placed in monotypic

genera: *Microsternarchus*, Fernández-Yépez 1968, *Racenisia*, Mago-Leccia 1994, and *Procerusternarchus* Cox Fernandes, Nogueira and Alves-Gomes 2014. Recent collections from tributaries in Rio Negro have produced new specimens of *Microsternarchus* and *Racenisia*. A recent molecular study (Maia and Alves-Gomes, 2012) suggests that within these genera, multiple divergent lineages are present. Here we compare specimens from these new collections of *Microsternarchus* from Negro river to Mago's (1994) redescription of *Microsternarchus bilineatus*, and the original description by Fernandez-Yepes (1968). The holotype of *Microsternarchus* is apparently lost. We have examined specimens identified by Mago and we suspect that more than one morphotype is included in this species. To complicate matters, *Microsternarchus* is usually diagnosed by characteristics also present in the other two genera. External morphologies of this genus are quite similar, except for slight variations in the position of the mouth. We used cleared and stained specimens, X-ray computed tomography and X-radiography to determine meristic and morphometric features, and to illustrate the bony skeleton of *Microsternarchus* from Brazil and Venezuela rivers. Morphological variations include the ventral ethmoids and different shapes of the maxillae, dentaries and metapterygoids.

0660 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Jack Craig

UL Lafayette, Lafayette, Louisiana, USA

Community Phylogenetics Illuminates the Origin of the Fitzcarrald Fish Fauna, Peruvian Amazon

The Fitzcarrald region in Southwestern Amazonia is home to a diverse fish fauna spread unevenly across four river basins: Purus, Jurua, Ucayali and Upper Madeira. As with most portions of the Neotropical ichthyofauna, the ecological and evolutionary processes that affect species composition in each of these basins remains unclear. This study examines two hypotheses, that the basin-wide assemblages are either niche or dispersal assembled. Here we present results of three analyses, using distinct datasets and methodologies. Community ecology assesses beta diversity measures, phylogeography assesses genetic structuring at the population level, and community phylogenetics assesses the degree to which assemblages are formed from species with similar evolutionary histories. Beta diversity (species turnover among basins) is correlated with Euclidian (map) distance, but not floodplain distance, suggesting a role for stream capture as a filter on small-bodied terra firme specialists, but not for large-bodied floodplain and river channel specialists. Phylogeographic analysis of two mitochondrial genes recovered a common pattern in which there is a basal split between populations in the Madeira vs. other Amazonian basins, but only for small-bodied terra

firme species. Community phylogenetics suggests a lack of phylogenetic clustering of species among river basins, but the presence of phylogenetic clustering among habitat types, suggesting habitat filtering. Taken together, these results suggest that the four distinct basin faunas in the Fitzcarrald region are largely dispersal assembled, and that stream capture poses a ecological filter for terra firme stream species, but not larger river channel species.

0464 Fish Systematics & Taxonomy III, Banquet Room G, Sunday 3 August 2014

Matthew Craig[1], Elizabeth Smith[1], John Hyde[2], Larry Allen[3]

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How Many Species of Wreckfishes (Genus *Polyprion*) are There?

The wreckfish genus *Polyprion* currently comprises two species: *P. americanus* and *P. oxygeneios*. With a circumglobal distribution, and despite the no less than eight nominal species that have been placed in its synonomy, *P. americanus* is currently considered the only valid species. Preliminary genetic and morphological analyses suggested that *P. americanus* is not, in fact, a single, widely distributed species, but rather at least two (and possibly more) species. In the current study we apply additional genetic data to create a molecular phylogenetic hypothesis for the genus *Polyprion* in an attempt to clarify the number of species represented.

0686 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

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Phylogeny, Biogeography, and Electric Signal Diversification in the Neotropical Electric Knifefish Genus *Brachyhypopomus*

The weakly electric "bluntnose knifefish" genus *Brachyhypopomus* (Gymnotiformes) occurs in lowland tropical and subtropical freshwater habitats from southern Costa Rica to Uruguay. We recently completed a taxonomic revision of the *Brachyhypopomus*, which will increase the number of species from 13 to 28. We also generated a species-level phylogenetic reconstruction based on both morphological (60 characters) and molecular data (ca. 1100 bp from the mitochondrial cyt-b gene, and ca. 1200 bp from the nuclear rag2 gene). Here we summarize, in a biogeographic and phylogenetic context, patterns of electric signal diversity in the genus. We assessed species distributions based on the examination of 11,868 specimens from 2,754 museum lots and used these to define areas of geographical allopatry and sympatric overlap for sister species pairs. Based on head-to-tail recordings of the electric organ discharge (EOD) waveforms of 27 of the 28 species, we determined that sister species which co-occur in sympatry over large parts of their range exhibit substantial divergence in EOD waveform in comparison to allopatric sister species pairs. This pattern supports the hypothesis that reproductive interference may drive EOD waveform divergence and contribute to speciation in electric fishes.

0157 SSAR SEIBERT CONSERVATION AWARD, Banquet Room J, Friday 1 August 2014

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Does Pride Work? Evaluating an NGO's Integrative Model for Promoting Community Conservation Behavior

To reduce anthropogenic threats to biodiversity, several models have been developed for promoting human behavior change, which have yielded limited success. An international conservation non-government organization (Rare) has targeted such

threats with a novel approach using community-based social marketing, known as Pride campaigns. Pride operates under an integrative model, the Theory of Change (ToC), designed to progressively influence several psycho-social components leading to conservation behaviors. However, the effectiveness of this approach has not been empirically tested. We conducted a meta-analysis of 84 in-house studies that measured changes in ToC components to 1) estimate Pride campaigns' effects on conservation behavior and its antecedents as reported by communities in before-after surveys and 2) determine the relationships among components and assess this model's ability to predict behavior change relative to alternative models. Overall, we estimated significant mean increases in pro-environmental outcomes for all ToC components during Pride campaigns, including an 18.1 percentage point increase in the targeted behavior. Results from path analyses showed that the model containing all ToC components performed best relative to other models at predicting behavior change (71% explained variance). Behavior intention had a significant, positive, and direct effect on behavior change and mediated the influence of all other components. Pro-environmental knowledge and attitudes were insufficient at predicting behavior change without also including interpersonal communication in the model. Our results support that Pride's approach can effectively produce conservation behavior change related to localized anthropogenic threats and highlight the importance of behavioral antecedents that could be targeted by social marketing activities.

0093 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; AES CARRIER AWARD

Callie Crawford[1], Christian Canstein[2], Gavin Naylor[1]

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CT Scanning Chondrichthyans: No Bones About It

Computed Tomography (CT) imaging is a nondestructive method for viewing internal structures of extant and fossilized specimens. Once CT scan data is acquired, reconstruction programs can be used to manually segment the data into constituent skeletal structures, creating 3-Dimensional representations of the structures which can then be viewed digitally or printed in 3D. The quality and ease of segmentation is tightly tied to the visible contrast between study structures and other tissues in the organism. In most groups of vertebrate organisms, skeletal structures are made of calcified bone which has high radio-opacity, leading to greater contrast between the skeleton and soft tissues. Chondrichthyans (sharks, skates, rays, and chimaeras), by comparison, have skeletons composed of cartilage which is much less radio-opaque than bone, resulting in lower contrast with surrounding tissues. Settings within the CT

scanners and the type of scanner can make a large difference in the quality of the scan data. Better scan data will result in more accurate reconstructions of the skeletal anatomy. We will explore the difficulties inherent in CT scanning and segmenting cartilaginous skeletal structures in Chondrichthyan fishes and discuss the differences in single source and dual source Siemens CT Scanning.

0094 General Ichthyology II, Banquet Room G, Friday 1 August 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Callie Crawford[1], Amy Balanoff[2], John Denton[2], John Maisey[2], Gavin Naylor[1]

[1]College of Charleston, Charleston, SC, USA, [2]American Museum of Natural History, New York, NY, USA

Anatomical Characters as Ornaments on the Chondrichthyan Tree of Life

Despite over 150 years of study, the phylogenetic relationships among Chondrichthyan fishes remain poorly understood. Estimates of these relationships vary greatly depending on the tools used to develop the phylogenies. Two schemes have garnered a lot of attention: a traditional view of sharks and rays being reciprocally monophyletic sister taxa and the Hypnosqualean relationship developed by Shigaru Shirai which suggests batoids arose from within the Squalean lineage. The relationship suggesting reciprocal monophyly is supported by multiple data sets including molecular data whereas the Hypnosqualean relationship is based solely on anatomical variation. Taxon sampling in past evaluations for both hypotheses has been notably unbalanced among lower classifications within the major lineages. Shirai mostly detailed the Squalean lineage, only exploring a few families of Galeomorphs and batoids and molecular work has mostly focussed on the major lineages. Recent technological advances have allowed us to examine a broader coverage of Chondrichthyan diversity. We use Computed Tomography (CT) imaging to evaluate skeletal anatomy at the family level for extant Chondrichthyans. CT scans of Chondrichthyan fishes were segmented for the Chondrichthyan Tree of Life Project, developing digital representations of the skeletal anatomy. I will present anatomical findings in light of competing phylogenetic hypotheses which have been previously proposed as well as some character distributions that suggest novel relationships.

0424 Ecology & Ethology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Dan Crear[1], Dan Lawson[2], Jeff Seminoff[3], Tomo Eguchi[3], Robin LeRoux[3], Chris Lowe[1]

[1]California State University Long Beach, Long Beach, CA, USA, [2]Southwest Regional Office, National Marine Fisheries Service, Long Beach, CA, USA, [3]Southwest Fisheries Science Center, National Marine Fisheries, San Diego, CA, USA

Seasonal Shifts in the Distribution of Green Sea Turtles (*Chelonia mydas*) within Anthropogenically-Altered Water Temperatures

Anthropogenic influence on coastal thermal conditions has the potential to affect the behavior of the endangered East Pacific green sea turtle (*Chelonia mydas;* GST), allowing them to occupy their most northern range year-round. It is hypothesized that warm water effluent from coastal power plants along the San Gabriel River, Long Beach, CA and neighboring Anaheim Bay Estuary, Seal Beach, CA, have created a suitable habitat for GSTs. Due to power plant effluent, temperatures within the river have varied up to 20°C in one month, ultimately affecting GST movements. To date, 18 GSTs have been tracked using passive acoustic telemetry between the two sites. Sixty-five percent of tagged individuals have not left the river to date, while the turtles that did leave the river returned in less than a day. Average weekly presence was highest in the warmest zone of the river during both summer (26.1±0.3°C) and winter (18.0±0.2°C). Within the river habitat, water temperature, location, and month explained 83% of variability in turtle presence, whereas just location and month alone explained 70% of variability in presence, suggesting temperature has a strong influence on turtle movement and distribution. In addition, all tagged turtles in the neighboring estuary moved into the river once temperatures dropped below approximately 15°C during the winter. Preliminary data suggests that the river may act as a thermal refuge for GSTs, allowing them to inhabit this area year-round.

0343 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

Alison Cree

University of Otago, Dunedin, New Zealand

The Challenges of an Evolutionary Relict: Reproductive Biology of the Tuatara

Phylogenetic relicts pose challenges for understanding evolutionary history. The tuatara (*Sphenodon punctatus*) is a phylogenetic relict in the evolutionary history of lepidosaurs. Tuatara are the last representatives of Rhynchocephalia, the lineage placed by

morphological and molecular analyses as the sister group to squamates. Rhynchocephalians and squamates last shared a common ancestor about 250 million years ago. Although several dozen species of rhynchocephalians have been described, apparently all but the lineage leading to tuatara were extinct before the end of the Mesozoic 65 million years ago. Contrary to some 20th century views, the tuatara is a derived rhynchocephalian and cannot be viewed as ancestral to squamates. In its reproductive anatomy, the egg-laying tuatara shares some features with squamates such as a transverse vent and the lack of an obvious albumen-producing region of the oviduct, whereas some features such as a single-layered ovarian granulosa without pyriform cells and aspects of sperm structure are shared with crocodilians and turtles. Infrequent female reproduction and continuous spermatocytogenesis, while unusual in lepidosaurs, are also seen in some New Zealand lizards and are parsimoniously explained as common responses of semi-nocturnal reptiles to a cool climate. Research into how sperm structure and cloacal anatomy of tuatara contribute to successful fertilization without male intromittent organs is needed. The absence in tuatara of several distinctive features of squamates including paired intromittent organs, a renal sex segment and ovarian pyriform cells leaves unanswered the sequence of evolution of these features in squamates and their possible relationships with the evolution of viviparity.

0772 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Matthew Cross[1], Gregory Lipps, Jr.[2], Karen Root[1]

[1]Bowling Green State University, Bowling Green, OH, USA, [2]Gregory Lipps, LLC, Delta, OH, USA

Temporal Distributions of Female Eastern Box Turtles in a Biodiversity Hotspot

Eastern box turtles (*Terrapene c. carolina*) are a species on the decline throughout their remaining range and are one of nine target species for conservation efforts in the Oak Openings Region of northwest Ohio. This region is a local biodiversity hotspot that is maintained by management activities (i.e., prescribed fire) known to impact box turtles. Understanding the ecology of the box turtles in this region at a scale relevant to land managers is a critical factor governing their long-term survival in this area. We used box turtle presence data from an ongoing telemetry study, visual-encounter surveys and reported sightings to generate predictive models of the environmental requirements and geographic distribution of female box turtles within our study area. Our models indicated that habitat type, soil type and canopy density were the most important environmental variables and, to a lesser extent, elevation and distance to forest edge. Similarly, month-to-month models showed shifts in predicted distributions and related

environmental variables. Analysis of the distribution of occurrence probability quantiles (0-100%) revealed that 70% of the region has very low occurrence probability (< 10%) with approximately 80% of highly-ranked habitat (80-100%) occurring within the protected areas that make up 10% of the study area. Our results highlight temporal shifts in habitat usage and distributions for box turtles in this region that can be used to guide conservation and management efforts.

0155 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Jenna Crovo, Carol Johnston

Auburn University, Auburn, AL, USA

A Little Less Noise There: Traffic Noise Increases Cortisol Levels in *Cyprinella venusta*.

Noise pollution from anthropogenic sources is an increasingly problematic challenge faced by many taxa, including fishes. Noise generated from boat engines induces a significant elevation in the stress hormone cortisol, in several fish species. Recent studies also confirm that vehicular traffic noise propagates effectively from bridge crossings into surrounding freshwater ecosystems; however, the effect of traffic noise on cortisol levels in freshwater fishes has not been examined. The Blacktail Shiner (*Cyprinella venusta*) is a ubiquitous hearing specialist found throughout the Southeastern United States and was used as a model to investigate the degree to which traffic noise elevates cortisol levels. In this study, fish were exposed to a recording of interstate traffic, and waterborne cortisol was measured to assess the stress response of *C. venusta*. Cortisol levels were significantly elevated in fish exposed the traffic noise relative to quiet controls. Future work is aimed at investigating the potential benefits of cortisol in reducing noise-induced hearing threshold shifts.

0083 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Adam Cummings, Jeffrey Schineller, Karen Kiemnec-Tyburczy, John Reiss

Humboldt State University, Arcata, CA, USA

Lineage Diversification of an Aquatic Pheromone in Pacific Newts (*Taricha*)

The use of chemical signals during courtship and mating remains one of the salient problems of amphibian reproductive biology. Modern techniques make it possible to identify the specific structure of courtship pheromone molecules and this has now been done in representatives of evolutionarily diverse groups of salamanders. The first

chemically identified pheromone in amphibians, Sodefrin, is a decapeptide cleaved from a 200 amino acid precursor, Sodefrin Precursor Factor (SPF). An SPF homologue is used by plethodontids in courtship and it is unclear if cleavage is a derived state within *Cynops* or in salamandrids more broadly. The gene encoding SPF has been identified and sequenced in North American salamandrids using cDNA reverse-transcribed from dorsal gland mRNA; however the active form of the pheromone has not been determined. In this study we examine the primary structure of the active SPF pheromone in Pacific Newts (genus *Taricha*) using gland extract and secreted proteins separated using 2-D tricine-SDS-PAGE. The general approach was to use differential expression of proteins across a breeding season to identify putative courtship pheromones with limited source material. Additionally, we describe the diversification of the *spf* gene across the four lineages of *Taricha* by sequencing samples collected in sites of sympatry across California. This study aims to elucidate the role of chemical communication systems in lineage diversification and hybridization. To further elucidate the role of SPF in lineage diversification within *Taricha*, behavioral bioassays are necessary to test whether differential detection of SPF occurs across the lineages of *Taricha*.

0727 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Paul Cupp

Eastern Kentucky University, Richmond, KY, USA

On Head Up Displays in Green Salamanders, *Aneides aeneus*

Head up displays were observed in *Aneides aeneus* during aggressive interactions in lab and field. Male *A. aeneus* have large u-shaped or horseshoe-shaped glands located under the chin that are important in courtship behavior. The color of the mental gland ranges from white to yellow to orange which is unique among north american plethodontid salamanders. Two individuals with orange mental glands were observed in the lab raising their heads at an angle of about 45 degrees in the presence of intruding males. Five other males with lighter mental glands also exhibited the head up display. This display alone may serve as a threat to intruding males. The head up posture plus the orange color of the mental gland could represent a territorial display as well. This behavior may also occur in females. In the field, a head up display was observed three separate times by a single female brooding eggs in a rock crevice. The female was between the eggs and the crevice opening. This behavior was displayed once each month during July, August and September in response to a flashlight and a stick probe introduced into the crevice. In each instance, the female raised her head up and down several times which may be a further development of the head up response observed in males. Also, the female bit the probe in each instance. These display behaviors observed

in *A. aeneus* may be intraspecific displays that help in maintaining territories and /or preventing oophagy.

0259 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

James Cureton

University of Oklahoma, Norman, OK, USA

Phenotypic Divergence With or Without Gene Flow? That is the Question.

Different environments can impose different selection pressures on organisms and drive phenotypic divergence. If phenotypic divergence occurs rapidly and is adaptive, then assortative mating may lead to reduced gene flow between populations and further promote phenotypic divergence. The construction of reservoirs frequently induces the production of a deeper body in fishes, a phenotypic change that is thought to be adaptive because it aids fish in maneuvering through complex habitats and avoiding predators. Morphometric data suggests that bluntnose minnows (*Pimephales vigilax*) produce deeper body shapes within 10-20 generations of inhabiting reservoirs. This well-characterized pattern of rapid phenotypic divergence in this system provides a unique opportunity to test the hypothesis that phenotypic divergence can constrain gene flow. I sampled three Red River sites upstream of Lake Texoma (a reservoir), three sites within Lake Texoma, and three Red River sites downstream of Lake Texoma. I used six microsatellite loci to assess gene flow among these nine populations and assessed phenotypic divergence using standard geometric morphometrics. Using these nine populations, I compared the amount of expected gene flow to the observed flow to determine if gene flow is restricted as a result of phenotypic divergence. Phenotypic divergence among populations followed a priori expectations, but patterns of gene flow are more complex. These results are interpreted in light of the relationship between phenotypic divergence and gene flow and their role in contemporary evolution.

0675 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Amanda Curtis, Gabriela Bidart-Bouzat

Bowling Green State University, Bowling Green, OH, USA

Is the Solution Worse Than the Problem? Examining the Effects of the Invasive Plant *Myriophyllum spicatum* and the Herbicide Triclopyr on *Lithobates pipiens* Tadpole Growth, Morphology and Survival

Invasive plants impact amphibians by altering habitat, predator-prey interactions and reproductive sites. Despite being costly and having serious non-target impacts to wildlife, chemical management is the most common method to reduce or eliminate invasive plants. In spite of previous studies indicating that individual effects of invasive plants or pesticides can be harmful to amphibian populations, the impact of the interaction between invasive plants and herbicide management on amphibians has not yet been evaluated. We used a controlled laboratory experiment to assess the impact of the invasive aquatic plant Eurasian watermilfoil (*Myriophyllum spicatum*), the herbicide triclopyr and their interaction on the growth, morphology and survival of northern leopard frog (*Lithobates pipiens*) tadpoles. Tadpoles were raised in treatments groups for five weeks, after which treatment additions were stopped and tadpoles were left for another four weeks to assess for lag effects. Significant differences in weight and length were observed in milfoil and herbicide treatments after additions ceased. Overall, significant differences in morphology were found in milfoil, herbicide and milfoil + herbicide treatments. The greatest reduction in tadpole size was seen in the highest herbicide treatment. No effect of treatment on survival was observed. Results from this study may be useful to managers, since invasive species are spreading extremely rapidly in both aquatic and terrestrial environments, and current management techniques would likely need to be re-evaluated to minimize negative impacts on biodiversity.

0029 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Tobey Curtis[1], Jonathan Hare[2], Robert Kenney[3], Stephan Zeeman[4], Erin Summers[5], Gregory Skomal[6]

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Movements and Habitat Selection of Basking Sharks (*Cetorhinus maximus*) in Relation to Zooplankton Abundance in the Gulf of Maine

The distribution of prey can significantly influence the movements and habitat selection of predators. However, it is difficult to study prey-influenced habitat selection in the marine environment due to the challenges of simultaneously observing both predators and prey across available habitats. In this study, we examined the distribution and movements of the filter-feeding basking shark (*Cetorhinus maximus*) in relation to zooplankton abundance in the Gulf of Maine, western North Atlantic Ocean. Shark movements were observed using satellite-linked Smart Position or Temperature transmitting (SPOT) tags (N=10), and additional presence records during the tracking period were collected from routine marine mammal surveys (N=158). Zooplankton abundance landscapes were derived from standardized plankton surveys conducted concurrently with shark tracking. Activity spaces of the tracked sharks were quite small given their highly mobile habits. Basking shark habitat use was non-random with respect to the density of various zooplankton species groups. Sharks tended to select patches with high abundance of certain zooplankton species, but avoided areas with high abundance of others. They effectively tracked the shifting distributions of their preferred prey across seasons, supporting the idea that basking sharks can be considered "biological plankton recorders." The significance of efficient foraging in this species will be discussed with reference to recent insights into its long-distance seasonal migrations.

0512 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Michelle D'Aguillo[1], Antony Harold[1], Tanya Darden[2]

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Trophic Ecology of the Western Atlantic Goby *Gobiosoma bosc* (Gobiidae)

Gobiosoma bosc is a common inshore goby which occurs mainly in estuaries of the east coast of the United States and across the northern Gulf of Mexico. The feeding ecology of

this species was investigated through gut content analysis of specimens collected in four estuaries across South Carolina, North Carolina, Maryland, and New Jersey. Analysis of 391 individuals revealed that *G. bosc* is a benthic microcarnivore that feeds primarily on polychaetes, gammarid amphipods, and harpacticoid copepods. Diet composition varies with body size, tidal creek within an estuary, and broader geographic area. Analyses of gut fullness suggest that the species is a daytime visual predator. Significant variation in dietary breadth was documented and may reflect a foraging response to a decrease in prey diversity among estuaries of varying biotic and abiotic factors. An ontogenetic shift in diet from dominance of meiofauna to that of macrofauna was also observed. The energetic contribution of macrofaunal prey items is very high even in small gobies (down to about 12 mm standard length), suggesting a rapid ontogenetic shift towards the volumetric importance of macrofauna relatively early in life history. The volumetric diet shift can be described by two life history phases: the first phase characterized by high variability (plastic feeding patterns) in gobies less than 20 mm SL, followed by a phase of low dietary variability (fixed feeding patterns) in gobies greater than 20 mm SL. The role of this cryptic, although important, species in estuarine food webs is discussed.

0095 Ecology and Ethology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD ECOLOGY AND ETHOLOGY

Danny D'Amore[1], Oscar Rios-Cardenas[2], Molly Morris[1]

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Maternal Environment Influences Development of Behavioral Syndrome in Swordtail Fish, *Xiphophorus multilineatus.*

Despite a rising interest in behavioral syndromes, the correlation between different behaviors across context and time at a population level, the development of these syndromes is not yet well understood. Using the swordtail fish *Xiphophorus multilineatus*, we looked at the effects of maternal diet and social environment during development on the formation of behavioral syndromes. Females were raised on high or low quality diets and bred. Fry were isolated at two weeks of age and raised on a low quality diet. Half of the offspring from each maternal group were exposed to an adult male during development, and the other half were exposed to an empty fry box. Once fish reached sexual maturity, males were tested for aggression towards a conspecific and boldness under risk of predation. Maternal diet was shown to have an effect on the development of a behavioral syndrome. Specifically, offspring whose mothers were raised on a high quality diet exhibited a correlation between boldness and aggression, with maternal diet having a relationship with boldness under risk of predation. Exposure to an adult male did not have a significant effect on either behavior, or on a correlation between

behaviors. These results suggest that the maternal environment differed between females raised on high or low quality diets, and this in turn affected the relationship between boldness and aggression in their offspring.

0753 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR EVOLUTION, GENETICS, & SYSTEMATICS

Jasmine Dagg

Auburn University, Auburn, AL, USA

Genetic Diversity of the Invasive Neotropical Cane Toad (*Rhinella marina*) in Florida

Neotropical cane toads, *Rhinella marina*, are a premier example of the injurious effects an invasive species can have on native biodiversity. This is most clearly seen by their severe impact on native fauna in the wake of the cross continent dispersal in Australia. Despite their tendency for disastrous effects, this species has been relatively unstudied in Florida. Current surveys in Florida have revealed established cane toad populations in three new locations that are further north than previously recorded. Our lab is the first in documenting this northward spread in Florida and multiple physiological response profiles of cane toads from origin to invasion front in this state. This study attempts to address the need for understanding the molecular diversity, structure, as well as, genetic variation of several populations dispersed along invasion and latitudinal gradient within Florida to assess the potential for adaptation to environmental changes. Previously described microsatellites are used to elucidate these characteristics within and between populations. Results need to be compared to native population structure, diversity, and allelic diversity values along with physiological profiles to infer the invasion limitations or strengths for this species.

0490 AES Genetics, Genomics, & Systematics, Banquet Room E, Saturday 2 August 2014

Toby Daly-Engel[1], Dean Grubbs[3], Shawn Larson[2]

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Phylogeography Across the Global Range of an Ancient Deep-water Predator: the Bluntnose Sixgill Shark (*Hexanchus griseus*)

The evolutionary processes affecting the population structure of deep-water fishes are poorly understood, as is the potential impact of unprecedented human-mediated climate change on deep-ocean environments. We used mixed-marker analysis to examine the molecular ecology of the bluntnose sixgill shark (*Hexanchus griseus*), a bathypelagic species thought to have evolved approximately 200 million years ago, to better understand baseline genetic diversity and connectivity among populations. 124 samples from 11 collection sites across a global range were surveyed using seven mitochondrial genes totaling 3,978 base pairs and 11 species-specific microsatellite loci. Diversity was strikingly low across markers, to the point where relatively few were variable enough to be informative. Significant genetic structuring (global $F_{ST} = 0.967$, $p \leq 0.0001$) indicates the presence of at least two widely divergent evolutionary lineages, one restricted to the Pacific Ocean and the other encompassing the entire Indo-Atlantic, with partitioning across two major biogeographic barriers to marine dispersal, the Malay Archipelago and the Isthmus of Panama. We hypothesize that several factors have shaped contemporary diversity and connectivity in *H. griseus*, among them (1) an overall slow rate of molecular evolution compared with other taxa, a result of lowered metabolism and/or the relative lack of selection pressure on deep-ocean animals; and (2) the interaction between thermotolerance and sea water temperature over the geo-evolutionary history of *H. griseus*.

0059 Herp Ecology II, Banquet Room E, Sunday 3 August 2014

Jon Davenport[1], Blake Hossack[2], Winsor Lowe[1]

[1]University of Montana, Missoula, MT, USA, [2]U.S. Geological Survey, Missoula, MT, USA

Partitioning the Non-consumptive Effects of Predators on Prey with Complex Life Histories

Non-consumptive effects (NCE) of predators on prey can be as strong as consumptive effects and may be driven by numerous mechanisms, including predator characteristics.

Previous work has highlighted the importance of predator characteristics in predicting NCEs, but has not addressed how complex life histories of prey could mediate predator NCEs. We conducted a meta-analysis to compare the effects of predator gape limitation (gape-limited or not) and hunting mode (active or sit-and-pursue) on the activity, larval period, and size at metamorphosis on larval aquatic amphibians and invertebrates. Larval prey tended to reduce their activity and require more time to reach metamorphosis in the presence of all predator functional groups, but the responses did not differ from zero. Prey metamorphosed at smaller size in response to non-gape-limited, active predators, but counter to expectations, prey metamorphosed larger when confronted by non-gape-limited, sit-and-pursue predators. These results indicate NCEs on larval prey life history can be strongly influenced by predator functional characteristics. More broadly, our results suggest that understanding predator NCEs would benefit from greater consideration of how prey life-history attributes mediate population and community-level outcomes.

0325 SSAR SEIBERT CONSERVATION AWARD, Banquet Room J, Friday 1 August 2014

Drew Davis[1], Matthew Schwarz[2], Jacob Kerby[1]

[1]*University of South Dakota, Vermillion, SD, USA,* [2]*US Fish and Wildlife Service, Pierre, SD, USA*

Effects of Agricultural Tile Drainage on Amphibians in Eastern South Dakota

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 infectious diseases and environmental contaminants. Throughout eastern South Dakota, the use of subsurface tile drainage in agricultural fields has contributed to habitat degradation for many amphibian species. Subsurface tile drains are designed to drain water off agricultural fields, often increasing levels of environmental contaminants in nearby wetlands. These contaminants often represent additional stressors to amphibians at these sites, and chronic exposure may result in immunosuppression and increased prevalence of pathogens such as ranaviruses. Ranaviruses are considered an emerging infectious disease in amphibians and have contributed to mass-mortality events throughout the Midwest. As part of a two-year study, we visited 18 wetlands (6 reference, 6 surface, 6 tile) to assess habitat quality differences via a wetland rapid assessment protocol (WRAP) as well as to survey for amphibians. WRAP scores indicate significantly higher wetland quality at reference sites compared to surface and tile sites ($p < 0.0001$) and that both reference ($p = 0.042$) and surface wetland ($p = 0.009$) WRAP scores significantly increased from May to July. Additionally, we found no significant differences in amphibian densities or diversity scores among sites ($p > 0.05$). While no

differences in amphibian densities were observed, it is possible that other assessments, such as stress hormone levels or pathogen prevalence, may capture more immediate effects on populations at sites which receive agricultural tile drainage.

0335 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Karen Davis

University of Tennessee, Knoxville, Tennessee, USA

New Findings on Social Complexity in North American Turtles (Emydidae)

Turtles are often considered to have minimal social complexity deriving, in part, from their phylogenetic placement as a basal reptile and, in the case of many freshwater turtles, behavioral observations are limited to basking behavior. In previous research on emydid turtles I have shown that *Pseudemys nelsoni* and *Trachemys scripta* are capable of learning and remembering visual tasks for years and are even capable of social learning. However, detailed comparative studies of social dynamics (such as social behavioral repertoire, categories of behavior, and dominance hierarchies) of aquatic turtles are rare. Social interactions of an established mixed species group of closely related freshwater turtles (Emydidae) were studied in a naturalistic enclosure in the Chattanooga Aquarium. Turtles exhibited a wide range of interactive behaviors, suggesting more complexity in their interactions then previously considered. For example, turtles exhibited extensive interactions with conspecifics while ignoring other closely related species underwater, and exhibit defensive postures of head, tail, and carapace that resemble aspects of submissive body postures in mammals. Moreover extensive male-male contests, social hierarchies, and other phenomena were documented. For example, 'titillation displays' occurred in contexts other than courtship, which is counter to most of the literature. These findings indicate that turtles are active social animals and have much more complex interactive behaviors then previously considered. These findings also suggest that turtles are a key group to study to uncover processes of social evolution given the great variation in ecology, morphology, and behavior across extant species.

0331 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

Mark Davis[1], Michael Collyer[2], Marlis Douglas[3], Michael Douglas[3]

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Morphological Evidence for Adaptive Radiation in Western Rattlesnake (*Crotalus viridis*)

Morphological data are the standard by which species are recognized and described by taxonomists. Their inferential power has been strengthened by the advent of geometric morphometric (GM) approaches, such that compelling arguments for reevaluation of long-standing taxonomic designations are now possible, particularly when contrasted with a molecular perspective. Here we employ the Western Rattlesnake (*Crotalus viridis*) complex as the evolutionary context within which this juxtaposition is explored. Nine subspecies are recognized in the complex based on traditional morphological analysis, while molecular assessments reveal two distinct lineages with additional but unresolved divergences within each. Assessment (via MANOVA) of combined dorsal and lateral GM landmarks revealed that shape differed significantly among subspecies. Post hoc pairwise comparisons further determined that all subspecies differed one from another in head shape with the exception being a single subspecies pair (i.e. *abyssus* x *cerberus*). Discriminant Analysis was effective at 70% in correctly assigning individuals to their identified subspecies, and suggests that shape means in Western Rattlesnake exhibit some overlap in morphospace. Disparity Through Time analysis determined that shape divergence among subspecies was significantly greater than expected by chance, indicating adaptive divergence. Finally, Phylogenetic Generalized Least Squares revealed that both phylogeny and ecology contributed significantly to variance in head shape among subspecies. Thus, lack of congruence among phylogenetic hypotheses may stem from ecological adaptation. Results from our shape analyses reinforce morphological, venom, and molecular genetic data and may aid in solidifying taxonomic revisions.

0430 Fish Systematics & Taxonomy IV, Banquet Room G, Sunday 3 August 2014

Matthew Davis

University of Kansas, Lawrence, KS, USA

Evolution and Diversification of the Lizardfishes (Teleostei: Aulopiformes)

The extreme habitats of the deep sea (depths ≥200 m) have produced fascinating evolutionary transformations among the >5,000 species of marine fishes that have invaded this realm. As a group, deep-sea fishes are subject to similar selective pressures due to extreme environmental conditions (e.g., darkness, high atmospheric pressure); thus, convergent adaptations are extremely common. This study focuses on the morphologically diverse and species rich (>250 species) lineage of lizardfishes (Aulopiformes). Aulopiform species predominantly occur in the deep sea, and possess hypothesized morphological adaptations (e.g., bioluminescent organs, predatory innovations, hermaphroditism) that may facilitate diversification in this realm. For this study, the patterns and processes of diversification among aulopiform fishes that have invaded the deep sea are investigated. A densely sampled, multi locus (nuclear and mitochondrial), and temporal phylogenetic hypothesis of aulopiform evolutionary relationships is used to inform lineage diversification and character evolution studies (e.g., depth partitioning, bioluminescence, reproductive strategy). The potential impact of the evolution of deep-sea adaptations on the inferred patterns of diversification among the lizardfishes is also explored.

0300 Herp Behavior, Banquet Room I, Saturday 2 August 2014

Samantha Dean[1], Betsie Rothermel[1], Michael Yuan[2]

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Effects of Age and Size on Gopher Tortoise (*Gopherus polyphemus*) Courtship and Mating Behaviors

In life-history studies of turtles, age is often an unknown variable due to exceptional longevity. However, the 46-year study of Gopher Tortoises (*Gopherus polyphemus*) at Archbold Biological Station in Florida provides an opportunity to examine effects of age, independent of size, in the mating system. We monitored Gopher Tortoise burrows with motion-sensor cameras over a 6-month period to determine whether age or size (of both sexes) affected number or duration of courtship visits, and what traits (size, age, persistence) females prefer in potential sires as measured by mounting attempts. We found a positive linear relationship between male size and number of females visited ($r^2 = 0.437$, $p = 0.003$, $n = 18$). Mean duration of courting visits and mean size of females

visited also increased with male body size. Furthermore, there was a positive relationship between female size and number of mounts per camera-day ($r^2 = 0.172$, $p = 0.044$, $n = 24$). These initial findings suggest larger females have higher rates of male visitation and mounting, perhaps because they are more fecund. Our data indicate body size is an important factor affecting courtship behavior of males, whereas male age did not affect number of mounts per female or other male courting behaviors examined using analyses of covariance. Because neither size nor age was related to courtship success of males (i.e., number of mounts per female), additional research is needed to fully understand *G. polyphemus* mate choice in this multiple-signaling mating system.

0285 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Alison Deary, Eric Hilton

College of William and Mary, Virginia Institute of Marine Science, Gloucester Point, VA, USA

Using Phylogeny to Address Ecomorphology, Development of Feeding Structures and Dietary Shifts of Early Life History Stage Drums (Family Sciaenidae) from the Chesapeake Bay

To better understand the link between morphology and ecology in fishes, we are examining the diet and development of the feeding apparatus, which includes oral and pharyngeal elements, in members of the family Sciaenidae from the Chesapeake Bay. Sciaenids are an ideal group because they exhibit variation in the feeding apparatus and exploit many different foraging niches as adults (i.e., benthic and pelagic). The goals of this project are to: 1) identify when during ontogeny sciaenid species are structurally able to partition their foraging niches, 2) investigate whether these ecomorphological changes co-vary with phylogenetic relatedness and 3) describe the evolutionary patterns in closely sciaenid species. Dietary shifts were observed by 28 mm standard length, which corresponded to structural differentiation in both the oral and pharyngeal jaws. Although variations in the feeding apparatus have been correlated to the exploitation of different foraging niches, it has not been tested whether this variation in feeding apparatus anatomy is due to phylogenetic relatedness. To account for the phylogenetic signal in our dataset, we conducted a genus-level examination of sciaenids and used the phylogenetic hypothesis by Lo et al. (unpublished) to calculate phylogenetic independent contrasts (PIC). Once the autocorrelation was accounted for using PICs, we were able to use traditional statistics to investigate the links that exist between adaptations of the feeding apparatus and foraging niches.

0762 Fish Behavior, Banquet Room F, Sunday 3 August 2014

Raelynn Deaton Haynes, J. Alex Carr, Hillary Evans, Natalie Willard

St. Edward's University, Austin, TX, USA

Social Dominance-based Mating Preferences in Livebearing Fishes

Theory predicts that larger (or dominant) males also should choose higher quality females. Therefore, we tested the hypothesis that socially dominant males would prefer to mate with larger females in two species of livebearing fishes that differ substantially in mating strategies (courting guppies and coercive mosquitofishes). This prediction relies on the assumption that larger females are more fecund, and thus afford males higher reproductive success. In a series of three consecutive behavior experiments, we first established social dominance following methods outlined in Deaton Haynes and Steele (unpublished). Assuming dominant males were larger and/or showed higher frequency of matings, we then tested whether each male in social groups (x3) preferred larger females in both dichotomous and open choice experiments. All males preferred larger females, regardless of social dominance in both dichotomous and open water trials. We then tested whether males that ranked second in dominance would shift their behaviors according to the size of their competitor. Thus, half of the males were tested against larger competitors and half against smaller competitors. Number 2 ranked males (medium-sized) exhibited a higher frequency of display behaviors, but not copulation attempts, toward larger females, but only when the competitor was smaller. These results are surprising in that they suggest that males shift courtship but not coercive behaviors in the presence of smaller, sneaky males, which may present more of a threat than larger males. However, results also suggest that social rank does influence mating preferences and that the dominance hierarchy formed is linear.

0063 Snake Ecology, Banquet Room E, Saturday 2 August 2014

Brett DeGregorio[1], Patrick Weatherhead[1], James Westervelt[2], Jinelle Sperry[2]

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Ratsnakes as Predators of Bird Nests: Now and in a Warming World

Snakes have long been recognized as important predators of bird nests although much of the evidence has been anecdotal. Recent advances in miniature video cameras finally allow ecologists to identify predators at bird nests and literature regarding predatory identity is rapidly accumulating. Here, we review 50 North American studies that have used nest cameras to document predator identity at bird nests to explore geographic and

habitat-specific trends in nest predation by snakes. Although 12 species of snake have been identified as predators of bird nests, the ratsnake is the most frequently documented nest predator. We then used agent-based modeling to explore how nest predation by ratsnakes is expected to change with anticipated climate-warming scenarios. Our results suggest that the seasonal and diel timing of predation by ratsnakes is likely to change as ambient temperatures increase with snakes preying on nests earlier in the season and more frequently at night. Additionally, nest predation by ratsnakes in forest edge habitat is expected to increase with warming temperatures and decrease in more open habitat types. Increased nocturnal predation may result in the capture of incubating or brooding adult birds and have demographic repercussions for imperiled songbird populations. Forest edges are often considered ecological traps for nesting birds, if ratsnakes more frequently prey on nests in forest edge in the future these "edge effects" may increase.

0056 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Friday 1 August 2014

David Delaney, Daniel Warner

University of Alabama at Birmingham, Birmingham, Alabama, USA

Do Adults Drive Variation in Juvenile Habitat Use in a Territorial Lizard?

All organisms have specific habitat requirements that allow them to properly function in their environment. For many organisms, optimal habitats differ across age classes, and individuals shift habitat choice as they age. Field observations of the brown anole lizard (*Anolis sagrei*) suggest that juveniles perch in open-canopy areas on shorter vegetation whereas adults reside in forested areas on higher vegetation. We manipulated adult male densities in mesh enclosures with artificial trees to examine the response of juvenile habitat choice. Perch height, width, substrate and orientation were recorded 3 times each day and once per night for 14 days. We found that juveniles chose lower perches when adults were present, suggesting that adults force juveniles to less preferred habitat and that inter-age class competition contributes to the observed ontogenetic differences in habitat choice in the field. Perch width, substrate use, and orientation were all affected by time of day. Adults chose thicker perches than juveniles, and both age classes chose thinner perches at night. The use of leaves was much higher at night, which is consistent with observations of other *Anolis* species. There was no difference in orientation on horizontal perches during the day. However, lizards strongly preferred to face the trunk of the tree at night. This experiment shows that adult *A. sagrei* may drive ontogenetic variation in habitat use in this species, and that time of day affects how *A. sagrei* uses its habitat.

0333 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Michael DeLea[1], Dale DeNardo[2], Emily Taylor[1]

[1]California Polytechnic State University - San Luis Obispo, CA, USA, [2]Arizona State University, AZ, USA

The Role of Chemoreception in Rattlesnake Spatial Navigation

Several studies have demonstrated the importance of chemoreception in rattlesnake behavior, yet there is a lack of information on its role in a rattlesnake's ability to navigate through its environment. This study sought to examine the relationship between chemoreception and spatial navigation in free-ranging rattlesnakes (*Crotalus oreganus*). Adult males were tracked for three months after receiving lesions to the olfactory and vomeronasal nerves or a sham surgery. Snakes were subjected to weekly short distance translocation to examine their ability to navigate back to their site of capture. If chemoreception is used in navigation, then lesioned snakes will be less likely to successfully navigate back, will have smaller activity ranges, and show reduced tongue-flick rates when presented with chemical stimuli. In addition, we examined the effect of chemosensory nerve lesions on the size of several brain regions important in navigation and chemosensation.

0018 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Andrea Dell'Apa, Jeffrey Johnson, Dave Kimmel, Roger Rulifson

East Carolina University, Greenville, NC, USA

A Social Network Analysis of the International Trade of Spiny Dogfish (*Squalus acanthias*): Fishery Management Aspects

The spiny dogfish (*Squalus acanthias*) is an important commercial shark species, with recent concerns over its conservation status. The major demand for its meat is from the European Union (EU) market, with the U.S. and Canada as its two major contributors. The U.S. has yet to support a spiny dogfish listing in the CITES Appendix II, although the U.S. Atlantic stock is under a fishery management plan (FMP) that proved to be successful in providing a certified sustainable fishery. We employed a cumulative sum technique to compare trade data for spiny dogfish export from U.S. and Canada to the EU in relation to the FMP adoption. We also constructed a social network to visualize changes in the European trade for spiny dogfish after adoption of the FMP and to predict future trade flow potentially affecting the conservation status of regional dogfish stocks in relation to recent management measures introduced in Europe. The social

network analysis revealed that the exclusion of spiny dogfish from Appendix II will eventually affect the conservation status of dogfish stocks in Africa, Asia, South America, and the Mediterranean and Black Seas. Our results suggest that the species listing would provide an economic benefit for the U.S. Atlantic fishery, and will potentially foster the conservation status of other regional spiny dogfish stocks worldwide.

0476 Fish Behavior, Banquet Room F, Sunday 3 August 2014

Leo Demski

New College of Florida, Sarasota, Florida, USA

The Vertical Body Bands in Bluegills (*Lepomis macrochirus*): a Review of Studies and a Possible Model System for Understanding Neural Substrates of Fear and Inhibition of Aggression

Bluegills have 7-8 vertical bands (VB) of melanophores separated by light interspaces. The bars that extend from the dorsal fin to near the ventral surface are solid in small fish and later develop secondarily lighter spaces within the bars. In adults VB may be evident to varying degrees depending on the environment and physiological condition of the fish. The cells of the bars and interspaces are controlled by sympathetic nerves. Increased neural activity causes pigment aggregation or lightening. VB commonly occur within 15-30 seconds in situations that threaten the fish; e.g. confrontations with rivals (or their own mirror image) or capture in a net. Submissive fish are generally banded while male reproductive bluegills are light in color. Reproductive females exhibit strong VB which seem to inhibit aggression from nesting males. Indeed, small banded males mimic females to cuckold the nesting fish and models of pumpkinseed sunfish with bands are attacked less frequently than those lacking the marks. Brain pathways for electrically evoking banding have been mapped in both anesthetized and free-swimming bluegills. In the latter, the banding occurred with other components of defensive/escape behavior, thus supporting the idea that VB is a component of integrated response patterns related to "fear-like" mental states. The brain pathways for banding associate with structures (the amygdala, hypothalamus, midbrain tegmentum) known to control similar agonistic activity in tetrapods including mammals. The observations suggest that the bluegill VB system might serve as a general model system to study both anxiety and inhibition of aggression.

0463 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Friday 1 August 2014

Robert Denton, Lisle Gibbs

Ohio State University, Columbus, OH, USA

Sexuality on the Move: Dispersal of Unisexual and Sexual Mole Salamanders (*Ambystoma*) Across a Fragmented Landscape

Unisexual Mole Salamanders (*Ambystoma* sp.) are the oldest known unisexual vertebrate lineage, arising approximately 5 million years ago. These salamanders are both evolutionary and ecologically successful, outnumbering their sexual congenerics by almost 2:1 in some populations. However, the reasons for their success remain unclear. The geographic range of unisexuals includes a wide area of predominantly fragmented, agricultural land. Because sexual *Ambystoma* salamanders avoid open field habitats, this raises the possibility that one proximate reason that unisexuals are so wide-spread is that that they are superior dispersers in human-modified landscapes, allowing them to exploit ephemeral breeding habitats. We used genetic assignment tests based on species-specific DNA microsatellite data to estimate dispersal distances and connectivity of populations of unisexual and sexual *Ambystoma* within an agricultural area of Ohio. Results show that there is no significant difference in proportion of immigrant individuals or the distance from an immigrant's source population among unisexual and sexual individuals. These results suggest that unisexuals have no realized advantage of greater dispersal ability, and other ecological and/or evolutionary factors are responsible for their success.

0030 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Valerie Derouen, William Ludt, Prosanta Chakrabarty

Louisiana State University, Baton Rouge, Louisiana, USA

Phylogeny and Divergence Time Estimation in Batfishes (Lophiiformes: Ogcocephalidae)

Lophiiformes (anglerfishes) is a unique, diverse, and widely distributed order within teleosts, but it remains minimally understood. Most phylogenetic studies incorporating members of Lophiiformes have focused on the group as a whole or the Ceratioidei. Very few have looked specifically at the batfishes (Lophiiformes: Ogcocephaloidei: Ogcocephalidae). The family Ogcocephalidae is comprised of 10 genera and approximately 73 species. Illicial skeleton and escal morphology have been useful in

delineating these genera (Bradbury 1967), however, relationships among these genera are poorly studied and have not been resolved using morphological data alone (Endo and Shinohara 1999, Ho 2010). The position of Ogcocephaloidei within Lophiiformes is also unresolved with somewhat incongruent hypotheses suggested by molecular (Miya et al. 2010; Shedlock et al. 2004) and morphological data (Pietsch and Grobecker 1987; Pietsch and Orr 2007). In this study, a phylogenetic tree is constructed with more robust taxon and gene sampling to elucidate generic relationships among all 10 batfish genera using mitochondrial and nuclear markers, clarify the placement of Ogcocephaloidei within Lophiiformes, and estimate the divergence time of the clade. The phylogenetic analyses supported each sub-order within Lophiiformes as monophyletic, and placed Ogcocephaloidei as the sister group to a Chauncoidei + Ceratioidei clade. Relationships among batfish genera suggest a West Atlantic clade and an Indo-Pacific clade, with Halieutaea coming out as the sister group to the rest of the batfishes. Based on divergence time estimations, Ogcocephalidae diverged in the Eocene about 54 million years ago.

0537 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Anne Devan-Song, Nancy Karraker

University of Rhode Island, Kingston, Rhode Island, USA

Long-Distance Translocation is Not a Viable Conservation Option for Bamboo Pit Vipers (*Trimeresurus albolabris*)

The translocation of 'nuisance' snakes is often employed on a large scale in densely populated areas in order to mitigate human-wildlife conflict. However, the methods used are still haphazard and rarely evaluated, especially in Tropical East Asia. The effects of translocation on individual snakes are therefore not well understood. The objective of this experiment was to assess the effects of long-distance translocation on bamboo pit vipers (*Trimeresurus albolabris*) in Hong Kong, where they are routinely removed from urban areas or homes and translocated to national parks. With the aid of radio telemetry, we used various metrics to quantify the differences between 'resident' and 'translocated' bamboo pit vipers to find out if long-distance translocation is a viable conservation option. Translocated vipers were found to move greater distances and display unidirectional movements, and had significantly higher mortality rates. Translocation appears to have a negative effect on mortality, brumation, reproduction and movement of bamboo pit vipers. Findings of this study will be used to prescribe improvements for current translocation strategies in Hong Kong and around the region.

0551 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jennifer Dever[1], Jodi Rowley[2], Jeff Wilkinson[3]

[1]University of San Francisco, San Francisco, CA, USA, [2]Australian Museum Research Institute, Sydney, NSW, Australia, [3]H.T. Harvey & Associates, Los Gatos, CA, USA

Multiple Species of "Bird-poop" Frogs (genus *Theloderma*) Identified from Southeast Asia

Theloderma asperum is a small tree frog distributed "throughout northeastern India through Myanmar and adjacent China…through upland Thailand and Laos to central and northern Vietnam to south Indonesia" (Frost, 2014). It is known as the bird-poop frog due to its camouflage bird-poop like dorsal coloration. Lacking synapomorphic traits, these frogs are identified by possessing the following combination of characteristics: large finger and toe pads, having slight white-tipped asperities on the dorsum, lacking vomerine teeth, and lacking webbing between fingers. We examined adult specimens recently collected from Myanmar, Thailand and Vietnam comparing them to other known *T. asperum* and conducted a phylogenetic analysis of a region the mitochondrial 16S rRNA gene from these individuals and other members of the *Theloderma* along with their closest relatives. Herein we describe multiple new species and reveal a cryptic complex within *T. asperum*.

0498 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Valentina Di Santo

Boston University, Boston, MA, USA

Ocean Acidification Exacerbates the Impacts of Global Warming on Embryonic Skates.

Rapid ocean acidification and warming have the potential to profoundly impact marine fauna and consequently, ecosystem dynamics and stability. Recent studies suggest that embryonic fish survival and fitness will be likely reduced by increasing acidification and temperature, however researchers should now focus on multi-stressor studies aimed to test the combined effect of these two climatic factors on fish physiology. In addition, local adaptation to thermal gradients may reduce the impact of global warming, but whether fish from different populations may respond differently remains unknown. Here I show the synergistic effects of acidification and warming on body condition, survival and aerobic scope of little skate (*Leucoraja erinacea*) embryos from two populations. Temperature had the strongest effect on development, survival and metabolic rates, but acidification further exacerbated stress on embryos. Thermal performance curves of populations exhibited countergradient variation and were

affected differently by acidification. These findings emphasize the need for multi-stressor studies on different populations of fishes with wide geographic range to understand complex responses to climate change.

0712 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Samba Diallo[1], Jonathan Armbruster[2], Henry Bart[4], Thierno Diallo[1], John Friel[3], Malorie Hayes[2], Mambe Magase[1], Raymond Schmidt[4], Maimadou Sou[1], David Werneke[2]

[1]*Centre National des Sciences Halieutiques de Boussoura, Conakry, Guinea,* [2]*Auburn University, Auburn, AL, USA,* [3]*Cornell University, Ithaca, NY, USA,* [4]*Tulane University, New Orleans, LA, USA*

The Freshwater Fishes of Guinea

In January 2013, a team of researchers from Guinea, Auburn University, Cornell University, and Tulane University completed a survey in Guinea with a goal mainly to explore Cypriniform and Siluriform diversity. Guinea is an important country to explore biogeographically because many of the rivers of Western Africa have their headwaters in Guinea, and we made collections in the Gambie, Corubal, Konkouré, Senegal, Little Scarcies, Niger, etc. We collected approximately 140 species of fishes and ~12,000 specimens in 485 split lots. Within our collections are multiple undescribed species of *Chiloglanis*, '*Barbus*' and '*Amphilius*'. We document the diversity of the fishes of Guinea through photos and maps.

0774 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Banquet Room J, Friday 1 August 2014

Matthew M. Dickson[1], Sigfrido A. Zimmermann[1], Tanja Wolfmeyer[1], Heather E. M. Liwanag[2], Robert E. Espinoza[1]

[1]*California State University, Northridge, Northridge, California, USA,* [2]*Adelphi University, Garden City, New York, USA*

Rapidly Adapting to the Neighborhood: Physiological Responses of Mediterranean House Geckos to their Introduced Climates

Introduced species are more likely to evolve rapidly to adapt to local climates because of small founder populations and strong selective pressures in their new environments. Ectothermic species may be particularly sensitive to changes in their abiotic environment requiring immediate adaptive changes. To test these ideas, we compared

thermal tolerances (critical thermal minimum, CT_{min} and panting threshold, T_{pant}) and temperature-dependent rates of evaporative water loss (EWL) and resting metabolism (RMR) of Mediterranean House Geckos (*Hemidactylus turcicus*) collected from different climates. These "porch light" geckos have been widely introduced throughout the New World following their first appearance in Florida in the early 1900s. Eight populations of geckos were collected from the southern USA representing three climates: desert (hot/dry), Mediterranean (warm/dry), and subtropical (hot/humid). We hypothesized that geckos from these three climates would exhibit physiological differences consistent with local adaptation. Geckos from climates with lower daytime temperatures had lower CT_{min} compared to geckos from hotter climates, consistent with local adaptation. However, we found no significant differences in T_{pant} among gecko populations from the three climates. Geckos from arid climates had lower rates of EWL and RMR at higher body temperatures compared to geckos from humid regions, also suggesting adaptive evolution. The lower RMR at higher body temperatures also provides a mechanistic explanation for the EWL reduction. Future studies will include sprint performance and testing for developmental plasticity. Ultimately these data will be used in a mechanistic niche model to predict the future range expansion of this species in the USA.

0468 Fish Systematics & Taxonomy II, Banquet Room G, Sunday 3 August 2014

Casey Dillman, Eric Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Nuclear DNA Sequences and Their Bearing on Our Understanding of the Phylogenetic Relationships of Sturgeons (Acipenseridae)

Phylogenetic hypotheses are the foundation for answering questions in evolutionary biology, serve as a framework for classifications, and are important for conservation biology. DNA sequence data offer an alternative to morphology on which to base hypotheses of phylogenetic relationships. Numerous groups of species have hypotheses of relationships proposed based on analysis of mitochondrial DNA, and these relationships are increasingly being revisited with nuclear DNA sequences. Sturgeons pose an interesting problem with respect to nuclear DNA due to the variable ploidy levels exhibited by extant species. This phenomenon may have impeded the use of nuclear DNA sequences for estimating relationships among sturgeons. In this study we analyze data for six nuclear loci: five single-copy loci and one locus from a gene family for 15 species of sturgeon. To generate sequence data for all alleles at each locus the PCR amplicons for each species were barcoded by species. All loci for each species were subsequently pooled and sequenced using a next-generation approach. We will discuss our results with respect to allelic diversity; in this case the number of alleles recovered in

each taxon, and the comparison of analyses of these data with previously published hypotheses.

0124 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Vladimir Dinets

University of Tennessee, Knoxville, TN, USA

Swamp Smarts: Discovering Cryptic Intelligence in Crocodilians

In recent years, our understanding of the complexity of crocodilian behavior has changed completely. We now know that crocodilians have uniquely diverse predatory tactics, flexible multi-modal communication systems, advanced parental care that sometimes involves communal or biparental guarding and feeding of the young, unexpected dietary flexibility, diverse play behavior, and even interspecific emotional bonding. I will talk about my research on crocodilian communication and predatory behavior, and briefly cover other discoveries. I'll also analyze the reasons for the surprising fact that almost all this spectacular behavioral complexity has remained unknown until the beginning of the 21st century.

0067 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Graziella DiRenzo[1], Penny Langhammer[2], Kelly Zamudio[3], Karen Lips[1]

[1]*University of Maryland, College Park, MD, USA,* [2]*Arizona State University, Tempe, AZ, USA,* [3]*Cornell University, Ithaca, NY, USA*

Fungal Infection Intensity and Zoospore Output of *Atelopus zeteki*, a Potential Acute Chytrid Supershedder

Amphibians vary in their response to infection by the amphibian-killing chytrid fungus, *Batrachochytrium dendrobatidis* (Bd). Highly susceptible species are the first to decline and/or disappear once Bd arrives at a site. These competent hosts likely facilitate Bd proliferation because of ineffective innate and/or acquired immune defenses. We show that *Atelopus zeteki*, a highly susceptible species that has undergone substantial population declines throughout its range, rapidly and exponentially increases skin Bd infection intensity, achieving intensities that are several orders of magnitude greater than most other species reported. We experimentally infected individuals that were never exposed to Bd (n = 5) or previously exposed to an attenuated Bd strain (JEL427-

P39; n = 3). Within seven days post-inoculation, the average Bd infection intensity was 18,213 zoospores (SE: 9,010; range: 0 to 66,928). Both average Bd infection intensity and zoospore output (i.e., the number of zoospores released per minute by an infected individual) increased exponentially until time of death ($t50 = 7.018$, $p < 0.001$, $t46 = 3.164$, $p = 0.001$, respectively). Mean Bd infection intensity and zoospore output at death were 4,334,422 zoospores (SE: 1,236,431) and 23.55 zoospores per minute (SE: 22.78), respectively. All animals died between 22 and 33 days post-inoculation (mean: 28.88; SE: 1.58). Prior Bd infection had no effect on survival, Bd infection intensity, or zoospore output. We conclude that *A. zeteki*, a highly susceptible amphibian species, may be an acute supershedder. Our results can inform epidemiological models to estimate Bd outbreak probability, especially as they relate to reintroduction programs.

0256 Herp Ecology II, Banquet Room E, Sunday 3 August 2014

Drew Dittmer[1], Joseph Bidwell[2]

[1]*University of Newcastle, Callaghan, New South Wales, Australia,* [2]*East Tennessee State University, Johnson City, Tennessee, USA*

What's the Rock Got to do with it? The Influence of Australia's Iconic Inselberg on Herpetofaunal Assemblages

Uluru Kata-Tjuta National Park (UKTNP) is famous for its namesake inselberg Uluru, which rises roughly 350 meters above an otherwise topographically even landscape. Uluru offers the opportunity to investigate an inselberg's influence on a suite of abiotic variables (e.g. shade, temperature, humidity, and rainfall) and the influence these variable have on the structure of a highly diverse reptile community and a depauperate community of arid adapted amphibians. We installed 27 pitfall and drift fence arrays at the base and at 500 and 1000 meters from Uluru, with each array including temperature humidity data loggers. Pitfalls were checked during the months of April-May 2013, October-December 2013, and January-May 2014. Our analysis will describe patterns of community structure across more than 1000 captures of roughly 47 species coupled with 90 daily minimum, maximum, and average temperatures and humidity recordings for 26 sampled locations around Uluru. To date, habitats sampled at the north base of Uluru are the most diverse for reptiles, while sampled sites at the south base of Uluru have a comparatively low reptile diversity but a high abundance of amphibians. Habitats at the south base spend the bulk of daylight hours in shade from the inselberg and experience extended periods of lower temperatures and higher humidity compared to the warmer and drier microclimates that characterize the north base of Uluru.

0282 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Michael Doosey[1], Nicholas Domke[2]

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Development of the Caudal Fin Skeleton of Capelin *Mallotus villosus* (Osmeridae)

Characters of the caudal fin skeleton can provide important insights into the evolutionary relationships of major groups of fishes, and ontogenetic studies are important for understanding character homologies and examining interrelationships. The purpose of this study is to describe the development of the caudal fin skeleton of *Mallotus villosus* based on observations of cleared and stained specimens from a wild caught growth series ranging in size from 4.2 mm notochord length (NL) to 144 mm standard length (SL). The sequence of chondrification and ossification for each element is described and compared with that of related salmonoid and esocoid fishes. Caudal fin elements are first chondrified in specimens that are 8.9 mm NL and all elements are ossified by 52 mm SL. In general, hypaxial elements (e.g. parhypural, hypurals, hemal arches and spines of preural vertebrae) develop before epaxial elements (e.g. epurals, uroneurals, neural arches and spines of preural vertebrae). Preural centra are among the last elements to form in the caudal skeleton of *M. villosus*. Interestingly, preural centrum 1 does not form. The caudal fin skeleton morphology of adult *M. villosus* is nearly identical to that of other osmerid species. The developmental sequence of the caudal fin skeleton elements of *M. villosus* more closely resembles species of the Salmonoidei than Esocoidei. A ventral-to-dorsal developmental gradient in the caudal fin elements and anterior-posterior gradient in development of vertebral centra are discussed.

0283 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Michael Doosey[1], Henry Bart[1], Nelson Rios[1], Justin Mann[1], Megan Roberson[1], Mariangeles Hernandez[2], Benito Lorenzo[3], Laura Porturas[4], Justin Grubich[5], Paul DeSalles[6], Estella Hernandez[6], Michelle Vanderwel[7], Rachel Vinsel[8], Katy Wichman[9], Diego Barroso[10], Lorraine McInnes[11], Melissa Casarez[12]

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Georeferencing U.S. Fish Collections: A Community-Based Model to Georeferencing Natural History Collections in the FishNet2 Network

FishNet2 (www.fishnet2.net) is a global network of fish collection databases that gives researchers access to data on roughly 4 million fish species lots, representing over 30 million specimens. Prior to this project, less than two-thirds of the records in FishNet2 were georeferenced. The goals of this collaborative project were to georeference all localities without geographic coordinates and repatriate the results to data providers. The Collaborative Georeferencing Client (CoGe) of the GEOLocate Platform was used to georeference and verify the roughly 250,000 localities in FishNet2 lacking coordinates at the start of the project. Each of the twelve collaborating institutions hired a full-time georeferencing technician to verify and correct the CoGe generated geographic coordinates for localities assigned to his or her institution. Since January 2013, when the georeferencing phase of the project began, more than 244,000 localities of have been processed (214,000 corrected), and over 1 million specimen records have been processed (935,000 corrected). Records that could not be georeferenced were skipped and reasons for not correcting the coordinates were recorded. Every corrected record includes geographic coordinates, an uncertainty radius, and most of the records have a user generated error polygon to define the uncertainty in the determinations. Before the project began, less that half of the records from the U.S. were georeferenced. Now 85-90% of the records have geographic coordinates. The project has greatly increased the number of fish records available for the many kinds of research that depend on geographic plotting of records, examples of which will be highlighted.

0275 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Marlis R Douglas[1], Whitney JB Anthonysamy[2], Mark A Davis[2], Max R Bangs[1], Glen Selby[3], Jeff Cole[3], Michael E Douglas[1]

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Bluehead Sucker and the Complex Drainage History of the Upper Little Colorado River

Big River ecosystems and organisms that depend on them are increasingly imperiled and fishes of the Colorado River basin in western North America are no exception, with many native species listed under the Endangered Species Act (ESA). Currently, the Zuni Bluehead Sucker (Zuni BHS; *Catostomus discobolus jarrovii*) is a candidate for listing as endangered, yet disagreement exists regarding the extent of its distribution. We generated mitochondrial DNA (2 genes) and microsatellite data (17 loci) for 340 Bluehead Sucker (BHS: *C. discobolus)* from drainages straddling Arizona, New Mexico and Utah to assess degree of isolation among populations, and to identify distinct evolutionary lineages (=ESUs) and management units (=MUs). Based on our analyses, BHS in the Zuni River drainage is part of the main BHS lineage (the greater Colorado River ESU), but one population showed potential introgression by another species, the Rio Grande Sucker (*C. plebeius)*. Population-level analyses indicated that BHS persists as distinct, demographically independent units among drainages (MUs). In conclusion, Bluehead Sucker populations in the Upper Little Colorado River and adjacent drainages reflect a complex evolutionary history, with periods of isolation punctuated by drainage re-arrangements and potential stream captures. Our data suggest that for current consideration for listing under the ESA, the Zuni BHS is restricted to the Zuni River (NM).

0276 Herp Biogeography & Phylogeography, Banquet Room J, Sunday 3 August 2014

Michael E Douglas[1], Mark A Davis[2], Marlis R Douglas[1], Melissa Amarello[3], Jeffrey J. Smith[3], Hans-Werner Herrmann[4], Gordon W Schuett[5]

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From Pleistocene to Anthropocene: Climate Change and its Impact on Distribution of the Arizona Black Rattlesnake (*Crotalus cerberus*)

The vulnerability of a species to extinction is driven largely by several factors: its genetic capacity to adapt, its ability to disperse, and the rapidity with which its habitat is fragmented or decomposed. These can be gaged in a study species by evaluating its contemporary molecular diversity and dispersal patterns, the modeling of its environmental niche and the manner by which these match future climate projections. Here we examine genetic diversity in the Arizona Black Rattlesnake (*Crotalus cerberus*) by evaluating 100 individuals from across its range using 852 bp of mtDNA ATPase 6 & 8. We compiled geospatial data from these and another 302 museum specimens and employed 19 North American bioclimatic variables (i.e. yearly trends, seasonality, and extreme environmental conditions at 2.5′ spatial resolution; WorldClim) to derive an environmental niche model. These data reveal a restricted distribution during the last interglacial, an expansion during the last glacial maximum, a recession post-Pleistocene, and a northwestern shift driven by projected future climate change, with Grand Canyon a barrier to dispersal. The Arizona Black Rattlesnake is a high elevation woodland specialist associated with riparian areas, and its available habitat has been (and will continue to be) compressed by wildfire. Furthermore, its niche conservatism will promote altitudinal rather than latitudinal range shifts. These aspects, coupled with its shallow genetic divergence, will exacerbate the impacts of a changing climate and promote its potential extirpation.

0249 Herp Ecology & Phylogeography, Banquet Room E, Sunday 3 August 2014

Stephanie Dowell, Evon Hekkala

Fordham Universtiy, Bronx, New York, USA

Phylogeography of the Widespread Nile monitor, *Varanus niloticus*

Large-scale climatic fluctuations and tectonic shifts throughout Africa have influenced present-day species distributions as well as intraspecific genetic variation. By examining

the phylogeography of widespread species, such as the Nile monitor (*Varanus niloticus*), I can gain insight into how historic events have shaped the continent's diversity. *V. niloticus* is distributed throughout most of Sub-Saharan Africa and is largely dependent on permanent sources of water. Historic periods of drought which significantly affected the flow of major river systems likely played a role in structuring *V. niloticus* populations. To examine this idea, I obtained tissue samples from natural history museums and collaborators which span a majority of the species' range. I then sequenced three mitochondrial (*ND1*, *ND2*, and *ND4*) and three nuclear (*RAG-1*, *KIAA1217*, and *KIAA15649*) gene regions known to be variable in the genus *Varanus*. The phylogenetic trees created with this data revealed a large degree of genetic partitioning within *V. niloticus*, separating into a western group (exhibiting the highest level of differentiation) a northern group, and a southern group. West Africa is thought to have contained a forest refuge during the Pleistocene and could potentially explain the high degree of genetic differentiation. The suture zone between the northern and southern genetic groups lies within the Congo Basin and may reflect an ancient connection between the Nile and Congo watersheds. Further investigation with Species Distribution Modeling could elucidate how *V. niloticus* habitat changed throughout past climates and determine if their historic distribution is congruent with the present-day genetic patterns.

0068 AES Ecology, Banquet Room E, Saturday 2 August 2014

William Driggers[1], Bryan Frazier[2], Douglas Adams[3], Glen Ulrich[2], Christian Jones[1], Eric Hoffmayer[1], Matthew Campbell[1]

[1]NMFS Southeast Fisheries Science Center, Pascagoula, MS, USA, [2]South Carolina Dept. of Natural Resources, Charleston, SC, USA, [3]Florida Fish and Wildlife Conservation Commission, Melbourne, FL, USA

Site Fidelity of Bonnetheads (*Sphyrna tiburo*) to Two Discrete Coastal Ecosystems in the Western North Atlantic Ocean

To examine the migratory patterns, habitat utilization and residency of bonnetheads (*Sphyrna tiburo*) in two separate estuarine systems within coastal South Carolina, tags were attached to 2,014 individuals from 1998-2012. In total, 190 bonnetheads were subsequently recaptured after 3-3,263 days at liberty, representing a recapture rate of approximately 9%. All bonnetheads were recaptured within the same estuary where originally tagged on intra and/or inter-annual scales, with the exception of six individuals, which were recaptured during migratory periods (i.e. late fall, winter and spring) in coastal waters off Florida, Georgia, North Carolina, and South Carolina. On 23 occasions groups ranging in size from 2-5 individuals were tagged together on the same day and location and subsequently recaptured together on the same date and location

where initially tagged with times at liberty ranging from 12-1,329 days. Additionally, 17 individuals were recaptured multiple times with times at liberty ranging from 12-3,263 days; all individuals were recaptured in the same estuary where initially tagged. We hypothesize that bonnetheads are using South Carolina's estuaries as summer feeding grounds due to the relatively high abundance of nutrient rich ovigerous blue crabs (*Callinectes sapidus*) during spring and summer months. The high degree of intra and inter-annual site fidelity demonstrated by bonnetheads in this region offers unique opportunities for *in situ* study of various aspects of the biology of chondrichthyan fishes, including identification of essential habitats, growth, homing mechanisms, mortality rates, movement patterns and social behavior.

0191 AES Ecology, Banquet Room E, Saturday 2 August 2014

J. Marcus Drymon[1], Matthew Ajemian[2], Sean Powers[1]

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Dynamic Habitat Use of Young Bull Sharks *Carcharhinus leucas* in a Northern Gulf of Mexico Estuary

Understanding how animals alter habitat use in response to changing abiotic conditions is important for effective conservation management. For bull sharks (*Carcharhinus leucas*), habitat use has been widely examined in the eastern and western Gulf of Mexico; however, knowledge of their movements and the factors influencing them is lacking for populations in the more temperate north-central Gulf of Mexico. To examine how changes in hydrographic conditions affected the presence of young bull sharks in Mobile Bay, Alabama, thirty five sharks were fitted with internal acoustic transmitters and monitored through an acoustic telemetry array consisting of thirty four receivers between June 2009 and December 2010. Tagged sharks ranged in size from 60 to 114 cm fork length and were detected between the upper and lower portions of Mobile Bay. Our findings suggest a combination of hydrographic factors interact to influence the distribution of young bull sharks in Mobile Bay. The factors affecting the probability of detecting at least one bull shark varied both temporally (2009 vs 2010) and spatially (upper vs lower bay). Electivity analysis demonstrated that bull sharks showed highest affinity for warm water (29-32 °C), moderate salinities (10-11 psu) and normoxic waters (5-7 mg/l), although these patterns were not consistent between regions or across years. We suggest future studies coupling telemetry and hydrographic variables should, when possible, consider the interactions of multiple environmental parameters when defining the dynamic variables explaining the spatial distribution of the bull shark.

0218 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Jessica Duke, Joseph Pechmann

Western Carolina University, Cullowhee, NC, USA

Assessing the Effectiveness and Value of Wetland Habitat Created for Amphibians in the Nantahala National Forest in NC

Amphibians have been declining rapidly in recent years due to many factors. One of the largest threats comes from alteration and destruction of both terrestrial and aquatic habitat. The U.S. Forest Service has been creating and restoring wetland habitat across the United States including the creation of 60 vernal ponds in Western North Carolina. These NC ponds were created to increase breeding habitat for amphibians and help curb further population declines. I visited 50 of the ponds in 2013 to determine if they have been successful at providing amphibian breeding habitat. Only 25 of the 50 ponds held water during the first visit in early spring. I revisited these 25 ponds three more times to examine amphibian presence and diversity, aquatic vegetation presence and diversity, and other environmental factors including hydroperiod, canopy closure, and slope. Terrestrial habitat surrounding all ponds was dominated by second growth hardwood forests. Ten of the twelve expected pond-breeding amphibians were observed at one or more ponds. Amphibian species richness increased with pond hydroperiod. The abundance of *P. crucifer* increased with plant species richness and slope and decreased with pond canopy closure and distance to nearest pond. The abundance of *R. clamitans* increased with increased pond hydroperiod. The abundance of *A. americanus* decreased with slope and plant species richness. Future ponds should be created to have longer hydroperiods (not permanent water) to increase amphibian species richness. The abundance of particular species may be influenced by manipulating other factors, including plant species richness and pond canopy openness.

0047 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Andrew M. Durso, Geoff D. Smith, Lorin A. Neuman-Lee, Susannah S. French

Utah State University, Logan, Utah, USA

Using Labeled Nutrient Tracers to Reveal Resource Allocation in Lizards with Competing Needs

Animals must allocate limited resources to competing needs, necessitating trade-offs. Evidence for a fundamental trade-off between self-maintenance and reproduction is widespread but mostly indirect. We used a stable isotope label to measure how nutrition

and handling stress interact to mediate decisions in energy allocation between growth and reproduction in a reptile with a high degree of plasticity in life history traits. Fifty-six gravid female Side-blotched Lizards (*Uta stansburiana*) were wounded and injected with ^{15}N-labeled leucine at the start of the experiment. They were then subjected to one week of frequent handling stress and/or food restriction in a 2x2 design. The proportion of ^{15}N in healed wound scabs was used to evaluate energy allocation to self-maintenance, whereas ^{15}N in eggs was used as a measure of allocation to reproduction. We also measured wound healing rate, immune function, oxidative stress, and corticosterone as indirect measurements of the trade-off. We found significant effects of both types of stress treatments on both direct and indirect endpoints of energy allocation. Although these lizards live only 1-2 years, individuals in stress treatments allocated more energy to self-maintenance than controls, perhaps because all lizards were still in a relatively early stage of their lifetime reproductive output.

0705 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Richard D. Durtsche, Julie A. Moses, Madeline Walker, Joshua Frost, Josué Guerrero, Alexus Rice, Nate Shields, Maider Marin-McGee, Brad McCombs, Miriam Steinitz-Kannan

Northern Kentucky University, Highland Heights, KY, USA

There's an App for That! Developing Mobile Technologies for Stream Parameters and Water Quality Assessment

The ability to record stream conditions at any particular site for a variety of measurement parameters can often be cumbersome, and datasheets can either get wet, mixed up, or lost. Moreover, a research program might enlist a range of data collectors with skill sets that vary from novice to professional. We are developing a "Water Quality PRO" (WQP) app, companion website and database that will facilitate credible field data collection by citizen scientists and professionals alike, and engage the public in science, improving scientific literacy. Reports would then be databased and open access for transfer to other databases (personal, agency, DataONE, etc.). App development is in both English and Spanish to expand the water protection efforts globally. The inability of agency personnel to simultaneously bioassess the quality of all these streams, impacted or not, provides a unique opportunity to educate, engage, and empower students and citizen scientists in watershed monitoring. However, concerns of data credibility are justified for those not trained, as well as for data storage prior to agency or professional use. Our program should ease these concerns, with developing app and database "smart filters." With new technological innovations, the WQP app will have six modules for stream quality assessment including: a site profile, water quality parameters, macroinvertebrates, fish, algae, and habitat quality. In conjunction with

research and development of this app, we have established a website (http://waterqualityprotection.nku.edu) where databased parameters and field reports can be accessed, and further information about stream monitoring, conditions, and health can be acquired.

0170 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

Julia Earl[1], Sean Blomquist[2], Christopher Conner[3], Elizabeth Harper[4], Daniel Hocking[5], Malcolm Hunter[6], Michael Osbourn[7], David Patrick[4], Viorel Popescu[8], Tracy Rittenhouse[9], Raymond Semlitsch[3]

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Estimates of Amphibian Biomass Export from Ponds in Maine and Missouri, USA

Pond breeding amphibians transfer energy, biomass and nutrients between ponds and the terrestrial environment as a necessary part of their life cycle, but the impact on ecosystems is unclear. Previous work shows that a large pond in South Carolina (SC) can export more than a metric ton of amphibian biomass (wet mass) in a single year to terrestrial habitat. Currently, we have little idea if this is typical or whether the large pond size and low predator abundance made this an outstanding year. To investigate variability in amphibian biomass export from ponds, we estimated biomass export from seven ponds over multiple years in Missouri and four ponds over six years in Maine. Amphibian biomass export per year varied greatly among ponds and years. Biomass export was greater on average in Missouri than Maine, but both were much less than the SC pond. However, the SC pond was almost 150 times larger in surface area than the largest pond in our study. One Missouri pond produced greater biomass export per wetland area than the SC pond and three other ponds had similar exports per wetland area, which is remarkable given the longer growing seasons in SC. Though variable, anurans made up the largest portion of amphibian biomass on average in all study areas. Our results show that amphibian biomass export is dynamic in time and space. Greater research in this area will help determine the role of amphibians in ecosystems and the effect of continued amphibian declines.

0702 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Arthur Echternacht[1], Todd Vincent[2]

[1]*University of Tennessee, Knoxville, TN, USA,* [2]*SUNY Jefferson Community College, Watertown, NY, USA*

Asymmetrical Density Effects on Reproduction: Another Mechanism by Which an Introduced Anole Impacts a Native Congener?

Since its introduction in the 1940's in the vicinity of Tampa and Miami in South Florida, the brown anole, *Anolis* (or *Norops*) *sagrei* has expanded its range northward at least as far as coastal northern Georgia. Its arrival at a site has been followed by the displacement or, in heavily disturbed areas, extirpation of native green anoles, *Anolis carolinensis*. We have been interested in the mechanisms that might account for the negative impact of brown on green anoles. Here we report an enclosure study designed to assess the potential importance of population density on the egg production by the two species. Replicate enclosures were stocked with 1 or 2 pairs of either brown or green anoles (conspecific treatments), or with 1 pairs of each species (heterospecific treatment). We attempted to match the size of male lizards and of female lizards, repectively, across treatments and replicates. Lizards from central Florida were introduced into the enclosures on 7 July each year, the lizards were fed crickets ad libitum and the enclosures were sprayed with watered daily unless it was raining. Eggs were harvested daily for the following 85 days. A density effect was observed in conspecific treatments (egg production was reduced in 2-pair treatments as compared to 1-pair treatments). *Anolis carolinensis* exhibited a density effect in heterospecific replicates and the effect was greater than that observed in 2-pair conspecific carolinensis replicates. Egg production by female *A. sagrei* in heterospecific 2-pair replicates approximated that observed in 1-pair conspecific sagrei replicates.

0420 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Cameron Eddy, Daniel Paluh, Kal Ivanov, Cari-Ann Hickerson, Carl Anthony

John Carroll University, University Heights, OH, USA

Selective Foraging Behavior of *Plethodon cinereus* on Ants

Numerous authors have investigated the dietary preferences of the Eastern Red-backed Salamander (*Plethodon cinereus*) and have described this species as a generalist predator of invertebrates. Most of these authors identified prey taxa only to the family or order level and few studies have directly assessed dietary preference. We examined stomach contents, relative to available prey collected from surrounding leaf litter, to determine if

P. cinereus selectively forages on different ant species. Our estimates of prey diversity and richness indicate that salamanders consumed a subset of available ant species. *Aphaenogaster picea*, an abundant species that prefers similar microhabitat characteristics to *P. cinereus*, made up a majority of ant species in the diet. However, *P. cinereus* appears to avoid foraging on *Myrmica punctiventris*, *Myrmecina americana*, and *Lasius alienus*, species that are among the most abundant species in forested areas of northeastern Ohio where our study was conducted. These three species are potentially aggressive and/or chemically defended and these traits may make them less profitable as prey. Our findings suggest that selective foraging may be more common among predators than previously considered, and we suggest that future studies consider maximizing taxonomic resolution when examining diet preferences. For ecologically important generalist predators, such as *P. cinereus*, species level identification of prey has the potential to impact our understanding of trophic interactions within complex communities.

0120 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jacob Egge, Dakota Rowsey, Erinn Kuest

Pacific Lutheran University, Tacoma, WA, USA

A Survey of Extraoral Taste Buds in Otophysan Fishes

Gustation, the 'taste sense,' represents a major chemosensory system in vertebrates. Taste buds, the primary gustatory sense organs, are generally thought of as being restricted to the oral cavity where they play a discriminatory role during ingestion. Unlike other vertebrates, many fish lineages have evolved extraoral taste buds on other surfaces including: gill epithelia, lips, barbels, head, fins, and, in some cases, across the entire body surface. While there are scattered reports of extraoral taste buds in the literature, a systematic survey for the presence of extraoral taste buds has yet to be performed, hindering analyses of their function and evolutionary origin. In order to gain a better understanding of extraoral taste bud distribution and evolution, 24 species representing 24 families and all four major orders of otophysan fishes were surveyed. A combination of light microscopy (LM) and scanning electron microscopy (SEM) were used to search 15 different body regions for the presence of extraoral taste buds. Tissue sections examined under LM were paraffin embedded and stained using hematoxylin and eosin while those used for SEM were dehydrated with hexamethyldisilazane (HMDS) and sputter coated with gold. Taste bud morphologies and distributions were then mapped onto an existing phylogeny of otophysan fishes, allowing for inferences regarding evolutionary history. Results suggest that extraoral taste buds may have evolved multiple times within otophysans. Cypriniformes and Siluriformes demonstrate

the most widespread distribution of taste buds, but also the most variability among lineages.

0055 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Carla Eisemberg[1,2], Tim Berra [2,3]

[1]*Institute for Applied Ecology, University of Canberra, Canberra, ACT, Australia,* [2]*Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin, NT, Australia,* [3]*Department of Evolution, Ecology & Organismal Biology, The Ohio State University, Mansfield, OH, USA*

Notes on the Sale of the Nurseryfish (*Kurtus gulliveri*) in the Kikori Market, Papua New Guinea

The Nurseryfish, *Kurtus gulliveri* (Perciformes, Kurtidae), is a distinctive species restricted to rivers in northern Australia and southern New Guinea. Most studies of this species have been conducted in Australia, where it is not considered a commercial fish. The aim of this study was to collect information on the local sale of the Nurseryfish in the Kikori Market, Gulf Province, Papua New Guinea. A pilot study for monitoring fishes in the Kikori Market was conducted on the 17th, 19th and 23rd of January 2012. The Nurseryfish accounted for 9.3% of the total number of fish recorded (n = 107). Sellers of Nurseryfish belonged to four villages, all located in the delta. The Kikori River delta is a large alluvial plain, where the dominant tree species are *Sonneratia lanceolata* and *Nypa fruticans*. The English local name for the Nurseryfish is Glassfish, while the four language groups in the area called this species Ago (Kibiri), Ebei (Porome), Hago (Kerewa) and Eba (Urama). Eight specimens of nurseryfish were sold smoked, with prices varying from 40 Toea to 2 Kina ($0.15 to $0.76 USD). Two specimens were sold fresh for 1 Kina each ($0.38 USD). Sellers from the delta area regard the Nurseryfish as a common species and no anecdotal report of decline was mentioned. However, this survey was undertaken before the spread of Tilapia *Oreochromis mossambicus*, an introduced species that has become widespread in the Kikori delta. In 2012, no Tilapia was recorded in the Market while in 2013 it was considered common.

0054 Turtle Ecology, Banquet Room H, Sunday 3 August 2014

Carla Eisemberg[1,2], Arthur Georges[1]

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Pig-nosed Turtle (*Carettochelys insculpta*) Coastal-riverine Nesting Dichotomy in the Kikori River, Papua New Guinea: Choice and Trade-offs

The nest environment is a key factor driving reproductive success in oviparous reptiles. Cases of riverine turtles nesting on coastal beaches are particularly intriguing. We addressed the question of the evolution and maintenance of the pig-nosed turtle (*Carettochelys insculpta*) coastal-riverine nesting dichotomy in the Kikori of Papua New Guinea. Nesting starts earlier on the coast, before the dry season, while riverine sandbanks are still under the water. Coastal sandbanks are usually located on islands where monitor lizards (*Varanus indicus*), the major nest predator at riverine sites, are absent. The height of available sandbanks did not differ significantly between coastal and riverine areas, but females nested closer to the highest point of the sandbank in areas with more frequent inundation events. In riverine areas, flooding is highly unpredictable, often remodelling the distribution of sandbanks annually. Riverine inundation can last for several days, increasing the risk of egg mortality; or, depending on rainfall, may not happen at all. In contrast, on the coast, inundation is caused by tides and is spatially universal and more frequent, but it is predictable and of short duration. However, coastal nesting alone is probably not sufficient to maintain *C. insculpta* population in the long-term. Due to its delta sediment dynamics, viable nesting sandbanks are often absent for decades in the Kikori coast. Coastal nesting exhibited by *C. insculpta* is probably a response to highly a stochastic environment, where it is complementary to riverine nesting, increasing the nesting season period and providing predator-free nesting areas.

0423 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

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Estimating Gopher Tortoise Populations in Georgia

Since 2007 the Georgia Department of Natural Resources (DNR) has contracted with the Joseph W. Jones Ecological Research Center at Ichauway to conduct line transect distance sampling (LTDS) to estimate gopher tortoise populations on state, private, and

federal lands in Georgia. Since 2012 we have added an additional in-house DNR tortoise crew to survey more properties. Results of both those efforts are presented here. In addition, we have applied these population estimates, in combination with soil maps and other data, to obtain a preliminary estimate of viable tortoise populations across the state. Although these estimates will need refinement, they provide us with an early working map to assist with tortoise conservation planning at the state level.

0781 SSAR Infrared Imaging Symposium, Banquet Room J, Sunday 3 August 2014

S.A. Emer[1], C. Mora[2], M. Harvey[1], M.S. Grace[1]

[1]Florida Institute of Technology, Melbourne, FL, USA, [2]Bowling Green State University, Bowling Green, OH, USA

Hot or Not: Conditioned Responding and Pit Organ-Based Thermal Stimulus Detection by Burmese Pythons

Large pythons have biological requirements and functions that are extremely different from traditional animal models often used in sensory discrimination experiments. For example, the poorly understood thermal imaging system is a unique sensory modality that enables pythons to "see" thermal images in complete darkness using facial structures called pit organs. Discrimination of thermal stimuli is important for prey detection and acquisition, predator avoidance and thermoregulatory behavior. While natural behavior assays can be used to determine discriminability of stimuli, operant techniques eliminate potentially complicating effects of other cues and habituation of the animals. We report here behavioral conditioning of Burmese pythons, and the first experiments on pit organ-based thermal discrimination by pythons using operant conditioning. Wild pythons transitioned from sessions with a live free-roaming adult rat, to sessions during which access to each of six, pre-killed juvenile mice was contingent on pushbutton contact. Learning was demonstrated by decreased latencies to respond over the course of training sessions. Pythons then performed left and right responses to 25°C and 37°C stimuli during forced choice sessions, for which mean percentage of correct choices was 71%, which was significantly greater than the chance level of 50%. Physical impairment of pit organs resulted in significantly decreased correct choices (mean = 49%) compared to baseline and sham treatments. The techniques presented here can be used to create a detailed description of behavioral thresholds and transduction mechanisms associated with thermal stimuli, producing a better understanding of the functional relationship between the brain, behavior and the environment.

0739 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Sherri Emer[1], Cordula Mora[2], Mark Harvey[1], Michael Grace[1]

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The Heat is On: Behavioral Sensitivity of Burmese Pythons to Thermal Stimuli

The thermal imaging system of Burmese pythons is a unique sensory modality that enables the snakes to "see" thermal images in complete darkness using facial structures called pit organs. Discrimination of environmental thermal stimuli is important for prey detection and acquisition, predator detection and avoidance, and thermoregulatory behavior. Natural behavior assays can be used to determine behavioral thresholds in response to thermal stimuli, but operant techniques eliminate potentially complicating effects of other cues and habituation. We report the first results of thermal sensitivity using pit-organ based thermal discrimination and operant conditioning in wild Burmese pythons. Pythons trained to perform left and right responses to 24°C and 37°C stimuli, exhibited a mean percentage of correct choices (76%) significantly greater than chance (50%). During behavioral sensitivity trials, the trained pythons were presented with randomized temperature differentials ranging from 0.5°C to 12.8°C. The pythons continued to perform at significantly greater than chance levels (mean = 61%) even when presented with the 0.5°C temperature differential; this is the most sensitive value for behavioral responsiveness yet reported for the thermal imaging system of a boid snake. The techniques and results presented here provide a foundation for a detailed description of behavioral thresholds associated with the thermal imaging system. The findings produce a better understanding of the functional relationship between the brain, behavior and environment and its role in python survival and ultimate ecological success in a changing environment.

0359 Turtle Ecology, Banquet Room H, Sunday 3 August 2014

Joshua Ennen[1], Marley Kalis[2], Adam Patterson[2], Brian Kreiser[3], Jeffrey Lovich[4], James Godwin[5], Carl Qualls[3]

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Intradrainage Morphological and Pigmentation Variation and the Potential for Sexual Dichromatism Within Several *Graptemys* Species.

Phenotypic variation (e.g., morphology and pigmentation) within a species is common and there are several ways by which it can originate and be maintained. Often phenotypic variation is found in species with large distributions, where the numerous environmental gradients create a geographic mosaic of phenotypes across the range. In addition, sexual dimorphism may be present when natural and/or sexual selection act upon the sexes differently. Turtles in the genus *Graptemys* provide an interesting model to examine the evolution of phenotypic variation. Many species in the genus are narrowly distributed (restricted to a single drainage system) yet they are characterized by colorful and diverse pigmentation patterns as well as extreme differences in size between the sexes. The objectives of this study were to investigate intradrainage morphological and pigmentation variation and sexual dichromatism in three species, *Graptemys nigrinoda*, *G.flavimaculata*, and *G. oculifera*. We found clinal variation within *G. nigrinoda* and this variation in morphology and pigmentation is likely associated with environmental factors. The investigation of intradrainage phenotypic variation within *G. flavimaculata* and *G. oculifera* is still on going. Our preliminary results also suggest that all three species display sexual dichromatism, where males possess a larger quantity of yellow pigmentation than females.

0031 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Bradley Ennis[2], Mark S. Peterson[1]

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Nekton and Macro-Crustacean Habitat Use of Mississippi Micro-Tidal Saltmarsh Landscapes

Salt marshes have long been recognized as productive habitats that form an important trophic link between the aquatic and terrestrial biomes through the dynamic intertidal zone. We focused on the distribution of nekton (free-swimming organisms) and

common macro-crustaceans within the intertidal to assess the breadth of habitat use by these assemblages based on geo-spatial and hydrological variables. Sampling was conducted on the flooded marsh intertidal in August and September 2011 at three sites in the micro-tidal Grand Bay National Estuarine Research Reserve, MS using bottomless lift nets and pit traps in a landscape design. The sampled assemblage data were compared with concurrent site hydrological analyses in order to determine how distribution on the salt marsh intertidal may be influenced by defined inundation components (e.g., inundation time, frequency of inundation) and by the distance to the nearest water source. A total of 3,238 organisms were collected comprising 12 fish and 13 macro-crustacean species. A two-way nested analysis of similarities (ANOSIM) indicated that the density of the assemblage varied by site (p = 0.1%) and across the salt marsh intertidal (MLV; p = 1.4%), with smaller Diamond killifish, Bayou killifish, and daggerblade grass shrimp individuals moving further up the intertidal landscape compared to near-channel individuals. Overall, assemblages were found to be strongly influenced by the inundation characteristics along the marsh elevation gradient as well as by the unique micro-topography of each site.

0189 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Luke Etchison, Mark Pyron

Ball State University, Muncie, IN, USA

GIS Analysis of River Habitat and Fish Assemblage Structure

Species-habitat relationships of large river fish assemblages historically were limited by the size and spatial complexity of river ecosystems. Recent technological advances include habitat characterization using sonar. We used side scan sonar to characterize substrate size, woody debris presence, and water depth for four 10-km reaches of the Wabash River in Indiana. Fish coordinate data were collected and used to estimate taxon-specific habitat relationships using GIS. We tested for spatial patterns in and among the four 10-km reaches. In addition we tested for temporal patterns in fish-habitat relationships for a single 10-km reach where we have three years of samples. By using sonar classified habitat and fish occurrence data we identified large scale microhabitat patterns in a large river system. These species-habitat relationships for a large river system allow improved understanding of ecosystem structure and potential conservation.

0573 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Kory Evans

University of Louisiana at Lafayette, Lafayette, Louisiana, USA

On Knifefishes and Needlefishes: Ontogeny and Phylogeny of Mouth Position

Apteronotids are a species-rich clade of Neotropical freshwater fishes exhibiting substantial diversity of head and mouth shape with little phenotypic discontinuities among the major taxa. Here we explore the role of heterochrony in the production of diversity in a clade of deep channel apteronotids, the Sternarchellini. We examined ontogenetic and interspecific differences in head and skull morphology among all nine sternarchelline species using landmark-based geometric morphometrics in an explicitly phylogenetic framework. PC1 in head shape explains 25.9% of total variance and represents shape change associated with overall body size. PC2 in head shape explains 24.1% of total variance and includes shape change localized to mouth position. PC1 of neurocranial morphology represents variance from relatively rounded (brachycephalic) to elongate (dolichocephalic) skull shape. PC2 of neurocranial morphology represents differences observed in mouth position among sternarchelline species. Sub-terminal mouth position was found to be both plesiomorphic and paedomorphic, present in out-group taxa, *Pariosternarchus amazonensis*, *Sternarchella orinoco*, and *S. sima*, and in most juvenile sternarchellines. Terminal and superior mouth positions were found to be derived and hypermorphic in *S. terminals*, *S. orthos*, *S. schotti*, *S. calhamazon*, *Magosternarchus duccis* and *M. raptor*. Phylomorphospace analysis shows a sequence of peramorphic elongations of lower and upper jaw morphologies in a transformation series from a sub-terminal to terminal to superior mouth positions, and finally to a derived terminal position in *M. raptor*. This phylogenetic sequence curiously resembles patterns of jaw evolution in the distantly related half-beaks and needlefishes (Belonidae).

0569 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Kory Evans[1], Fabio Pupo[2], James Albert[1]

[1]*University of Louisiana at Lafayette, Lafayette, Louisiana, USA,* [2]*Museu Nacional/UFRJ, Rio de Janeiro, RJ, Brazil*

Neuromorphological Evolution in Loricarioidea Using Geometric Morphometrics

In many fish taxa brain morphology is correlated with habitat and life history variables. The Loricarioidea is a monophyletic group that is the most species-rich clade of

Neoptropical catfishes, representing c. 40% of all Siluriformes. Here we examined neuromorphological diversity in 30 species of Loricarioidea including phylogenetically-basal members (genera) of four families, Astroblepidae, Callichthyidae, Loricariidae and Trichomycteridae, and excluding high specialized taxa like *Corydoras*, *Loricariichthys*, and *Vandellia*. Data from 59 landmarks selected in dorsal view were subjected to geometric morphological analysis in a formal phylogenetic framework, using published phylogenetic trees. Brain morphology was found to be distinct for each family, and strongly structured phylogenetically, with a permutation text against the hypothesis of no phylogenetic signal being rejected (P = 0.048). PC1 explains 55.3% of the brain shape variation in the horizontal plane, describing shape differences localized to the rhomencephalon, especially an enlarged vagal lobes (VL), a reduced cerebellar corpus (CCb), and medially-positioned facial lobes (FL) in Callichthyidae, reduced VL, an expanded CCb, and a laterally-positioned FL in Loricariidae and Astroblepidae. Trichomycteridae exhibits intermediate and plesiomorphic values of PC1. PC2 explains 14.7% of the variation, describing a shape difference in whole brain morphology that is axially compressed and laterally expanded independently in Loricariidae and Callichthyidae. We interpret PC1 to represent evolution towards increased sensitivity to oral stimulation (chemo- and mechanosensation) in Callichthyidae, and towards extra-oral stimulation (from barbles and lips) Astroblepidae.

0520 Ecology and Ethology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD ECOLOGY AND ETHOLOGY

Lauren Eveland[1], Alon Silberbush[2], William Resetarits Jr.[1]

[1]*University of Mississippi, Oxford, MS, USA,* [2]*Ben-Gurion University of the Negev, Beer-Sheva, Israel*

Detection of Predatory Fish Kairomones by Ovipositing Mosquitoes

Many ovipositing species offer little parental care to their offspring other than selecting a site to lay their eggs. Determining the mechanisms that are used to select an adequate site is critical to understanding the dynamics of habitat selection. One possibility is the use of chemical cues. Previous research has found that ovipositing mosquitoes have the ability to detect chemical cues of predators that prey on larval offspring. Fish, in particular, are significant predators of mosquitoe larvae, and have been found to deter mosquitoes from ovipositng in habitats were they reside. In this context, we conducted two experiments to investigate whether *Culex* mosquitoes detect fish kairomones when selecting an oviposition site. We conducted two simultaneous experiments. Each consisted of a paired test with eight sets of pools; half of which were conditioned with mosquitofish (*Gambusia affinis*) or green sunfish (*Lepomis cyanellus*). *Culex* egg rafts were removed daily, reared to fourth instar, and identified to species. *Culex restuans* avoided

mosquitofish treatments, ovipositing 206 egg rafts in the control and 32 in the mosquitofish treatments. *Culex pipiens* did not show preference to either the control or fish treatments. Our findings display evidence that some species of ovipositing mosquitoes are clearly detecting fish kairomones to avoid oviposition in sites that contain fish, and results are species specific toward fish. Determining the fish-released chemicals mosquitoes are detecting could lead to the development of management plans. This would involve the use of natural chemical implantation instead of physically introducing non-native fish to aquatic habitats.

0287 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Gabriel Faggioni[1], Franco Souza[1], Cynthia Prado[2]

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Habitat Occupancy Estimation for Two Neotropical Frogs with Imperfect Detectability

We applied habitat occupancy models to estimate occupancy and detectability of two frog species, *Leptodactylus bufonius* and *L. chaquensis*, inhabiting the Brazilian Chaco, while accounting for imperfect detectability (false-absence data). At our study site, ephemeral ponds are formed during the rainy season (Oct-Mar) when both species reproduce. Although both species can be easily found at the study area, they exhibit different levels of water dependence for reproduction: *L. chaquensis* deposit foam nests directly on the water surface while *L. bufonius* uses dry subterranean chambers built in bare soil to place foam nests. Based on species´ natural history and local habitat characteristics´, we predicted that contrary to *L. bufonius*, *L. chaquensis* should be favored by increasing grass cover, high scrub percentage and canopy opening habitats. In order to obtain presence-absence data and sample history, we visited 50 temporary ponds, three times each, between Oct 2012 and Jan 2013. Simultaneously, we measured habitat variables thought to affect occupancy and detectability. Our results showed that both species had the same imperfect detectability (around 52%) but different occupancy values (*L. bufonius* = 55% and *L. chaquensis* = 96%), which were dependent on grass percentage cover and canopy opening, respectively. Differences in species´ reproductive modes and other natural history features may explain the patterns of habitat occupancy we detected here. We are still sampling the area at different spatial scales to further investigate the influence of habitat variables on species occupancy, dispersion and gene flow.

0045 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Vincent Farallo, Donald Miles

Ohio University, Athens, OH, USA

Exploring Below the Undergrowth: The Role of Microhabitat in the Evolutionary Ecology of Plethodontid Salamanders

One of the primary factors affecting the distribution of a species is the availability of suitable habitat. However, ascertaining those aspects of a habitat linked to population occurrence and persistence is a critical task. Salamanders of the family Plethodontidae are an important component of forest floor ecosystems. Habitat use in this group has been studied extensively, but the majority of studies are either narrowly focused, or involve analyses based on broad scale climate data. Habitat occupancy by salamanders is influenced by the availability of suitable microhabitats, which is the appropriate spatial scale for individual activities associated with survival and reproduction. The generation of large-scale multi-species inferences requires incorporating microhabitat data on a broad spatial-scale. We are gathering microhabitat data over a large portion of the range of plethodontid salamanders from West Virginia south to Georgia. These data will be used to address three questions: 1) Is there significant variation in microhabitat variables in areas of differing species richness? 2) Are microhabitats phylogenetically conserved in plethodontid salamanders or within subclades of Plethodontidae? 3) Can behavioral compensation act to maintain constant physiological performance across habitats that vary in thermal and hydric quality? We began data collection in 2012 and will continue through 2015. Variation in microhabitat use among species and geographic regions will be presented and discussed.

0472 General Ichthyology, Banquet Room G, Sunday 3 August 2014

Stacy Farina[1], Thomas Near[2], William Bemis[1]

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Evolution of the Branchiostegal Membrane and Restricted Gill Openings in Actinopterygian Fishes

The branchiostegal apparatus of actinopterygian fishes forms the ventro-lateral surface of the gill chamber, and variation in its morphology has been linked to variation in ventilatory function. In this study, we examine the evolution of branchiostegal membrane morphology and highlight the convergent evolution of restricted gill openings. We surveyed museum specimens from 433 actinopterygian families and recorded branchiostegal membrane morphology as well as measurements of the head

and body. To reconstruct character state evolution of membrane morphology, we inferred a relaxed molecular clock phylogeny with relative divergence time estimates based on nine nuclear genes that included species from 284 families. We used maximum likelihood and stochastic character mapping to reconstruct probabilities of character states at each node. We found that restricted gill openings have evolved independently in at least 11 clades that are widely distributed across Actinopterygii. A PCA analysis of morphometrics revealed that fishes with restricted gill openings occupy a larger morphospace than fishes with other branchiostegal membrane morphologies. We compiled ecological data on each surveyed species and used a decision tree analysis to determine if restricted gill openings were linked to certain environments. We found that fishes with restricted gill openings occur under a large variety of ecological conditions, with the exception of open-ocean pelagic environments (the only example being molids). Functional and historical explanations for this specialized morphology likely differ within each group, but its ubiquity indicates a need for a better understanding of the diversity of ventilatory morphology and function among fishes.

0685 Fish Systematics & Taxonomy IV, Banquet Room G, Sunday 3 August 2014

Rebecca Farr, Asadullah Siddiqui, Kevin Tang

University of Michigan-Flint, Flint, Michigan, USA

Molecular Phylogeny of Cusk-eels (Teleostei: Ophidiiformes: Ophidiidae)

Cusk-eels (family Ophidiidae) are an enigmatic group of bony fishes that are found predominantly in marine waters around the world. Because the evolutionary relationships between the species of cusk-eels remain poorly understood, the purpose of this project is to reconstruct a phylogeny of them and determine their relationship to other fishes in the order Ophidiiformes. Genomic DNA will be extracted from subjects of all four subfamilies. Eleven genes from their respective genomes will be amplified and sequenced using standard molecular biology techniques. To generate the tree of relationships, the data will be combined and analyzed using modern phylogeny reconstruction methods. The results of this study will provide an evolutionary framework that will be used to revise the classification.

0478 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Logan Fehrenbach, Richard Durtsche, Wesley Parsons

Northern Kentucky University, Highland Heights, KY, USA

Invasive Species Impacts on Amphibian Colonization of Newly Formed Ephemeral Ponds

Wetlands are a critical component as habitat and resources for the survival and reproduction of many amphibian species. Since the Europeans colonized North America, wetlands by size and number available to amphibians have vastly declined. The purpose of our research is to analyze the colonization of newly formed ephemeral ponds in comparison to established ephemeral ponds, to evaluate any differences that exist between ponds with or without invasive species present. We monitored the local amphibian population by using drift fences with pitfall traps, hyla tubes, and cover boards. We also monitored anuran calls by using Wildlife Acoustics sound recorders. Colonization occurred in all new ponds, regardless of invasive or non-invasive designation. However, our findings suggest there is a difference in the use of ponds with invasive species present versus those devoid of invasive species in the established ponds.

0475 SSAR SEIBERT CONSERVATION AWARD, Banquet Room J, Friday 1 August 2014

Jeremy Feinberg, Joanna Burger

Rutgers Univeristy, New Brunswick, New Jersey, USA

Fitness and Survival Effects of the Invasive Grass, *Phragmites australis*, on Tadpoles Transplanted into an Extirpation Zone

Understanding the ecological processes and causes behind species extirpations is important from a conservation perspective, but difficult to investigate without extant populations to sample and examine. This is especially relevant for amphibians, and frogs in particular, that have experienced widespread enigmatic extirpations over recent decades. Herein we present our in situ efforts to retrospectively investigate the specific decline of leopard frogs in New York. We tested the effects of the invasive grass, *Phragmites australis*, on survival and fitness in field-raised tadpoles. Tadpoles were collected as eggs from extant sites outside the extirpation zone and distributed and reared within mesh enclosures at multiple field sites within the extirpation zone. We tested the hypothesis that survival and fitness should decrease with increased levels of invasion, and we repeated our experiments over several seasons and locations to look at

spatial and temporal differences as well. Our preliminary results indicate that survival was not markedly lower at heavily invaded sites, and in fact may have actually been higher than sites with low-or-medium invasion. Thus, *Phragmites* alone may not be responsible for this particular decline. We also observed faster growth rates in tadpoles deployed in mid-spring versus those deployed in mid-summer. Our within-site results were similar (across repeated trials) but our between-site results varied considerably. This type of research can be valuable to researchers studying the effects of environmental, ecological, and temporal conditions on amphibian survival and growth, but also has applications in invasive species study, conservation, and restoration.

0338 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Chris Feldman[1], Edmund Brodie, Jr[2], Edmund Brodie, III[3], Michael Pfrender[4]

[1]University of Nevada, Reno, Reno, NV, USA, [2]Utah State University, Logan, UT, USA, [3]University of Virginia, Charlottesville, VA, USA, [4]University of Notre Dame, Notre Dame, IN, USA

Geographic Structure in TTX Resistance in the Sierra Garter Snake (*Thamnophis couchii*): The Imprint of History and Biogeography on Adaptive Variation

The Geographic Mosaic Theory of Coevolution (GMTC) is the current framework for understanding coevolution, and is based on the notion that populations of species are ecologically and genetically structured over the landscape, leading to diverse coevolutionary dynamics between ecological partners. This geographic structure allows divergent evolutionary processes such as spatially heterogeneous selection, gene flow, and genetic drift to operate independently on subdivided populations, creating a mosaic of coevolution across the landscape. Here, we examine geographic variation in an adaptive trait in the Sierra garter snake (*Thamnophis couchii*). Some populations of *T. couchii* show dramatic resistance to tetrodotoxin (TTX), the lethal poison of their newt prey (*Tarciha*). Geographic patterns of TTX resistance in *T. couchii* suggest that newts and snakes may not have escalated an arms race in the northern Sierra Nevada, while in the southern Sierra these species appear to have intensified an arms-race, with resistance varying more than an order of magnitude across the range of *T. couchii*. These phenotypic patterns correlate strongly with patterns of neutral genetic structure and gene flow, suggesting that biogeography and landscape features have indeed structured coevolution in this system.

0431 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jessica Fenker[1], Leonardo Tedeschi[1], Alexander Pyron[2], Cristiano Nogueira[3]

[1]Universidade de Brasília, Brasília, DF, Brazil, [2]The George Washington University, Washington, DC, USA, [3]Museu de Zollogia da Universidade de São Paulo, São Paulo, SP, Brazil

Phylogenetic Diversity and Conservation of South American Pitvipers

To analyse impacts of habitat loss on evolutionary diversity, and to test if biodiversity metrics work as surrogates for phylogenetic diversity, we study spatial and taxonomic patterns of phylogenetic diversity in a wide-ranging endemic Neotropical snake lineage. We updated distribution maps using species distribution models and a revised presence-records database. We estimated evolutionary distinctiveness using recent molecular and morphological phylogenies, weighted by two measures of extinction risk: percentages of habitat loss and IUCN threat status. We mapped phylogenetic diversity and richness levels, and compared phylogenetic distances in pitviper subsets selected via endemism, richness, threat, habitat loss, biome type and presence in biodiversity hotspots to values obtained in randomized assemblages. Evolutionary distinctiveness differed according to the phylogeny used, and conservation assessment ranks varied according to the chosen proxy of extinction risk. Two of the three main areas of high phylogenetic diversity matched with areas of high species richness. A third area was identified by one phylogeny, and was not a richness hotspot. Faunal assemblages captured phylogenetic diversity levels no better than random. Pitvipers found in the richest areas or in the IUCN Redlist showed significant phylogenetic clustering. Usual biodiversity metrics were unable to adequately represent spatial patterns of evolutionary diversity in pitvipers and current Redlist status fails to properly represent evolutionary distinctiveness. Phylogenetic diversity is unevenly distributed even within biodiversity hotspots, and species-poor areas may harbour high phylogenetic diversity. This reinforces the need for targeted and spatially accurate approaches for adequately representing evolutionary processes in conservation planning.

0264 Fish Systematics & Taxonomy II, Banquet Room G, Sunday 3 August 2014

Shobnom Ferdous, Jonathan Armbruster

Auburn University, Auburn, AL, USA

The Identity of Catfishes Identified as *Mystus gulio* (Hamilton, 1822) (Teleostei: Bagridae), and Designation of a Neotype

The identity of *Mystus gulio*, a bagrid catfish species, widely distributed in Southeast Asia was redescribed and a Neotype was designated. The designation of a Neotype was necessary because of ambiguous data in Hamilton's (1822) original description and there were never a type specimen for this species. At least nine species have been named that are now considered to be synonyms of *M. gulio*. Morphological and molecular data indicate that *M. gulio* species complex is one single species.

0302 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Amber Ferguson[1], Daniel Huber[2], Philip Motta[1]

[1]University of South Florida, Tampa, FL, USA, [2]University of Tampa, Tampa, FL, USA

Feeding Performance of King Mackerel, *Scomberomorus cavalla*

Feeding performance is the ability to capture and handle prey successfully. Bite force is a common measure of feeding performance that is constrained in part by the morphology of the head and jaws, muscle physiology and architecture, and lever arms. Other factors including ram speed and dentition may also affect feeding performance. King mackerel, *Scomberomorus cavalla*, are a fast swimming, large coastal pelagic species that uses ram feeding on teleost fishes. They have a large gape and sharp laterally compressed teeth. This study investigates both static bite force, dynamic forces resulting from ram strikes, as well as bite pressure to examine their relative contributions to overall feeding performance. A three dimensional static equilibrium model is used to estimate maximum static bite force. Theoretical values of posterior bite force reach 123 N for the largest specimen of 117cm FL. Ram speed measurements ranging from 3.3-15.8 bl/s were recorded with a rod and reel incorporated with a line counter and video camera. Using cross sectional area of the tooth as it pierces the prey, bite pressure is estimated using theoretical bite forces at three gapes. King mackerel exhibit bilateral bite pressures up to 57 MPa. Mass specific bite force for king mackerel is relatively low in comparison with other bony fishes and sharks with relatively little force transferred to the prey during the strike suggesting they rely on high velocity chases coupled with biting with sharp teeth to maximize feeding performance.

0224 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Jennifer Fill[1], Jayme Waldron[2], Shane Welch[2], Timothy Mousseau[1]

[1]University of South Carolina Columbia, Columbia, SC, USA, [2]Marshall University, Huntington, WV, USA

Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) Habitat Selection in the Southeast Coastal Plain Tidewater Region

The eastern diamondback rattlesnake (*Crotalus adamanteus*; EDB) is an endemic predator of imperiled longleaf pine (LLP) savannas and woodlands in the southeastern Coastal Plain. Habitat loss has been suggested as the principle cause of the species' dramatic decline. We examined EDB habitat selection in the Coastal Plain tidewater region at two scales: home range (HR) and within the home range (WHR). We examined the relative importance of vegetative and surface characteristics, as well as the role of ecosystem structure (canopy/ground cover) or function (cover type) in EDB habitat selection. We used an information-theoretic approach and binomial logistic regression to model habitat selection as use vs. availability. At the HR scale, cover type, aspect, and elevation best predicted EDB habitat selection. EDBs exhibited significantly negative associations with cover types other than pine savanna, and selected locations that were oriented in a southwesterly direction. At the WHR scale, canopy and ground cover were additional predictors. Although canopy cover was not significant, EDBs selected locations with greater ground cover than random, and we detected a strong negative association with forest cover. Our results underscore the importance of functional pine savannas for maintaining rattlesnake populations. Management for pine savanna integrity at multiple scales will enhance EDB conservation and support the persistence of their populations in southeastern landscapes.

0513 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Michael Finkler

Indiana University Kokomo, Kokomo, Indiana, USA

Sexual Dimorphism in Heart Size in Four Species of North American Anurans

Sexual selection exerts different pressures on males and females in terms of how they allocate resources to reproduction. In anurans, much of the resource investment in reproduction by females occurs during gametogenesis, whereas the primary investment of males is in breeding activities such as calling, female location and displacing rival

males. As such, one might hypothesize that males and females may exhibit dimorphisms in the relative size of visceral organs related to whole animal. In this study, I examined the scaling of heart mass with carcass mass in males and females from four species of anuran (*Anaxyrus americanus*, *Hyla versicolor*, *Lithobates pipiens*, and *Pseudacris crucifer*) collected early in their respective breeding seasons. Heart mass tended to increase more with increasing body size in males than in females. Moreover, size-adjusted mean heart size was significantly larger in males than in females in the two hylid species (*H. versicolor* and *P. crucifer*). Our findings suggest that differential scaling of heart mass is commonplace among anurans, with heart mass scaling more acutely in males than in females. This likely reflects higher levels of activity by males during the breeding season.

0750 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Daniel Fitzgerald[1], Mario Zuluaga[2], Tommaso Giarrizzo[2], Mark Sabaj[3], Nathan Lujan[4], Leandro Sousa[5], Lucia Rapp[6], Jansen Zuanon[6], Kirk Winemiller[1], John Lundberg[3]

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Food Web Structure of the Lower Xingu River: A Unique and Immediately Imperiled Ecosystem in the Lower Amazon Basin

The Xingu River is a large, clear water tributary of the lower Amazon, distinguished by a 130 km system of rapids and a highly diverse, endemic fish fauna. As with other high-gradient rivers throughout the world, the Xingu faces substantial pressure from hydroelectric development. Construction is nearly completed on the Belo Monte Hydroelectric Complex, which is set to be the third largest hydropower complex in the world. This complex will impound a major river segment, may dewater the Volta Grande rapids between Pimental diversion dam and Belo Monte, and will drastically change aquatic habitats and ecological dynamics in the lower Xingu. In addition to potential impacts on the endemic fauna of the rapids, the change from lotic to lentic habitats may alter the flow of energy through the aquatic food web. In order to develop baseline understanding of food web structure within the Xingu prior to completion of the Belo Monte Dam, we are using carbon and nitrogen stable isotope ratios to estimate

the principal basal production sources supporting fish diversity, and how assimilation of these sources into biomass of species and functional groups changes seasonally. Here we present preliminary findings from an analysis of 21 fish species collected during the 2013 dry season. Results indicate that the most important primary production sources supporting fishes in the dry season are epilithic algae and C3 riparian plants. In addition, we found higher trophic diversity within more complex, rocky rapids habitats compared to sandy beach habitats.

0474 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Ben Fitzpatrick

University of Tennessee, Knoxville, TN, USA

Diffuse Associations Between Salamanders and Skin Bacteria

A growing body of evidence indicates that all animals and plants have intimate associations with microbes, but how symbiotic communities should be incorporated into general ecology is not well established. We distinguish two qualitative models of host-symbiont community structure. The metaorganismal model describes hosts and their associated microbial assemblages as highly organized, collective units of ecology and evolution. This model predicts that each host species will be associated with highly specialized microbes. The individualistic model describes generalized interaction networks as markets in which many different kinds of host interact with many different symbionts. This model predicts a diffuse distribution of each microbial species across many host species. We tested for diffuse vs. specialized interactions by evaluating the specificity and consistency of microbial associations with salamander skin at community and population levels. We analyzed over 1.6 million 16S ribosomal RNA gene sequences of bacteria amplified from the skin of 62 salamanders in the Great Smoky Mountains. Overall, bacterial assemblages from eight different host species were not statistically distinguishable. Community differences among hosts were associated with spatial distance rather than host species, suggesting a dominant role for horizontal or environmental transmission. Indicator species analyses produced no evidence of microbial specialization, even between salamanders with quite different skin secretions. Our results are consistent with an individualistic model in which host-microbe interactions are generally diffuse rather than specialized.

0652 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Michael Flinn, Jared Militello

Murray State University, Murray, KY, USA

Restoration and Movement Patterns of Juvenile Alligator Gar in Western Kentucky

Alligator Gar (*Atractosteus spatula*) populations have been threatened, extirpated, or are experiencing serious decline across most of their native range throughout the Lower Mississippi River valley. The Kentucky Department of Fish and Wildlife Resources (KDFWR) has made a commitment to restore alligator gar in their native waters within the Commonwealth by actively rearing and propagating hatchery fry beginning in 2009. In October 2010, 20 juvenile alligator gar (age-0, ~20-25 inches long) were surgically implanted with Vemco V13 acoustic telemetry tags and stocked in the Clarks River in northwestern Kentucky. After nearly one full year of tracking these juvenile alligator gar, linear kernel density estimates of home ranges showed that the overall 50% utilization distribution (i.e. core range) was 4.65 km, but seasonal core ranges varied across seasons (1.09 - 4.75 km). Spatial distribution was heavily influenced by home range selection, as most fish maintained position near a core range, but occasionally departed with seasonal and environmental changes. Home range fidelity was high for all fish, while 70% of all movements were 2,000 m or less, indicating that juvenile alligator gar exhibit strong affinities towards available habitat in the Clarks River. Analysis of habitat transects showed that fish distribution in the upper river was correlated with abundance of coarse woody debris (0.84) and riparian canopy cover (0.87) in the lower river distribution was influenced by bank slope and median depth in the channel (0.95). These results show that initial attempts for restoration of juvenile alligator gar in western Kentucky is promising.

0436 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Brian Folt, Nicole Garrison, Craig Guyer, Jason Bond

Auburn University, Auburn, Alabama, USA

Phylogeography of the Red Salamander (*Pseudotriton ruber*)

The Red Salamander (*Pseudotriton ruber*) is a widely-distributed and secretive plethodontid occupying small stream and spring habitats in the eastern United States. Four subspecific taxa have been used to describe geographic variation of the species: *P. r. ruber* occupies upland habitats above the Fall Line, *P. r. vioscai* occurs in Gulf and Atlantic Coastal Plain habitats, and *P. r. nitidus* and *P. r. schencki* inhabit disjunct areas in

the Blue Ridge Mountains. Although these four taxa are largely allopatric, Mount (1975) suggested that *ruber* and *vioscai* intergrade through central Alabama. In this study, we sequenced regions of the mitochondrial genes encoding cytochrome b (866 bp) and NADH dehydrogenase subunit 2 (474 bp) from 83 individuals representing 44 localities across the distribution of *P. ruber*. We used maximum likelihood-based phylogenetic inference methods to test the monophyly of currently recognized taxa and to evaluate whether putative intergrade populations are attributable to particular taxa. Our phylogeny recovered two strongly supported clades within *P. ruber*: a Gulf Coastal Plain population from western Kentucky to south-central Alabama, and a population from the Apalachicola drainage north through Appalachia. Morphological phenotypes were not monophyletic, and populations from the proposed intergradation zone were most closely related to *P. r. ruber*. *Pseudotriton r. schencki* was paraphyletic with respect to *nitidus*, but interior nodes describing montane populations were not well supported. We suggest the Choctawhatchee River may have been an important barrier in the historical biogeography of *P. ruber* and discuss the results relative to the evolution of plethodontid salamanders.

0346 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Enrique Font[1], Esther Ortí[1], Elisa Toscano[1], Pau Carazo[2]

[1]*University of Valencia, Valencia, Spain,* [2]*University of Oxford, Oxford, UK*

Structure and Function of Lacertid Visual Displays: Foot Shaking in European Wall Lizards (*Podarcis muralis*)

Diurnal lizards have become a model group for the study of dynamic (movement-based) visual signals. Best known among these are the head bobbing displays of lizards in the Iguania group. In contrast, the forelimb displays (foot shaking, arm waving) produced by many lizards have received much less attention. Here we present data on the structure, variability, frequency of occurrence and putative signaling function of foot shakes in a population of wall lizards (*Podarcis muralis*) from the south-eastern Pyrenees. Foot shakes consist of one or more up and down, roughly circular movements of the hand or the entire forelimb that may engage one or both forelegs, either sequentially or simultaneously. Foot shakes may be given in conjunction with other displays such as head bobbing and tail waving. Wall lizards produce three types of stereotyped foot shake displays that are performed in different contexts and differ in their structure and body posture of the displaying lizard. Type I foot shakes are broadcast (non-directed) displays of low amplitude performed by lizards belonging to all sex-age classes, often after a bout of locomotion. Type II foot shakes are faster than other types and are performed by females in the course of close-range male-female interactions (female greeting display). Type III foot shakes are large amplitude pursuit-deterrent displays

addressed to potential predators and are often performed with the leg facing the predator. The available information suggests that lacertid foot shakes are complex visual signals analogous to the head bobbing displays of iguanids and other lizards.

0221 AES Genetics, Genomics, & Systematics, Banquet Room E, Saturday 2 August 2014

Joao Pedro Fontenelle, Marcelo Carvalho

Universidade de São Paulo, Sao Paulo/SP, Brazil

Morphological Variation and Distribution of the *Potamotrygon scobina* Species Complex in the Amazon Basin (Chondrichthyes: Potamotrygonidae)

The species *Potamotrygon scobina* Garman, 1913, described from the lower Amazon River and recorded in many tributaries of the Amazon basin, has been reviewed and characterized based on its morphological characters and distribution. This widespread species has been subdivided into five separate species. Each species is diagnosed, described and compared to all species of *Potamotrygon*; their distribution is discussed in light of neotectonic transformations documented in the Amazonian region. Most of these species occur in specific rivers of the Amazon basin, providing relevant data for biogeographical studies. The documented morphological variation exemplifies how a thorough morphological approach is still a very important tool in systematics.

0241 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

João Pedro Fontenelle, Thiago Loboda, Marcelo Carvalho

Instituto de Biociências USP, São Paulo, SP, Brazil

Angular Cartilage Variation and Structure Among Neotropical Freshwater Stingrays (Chondrichthyes: Myliobatiformes: Potamotrygonidae)

A study of the morphological patterns of the angular cartilages of Neotropical freshwater stingrays has been undertaken in parallel to ongoing morphological and taxonomic revisions of this group. Data on the number, size and shape of these structures were gathered from radiographs, manual dissection, cleared and stained specimens, and dry skeletons of 24 of the currently recognized 28 species of the family. *Potamotrygon* species vary significantly in number (from one to three) and shape of the angulars, whereas *Plesiotrygon* presents a single, well formed element. Some specimens of *Paratrygon aiereba* present a single, reduced angular cartilage, but *Heliotrygon* lacks

them entirely. Morphological patterns of the angular cartilages may help elucidate issues regarding the taxonomy, biogeography, origin and diversification of the family.

0090 Herp Reproduction, Banquet Room I, Sunday 3 August 2014

Neil Ford[1], Richard Seigel[2]

[1]University of Texas-Tyler, Tyler, TX, USA, [2]Towson University, Towson, MD, USA

The Influence of Female Body Size and Shape on the Trade-Off Between Offspring Number and Offspring Size in Two Viviparous Snakes

Although the trade-off between offspring size and the number of offspring is a critical component of life-history theory, many empirical tests fail to show that such a trade-off exists. Although this may be due to statistical issues (i.e., failure to control for maternal body size), other complications such as female body shape may play a role as well. Here, we examined reproductive traits in two species of viviparous Garter Snakes with very different body morphologies (*Thamnophis marcianus* and *T. proximus*) to see how female body shape affects this trade-off. In the more slender species (*T. proximus*), we found a strong, negative relationship between brood size and offspring size, with the effect most notable in smaller females. However, in the more robust snake (*T. marcianus*), the trade-off was only seen in smaller females and was not significant for either larger females or for the sample as a whole. Our data support earlier work on ectotherms, which indicates that body shape can act to constrain how offspring size and clutch or litter size are related.

0148 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Neil Ford[1], Kaitlyn Pettingill[2], Corey Cates[3]

[1]University of Texas at Tyler, Tyler, TX, USA, [2]Iowa State Univ., Ames, IA, USA, [3]Univ. of Alabama at Birmingham, Birmingham, AL, USA

Behavioral and Reproductive Consequences of Compensatory Growth in Snake Species Exhibiting Differential Sexual Size Dimorphism

Nutritional stress during natal periods can have significant long-term consequences for adult characteristics. Response to poor early nutrition can either be to exhibit catch up growth (compensation) when prey availability improves or to delay maturation. Compensatory growth can be accomplished by the diversion of energy towards growth from other physiological functions (i.e. immunity) or by increasing energy intake

through behavioral changes. Neither method comes without consequence, i.e. increased foraging may expose young animals to increased predatory pressure. The allocation of resources towards growth varies amongst species, depending on their evolutionary drive for overall body size. In species with female biased sexual size dimorphism, female growth is directly related to adult fitness but is not in males. In male biased sexual size dimorphism (with male combat) large body size is advantageous to both sexes. We subjected neonates of two species of snake that differ in sexual size dimorphism (*Thamnophis marcianus* and *Pantherophis guttata*) to either dietary restriction (20% BM/week) or high diets (60% BM/ week) for 3 months and then fed them ad libitum. As hypothesized the male *T. marcianus* exhibited the fastest compensatory responses. The diet restricted groups explored more, fed more quickly and displayed more aggressive behaviors indicating that behavioral changes were involved in compensatory growth. Surprisingly, after reaching maturity neither species had differences in courtship activity or in reproductive traits.

0699 AES Conservation & Physiology, Banquet Room E, Sunday 3 August 2014

Sonja Fordham

Shark Advocates International, Washington, DC, USA

Conserving America's Forgotten Shark: Management of Dusky Smoothhound (*Mustelus canis*) Fishing in the U.S. Atlantic

The dusky smoothhound (*Mustelus canis*), also known as the smooth dogfish, is the only U.S. Atlantic shark subject to targeted, unlimited fishing. Unlike most other commercially valuable elasmobranchs in the region, smoothhounds have not yet been evaluated in terms of population status or ecological risk. Landings more than doubled from 2000 to 2011, making smoothhounds one of the country's most heavily fished sharks. While smoothhounds are marketed locally in Mid-Atlantic states, international demand for meat (particularly fish and chips) reportedly drives fisheries. Fins are sent to Asia for use in shark fin soup. Specific information on exports is scarce due to the lack of federal regulation, which has been stalled due to the absence of sustainable catch recommendations, changes in lead management responsibility, and low public concern. Initial state catch limits were quickly revoked. Text in the federal Shark Conservation Act of 2010 suggesting smooth dogfish be exempted from tougher national shark finning prevention measures - although not yet interpreted into federal regulation -- has led to weaker state finning bans and postponement of a federal precautionary landings cap. Exceptions for smoothhounds have also been included in several East coast state shark fin bans, without justification. Long-term sustainable fishing for this relatively prolific shark depends on prompt evaluation and regulation of exploitation, while

harmonization of shark conservation standards would benefit national, regional, and international elasmobranch policy development. Scientists, resource managers, elected officials, and concerned citizens all have roles in achieving these goals.

0567 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Jacob Fose, Peter Zervas, Philip Lienesch

Western Kentucky University, Bowling Green, KY, USA

Possible Reproductive Interference by Introduced Yellow Bass (*Morone mississippienesis*) on Native White Bass (*Morone chrysops*) in Barren River Lake, KY

Barren River Lake is a 4,000 hectare flood-control reservoir in south central Kentucky. White bass (*Morone chrysops*) occurred in the drainage prior to impoundment in 1964 and developed into a valuable fishery over the next few decades. Following the intentional introduction of hybrid striped bass (*Morone chrysops* X *Morone saxatilis*) (1980-present) and unintentional introduction of yellow bass (*Morone mississipiensis*)(ca. 2001), white bass populations have declined to where few anglers target the species. We examined the life-history traits of newly introduced yellow bass in 2008-2009 and the interactions of *Morone* spp. on the spawning grounds in 2012 -2013. Monthly evening boat electrofishing along main-lake shoreline and tributary arms from March 2008 to March 2009 resulted in the capture of 336 yellow bass. Capture of adults declined in May while they were presumed to be in tributary creeks spawning. Data from Barren River upstream of the reservoir in 2012-2013 verified that yellow bass were migrating upstream to spawn in late spring, after white bass had been on the spawning grounds for multiple weeks. The presence of fish eggs in the stomachs of yellow bass on the spawning grounds supports the hypothesis that they may be having a negative effect on the white bass population through direct predation on young. We hypothesize that the timing of yellow bass and white bass spawning may make white bass larvae susceptible to predation by yellow bass as they are drifting downstream toward the reservoir.

0413 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Kimberly Foster[1], Luke M. Bower[2], Kyle R. Piller[1]

[1]Southeastern Louisiana University, Hammond, LA, USA, [2]Texas A&M, College Station, TX, USA

Getting in Shape: Habitat-based Body Shape Divergence for Two Sympatric Fishes

Freshwater fishes often show large amounts of body shape variation across divergent habitats, and in most cases the observed differences have been attributed to the environmental pressures of living in lentic or lotic habitats. Previous researchers have suggested a distinct set of characters and morphological features for species occupying each habitat under the steady-unsteady swimming performance model. We tested this model and assessed body shape variation using geometric morphometrics for two widespread fishes, *Goodea atripinnis* (Goodeidae) and *Chirostoma jordani* (Atherinopsidae), inhabiting lentic and lotic habitats across the Mesa Central of Mexico. Our analyses reveal morphometric differentiation along the same axes for both species in each habitat. Both possess a deeper body shape in lentic habitats and a more streamlined body in lotic habitats, although the degree of divergence between habitats was less for *C. jordani*. Differences in the position of the mouth differed between habitats as well, with both species possessing a more superior mouth in lentic habitats. These recovered patterns are generally consistent with the steady-unsteady swimming model and highlight the significance of environmental forces in driving body shape differences of organisms in divergent habitats.

0310 NIA STUDENT COMPETITION, Banquet Room G, Friday 1 August 2014

Benjamin Frable, Brian Sidlauskas

Oregon State University, Corvallis, Oregon, USA

It's Inner Beauty that Counts: Ecomorphological Diversification and Speciation in the Neotropical Fish Superfamily, Anostomoidea (Ostariophysi:Characiformes)

The hyper-abundant Neotropical freshwater fish superfamily, Anostomoidea contains two groups with seemingly disparate evolutionary strategies. The first group, the anostomids, represent ~150 species with a wide variety of body coloration, mouth position, tooth shape and trophic strategies ranging from herbivory to insectivory and even freshwater sponges. The other major group, the families: curimatids, chilodontids and prochilodontids, contains around the same number of species but members are

generally silvery with some pigmentation and fin coloration, have little variation in mouth position, possess reduced or no teeth and all feed mostly on detritus, or decaying organic matter and associated microorganisms. Although the detritivores may be superficially similar, there is substantial variation in the arrangement of the gill arches, which are used in processing food, within each family and even at the generic level. We investigate 1) how a group that presumably feeds on the same resource exhibits similar species diversity to the Anostomidae, 2) if detritivore gill arches are more variable than anostomids, 3) if detritivores are evolving gill arch morphology faster than the anostomids and finally 4) if there is a relationship between ecomorphological diversity and speciation rates. To answer these questions, we generate the first time-calibrated phylogenies for the Anostomoidea and collected multivariate morphometric data of ventral gill arch shape for over 70% of known species and determine rates of phenotypic evolution and speciation. This system provides a crucial example for investigating both the role of ecomorphology in speciation and whether detritivory encompasses a spectrum of morphological and ecological specialization.

0544 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Banquet Room J, Friday 1 August 2014

Elyse Freitas, Aaron Bauer, Todd Jackman

Villanova University, Villanova, Pennsylvania, USA

Molecular Phylogenetics and Patterns of Limb Loss in the Genus *Scelotes*

The genus *Scelotes* Fitzinger 1826 comprises 21 species of limb-reduced and limbless semi-fossorial skinks from sub-Saharan Africa, with 20 species found in southern Africa. Species inhabit narrow allopatric ranges throughout coastal and inland sandy areas of the subcontinent, and limbed and limbless forms are found in neighboring localities. As a result of anthropogenic factors, one species has gone extinct and seven others are listed as threatened, vulnerable, or critically endangered. Additional species may be threatened in the future as coastal development expands. Despite the importance of understanding the species-level relationships of the genus, there have been no comprehensive genus-wide phylogenetic studies of *Scelotes*. Previous phylogenetic studies of *Scelotes* have predominately focused on western species, with few eastern species included, and these studies indicate paraphyly of several species and suggest instances of cryptic speciation. Additionally, although limb loss in *Scelotes* is generally thought to follow an evolutionary gradient in which the loss of limbs is irreversible, a previous study suggests that evolutionary reversals in limb reduction may have occurred. Using the mitochondrial genes 12S and ND2 and the nuclear genes RAG1, MXRA5, and EXPH5, we developed a robust phylogeny of the genus with more complete taxon sampling to infer relationships between the species. Using this

phylogeny, we examined patterns of limb loss and developed ancestral state reconstructions to investigate the progression of limb loss within the genus. Data reveals monophyletic eastern and western clades with evidence of multiple instances of limb loss in the genus.

0372 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Michael Fulbright, James Flaherty, C. M. Gienger

Austin Peay State University, Clarksville, TN, USA

Ontogenetic Differences in Habitat Selection by Cottonmouth Snakes (*Agkistrodon piscivorus*)

Intraspecific competition plays a significant role in determining how species are distributed throughout a habitat. Because of morphological and ecological similarities, conspecifics are directly competing for the same resources and must find ways to partition the available resources within an area. When the conspecifics are cannibalistic, smaller individuals must also avoid larger conspecifics. We investigated the spatial distribution of cottonmouths in an isolated wetland and measured microhabitat variables for locations where snakes were found and compared them to randomly-selected sites within the wetland. We found that juvenile snakes are limited to areas of shallow or no standing water along margins of the wetland, whereas adult males were more commonly found in areas with deeper water in the wetland interior. Adult females were found primarily in intermediate habitats between open canopy buttonbush (*Cephalanthus occidentalis*) slough and dense canopy lowland forest.

0486 Ecology and Ethology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD ECOLOGY AND ETHOLOGY

Brittany V. Furtado, Jessie J. Green, Ginny L. Adams, Reid Adams

University of Central Arkansas, Conway, AR, USA

The Impact of Natural Gas Development on Fish Communities of the Fayetteville Shale, Arkansas

The Fayetteville Shale has experienced exponential growth in gas well development over the last decade, yet long-term effects of this development on aquatic communities remain relatively unknown. In spring 2012 and 2013, we sampled 12 sites throughout the eastern Fayetteville Shale in north central Arkansas. Fishes were sampled

quantitatively using backpack electrofishing and three-pass depletion at multiple riffle-pool units per site. We examined a suite of biotic metrics in relation to increasing gas well density (GWD). Pairwise correlations from 2012 and 2013 show persisting significant ($p < 0.05$) relationships for all variables, except species richness. Proportional abundance of sensitive taxa ranged from 19.5 to 63.0% (2012) and 16.6 to 78.2% (2013) and was negatively correlated with GWD in both years (2012: r= -0.81; 2013: r=-0.75). Proportional abundance of darters ranged from 6.1 to 63.0% (2012) and 0.0 to 78.2% (2013) and was negatively correlated with GWD (2012: r= -0.84; 2013: r=-0.70). Proportional abundance of *L. cyanellus* ranged from 1.31 to 23.6% (2012) and 0.0 to 47.4% (2013) and was positively correlated with GWD (2012: r= 0.61; 2013: r=0.77). We used partial correlations to examine strength of the relations to GWD when % pasture, the only land use variable with a similar significant relationship with all variables, was held constant. With the exception of species richness, all other variables showed the strongest relationship with GWD in each year and were significantly correlated with GWD. Results from both years indicate persisting disturbance at the study sites strongly linked to gas well development.

0411 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Keisuke Furumitsu, Atsuko Yamaguchi

Nagasaki University, Nagasaki, Japan

Reproductive Aspects of the Pale-edged Stingray, *Dasyatis zugei*, in Ariake Bay, Japan

The pale-edged stingray, *Dasyatis zugei*, is a small dasyatid with an extremely elongated snout, and it is found in waters between India and Southern Japan. The stingray has been used as a fishery resource in Southeast Asia; therefore, reduction in its abundance has been a concern. We examined the species composition, abundance, and biomass of demersal fish species in the central region of Ariake Bay, Japan, and found that the genus *Dasyatis* is the abundant species. Information on the reproductive biology of *D. zugei* is considerably limited. In this study, we investigated the reproductive biology of *D. zugei* in Ariake Bay. Between November 2001 and September 2013, a total of 190 specimens (64 males and 126 females) were collected using trawls, gill nets, and set nets from Ariake Bay. Maturity stages of the specimens were assessed on the basis of the degree of development of the testes and claspers for males and the presence of yolky ova in the ovaries and eggs or embryos in the uterus for females. Females reached greater maximum DW (331 mm) than males (257 mm). DW50 was estimated at 213.5 mm DW for males and 275.1 mm DW for females. The reproductive mode for *D. zugei* was aplacental viviparity with uterine trophonemata. From a dorsal perspective, the uterus and ovaries were functional only on the left side of the body. The number of uterine

eggs and embryos ranged from 2 to 8 (mean, 4.6) and was correlated with maternal size; parturition occurred in August.

0765 Herp & Ich Genomics, Banquet Room J, Sunday 3 August 2014

Michelle Gaither[1], Moises Bernal[1], Richard Coleman[2], Brian Bowen[2], Shelley Jones[1], Brian Simison[1], Luiz Rocha[1]

[1]California Academy of Sciences, San Francisco, CA, USA, [2]Hawaii Institute of Marine Biology, Kaneohe, HI, USA

Genomic Evidence for Ecological Speciation in a Coral Reef Fish

The drivers of speciation remain among the most controversial topics in evolutionary biology. Initially, Darwin emphasized natural selection, but that view was largely abandoned by the architects of the Modern Synthesis in favor of speciation by geographic isolation. The balance between selection and isolation is still at the forefront of evolutionary debate, especially for the world's tropical oceans where biodiversity is high but isolating barriers are few. Here we illuminate the drivers of speciation in a Pacific reef fish *Acanthurus olivaceus* by comparative genomics of two peripheral populations that nearly-synchronously split from a large Central-West Pacific lineage. Conventional mtDNA and nuclear intron sequences show that the populations in the Hawaiian Archipelago and the Marquesas Islands were both isolated approximately half a million years ago. The Hawaiian lineage is morphologically indistinguishable from the widespread Pacific form, but the Marquesan form is recognized as a distinct species *A. reversus*, occupying an unusual tropical ecosystem characterized by upwelling, temperature fluctuations, algal blooms, and little coral cover. An analysis of 3737 single nucleotide polymorphisms (via RADSeq) reveals a strong signal of selection at the Marquesas, which includes 59 outlier loci, while the Hawaiian population shows no signal of selection. This contrast between closely related lineages reveals one population diverging due to geographic isolation and genetic drift, and the other achieving speciation under the influence of selection.

0596 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Sandra Galeano, Kyle Harms

Louisiana State University, Baton Rouge, LA, USA

Coloration in the Polymorphic Frog *Oophaga pumilio* Predicts Aggressiveness and the Outcome of Intraspecific and Interspecific Interactions.

Intraspecific morphological variation may associate with behaviors that mediate the strength of species interactions, and may ultimately affect species distributions and abundances. The polymorphic frog *Oophaga pumilio* from Bocas del Toro Archipelago, Panama, exhibit either bright, aposematic (red, orange) or dull, cryptic colorations (green) in different islands, and marked body size variation; providing an excellent system to examine this association. We assessed how *O. pumilio* coloration and body size influenced agonistic interactions with conspecific and heterospecific frogs of two sympatric species. We predicted red frogs would exhibit more behaviors that could increase detection than green (*e.g.* aggressiveness), influencing the outcome of agonistic interactions. We conducted male-male resident/intruder encounter experiments pairing small red, large red, small green, or large green *O. pumilio* with same morph conspecifics, heterospecifics, and clay models. *O. pumilio* coloration influenced aggressiveness and strength of interactions with conspecifics and one heterospecific, independent of body size. *O. pumilio* from red populations exhibited shorter latency, and higher Indices of Aggression (based on energy expenditure) and Aggression Scores (based on number of aggressive and submissive behaviors) than green, when paired with conspecifics. Aggression between *O. pumilio* and *Phyllobates lugubris* occurred 86% of the times, with *O. pumilio* from red populations exhibiting shorter latency, and higher Indices of Aggression than green. This suggest that *O. pumilio* coloration is a good indicator of aggressiveness that predicts the outcome of intraspecific and some interspecific interactions, providing support for a positive association among the strength of antipredator coloration, aggressiveness, and dominance in interspecific, intraguild interactions.

0262 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Natalia Gallego García[1], Vivian P. Páez[2]

[1]*Departamento de Ciencias Biológicas, Universidad de los Andes, Bogotá, D.C., Colombia,* [2]*Instituto de Biología, Universidad de Antioquia, Medellín, Antioquia, Colombia*

Geographic Variation in Pivotal Temperatures and Transitional Range of Temperatures in the Endangered Turtle *Podocnemis lewyana*: Implications for Global Warming

Species with temperature-dependent sex determination (TSD) are more vulnerable to climate change than species with genetically-based sex determination, since an increase in average environmental temperature could lead to skews in offspring sex ratios. In TSD species, the relationship between sex ratio and constant incubation temperature is characterized by two parameters: the pivotal temperature (T_{piv}) and the transitional range of temperature (TRT) that produces both sexes. TSD species with inter-populational variation in either of these parameters should have more potential to adapt to new climatic conditions, thus putting them at lower risk to global warming. We incubated eggs of the Colombian endemic river turtle *Podocnemis lewyana* from two geographically isolated populations (the Magdalena and Sinú Rivers) under controlled microclimatic conditions, to corroborate the TSD pattern previously reported for this species and to estimate the inter-populational variation in T_{piv} and TRT. We used these estimates, together with information on other life history traits obtained from the literature, to evaluate P. lewyana´s vulnerability to climate change. For the Sinú population T_{piv} was 33.11 °C and TRT was 1.757 °C. For the Magdalena population, T_{piv} was 33.34 °C and TRT was 0.095 °C. Given that both drainages share exceptionally high pivotal temperatures, and considering the narrow TRT found for both populations, coupled with other life history traits such as distribution near the equator, small population size and low genetic variability, we conclude that the potential of this species to adapt to temperature change is limited, making it highly vulnerable to global warming.

0516 AES Behavior, Banquet Room E, Thursday 31 July 2014

Jayne Gardiner, Nicholas Whitney, Robert Hueter

Mote Marine Laboratory, Sarasota, FL, USA

Smells Like Home: Olfactory Contributions to Homing Behavior in Blacktip Sharks

Homing is one of the most remarkable animal behaviors in the marine environment, as animals perform transoceanic migrations to return to their natal areas to reproduce. Marine navigation is believed to be guided by different sensory cues over different spatial scales. Geomagnetic cues are thought to guide long-range navigation, while visual or olfactory cues allow animals to pinpoint precise locations, but the complete behavioral sequence is not yet understood. Terra Ceia Bay (TCB) is a primary nursery area for blacktip sharks, *Carcharhinus limbatus*, on Florida's Gulf coast. Young-of-the-year animals show strong fidelity to a specific home range in the northeast end of the bay and will rapidly return if displaced. Older juveniles demonstrate annual philopatry for the first few years: migrating as far south as Florida Bay each fall, then returning to TCB each spring. To examine the sensory cues used in homing, we captured neonate (< 3 weeks) blacktip sharks from within their home range, fitted them with acoustic tags, and translocated them to release sites 8km away in adjacent Tampa Bay. Intact animals returned to their home range, within 36 hours on average, and remained there. Animals with olfaction blocked also returned to their home range, within 130 hours on average, but did not remain there. Instead, they moved throughout TCB and in and out of Tampa Bay. These results suggest that while other cues guide navigation over the long range, olfactory cues are used over the short range, allowing the animals to recognize their specific home ranges.

0509 General Ichthyology III, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Aaron Geheber[1], Philip Geheber[2]

[1]University of Oklahoma, Norman, OK, USA, [2]University of Southern Mississippi, Gulf Coast, Long Beach, MS, USA

The Effect of Spatial Scale on Darter Community Assembly: Evolutionary Relationships Illustrate Ecological Processes.

Although both biotic and abiotic processes are thought to influence stream fish community assembly, uncertainties still persist as to the importance of such ecological processes across different spatial scales. Phylogenetic approaches allow examination of assembly processes based on evolutionary relatedness of community members, where

competition will produce communities containing species less closely-related than expected by chance (i.e., phylogenetic overdispersion) due to fundamental niche similarity of closely related species, and habitat filtering can result in coexistence of species that are more closely related than expected by chance (i.e., phylogenetic clustering) due to closely related species sharing similar habitat requirements. In this study, we examined assembly processes in darter communities at both fine and broad spatial scales using a phylogenetic approach. We hypothesized that spatial scale will influence community assembly processes, and predicted that competition will be more influential at fine scales due to limited shared resources, and habitat filtering will be influential at broad spatial scales due to increased habitat heterogeneity. Darters and associated habitat parameters were collected at 42 sites in the Duck, Buffalo, Harpeth, and Stones Rivers, Tennessee. Phylogenetic relatedness metrics were calculated for communities within each site and drainage sampled. Darter assemblages were phylogenetically clustered at the site and drainage scales. However, an increase in community member relatedness was positively correlated with an increase in spatial scale. These results suggest habitat filtering is an influential process in darter community assembly, and the degree of influence is spatial scale dependent.

0731 AES Morphology & Reproduction, Banquet Room E, Sunday 3 August 2014

Jim Gelsleichter[1], R. Dean Grubbs[2], Gregg Poulakis[3], John Carlson[4], Brenda Anderson[1], Simon Gulak[4]

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Hermaphroditism and Other Aspects of Reproduction in the Endangered Smalltooth Sawfish (*Pristis pectinata*)

Because of its status as the only domestic U.S. marine fish currently listed as endangered under the U.S. Endangered Species Act (ESA), it is rare to have opportunities to necropsy specimens of the smalltooth sawfish (*Pristis pectinata*), a limitation that complicates efforts to obtain much-needed information on the reproductive biology of this poorly studied species. Due to this, the present study used plasma concentrations of the gonadal sex hormones testosterone, progesterone, and 17β-estradiol along with opportunistic, post-mortem examination of specimens that have died unintentionally as a result of various natural or unnatural causes (e.g., cold stress, capture as bycatch in fisheries) to obtain preliminary data on the reproductive cycle of *P. pectinata*. Based on these observations, a seasonal reproductive cycle for this biennially reproducing species

is proposed. In addition, based on necropsy data, it has been determined that male *P. pectinata* may normally exhibit a rudimentary form of hermaphroditism as all male sawfish examined to date have possessed ovaries in addition to testes and male genitalia.

0409 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Pablo Gesundheit[1], Constantino Macías-Garcia[2]

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The Roles of Hydrological Modification, Water Quality, and Species Introductions in the Decline of Native Freshwater Fishes in Central Mexico

Central Mexico is a densely populated area with a unique freshwater fish fauna that includes numerous endemic taxa. Its aquatic systems have been heavily disturbed, which has resulted in extirpations of native fishes and alteration of species assemblages. Hydrological modification, pollution, and species introductions have been the principal impacts. I present an overview of the conservation status of the fish fauna in the region and a statistical analysis of the roles of these impacts in the alteration of fish assemblages. Water physicochemical parameters were recorded and local fish assemblages were sampled at 64 localities within the region. I approximated the original composition of the fish assemblage at each location using historical records, graded the water parameters and aggregated them into an index of water quality, and estimated the level of hydrological modification for each locality using a GIS-based approach. I used water quality, hydrological modification, and the number of introduced species as variables in a General Linear Model (GLM) to explore the influence of each on the integrity of local fish assemblages. Numerical descriptors reveal a great amount of the fish diversity in this area of the country has been lost and the composition of the fish fauna as a whole has been greatly altered. Only 40% of the expected native populations were found in our sampling and only 30% of the sampled assemblages were free of introduced species. Mean species richness per locality was found to be only half of what historical records indicate.

0379 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Michael Ghedotti[1], Ryan Barton[1], Matthew Davis[2]

[1]Regis University, Denver, Colorado, USA, [2]University of Kansas, Lawrence, Kansas, USA

Morphology of the Ventral Luminescent Organ of the Japanese Barracudina (*Lestrolepis japonicus*), with Comments on the Evolution of Bioluminescence within the Barracudinas (Teleostei: Aulopiformes)

Luminescent organs have evolved repeatedly in different lineages of deep-sea fishes, with potential functions including camouflage, predation, and communication. Despite being a species-rich lineage of deep-sea fishes, bioluminescence is comparatively limited in distribution in the Order Aulopiformes, with ventral bioluminescent organs independently evolving in the families Chloropthalmidae (greeneyes), Scopelarchidae (pearleyes), Evermanellidae (sabretooth fishes), and Paralepididae (barracudinas). The bioluminescent organs of the barracudina genera *Lestidium* and *Lestrolepis* have never been anatomically investigated in significant detail. In this study we use gross and histological techniques to describe the morphology and likely structural origin of the bioluminescent organ in barracudinas, with anatomical comparisons to additional pelagic aulopiform species that lack bioluminescent organs. Uniquely in aulopiforms, the luminescent organ in *Lestrolepis* is derived from modified hepatopancreatic tissue that runs the ventral length of the coelom. We concur with prior studies that the luminescent organ likely is endogenous. The peritoneum underlying the luminescent organ forms a thickened structure that may function as a lens and that lacks the light-blocking guanine layer of the rest of the coelomic peritoneum. Character reconstructions based on a hypothesis of aulopiform evolutionary relationships indicate that the expanded midventral component of the hepatopancreas evolved first in the stem barracudina taxa that lack bioluminescent organs, followed by the evolution of the bioluminescent organ.

0449 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Sarah Z. Gibson

University of Kansas, Lawrence, Kansas, USA

The Enigmatic Taxon †*Hemicalypterus weiri* (Osteichthyes: Actinopterygii) from the Late Triassic: New Insights into its Evolutionary History and Ecological Role

Recent fieldwork in the Upper Triassic Chinle Formation of southeastern Utah has yielded hundreds of specimens of lower actinopterygian fishes. Many of these specimens belong to the species †*Hemicalypterus weiri*. This unique actinopterygian fish was endemic to Utah during the Late Triassic, and possesses a deep, disc-shaped body. The species has been placed in †Semionotidae and †Dapediidae in previous studies, but has largely been absent in most recent phylogenetic studies of neopterygian evolutionary relationships. As a result, the species continues to be poorly understood in its relationship to other lower actinopterygian fishes and remains *incertae sedis* within Actinopterygii. Like semionotiform and dapediid fishes, †*Hemicalypterus* possesses ganoid scales on its flank. However, the ganoid scales of †*Hemicalypterus* end mid-flank, and the posterior half of †*Hemicalypterus* is scaleless. Specimens of †*Hemicalypterus* recently collected reveal new morphological information about the species, in particular their teeth, which give potential insight into the feeding behavior and ecology of the fish. A thorough redescription of †*Hemicalypterus* is presented to account for new information obtained from these new specimens, and newly considered morphological data allows for new inferences regarding the relationship of †*Hemicalypterus* to other neopterygian fishes.

0360 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Sean Giery, Craig Layman

North Carolina State University, Raleigh, NC, USA

Interpopulation Variation in Condition Dependent Signaling: Predation Regime Affects Signal Reliability.

In many models of sexual selection, conspicuous ornaments are preferred by mates because they indicate heritable signaler viability. To function as indicators, ornaments must maintain a proportional relationship between expression and viability. These indicators are called condition dependent signals. To maintain condition dependence, signaling costs must prevent males with low viability from expressing disproportionate

conspicuous signals. Given ecological variation in signaling costs, it is likely that the strength of condition dependence varies concomitantly. In this study, we assess the effect of variable signal cost, predation risk, on the strength of condition dependence among 16 wild populations of Bahamas mosquitofish (*Gambusia hubbsi*) that use colorful dorsal fins in courtship displays. We found that the signal of interest, fin coloration, predicted body condition. However, this relationship was only seen in populations subject to predation from piscivorous fish. In contrast, populations without predators showed no signs of condition dependence suggesting that variation in ecological costs has important effects on communication system evolution. In summary, while our study addresses only one type of sexual signal (coloration), uses only one estimate of viability (condition), and focuses on a single type of signaling cost (predation), we confirm a crucial role for ecological signaling cost in communication.

0357 Herp Ecology II, Banquet Room E, Sunday 3 August 2014

Sean Giery[1], Nathan Lemoine[2], Caroline Hammerschlag-Peyer[2], Robin Abbey-Lee[2], Craig Layman[1]

[1]North Carolina State University, Raleigh, NC, USA, [2]Florida International University, Miami, FL, USA

Cross-habitat Trophic Coupling by *Anolis* Lizards: Allochthonous Inputs Follow Diverse Routes Between Food Webs.

All three *Anolis* species in this study consumed different prey, and occupied vertically distinct arboreal habitats. Despite these differences, carbon isotope and stomach content analysis revealed strong integration with understory and canopy food webs for all *Anolis* species. Modes of resource flux contributing to the observed cross-habitat trophic linkages included prey movement and the gravity-driven transport of detritus. Our study shows that terrestrial systems are linked by considerable bidirectional cross-system resource flux. Our results also suggest that considering species-specific interactions between predator and prey are necessary to fully understand the diversity of material and energy flows between spatially separated habitats.

0097 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Anthony L. Gilbert, Donald B. Miles

Ohio University, Athens, OH, USA

Relating Thermal Performance to Variation in Resource Use: Implications for Lizards in a Warming World

Understanding how climate change will impact lizards requires the understanding of how two ecological factors will change: habitat availability and resource use. Climate change is expected to alter the usable thermal environment available for lizards such that many areas will be rendered unsuitable for population persistence and growth. However, a less-examined aspect of the impacts of climate change details how a warming climate will impact resource (i.e. food) availability and use by lizards. Climate change has resulted in shifts in arthropod phenology, and these changes in prey availability and density have consequences for predator ecology and performance. By examining lizard thermal performance in relation to varying food resources, we can examine how performance at warming temperatures is impacted by declining food availability as a result of climate change or habitat alteration. Thus, integrating these two facets of climate change research results in the clearest depiction of how and why lizards will respond to climate change. Here, we analyze the thermal performance of adult *Urosaurus ornatus* in response to variation in food availability by experimentally manipulating access to food. If the optimal temperature for performance declines with decreasing resource saturation, then lower abundance of prey items coupled with warming temperatures could lead to significant physiological and behavioral shifts in lizards as a result of climate change.

0237 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

James Gillingham[1], David Clark[2], Jennifer Moore[3]

[1]*Central Michigan University, Mt. Pleasant, MI, USA,* [2]*Alma College, Alma, MI, USA,* [3]*Grand Valley State University, Allendale, MI, USA*

Tuatara Crest Morphology: Spine Size and Refectance May Contribute to Large Male Breeding Success in *Sphenodon punctatus*.

The Tuatara (*Sphenodon punctatus*), a long-lived ancient reptile, has been the subject of recent natural field investigations into its reproductive biology and fitness. Studies conducted on a dense population of Tuatara on Stephens Island, New Zealand, have shown that males are highly territorial and large males are more effective at

monopolizing areas where females are most dense. Only 25-30% of males mate successfully and male body size is the primary predictor of male reproductive success. Male tuatara tend to exhibit sexual dimorphism in several ways, including larger and more numerous dorsal and nuchal spines than seen in females. Within this same population we measured the number and total spine area of dorsal and nuchal spines in males, as well as spine total reflectivity (320 - 700 nm). In addition, reflectivity was measured at several other sites on the bodies of these same males. Regressing these data against male body mass showed that spine number is consistent over all body size ranges while spine area increases significantly with mass. Spine reflectivity is positively correlated with male mass while reflectivity at other body sites is not. Tuatara appear to be highly visual animals and large male spine size and reflectivity may contribute to male reproductive success either through female choice or male-male competitive evaluation, or both.

0269 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Laine Giovanetto

New Jersey City University, Jersey City, NJ, USA

Preliminary Findings on the Habitat Selection and Diet in a Population of Eastern Water Skinks (*Eulamprus quoyii*) During a Drought in New South Wales, Australia

Eulamprus quoyii is a diurnal, heliothermic skink usually associated with streams. They appear to be opportunistic predators, taking both terrestrial and aquatic prey. During a preliminary study of the skink populations at Carrabolla in New South Wales, 10 transects (10m x 1m) were sampled 5 times each for the presence of *E. quoyii*, tadpoles, and crayfish burrows along a 1 kilometer stretch of a stream running through a mixed sclerophyll forest. *E. quoyii* presence appeared to be negatively correlated to crayfish burrow density (r = -0.9554) and canopy cover (r = -0.9756) and positively correlated to tadpole presence (r = 1). Crayfish burrow densities ranged from $0.1/m^2$ to $2.5/m^2$. Since crayfish are probably unimportant predators for *E. quoyii*, but may be important predators of tadpoles, the correlation between *E. quoyii* presence and crayfish burrow density is possibly indirect. Tadpoles are consumed by *E. quoyii*, but may be consumed more often by crayfish. Choosing open sunny sites (20-30% canopy cover) over shady sites (65-85% canopy cover) for breeding by the local frog populations may be a way to avoid predaceous crayfish even though the choice of open sunny sites may increase the possibility of reduced reproductive success during long periods without rain. *E. quoyii* may be choosing the same open sunny sites for thermoregulation, but the possible correlation to the presence of tadpoles should not be considered unimportant as

tadpoles appeared more often in the gut contents of *E. quoyii* as the stream dried to a series of small pools.

0728 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Melissa Giresi[1], David Portnoy[2], Dean Grubbs[3], Gregory Skomal[4], Cami McCandless[5], Bryan Frazier[7], William Driggers[6], Mark Renshaw[8], John Gold[2]

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Genetic Population Structure of the Dusky Smoothhound Shark, *Mustelus canis,* in U.S. Waters

The dusky smoothhound shark, *Mustelus canis,* is listed as a Species of Concern under the Highly Migratory Species (HMS) fisheries management plan. The National Oceanographic and Atmospheric Association (NOAA) recognized the need for baseline data on stock structure of *M. canis* in U.S. waters. Elucidating patterns of genetic diversity and assessing genetic divergence among localities is an essential first step to managing *M. canis* resources. In this study, we utilized sequences of mitochondrially-encoded NADH-2 and 18-nuclear encoded microsatellites to test the null hypothesis that *M. canis* in comprised of one genetically panmictic population in U.S. waters. Results of the genetic analyses reject the null hypothesis and suggest that there are genetically distinct stocks in U.S. waters. Comparisons among sequences of NADH-2 within and among geographic localities suggest that there may have been a recent a recent expansion of *M. canis* across the U.S. Atlantic and that the insular form (*M. canis insularis)* has diverged from the continental form. Initial analyses comparing multi-locus genotypes across geographic localities revealed that there are likely multiple genetically diverged stocks within the U.S. Atlantic (study ongoing). Results of this study will provide a baseline assessment of connectivity among geographic localities of *M. canis*, which will be useful in the upcoming stock assessments for this species.

0087 Herp Behavior, Banquet Room I, Saturday 2 August 2014

Xavier Glaudas

University of the Witwatersrand, Johannesburg, Gauteng, South Africa

The Effect of Food Intake on Male Mate-Searching Activities in Puff Adders (*Bitis arietans*)

Sexual selection has long been a central topic in behavioral and evolutionary ecology, with thousands of investigations devoted to understanding the traits that determine which individuals mate successfully. A disproportionally large number of such studies focus on traits that are sexually selected for interference competition (i.e., fight between individuals) or mate choice (e.g., calls). However, these sexual characteristics become relevant only after a potential mate has been located, and we know little about the factors that affect investments in the behaviors that precede and lead to mate acquisition, such as mate-searching activities. Herein, I use data from an ongoing experimental field study to test the hypothesis that food intake affects the investments made by male Puff Adders (*Bitis arietans*) in mate-searching activities. To accomplish this research, I use radiotelemetry to (1) locate adders and manipulate their energy intake by offering supplemental food (thawed rodents) to half of the radiotracked males for a 2-month period just prior to the mating season, and (2) to quantify male adjustments in mate-searching activities in relation to energy intake (supplementally fed vs. unfed males) during the mating season. Supplementally-fed males exhibited a sharp increase in body mass compared to unfed snakes between the start and the end of the feeding period, demonstrating that overall feeding rates were higher in the former group. Preliminary analyses indicate that supplementally-fed male adders showed increased movements during the mating season, suggesting that investment in mate-searching activities by males is a plastic trait mediated by food intake.

0072 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

James Godwin[1], Lesley de Souza[2]

[1]*Auburn University, Auburn, Alabama, USA,* [2]*Shedd Aquarium, Chicago, Illinois, USA*

Black Warrior Waterdog (*Necturus alabamensis*) and Flattened Musk Turtle (*Sternotherus depressus*) Status Survey using Environmental DNA (eDNA)

The Black Warrior waterdog (*Necturus alabamensis*) and flattened musk turtle (*Sternotherus depressus*) are aquatic species endemic to the upper Black Warrior River basin of Alabama. The ranges of these species are essentially identical as is habitat. In contrast to these similarities *N. alabamensis* is cool-season active while *S. depressus* is warm-season active. Declines and loss of populations have been reported for both

species. In this study we employ eDNA sampling to detect the presence of these aquatic species. We selected 26 sites based on past collections of one or both species and collected a cool-season and warm-season water sample from each site. All water samples were analyzed using PCR for the presence of both species, and we report on the utility of eDNA analysis for this type of survey.

0628 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Jeffrey Goessling, Mary Mendonca, Craig Guyer

Auburn University, Auburn, AL, USA

Seasonal Acclimation of Immune Parameters in Gopher Tortoises

Wildlife diseases are of increasing importance as many vertebrate taxa have experienced recent and potentially devastating disease outbreaks. Several hypotheses have been generated that might explain why the frequency of disease in ectothermic vertebrates has increased as a result of recent patterns of climate change. Herein, we tested one of these hypotheses, the seasonal acclimation hypothesis, in Gopher Tortoises. Specifically, we used Gopher Tortoises in this study as they are of conservation concern, and have recently suffered population declines due to a highly enigmatic disease, upper respiratory tract disease. Because of the variable patterns of disease outbreaks in Gopher Tortoises, we tested this hypothesis to explain how changes in normal seasonal patterns might affect disease resistance. We quantified disease resistance using assays of both the innate immune system and the adaptive immune system to understand how season affects the immune system as a whole. Results from this study indicate support for the seasonal acclimation hypothesis in this species.

0632 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Mark Goldy-Brown, Tracy Langkilde, Chris Thawley

The Pennsylvania State University, University Park, PA, USA

The Effects of Red Imported Fire Ant Venom on Whole Body Performance and Hemolysis of Eastern Fence Lizards, *Sceloporus undulatus*

Native species that encounter ecologically novel invasive species may be under strong selective pressure to adapt to the new threats these invaders posed. The Red Imported Fire Ant, *Solenopsis invicta*, is a venomous predator that was introduced into the southeastern U.S. over 75 years ago. Native Eastern Fence Lizards (*Sceloporus undulatus*) from *S. invicta*-invaded sites have morphological and behavioral adaptations that allow

them to survive encounters with these invasive ants. These lizards, however, do not appear to have developed increased tolerance to fire ant venom. We test whether this apparent lack of adaptation is actually due to pre-adaptation of this lizard to the venom of two native fire ant species (*Solenopsis geminata* and *S. xyloni*). We examined the effects of fire ant venom on the whole-body performance (righting ability) and blood lysis of *Sceloporus undulatus* from *S. invicta*-invaded and uninvaded populations in the southern U.S., where these lizards overlap with native fire ants, and compare these to effects on lizards from northern sites outside the native fire ants' range. We found no evidence that *S. undulatus* have evolved increased physiological resistance to *S. invicta* venom: the impact of fire ant venom on performance and lysis did not differ between *S. invicta*-naïve versus experienced lizard populations, or between populations with or without historical exposure to native fire ants. Testing for effects of prior exposure to closely related and ecologically-similar native species can provide important insight into the prevalence of adaption, and importance of pre-adaptation, of native species to invasive threats.

0519 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Melissa Gonzalez De Acevedo, Jim Gelsleichter

University of North Florida, Jacksonville, Florida, USA

Hormone Regulation of Sperm Storage in Female Bonnethead Sharks (*Sphyrna tiburo*)

Female sperm storage is a phenomenon that arises in many different taxa, allowing viable sperm to be retained in the reproductive tract for an extended time period. Previous studies have determined that reproductive hormones may play an important role in regulating various aspects of sperm storage in certain vertebrates, including the long-term survival of sperm and its release near the end of the storage period. However, to date, no published studies have investigated the hormone regulation of sperm storage in the reproductive tract of female elasmobranchs despite evidence for this phenomenon in several shark species. Therefore, the purpose of this study was to investigate if gonadal steroid hormones such as 17β-estradiol, androgens, and progesterone, may play a role in regulating this poorly understood process, which have been shown to increase in circulation during various periods of sperm storage. To accomplish this, circulating concentrations of gonadal sex hormones and the distribution of sex steroid receptors in the oviducal gland, the sperm storage organ of female sharks, were examined in the bonnethead shark (*Sphyrna tiburo*), an annually-reproducing species known to store sperm for a 3-6 month period between copulation and ovulation/fertilization. As demonstrated in previous studies, female bonnetheads exhibited increases in circulating steroid concentrations both during (testosterone, 17β-estradiol) as well as near the end

(progesterone) of the sperm storage period. Immunocytochemical analysis of androgen, estrogen, and progesterone receptors in the oviducal gland demonstrated that epithelial cells of sperm-storage tubules and spermatozoa itself are direct targets for these hormones.

0390 AES Morphology & Reproduction, Banquet Room E, Sunday 3 August 2014

Melissa Gonzalez De Acevedo[1], Jim Gelsleichter[1], Bryan Frazier[2], Carolyn Belcher[3], Brenda Anderson[1]

[1]University of North Florida, Jacksonville, Florida, USA, [2]Department of Natural Resources, Charleston, South Carolina, USA, [3]Department of Natural Resources, Brunswick, Georgia, USA

Characterization of Reproduction in Bonnethead Sharks (*Sphyrna tiburo*) from the Southeastern U.S. Atlantic Coast

Bonnethead sharks (*Sphyrna tiburo*) are a component of the small coastal shark (SCS) fishery complex, and are caught regularly in recreational and commercial fisheries. Despite being well studied in the Gulf of Mexico, little is known about bonnetheads that reside on the U.S. Atlantic coast. The main goal of this study is to improve management of U.S. Atlantic bonnethead populations so they do not become overexploited. To contribute to this, my objective is to obtain critical information on reproductive biology of these populations. To accomplish this, male and female bonnetheads are being collected monthly through combined efforts of UNF, SCDNR, and GADNR along with commercial fishers from South Carolina and Florida waters. Reproduction stage is assessed using morphological, histological, and endocrinological analysis. Current data suggests that follicular development occurs in females between the months of January and early April followed by ovulation, which appears to take place in mid-to late April. Sperm storage appears to occur in the oviducal gland between late September to this same period based on histological analysis. Ova or pups were present in the uteri of mature females between late April to early September, suggesting that gestation is slightly greater than 4 months. Spermatogenesis in males appears to peak around late August/early September, based on testis morphology and histology. Further investigations use plasma sex steroid hormone concentrations throughout reproductive events to validate characterization of reproductive patterns. Resulting data will provide comparisons of reproductive cycles and seasonality between Atlantic and Gulf of Mexico bonnethead populations.

0291 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Hilary Goodwin

Dalhousie University, Halifax, NS, Canada

Top Priorities for Skate Management and Conservation in the US, Canada, and Northwest Atlantic Fisheries Organization

A comparative analysis of skate management and conservation in the US and Canada is given, with a focus on straddling stocks, Thorny skate (*Amblyraja radiata*) and Winter skate (*Leucoraja ocellata*). Skates are among the most vulnerable of exploited marine fish, not only due to target catches, but also because of high bycatch and discard rates in ground fisheries. The US and Canada have developed National Plans of Action for Sharks, which include sections on skate management. Targets species are typically assessed and managed in some way, but bycatch species tend to be ignored. The Northwest Atlantic Fisheries Organization (NAFO) set the world's first skate quota by a Regional Fishery Management Organization; however, this quota is not set in line with scientific advice. There are problematic data gaps as skate landings in the US, Canada, and NAFO are not reported by species, which hinders the quality of stock assessments. The US and Canada have both prohibited retention of certain skate species, but rebuilding the stocks will take considerable time and additional protection measures must be implemented, particularly to reduce skate bycatch and discards. Top priorities to help address the conservation of skates include: (1) collect and make public species-specific skate landings and discard data, (2) implement skate quotas based on scientific advice, (3) implement bycatch reduction measures, (4) research the stock structure, life history, growth, and population dynamics to further aid the development of reliable stock assessments, (5) initiate transboundary management between the US and Canada for skate stocks.

0205 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

John Gorsuch, Amy Miller, Keen Wilson, Patrick Owen

University of Cincinnati, Blue Ash College, Cincinnati, OH, USA

Invasive Earthworms Alter the Cutaneous Bacteria of Eastern Red-backed Salamanders.

The cutaneous microflora of woodland salamanders is affected by the microbial diversity of their habitat. Invasive Asian earthworms of the genus *Amynthas* change the composition of microbial communities at the soil surface, potentially influencing the cutaneous microflora of salamanders in contact with this soil. We conducted a soil microcosm study in which one group of Eastern Red-backed Salamanders (*Plethodon*

cinereus) was maintained on wild-type soil, and a second group was maintained on *Amynthas*-processed soil. Samples of bacteria from the skin were cultured and identified over a four-week period. Although no initial differences in cutaneous bacterial diversity were detected between the salamanders, significant differences in the distribution of *Pseudomonas* (dominant on salamanders from wild-type microcosms) and *Citrobacter* (dominant on salamanders from *Amynthas*-soil microcosms) began to emerge after 7 days. Further work will determine whether such shifts in cutaneous microflora occur in the field and whether such shifts impact the health or immunological responses of host salamanders.

0643 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Breanna Gould, Patrick Laarman, Jennifer Moore

Grand Valley State University, Allendale, MI, USA

Fine-scale Genetic Structure in Eastern Box Turtles

Understanding spatial genetic structuring provides insight about the natural or anthropogenic factors that affect gene flow and population isolation. Reduced gene flow and losses of genetic diversity can ultimately affect survival and reproduction via inbreeding depression, especially within species of reptiles that exhibit longevity accompanied by limited dispersal. We investigated the spatial genetic structure of a geographic range-edge population of eastern box turtles in northern Michigan where they are a species of special concern experiencing regional decline. We genotyped individuals at 11 microsatellite loci and detected the presence of fine-scale genetic structuring within a relatively small geographic area. While we suspect our findings can be attributed to distance and landscape features, in future we will seek to define the sources of the fine scale genetic structure exhibited by our population to provide further insight into the effects of genetic structure on potentially fragmented populations of long-lived reptiles such as the eastern box turtle.

0775 SSAR Infrared Imaging Symposium, Banquet Room J, Sunday 3 August 2014

Michael S. Grace[1], William T. McLamb[1], Sherri A. Emer[1], Trevor T. Zachariah[2]

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A TRiP Through the Snake Brain: Functional Magnetic Resonance Imaging (fMRI) of the Infrared Sensory System in the Burmese Python

Neuroanatomy and electrophysiology indicate that trigeminal sensory neurons innervating python pit organs project to the ipsilateral brainstem nucleus of the lateral descending trigeminal tract (nLTTD), after which infrared information is routed to the contralateral optic tectum, where integration of sensory information from pit organs and lateral eyes occurs. Previous functional analyses of sensory function in the snake brain snake involved technically difficult, invasive procedures (e.g., electrode implants) in heavily sedated snakes. The goal of this work was to develop functional magnetic resonance imaging (fMRI) for use in large snakes, and to use it to measure brain response when pit organs were presented with physiologically relevant thermal stimuli and agents designed to elucidate the mechanisms of thermosensory signal transduction. Unilaterally thermal stimulation of pit organs in sedated snakes resulted in differential blood-oxygenation-level-dependent (BOLD) response within the optic tectum and LTTD. Heat applied to the left labial pits elicited an average intensity increase of 14% and 13.75% within ipsilateral nLTTD and contralateral optic tectum, when compared to corresponding control lobes of the LTTD and optic tectum in the same snakes. Topical application of the TRPA1-channel antagonist A-967079 negated responses to heat (average differences in heat-induced voxel intensity in LTTD and optic tectum were 3.5% and 0.5%, respectively). These results provide the first *in vivo* physiological demonstration of TRPA1 channels as molecular thermosensors in any infrared-imaging snake species, validate fMRI for physiological assessment of brain function in live snakes, and provide the first imaging-based confirmation of the infrared pathway in the snake brain.

0565 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Fiona Graham, Neil Hammerschlag, Maria Estevanez

University of Miami, Miami, FL, USA

Quantifying Habitat Protection for Shark Species in South Florida and The Bahamas Using Satellite Telemetry

Many species of large sharks are in decline, and the benefits offered by marine protected areas to these wide ranging marine predators is still unclear. Florida and The Bahamas is an ideal location to examine core areas of habitat use in relation to spatial management zones, as Florida has varying levels of jurisdiction and protection for sharks, while The Bahamas is a shark sanctuary and information on the efficacy of these protected areas for sharks is lacking. Satellite telemetry data for a total of 92 individuals within three highly mobile species, the great hammerhead (*Sphyrna mokarran*), tiger shark (*Galeocerdo cuvier*), and bull shark (*Carcharhinus leucas*), was examined, in order to evaluate the use of MPAs in both the south Florida and Bahamas regions. Core areas of use were identified, and the proportion of core use within each management zone was quantified. Results from 26 tagged bull sharks demonstrate that none of their core habitat is currently within areas that protect the species from fishing pressure, more specifically, prohibiting the landing of the species. Analysis of data from 22 tagged great hammerhead sharks illustrates that 17.88% of their core habitat is currently protected, and that 34.74% of tagged tiger shark (n=44) core habitat is within protected areas. The results from this study have valuable implications for marine conservation planning and help to develop an understanding of the current and potential level of protection for these top predator species.

0277 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Sean Graham[3], Crystal Kelehear[2], Tracy Langkilde[1]

[1]Penn State University, University Park, PA, USA, [2]Smithsonian Tropical Research Institute, Panama City, Panama, [3]University of Findlay, Findlay, OH, USA

Trouble in Paradise: Responses of Anoles to Fire Ants in the British Virgin Islands

Besides habitat destruction, invasive species represent the most substantial threat to native vertebrates worldwide. The introduction and spread of these adaptable and often competitively superior species leads to direct persecution of native vertebrates through predation and competition, and indirect effects through the spread of novel pathogens, ecosystem cascades, and habitat modification. Fire ants are a notorious invasive species that have been introduced to multiple Caribbean Islands. To date their effects on native

vertebrates on these islands is unknown, but predicted to be considerable. Anoles are an interesting vertebrate group found throughout the West Indies, and since they often exhibit exceedingly high local population densities and have a range of habitat preferences, they are ideal candidates for studying their responses to invasive species. To test the hypothesis that anole ecomorphs can be used to predict fire ant risk, we studied three anole species and two fire ant species on Guana Island, British Virgin Islands. We found that one fire ant species, *Solenopsis geminata*, is not as aggressive as its congener *Solenopsis invicta*. Although the three anole species on Guana vary substantially in their average perch height, for the most part these species had similar responses to fire ants. However, the bush-grass species *Anolis pulchellus* was less likely to flee from fire ants, suggesting this species may be at great risk from the effect of fire ants.

0426 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Terry Grande[1], Mark Wilson[2], Michael Hanson[1], W. Cal Borden[3], Allison Murray[2]

[1]Loyola University Chicago, Chicago, Illinois, USA, [2]University of Alberta, Edmonton, Alberta, Canada, [3]Saginaw Valley State University, University Center, Michigan, USA

First Osteological Description of the Type Species of *Polymixia*, *P. nobilis* Lowe, 1836, with Comparisons to Other Extant Species of *Polymixia*

An integral part of understanding the evolution of the Acanthomorpha (spiny-rayed fishes) is determining their most basal clade (i.e., the sister-group to all other living acanthomorphs). Unfortunately, a major impediment to answering this question is a lack of information about the "living fossil" genus *Polymixia*, the only survivor of a Late Cretaceous radiation, the most-often cited basal acanthomorph, and exemplar of a "primitive" spiny-rayed fish. It is commonly used as an outgroup in phylogenetic analyses, although its morphological and genetic diversity are scarcely known. For example, the type species *Polymixia nobilis* (Stout Beardfish) and all six species named since 1970 are described solely on external morphology and meristics. The only osteological treatment of *Polymixia* was a comparison of just one species (*P. lowei*) to the Beryciformes, of which it was then thought to be a member. As part of our interdisciplinary study (morphology, paleontology, molecular phylogeny) of Polymixiiformes, we have begun to re-describe and compare the osteology of all species of *Polymixia*. Here we present a critical first step in this study: a detailed osteological description of the type species *P. nobilis*. For this study, new material was obtained from throughout the known range of the species, thus accounting for intraspecific variation. The osteology of *P. nobilis* was carefully illustrated and is presented here. This new and better understanding of the morphology of the type species will form the basis for a comparative morphological study of all extant species of *Polymixia* and of its many nominal fossil relatives.

0663 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Sarah Green, Felisa Hseih, Alex Pyron

The George Washington University, Washington, D.C., USA

Ecomorphotypes of Snakes: Preliminary Results of a Global Analysis

Despite the fearsome reputation snakes seem to have, they perform a variety of important functions in ecosystems around the world. Usually occupying secondary trophic levels, snakes not only keep the numbers of their prey in check but provide food for predators higher in the trophic web. However, because of this position, snakes have been able to branch out and occupy a variety niches. We can see this when trying to find a specific species in the field. Some prefer wetlands, some are found in fields, others are only found in trees. As snake biologists we know the preferred habitat and prey of our study species but how does that translate to their morphology? There have been some attempts to quantify these snake ecomorphotypes depending on what type of predator they are, such as foraging or ambush. And there have been other attempts to classify ecomorphotypes of snakes based on what habitat they are found in, whether it is a tree, aquatic, etc. The long term goal of my research is to quantify these ecomorphotypes, not just in the sense of what habitat the animals are found in, but to really understand what characters make an aquatic snake aquatic for example. This is presenting preliminary results on the ecomorphotypes of snakes. Specifically this data is presenting what landmarks and measurements can be used for this type of analysis.

0201 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Taylor Green, David M. Green

McGill University, Montreal, Quebec, Canada

Environmental Correlates of Spring Emergence in Fowler's Toad, *Anaxyrus fowleri*

Global climate warming, bringing with it shorter winters and earlier springs, is predicted to lead to an increasingly earlier onset of spring breeding by anurans. There have been numerous observations in line with this prediction but there has also been apparently contradictory evidence, particularly from a population of Fowler's toads at Long Point, Ontario, at the northern limit of their range. We re-examined the onset of springtime emergence and chorusing behaviour using data collected over 24 years (1989 - 2012) to test for environmental correlates to an hypothesized early spring ascent of the

animals through the soil column, associated with the vernal turnover of the subsurface temperature gradient, and emergence from the ground and resumption of surface activity six to nine weeks later. Although spring emergence from hibernation tended, overall, to be earlier in spring over the period of 24 years, there was considerable variation in emergence date and no strong correlation with average annual spring air temperatures. However, air temperature during the 11 days just after the spring equinox was significantly correlated with the timing of spring emergence weeks later. Proximal cues associated with the start of surface activity, meanwhile, did not differ significantly from year to year. Species that hibernate terrestrially deep underground to escape penetrating frost may respond differently to springtime surface temperature trends than do species that overwinter nearer to the surface.

0195 Herp Systematics, Banquet Room H, Sunday 3 August 2014

Eli Greenbaum[1], Nancy Conkey[1], Rachel Romero[1], Felix Alonda[2], Michael Barej[3], Mareike Hirschfeld[3], Nono Gonwouo[4], Mark -Oliver Rödel[3], Kate Jackson[5], J. Maximilian Dehling[6]

[1]University of Texas at El Paso, El Paso, TX, USA, [2]Réserve Naturelle d'Itombwe, Bukavu, South Kivu, Democratic Republic of the Congo, [3]Museum für Naturkunde Berlin, Berlin, Germany, [4]Project CamHerp, Yaoundé, Cameroon, [5]Whitman College, Walla Walla, WA, USA, [6]Institut für Integrierte Naturwissenschaften, Koblenz, Germany

A Phylogeny of Central African Spiny Reed Frogs (Anura: Hyperoliidae: *Afrixalus*)

The 31 species of frogs in the genus *Afrixalus* (Anura: Hyperoliidae) have never been the focus of a phylogenetic analysis. We focused on Central African populations of the genus to understand their phylogenetic relationships, identify cryptic species, and understand historical processes that contributed to speciation patterns in the Congo Basin. Approximately 2,040 base pairs of mitochondrial (16S and cyt b) and nuclear (RAG1) genes were sequenced from 45 *Afrixalus* samples representing 10 species, and outgroups from the genera *Callixalus*, *Cryptothylax* and *Phlyctimantis*. Maximum-likelihood and Bayesian inference analyses of these data and additional samples from GenBank demonstrated strong support for the monophyly of *Afrixalus* and extensive evidence of cryptic speciation in *A. equatorialis*, *A. quadrivittatus*, *A. dorsalis*, *A. paradorsalis*, and *A. laevis*. A surprising amount of cryptic speciation within ecoregions of the Congo Basin suggests this region is a center of endemism, a result that is consistent with other recent phylogenetic studies of birds, rodents and toads. Because nearly all of the distinct lineages identified in our study have relatively small geographic

distributions, it is likely that these unrecognized species are threatened, and numerous additional lineages await discovery in the poorly explored forests of Central Africa.

0122 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Harry Greene

Cornell University, Ithcaa, NY, USA

Snakes and Primates, an 80 Million Year Dialog?

Mounting evidence suggests that snakes and primates have been reciprocally influencing each others' evolution throughout ~65-80 million years of shared history. The threat of death from snake predation likely influenced the origin of certain primate traits, and later evolution of front-fanged venom injection in snakes further fine-tuned neurobiological aspects of recognition and fear in primates. There is intriguing evidence that primates, as both predators and fearful adversaries, also influenced snake evolution once front fangs evolved, especially thanks to primate cognitive abilities, social and cultural relationships, and capacity for long-distance weaponry—and the latter was perhaps involved in the evolution of spitting in cobras. This research is a direct result of my doctoral dissertation on early snake evolution, supervised by Gordon Burghardt, and very much inspired by the amazing breadth of scholarship exhibited by Gordon throughout his career.

0100 Turtle Ecology, Banquet Room H, Sunday 3 August 2014

Sasha Greenspan, Erin Condon, Lora Smith

Joseph W. Jones Ecological Research Center, Newton, Georgia, USA

Home Range and Habitat Selection in the Eastern Box Turtle (*Terrapene carolina carolina*) in a Longleaf Pine Forest

The Eastern Box Turtle (*Terrapene carolina carolina*) is a species of conservation concern throughout North America, with recent population declines attributed primarily to habitat loss. The habitat requirements of this species in the southeastern United States have not been fully described. Our objectives were to estimate home range size and to describe movement and habitat selection of Eastern Box Turtles in a landscape dominated by longleaf pine (*Pinus palustris*) forest, the once dominant ecosystem in the Southeastern Coastal Plain. We conducted a radio-telemetry study of adult Eastern Box Turtles in a managed Longleaf Pine forest in southwestern Georgia, USA. Home ranges

expressed as 95% minimum convex polygons were 0.33-54.37 ha in size and averaged 10.33 ± 3.33 ha. Habitat composition of home ranges differed from that of the study area; turtles selected natural forests with mixed pine and hardwoods and Longleaf Pine and avoided pine plantations. At a microhabitat scale, turtles most frequently used patches of forbs. Additional studies, particularly regarding microhabitat selection of Eastern Box Turtles in the Longleaf Pine ecosystem and use of disturbed habitats that are more characteristic of the modern southeastern landscape, would further clarify the life history and environmental requirements of Eastern Box Turtles in this region.

0624 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

Katherine Greenwald

Eastern Michigan University, Ypsilanti, MI, USA

Capture-Mark-Recapture Analysis and Demography in a Unisexual-Bisexual *Ambystoma* Salamander Community

Unisexual (all female) *Ambystoma* salamanders reproduce via kleptogenesis, a unique system of "leaky" gynogenesis. These salamanders are frequently polyploid, containing 2-5 genomes "stolen" from any of five sexually reproducing congeners: the blue-spotted salamander (*A. laterale*), Jefferson salamander (*A. jeffersonianum*), smallmouth salamander (*A. texanum*), tiger salamander (*A. tigrinum*), and streamside salamander (*A. barbouri*). Unisexuals typically closely resemble the "sperm donor" species with which they coexist, and thus genetic analysis is required to definitively identify them and determine biotype (genome combination). This complexity has meant that historically, sexual and unisexual animals have frequently been grouped in population assessments. I am conducting a multi-year capture-mark-recapture (CMR) analysis, which includes over 1500 individually marked and genotyped animals across four breeding ponds. I intend to assess differences between sexual and unisexual salamanders (and among unisexual biotypes) in terms of growth, survivorship, frequency of reproduction, or other factors influencing population dynamics. I will also examine temporal stability of the unisexual-bisexual community of salamanders. Preliminary analysis suggests that triploid LLJ unisexuals are significantly larger than *A. laterale* or LLLJ unisexuals in terms of both mass and snout-vent length. LLJ unisexuals are also recaptured at a higher rate than *A. laterale* or LLLJ unisexuals, implying that they may have advantages in terms of survivorship or reproductive frequency. Results to date also suggest that population composition is relatively stable across years. However, there is large variability among ponds, with unisexuals ranging from 80-98% of the total sampled population.

0061 Snake Ecology, Banquet Room E, Saturday 2 August 2014

Patrick Gregory

University of Victoria, British Columbia, Canada

The Relationship Between Body Size and Cover Use in Five Species of Natricine Snakes

Cover plays an important role in the lives of snakes, providing shelter from the elements and predators and also providing thermoregulatory opportunities. If cover use is an anti-predator behaviour, then it should be especially important for the most vulnerable individuals, such as small snakes. In this study, I test for a negative relationship between frequency of cover use and body size in 5 species of natricine snakes at three sites (southern Ontario and central Alberta in Canada, southeastern UK). Cover objects were most abundant at the Ontario site, where most snakes were found under rocks; by contrast, cover objects (all artificial) were scarce at the UK site, where most snakes were found in the open. Nonetheless, there was a significant trend across all sites for smaller snakes to be more likely to be found under cover. Furthermore, in all but one species, the significant size-cover use relationship held up in all months of the active season. In two species, gravid females were significantly more likely to be found in the open than other snakes, presumably reflecting the priority that gravid snakes place on thermoregulatory basking. Differences between small and large snakes in frequency of cover use also might reflect thermoregulatory differences, but evidence suggests that small snakes often trade off thermoregulatory benefits for the safety of hiding under cover.

0159 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

Kevin Gribbnins[1], Justin Rheubert[2]

[1]Wittenberg University, Springfield, OH, USA, [2]Saint Louis University, St. Louis, MO, USA

Histological Survey of Spermiogenesis in Lizards

To date, histological and ultrastructural studies on the entire process of spermatogenesis are relatively limited in squamates. Most available morphological data on sperm development focus on specific stages of spermatogenesis, when spermatogenesis is active, or on the ultrastructure of the spermatozoa in lizards. Few studies, based on the large number of lizard species, provide a comprehensive understanding of the microscopic anatomy, process, and ultrastructure of germ cell development. Thus, this review will provide detailed analysis on what is currently known about lizard

spermiogenesis and provide new data for the ultrastructure of spermatid ontogeny, which will be combined comparatively in a phylogenetic context. The process of acrosome development, elongation and condensation, and flagellar development will be compared among species that have been studied to date. We test the hypothesis that the ultrastructure of spermatids during spermiogenesis is species specific, leading to comparative differences between lizard species, even if they reside within the same genus. The ultrastructural spermatid atlas provided here will hopefully stimulate more interest in collecting this type of histological data. Such attention would allow for the collection of larger morphological data sets that could be useful for nontraditional phylogenetic analyses and histopathological studies on chemical exposure and its effect on sperm development.

0496 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Jose Griego, Sarah Corey-Rivas

New Mexico Highlands University, Las Vegas, NM, USA

Genetic Structure and Hybridization of the Northern Leopard Frog (*Lithobates pipiens*) in the Mora Watershed in Northern New Mexico

The dramatic declines of the northern leopard frog, *Lithobates pipiens*, in the western US is a cause for concern particularly when combined with climate change altered habitats in the Southwestern US. In this study, we investigate population-level connectivity of *L. pipiens* across a landscape of agriculture, acequias, and protected lands and potential introgression with *L. blairi* using nuclear (FIBI7 and microsatellite) and mitochondrial (ND1) markers. Interestingly, we found cytonuclear discordance in the Sapello river region of the watershed where frogs appear to be *L. pipiens* based on morphology and mtDNA, but have *L. blairi* FIB7 genotypes. Hybrids therefore appear to be the result of mating between *L. pipiens* females and *L. blairi* males. The Sapello area also had one individual with intermediate dorsolateral fold morphology between *L. blairi* and *L. pipiens*. Microsatellite analysis corroborates evidence of cytonuclear discordance, with gene flow among sampling sites along the Mora River (all *L. pipiens* morphology, ND1, and FIB7; FST = 0.0001) and genetic structure between the Mora (*L. pipiens*) and Sapello sites (*L. blairi x L. pipiens*; FST = 0.235). The Mora River remains a viable corridor for *L. pipiens* despite the diversity of land uses in the area. The introgression zone within the Mora Watershed transverses the ecocline from the Great Plains to Southern Rocky Mountains. Future work will address the landscape attributes associated with presence and spread of *L. blairi* west into the foothills and the extent and impacts of the hybrid zone on *L. pipiens* in Northern New Mexico.

0152 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Iwo Gross[1], Yong Wang[1], Callie Schweitzer[2]

[1]Alabama A&M University, Huntsville, Alabama, USA, [2]USDA Forest Service, Southern Research Station, Normal, Alabama, USA

Maternal and Juvenile Habitat Use, Dispersal, Hibernation, and Survival in Copperheads (Crotalinae; *Agkistrodon*)

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 as a result of ineffective tracking techniques and low detection probabilities in wild populations. In this study, we will examine the activity patterns, overwintering habitat requirements, and survival of gravid female copperheads (*Agkistrodon contortrix*) and their offspring that inhabit Bankhead National Forest (BNF) in northern Alabama. Gravid snakes will be implanted with standard radiotransmitters and tracked continuously from early summer until hibernation. In advance of parturition (late August), we will bring females into the lab and hold each snake in isolation until they give birth. Select neonates >8g will be tracked using harmonic direction finder (HDF) tags, which function by reemitting incoming radio signals at a harmonic frequency that can be detected by a handheld transceiver and pinpointed using basic telemetry methods. These schottky diodes require no batteries, are lightweight (ca. 80 mg), and have a detection range appropriate for a study involving small organisms. Macro- and microhabitat surveys will be conducted alongside tracking efforts of both age classes throughout the activity season. The simultaneous implementation of these methods will help us draw conclusions concerning vital snake nesting and overwintering habitat, and the variation in habitat use and survival across Copperhead age classes.

0645 AES Behavior, Banquet Room E, Thursday 31 July 2014

R. Dean Grubbs[1], Charles Cotton[1], Toby Daly-Engel[2], David Kerstetter[3]

[1]Florida State University Coastal and Marine Lab, St. Teresa, Florida, USA, [2]University of West Florida, Pensacola, Florida, USA, [3]Nova Southeastern University Oceanographic Center, Dania Beach, Florida, USA

Post-release Survival and Vertical Movements of Bluntnose Sixgill Sharks (*Hexanchus griseus*) in Four Oceanic Regions

The bluntnose sixgill shark (*Hexanchus griseus*) occurs worldwide in tropical and temperate seas typically at depths over 200 m associated with insular and continental slopes, seamounts and submarine canyons. We used modified longlines to capture bluntnose sixgill sharks in the Central Pacific Ocean (off Hawaii, N=26), in the Northwest Atlantic Ocean (off Virginia, N=4), in the northern Gulf of Mexico (off Florida, N=19) and in the Bahamas (Exuma Sound, N=8). Sharks 175-500 cm total length were captured 265-1,153 m deep. Twenty sixgill sharks were tagged with pop-off archival satellite transmitters (PSATs) to assess post-release survival and recovery time and to compare patterns of vertical movements between regions. Eighteen of 20 PSATs (90%) reported after 9 to 187 days at liberty (average retention was 87% of programmed time). Post-release survival was high (83%) but depth data suggest recovery from capture requires 48-60 hours. Mortality rates and recovery time did not differ significantly between sharks that were brought aboard the vessel and those that remained in the water during tagging. Bluntnose sixgill sharks displayed distinct diel vertical migrations in all regions, occurring shallower during night than during day. Vertical migrations were mediated by water temperature and migration depths reflected regional differences in thermoclines and perhaps light attenuation (turbidity/productivity). Average nighttime depths ranged from 175 m (Virginia) to 450 m (Exuma Sound) whereas daytime depths ranged from 300 m (Virginia) to 900 m (Exuma Sound). Nighttime and daytime temperatures were near 17°C and 5°C, respectively, across all regions.

0631 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Friday 1 August 2014

Jared Grummer, Adam Leaché

University of Washington, Seattle, WA, USA

Those Dammed Frogs: Investigating the Impacts of River Dams on the Micro-population Genetic Structure of the Tailed Frog (*Ascaphus truei*) Using Thousands of SNPs

Anthropogenic habitat modification can divide suitable environments into patchy networks of sup-optimal, or even inhospitable, habitats. Although most studies focus on terrestrial alterations, we examined the impacts of manmade aquatic barriers on the fine-scale population genetic structure of the tailed frog (*Ascaphus truei*). Beginning in 1921, three hydroelectric dams were erected on the Skagit River in north-central Washington state. Since then, three lakes have formed, presenting a potentially formidable barrier to migration of both aquatic and terrestrial organisms, e.g., larval and adult amphibian stages, respectively. We performed double-digestion restriction site-associated DNA sequencing (ddRADseq) on 196 *A. truei* samples obtained from 15 streams in the areas immediately surrounding these riverine impoundments to determine the level of population structuring that has resulted from these manmade barriers. Our dataset consisted of ~2,000 unlinked SNPs shared across individuals from all sampling sites. We inferred population-genetic structure and differentiation amongst populations through an analysis of molecular variance (AMOVA). We also used the program STRUCTURE to infer the number of populations in Hardy-Weinberg equilibrium, and estimated migration rates using the program G-PhoCS. We find varying levels of genetic differentiation between streams on either side of each lake, in spite of a maximal population separation time of 30 generations, indicating either large ancestral population sizes or the insignificance of these lakes as a barrier to migration. Our results highlight the power of recently developed next-gen sequencing approaches for examining population divergence at fine geographic and recent temporal scales.

0364 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Michelle Guidugli[1], Kari Dupler[1], John MacGregor[2], Stephen Richter[1], David Brown[1]

[1]Eastern Kentucky University, Richmond, KY, USA, [2]Kentucky Department of Fish and Wildlife Resources, Frankfort, KY, USA

Developing an Amphibian Index of Biotic Integrity and Validating a Rapid Assessment Method for Kentucky's Wetlands

In Kentucky, at least 80% of wetlands have been lost or degraded; however, the amount of impact is most likely underestimated. Recently, the Kentucky Division of Water, Eastern Kentucky University, and various state and federal agencies have developed a rapid wetland assessment (i.e. KY-WRAM) to assess the quality of wetlands to aid in establishing mitigation levels and long-term monitoring. In an effort to validate the KY-WRAM's ability to reflect wetland condition, more intensive assessments of wetland condition such as amphibian, avian, vegetation, macroinvertebrate, chlorophyll a, and water quality surveys are being conducted. These rapid assessment data and intensive bio-assessment data will be compared for each wetland where both assessments occurred. To make these comparisons possible with the amphibian survey data, EKU and John MacGregor (Kentucky Department of Fish and Wildlife Resources) have begun developing an Amphibian Index of Biotic Integrity (Amphibian IBI), which will be just one of several tools used for KY-WRAM validation and assessment and as a tool to monitor amphibian communities throughout Kentucky. In this presentation, we discuss the process we are using to develop the KY-WRAM and Amphibian IBI, which are based upon the methods established by Ohio EPA's Wetland Ecology Group, and some preliminary results based on two seasons of amphibian surveys. These topics include a description of Coefficients of Conservatism, an Amphibian Quality Assessment Index, other amphibian community metrics, and our approach to developing these for Kentucky.

0368 Turtle Ecology, Banquet Room H, Sunday 3 August 2014

George Guillen

University of Houston Clear Lake - EIH, Houston, Texas, USA

Movement and Habitat Utilization by the Texas Diamondback Terrapin, *Malaclemys terrapin littoralis*

The Texas Diamondback Terrapin, *Malaclemys terrapin littoralis*, is found exclusively in coastal waterways from the western portion of Louisiana to Nueces Bay, Texas. Several studies have been conducted on large-scale movement patterns, range, and migration of

terrapin. However, few comprehensive studies combining multiple methods to assess both land and water movement and habitat utilization have been conducted. The objectives of our study were to estimate the density, demographics, movement and habitat utilization of terrapin within the West Galveston Bay, Texas complex. To estimate short and long-term movement and habitat utilization of terrapin on both water and land we utilized a combination of manual searches, acoustic and radio-telemetry. All terrapin captured were notched on their carapace and injected with a PIT tag to allow individual recognition during recapture. An acoustic telemetry receiver array was established to document terrapin movement within tidal creeks and adjacent open bay habitat during May 2009-May 2013. This effort was coordinated with weekly or monthly terrestrial radio-telemetry manual searches. The combined use of radio and acoustic telemetry provided unique insight into both short and long term terrapin movement and habitat use. We observed previously undocumented long-distance movement between islands and mainland habitats using radio-telemetry and manual searches. We however documented high site fidelity by some terrapin within tidal creeks and adjacent open bay habitat using acoustic telemetry. Our findings highlight the need for multiple monitoring approaches to characterize terrapin behavior and habitat use over multiple spatial and temporal scales.

0756 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jennifer Gumm

Stephen F. Austin State University, Nacogdoches, TX, USA

Quaardvark and the Animal Diversity Web: A New Tool To Help Students Explore Ecological Patterns

Quaardvark is a tool for creating complex queries to explore ecological and evolutionary patterns in the Animal Diversity Web database. In the classroom, it allows students to develop and test hypotheses using comparative datasets. I highlight the resources available through Quaardvark and the Animal Diversity Web, and provide two student centered activities to be used in class or lab settings. In the first, students collect data from multiple taxonomic groups in order to test general patterns of patterns in trade-offs of life history traits. In a second activity, students explore what types of traits may be more associated with being listed as threatened or endangered for a particular taxonomic group. Finally, I highlight how students in ichthyology and herpetology courses can contribute to the Animal Diversity Web to further develop the database of information about these groups.

0754 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Jennifer Gumm[1], Cory Becher[1], Christopher Brooks[1], Gene Wilde[2]

[1]Stephen F. Austin State University, Nacogdoches, TX, USA, [2]Texas Tech University, Lubbock, TX, USA

Genetic and Behavioral Analysis of Hybridization Between Red River Pupfish (*Cyprinodon rubrofluviatilis)* and Sheepshead Minnow (*Cyprinodon variegatus)*

Hybridization by invasive species is a major threat to biodiversity, and has impacted pupfish species throughout the US Southwest. We are examining hybridization and genetic introgression in the Red River Pupfish (*Cyprinodon rubrofluviatilis*). Recently, morphological characters have documented the occurrence of Sheepshead Minnow, *Cyprinodon variegatus,* in the Brazos River and identified potential hybrids between these species. Patterns from morphological data suggest that hybridization is rapid. This poses a significant threat to remaining populations of Red River pupfish. We are using genetic analysis of microsatellites to confirm and assess the extent of hybridization and introgression in this system. Preliminary results suggest introgression between these species. For hybridization to occur, reproductive isolating mechanisms must break down. We present preliminary results from experiments testing the hypotheses that incomplete pre- and post-zygotic isolating mechanisms facilitate hybridization and that relative abundance of Sheepshead Minnow influences hybdridization rates. Understanding behavioral and ecological dynamics of hybridization in one system allows for development of new conservation strategies based on behavioral management.

0706 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Daniel J. Gurdak

SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

Identifying Geographic Gaps Between Management and Research

Environmental management depends on reliable ecological data that is accurate to the region in which management practices are being implemented. Fisheries management typically regulates the amount of a resource harvested, minimum size of capture, and when capture happens through seasonal closures. Although these regulations all depend on sound ecological information, data deficiencies are all too common. In South America, the arapaima, among the largest freshwater fishes, has emerged as a focus of management efforts because of its large size, high value and unique ecology. However, these efforts span across an entire continent and across a range of environmental

gradients and arapaima populations. As a result, fisheries regulations based on research conducted in one region may not be appropriate for another. This study looked through published and peer-reviewed research on arapaima to compare geographic overlap of management efforts and research by producing various maps. Results demonstrate a significant spatial gap in arapaima research and management efforts that could hinder a promising South American management and conservation initiative. This highlights that even in a "best-case" scenario with a large fish, existing management efforts need to be linked with research at appropriate site-, species-, and habitat- levels.

0677 NIA STUDENT COMPETITION, Banquet Room G, Friday 1 August 2014

Daniel J. Gurdak[1], Donald J. Stewart[1], Paulo A. Buckup[2]

[1]*SUNY College of Environmental Science and Forestry, Syracuse, NY, USA,*
[2]*Universidade Federal do Rio de Janeiro, Museu Nacional, Departamento de Vertebrados, Rio de Janeiro, RJ, Brazil*

A New Species of *Arapaima* (Osteoglossomorpha, Osteoglossidae) from the Lower Amazon, Near Santarém, Brazil

A new species of *Arapaima* has been discovered from the Brazilian Lower Amazon. This new taxon is readily distinguished from all other *Arapaima* by the following characters: body depth, fourth infraorbital length, caudal peduncle depth, tooth formation, scale morphology, and coloration. It is readily distinguished from all nominal species of *Arapaima* except *A. arapaima* by its relatively deep body (~18% SL vs. <15% in others). Color distinguishes this species from *A. arapaima* by: 1) dark grey margins on lateral scales at all life stages, and 2) thin white margins on scales of mature adults in mid and posterior flank (vs. no dark or white margins on scales). Further distinguished from *A. agassizii* and *A. leptosoma* by having relatively shorter fourth infraorbital (mean 8.6% SL vs. 10% SL), and from *A. mapae* and *A. agassizii* by having relatively deep caudal peduncle (mean 6% SL, vs. 4% SL in those two taxa); also distinguished from *A. gigas* by having dentary teeth in a single row (vs. dentary teeth in 2─2.5 irregular rows). This species was collected from Amazonian floodplain (or várzea) habitats near the city of Santarém, Pará State. The new species appears to show ecological separation from other *Arapaima* in this region by specializing in "aningal" habitats, comprised of floating, aningal vegetation that tend to be relatively low in pH with clear, dark waters during part (if not most) of the year.

0202 AES Behavior, Banquet Room E, Thursday 31 July 2014

Tristan Guttridge[1], Steven Kessel[2], Demian Chapman[3], Lucy Howey-Jordan[4], Mark Bond[3], Jean-Sebastien Finger[6], Robert Bullock[5], Jill Brooks[1], Rachael Cashman[1], David Flanagan[1], Samuel Gruber[1]

[1]Bimini Biological Field Station Foundation, South Bimini, Bahamas, [2]Windsor University, Windsor, Canada, [3]Stony Brook University, New York, NY, USA, [4]Microwave Telemetry, Columbia, MD, USA, [5]Hull University, Hull, UK, [6]Humboldt Institute, Berlin, Germany

Movement Patterns and Habitat Use of the Great Hammerhead Shark, *Sphynra mokarran* in Bimini, Bahamas and Florida, USA

Sphynra mokarran is a bycatch species in a variety of fisheries throughout its range and population declines are suspected because of the high value of their fins in the international fin trade. Further management of this species is hindered by susceptibility to mortality during capture and lack of basic information about spatial and habitat use. Using a combination of satellite and acoustic telemetry we aim to assess the movement patterns and habitat use of endangered (IUCN) *S. mokarran* tagged in two ecologically dissimilar sites; 1) Bimini, The Bahamas and 2) Jupiter Inlet, Florida, USA. Since 2011, sharks have been tagged intermittently in Florida with 9 individuals (250-350cm) implanted with V16 acoustic transmitters. These sharks are tracked through an acoustic array data share consortium (http://www.theactnetwork.com/). Preliminary analysis indicates no post-tagging mortality and all individuals were detected throughout the array for > 12 months. Two individuals were detected ~300km north of Jupiter Inlet near Cape Canaveral, and 4 sharks were detected returning to the Jupiter area over two consecutive years during the winter months. During 2014 in Bimini, 17 sharks were externally fitted (via free-diving) with acoustic tags and a receiver array was established to monitor their local movements. Preliminary results from The Bahamas and the US suggest this species is migratory with evidence of seasonal site fidelity to local areas. The deployment of high-rate satellite tags will provide high-resolution vertical behavioral data to be combined with acoustic telemetry data for the purpose of providing spatial information critical for conservation management.

0322 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Friday 1 August 2014

Jacquelyn Guzy[1], Steven Price[2], Evan Eskew[3], Michael Dorcas[4]

[1]University of Arkansas, Fayetteville, AR, USA, [2]University of Kentucky, Lexington, KY, USA, [3]University of California, Davis, CA, USA, [4]Davidson College, Davidson, NC, USA

The Influence of Damming on Anuran Species Richness in Riparian Areas

Damming has heavily altered the natural flow regime of riverine ecosystems worldwide and has been shown to negatively influence the species richness of many groups including invertebrates and fish. However, anuran species richness patterns in riparian areas affected by damming have not been well documented. We conducted anuran calling surveys at 42 study locations along the Broad and Pacolet Rivers in South Carolina to address the potential effects of flow regulation by damming on community and species-specific anuran occupancy patterns. Using a hierarchical Bayesian analysis, we modeled anuran occupancy responses to a site's distance upstream from dam and distance downstream from dam. The mean occupancy response by the anuran community indicated that anuran occupancy and species richness were maximized when sites were farther downstream from dams. Species-specific occupancy estimates showed a similar trend of higher occupancy downstream from dams. Our results extend the observed negative influence of dams to include anuran communities and indicate that damming has a negative effect on anuran species richness across a large spatial extent.

0358 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Laura Habegger[1], Philip Motta[1], Daniel Pulasky[2], Daniel Huber[3], Elizabeth Dumont[2]

[1]University of South Florida, Tampa, Fl, USA, [2]University of Massachusetts, Amherst, MA, USA, [3]University of Tampa, Tampa, Fl, USA

Feeding Biomechanics in Billfishes: Inferring the Role of the Rostrum Through FEA

Billfishes are a group of fishes characterized by the extreme elongation of the premaxillary bones comprising the rostrum. Surprisingly, the role of this structure is still controversial. The goal of this study was to investigate through finite element analysis the role of the rostrum during feeding, to ultimately predict patterns of feeding behavior

in two billfishes with different rostral morphologies. Three loading regimes (lateral, dorsoventral and axial) were applied to the models to simulate tentative feeding behaviors and the predicted stress along the rostra was compared. Model validation was performed by comparing strain gauge data from previous bending experiments to our FE models. Preliminary results of the FE analyses accord well with the strain gauge data. Our results imply that the bill in blue marlin may be better suited to perform a wider range of striking motions during feeding, as the stress along the bill in this species was predicted to be less compared to that observed in swordfishes under the same loading regimes. Alternatively, swordfishes are predicted to more likely strike prey with lateral movement of the head, as models of dorsoventral movement predicted significantly higher stresses. In both species the middle section of the rostrum was predicted to undergo the highest stress during striking, suggesting this region is the most likely area to break under higher loads.

0619 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Lauren Hall, Bruce Kingsbury

Indiana-Purdue Fort Wayne (IPFW), Fort Wayne, IN, USA

Basking Platforms and Wildlife Cameras as Novel Monitoring Techniques for Aquatic Reptiles

Aquatic herpetofauna are often difficult to survey by visual encounter methods because of their clandestine nature, including their tendency to plop into the water when a perceived threat approaches. We explored the use of artificial basking platforms and wildlife cameras to help overcome these challenges to assess habitat occupancy by aquatic herpetofauna, including the Copper-bellied Watersnake (*Nerodia erythrogaster neglecta*). The copperbelly is federally listed as threatened, and is endangered in Indiana, Michigan, and Ohio. The study was conducted in the area occupied by the federally threatened populations of this species. Wildlife cameras set up in this area will take pictures of each platform's surface every five minutes during May, June, and July of 2014 to determine which reptiles will utilize these platforms. This data will be compared to occupancy data from these locations from previous years (2005-2008, 2011-2013) and the current season to determine if the use of basking platforms and wildlife cameras is a viable alternative to visual encounter occupancy surveys for copperbellies. Preliminary data will be presented. If the monitoring technique described here is successful, it has the potential to significantly reduce costs and surveying effort for continued monitoring of these small and imperiled populations, and the approach may have broader application as well.

0127 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Monique Halloy

Instituto de Herpetología, Fundación Miguel Lillo, Tucumán, Argentina

Gordon Burghardt and the Butterfly Effect

It is said that the butterfly effect has to do with initial conditions in which a small change can result in unforeseen consequences later on. I met Gordon in August 1985. Little did I know that, on that day, an imperceptible but profound change had begun. Today, almost thirty years later, I am here to tell you about it. First I obtained a Master´s Degree working on the ontogeny of prey ingestion in four species of *Thamnophis*. Then came a PhD working on the phylogeny of a group of 19 different species of *Liolaemus*, based on their burying behavior. After returning to Tucumán, in northwestern Argentina, I continued with my research and started teaching at the University. My course in Animal Behavior was inspired by the teachings of Gordon in his classes at the University of Tennessee, Knoxville. Students were fascinated. No such thing existed in their curricula at the University. They approached me and we started working on the local fauna. And so it was that we studied lizards and frogs, mostly, but also the anteater, cebus monkeys, parrots and snakes. We were interested in topics such as communication, parental behavior, and sexual selection, among others, familiar themes to my mentor in whose honor we are having this Symposium. Today the study of Animal Behavior is no longer an unknown in northwestern Argentina thanks to the ripple effects initiated that far-away day in 1985.

0330 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Brian Halstead[1], Glenn Wylie[1], Melissa Amarello[1], Jeffrey Smith[1], Michelle Thompson[2], Eric Routman[2], Michael Casazza[1]

[1]U.S. Geological Survey, Dixon, CA, USA, [2]San Francisco State University, San Francisco, CA, USA

Short-term Effects of Prescribed Fire on Apparent Survival of San Francisco Gartersnakes (*Thamnophis sirtalis tetrataenia*)

Prescribed fire is a management tool commonly used to improve habitat for species occurring in early seral stage communities, but the effects of prescribed fire on herpetofauna are variable. Although they have been federally endangered since 1967, little is known about the effects of management practices on San Francisco Gartersnakes

(*Thamnophis sirtalis tetrataenia*). We conducted a capture-mark-recapture study of San Francisco Gartersnakes at a single site in San Mateo County, California, from 2008-2013. A prescribed burn was conducted on a portion of the site in the fall of 2010. We used multi-state Cormack-Jolly-Seber models to evaluate transition probabilities and apparent survival of San Francisco Gartersnakes between burned and unburned areas, as well as time-varying individual covariates in standard Cormack-Jolly-Seber models to examine acute and persistent responses to fire. Mean apparent survival was 0.58 (0.16-0.95) in the unburned area prior to the prescribed burn, and 0.74 (0.13-0.99) after the prescribed burn. In the burned area, mean apparent survival was 0.87 (0.27-0.99) prior to the burn and 0.64 (0.03-1.00) after the burn. Although estimates were imprecise, the short-term persistent effects of prescribed fire on apparent survival were 3.71 times more likely to be negative than positive. Further evaluation of prescribed fire as an acceptable tool for managing habitat for San Francisco Gartersnakes is warranted; replication at the site level would be particularly advantageous. Our study further highlights the need for controls in space and time when evaluating the effects of management actions.

0396 Herp Conservation I, Banquet Room F, Friday 1 August 2014

M. Kevin Hamed[2], Matthew Gray[1]

[1]*University of Tennessee, Knoxville, TN, USA,* [2]*Virginia Highlands Community College, Abingdon, VA, USA*

Temporal and Spatial Changes of Mercury Contamination of Black-bellied Salamanders (*Desmognathus quadramaculatus*) from Whitetop Mt., Virginia

Mercury is a toxic contaminant which bioaccumulates especially in aquatic environments. Precipitation and dry deposition through clouds are the predominate methods in which mercury enters forested ecosystems. Salamanders are apex predators in high elevation, Appalachian streams are potentially at risk of mercury contamination due to persistent cloud cover. We compared mercury concentrations from black-bellied salamanders (*Desmognathus quadramaculatus*) along elevational transaction on Whitetop Mountain, Virginia. Salamanders from a northern aspect stream (Big Branch) had higher total mercury concentrations (THg) than those from a southern aspect stream (Whitetop Creek). In Big Branch (THg) concentrations were higher from salamanders at higher elevations (1128 – 1280 m) than lower elevations (945 – 1097 m). We examined the effects of preservation on THg concentrations in preserved salamander tissue. After 40 days THg concentrations increased by 9% and remained constant at 12% after 160 days suggesting that preserved museum specimens can provide accurate THg concentrations. Samples collected from 1957-8 on Whitetop Mt. were compared to those from 2011-2 and historic samples had 4.5 times higher THg concentrations than those

from 2011-2. We also established a non-lethal sampling technique only requiring tail tissue for black-bellied salamanders.

0709 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

M. Kevin Hamed[2], Matthew Gray[1], William Sutton[3]

[1]University of Tennessee, Knoxville, TN, USA, [2]Virginia Highlands Community College, Abingdon, VA, USA, [3]Tennessee State University, Nashville, TN, USA

Changes in Spatial Distributions of Plethodontid Salamanders Along Elevation Gradients in the Mt. Rogers National Recreation Area Over a 50-year Period

Climate change has been shown to alter species distributions as many species shift distributions to maintain their preferred niche. Although Southern Appalachian salamanders are projected to experience range changes and extirpations due to climate change, limited knowledge exists on past range changes. We resampled plethodontid salamanders from 2008 - 2011 at sites in the Mt. Rogers National Recreation Area (MRNRA), Virginia that were previously sampled in the 1950s and 1990s. We used an occupancy-based approach to detect range shifts and to account for imperfect detection. The median change of elevation midpoints was 15.2 m upward since 1950s and no changes since the 1990s. Median range limits were more variable as the lower limit for *P. welleri* expanded downslope since both the 1950s and 1990s. *Plethodon yonahlossee* increased upper range limits since the 1950s and expanded both upslope and downslope since the 1990s surveys. *Plethodon cylindraceus* contracted its range as lower range limits expanded upward and upper range limits moved downslope since the 1950s. Habitat generalists such as *P. montanus* and *Desmognathus orestes* experienced no median range limits over the 50-year period. Occupancy probabilities suggest a lack of change in range limits for most members of the genus *Desmognathus*. Regional weather patterns indicated stable mean temperatures since 1948. Our results suggest species-specific changes for MRNRA salamanders, with observed changes not related to increasing mean temperatures.

0613 Conservation, Banquet Room F, Friday 1 August; ASIH STOYE AWARD CONSERVATION

Matthew Hamilton[1], John Finger[1], Andrew Grosse[2], Robert Horan[3], Robert Kennamer[1], I. Lehr Brisbin[1], Tracey Tuberville[1]

[1]University of Georgia, Athens, GA, USA, [2]South Carolina Department of Natural Resources, Charleston, SC, USA, [3]Georgia Department of Natural Resources, Atlanta, GA, USA

American Alligator (*Alligator mississippiensis*) Population Trends on Radiologically-Contaminated Reservoirs

Long-term data sets are necessary to monitor population trends of species residing in contaminated environments, to detect potential negative effects of contaminant exposure, and to determine if management intervention is warranted. Contaminated environments in natural settings are increasingly affecting wildlife populations worldwide and may even attract wildlife, even though they are potentially harmful, by providing a permanent source of water when natural wetlands dry. The Savannah River Site (SRS) is an 80,000-hectare Department of Energy (DOE) site located in Aiken, South Carolina that contains several man-made wetlands and reservoirs for mitigating contaminants on site. Two of these reservoirs, PAR Pond and L-Lake, were historically used as cooling reservoirs for thermal effluent from nuclear reactors. Population surveys for American alligators (*Alligator mississippiensis*) have been conducted from 1971-2014 using a variety of methods. We analyzed these data to characterize population trends for American alligators and placed them in the context of the site management and contaminant release history for these two wetland systems over the 43-year period. Based on these results, we can evaluate whether contaminants have had a negative population-level effect on alligators at our study sites.

0503 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Kerry Hansknecht

Lander University, Greenwood, SC, USA

Do What You Love, Love What You Do - That's "Easy" in the Burghardt Lab.

One benefit of being a member of the Burghardt lab was the opportunity to pursue the study of reptiles (and other animals) along many disciplinary lines. Studying animal behavior is rarely easy, but in the Reptile Ethology Laboratory, expanding or even changing research topics or organisms was. In some labs, substantial project changes can mean considerable departures from one's advisor's comfort zone, but Gordon's vast

experience and knowledge made the lab a fairly easy place to pursue a tremendous variety of research questions, be they behavioral, ecological, morphological, physiological, or genetic. I illustrate these points with examples drawn from my own research on watersnake foraging behavior and its ecological, morphological, and sensory influences and discuss how Gordon and his body of work, and the work of his many other students, guided and inspired me.

0504 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Kerry Hansknecht, Ryan Messenger, Taylor Baddeley

Lander University, Greenwood, SC, USA

Studies of Discrimination Learning in Watersnakes

Macrostomatan snakes present some unique challenges to studying their learning ability. Their raptorial teeth and lack of a fleshy tongue to aid in food processing necessitate a somewhat large relative prey size, and this can make frequent food rewards less feasible in studies of snakes than in those of other animals, particularly mammals but even turtles and lizards. Such issues might partly explain the relative dearth of studies on learning involving snakes; few learning trials can be conducted in a single session in part because of rapid reduction in appetite, and the recovery of appetite can take days, necessitating a large time gap between training sessions. These characteristics make studying learning in snakes of many taxa a potentially long and arduous task. However, we should not let that deter us if we are to gain appreciable knowledge of snakes' capacity to learn. Here we offer suggestions for addressing the aforementioned problems and present findings from a newly established research program to study learning in watersnakes.

0438 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR EVOLUTION, GENETICS, & SYSTEMATICS

Maggie Hantak, Shawn Kuchta

Ohio University, Athens, Ohio, USA

Color Polymorphism in the Eastern Red-backed Salamander (*Plethodon cinereus*): How Morphs are Seen through the Eyes of Visual Predators

Color polymorphism is an example of intraspecific morphological diversity within and between populations. Differing coloration of morphs may result in divergent interactions with visual predators. Organisms that are able to blend into their

background (camouflage) more efficiently have a better chance of survival. The Eastern Red-backed Salamander, *Plethodon cinereus*, contains two common color morphs, a striped morph and an all-black 'lead' morph. Presently, it is not known if one of these morphs is better camouflaged in their natural habitat. To address this question, we are studying three populations in Ohio: a monomorphic striped population, a monomorphic lead population, and a polymorphic population. For this study, I am gathering data across seasons, light conditions, and habitats. A spectrometer is being used to collect reflectance measurements from color patches, providing measures of brightness, hue and chroma. Measurements are being collected from five patches on each salamander, as well as random samples of color throughout the habitat. Ambient light from each location is also being measured, as the quality of available light impacts perceived color. This color data will then be analyzed using mathematical models of the avian and mammal visual system to calculate relative contrast, and thereby quantify how well each morph blends into the background. This study will provide essential data for evaluating what evolutionary and ecological dynamics are involved in the maintenance of the color polymorphism in *P. cinereus*.

0361 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Amanda Haponski, Carol Stepien

University of Toledo, Toledo, OH, USA

Genetic History of Maumee River Spawning Walleye (*Sander vitreus*): Comparisons of Adult and Larval Gene Pools

Walleye is an ecologically and economically valuable North American fish, supporting large fisheries, especially in Lake Erie. Our objective is to analyze the temporal genetic patterns of walleye from its largest and most highly exploited spawning run, Lake Erie's Maumee River, to determine if the spawning group exhibits genetic stability. Maumee River walleye have experienced a century of exploitation, habitat changes, and pollution that may have affected its genetic composition and possibly, its future sustainability. A recently published study by our laboratory showed relative genetic consistency across 14 years. We here expand this temporal sampling to 20 years, compare adult and larval gene pools, and increase the number of nuclear microsatellite loci from 9 to 14. We test 746 Maumee River walleye for differences in genetic composition (1) among annual spawning runs (1995-2013), (2) age cohorts, (3) between the sexes, and (4) adult vs. larval gene pools. Results show that genetic composition does not significantly vary among annual spawning runs (F_{ST}=0.000-0.011, p=0.059-0.998), age cohorts (F_{ST}=<0.001-0.009, p=0.059-0.999), or between the sexes (F_{ST}=<0.001, p=0.959). Genetic diversity levels also are consistently high (mean H_O=0.72, range=0.70-0.74), which is greater than the average for spawning groups across the range (mean H_O=0.68). Comparisons of adult and larval

gene pools indicate that larvae are most similar to adults spawning ~20 days prior to their sampling (F_{ST}=0.003, p=0.151). Overall, our results indicate Maumee River walleye exhibit temporal genetic stability and have maintained high diversity, despite intensive anthropogenic pressures.

0245 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Leigh Anne Harden[1,2], Amanda Williard[1], Kimberley Duernberger[1], T. Todd Jones[3]

[1]University of North Carolina Wilmington, Wilmington, North Carolina, USA, [2]Davidson College, Davidson, North Carolina, USA, [3]NOAA Fisheries, Pacific Islands Fisheries Science Center, Honolulu, Hawaii, USA

Water Relations of the Estuarine Diamondback Terrapin from Dormancy to Activity

Water and salt concentrations in an animal's body fluids can fluctuate with changing environmental conditions, posing osmoregulatory challenges that require behavioral and physiological adjustments. The purpose of this study was to investigate body water dynamics in the estuarine diamondback terrapin (*Malaclemys terrapin*), a species that withstands pronounced seasonal fluctuations in salinity, freshwater supply, and temperature. We conducted a field study to determine the total body water (TBW%), water turnover rate (WTR), and daily water flux (DWF) of female terrapins in southeastern North Carolina pre- and post-emergence from winter dormancy. Terrapins were injected with [^{2}H]deuterium on two occasions and washout of the isotope was monitored by taking successive blood samples during the period of transition from dormancy to activity. The WTR and DWF of dormant terrapins were significantly lower than those of active terrapins ($WTR_{dormant}$ = 49.70 ± 15.94 ml day^{-1}, WTR_{active} = 100.20 ± 20.36 ml day^{-1}, $DWF_{dormant}$ = 10.52 ± 2.92 %TBW day^{-1}, DWF_{active} = 21.84 ± 7.30 %TBW day^{-1}). There was no significant difference in TBW% between dormant and active terrapins (75.05 ± 6.19% and 74.54 ± 4.36%, respectively). This is the first experimental field study to investigate seasonal changes in body fluid dynamics of terrapins and has provided insight into the terrapin's ability to maintain osmotic homeostasis while experiencing shifts in behavioral and environmental conditions. Our findings shed light on the relative importance of behavioral and physiological adjustments that may have served as pivotal evolutionary steps in the freshwater chelonian invasion of marine environments.

0418 Fish Systematics & Taxonomy III, Banquet Room G, Sunday 3 August 2014

Rich Harrington, Matt Friedman

University of Oxford, Oxford, UK

Morphological Diversification in Carangimorphs: Perspectives from the Modern Day and the Fossil Record

Carangimorpha is a recently identified clade that encompasses almost 1,000 species of predominantly marine acanthomorphs. This exceptional radiation includes lineages with very disparate body plans and life histories, such as billfish, remora, flatfish, jacks, barracuda, and archerfish. The monophyly of Carangimorpha is strongly supported by molecular data, yet a well-supported hypothesis of relationships among major carangimorph lineages has proven elusive. Even in analyses with very dense sampling of genetic loci, these principal subgroups are separated by very short internodes, implying rapid divergence between them. Molecular clock estimates consistently suggest a Late Cretaceous (ca. 75-80 million years ago) origin for Carangimorpha. The fossil record of carangimorphs begins in the earliest Cenozoic, with morphologically modern examples of the most disparate extant lineages (excluding polydactylids, centropomids, echeneoids, leptobramids, and nematistiids) appearing during or before the early Eocene (ca. 50 million years ago). Here we examine patterns of morphological diversification in this remarkable clade of fishes through landmark-based geometric morphometric analysis of shape variation in modern carangimorphs and well-preserved fossil examples. Our study provides quantitative support for the qualitative observation that the limits of carangimorph morphospace were defined early in the group's evolutionary history. These empirical measures of disparity-through-time permit comparisons with theoretical expectations. The rapid establishment of highly divergent body plans—and by extension, ecologies—in carangimorphs is consistent with an adaptive model of evolutionary radiation. Given their good fossil record, carangimorphs represent an ideal system for exploring the impacts of paleontological data on our understanding of morphological diversification in modern groups.

0271 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Hannah Hart, Jim Gelsleichter, Greg Ahearn

University of North Florida, Jacksonville, FL, USA

Transport of Di and Tripeptides in the Intestine of *Sphyrna tiburo*

Many elasmobranchs are considered top predators with worldwide distribution, and in general these fish play an important role in the transfer of energy from the lower to the

upper trophic levels within the marine ecosystem. Despite this, with the exception of a few studies on glucose uptake in the shark gastrointestinal tract, the functional process of food absorption and digestion in elasmobranchs remains unclear. Given their carnivorous diet, the present study sought to expand knowledge on nutrient absorption in elasmobranchs by focusing on the uptake of products of protein metabolism. To accomplish this, the presence and function of Peptide transporter 1 (PEPT1), a protein found within the intestinal brush border membrane (BBM) of higher vertebrates that is responsible for the translocation and absorption of small peptides released during digestion by the luminal and membrane-bound proteases, was explored in the shark intestine, focusing on the bonnethead, *Sphyrna tiburo*. PEPT-1 was isolated and sequenced from *S. tiburo* scroll valve using molecular approaches and its presence and distribution in the gastrointestinal tract was explored using immunohistochemistry. Furthermore, BBM vesicles (BBMV) were isolated from *S. tiburo* intestine and used to investigate transmembrane transport properties and rates of ^{3}H-glycylsarcosine uptake as a model dipeptide.

0462 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Pamela Hart, Jonathan Armbruster

Auburn University, Auburn, AL, USA

Morphological Variation Among Southern Cavefish (*Typhlichthys subterraneus*) Lineages in Alabama

The Southern Cavefish (*Typhlichthys subterraneus*) inhabits cave and karst systems of the upper and lower highlands of the United States. The more eastern populations inhabit subterranean ecosystems in the Cumberland and Interior Low Plateaus extending from southern Indiana into Kentucky, Tennessee, northwest Georgia, and northern Alabama. As a highly adapted stygobite, morphology of the Southern Cavefish converges with other cave-obligate organisms (i.e., eye and pigment loss). This creates problems for taxonomists because distinct taxonomic characters are often lost or difficult to quantify. An apparent lack of morphological variation resulted in four previously described species of *Typhlichthys* to be synonymized under *Typhlichthys subterraneus*, thus rendering the genus monotypic. This has led to multiple hypotheses that this group represents a species complex (i.e., encompassing multiple cryptic species). Indeed, recent molecular data suggest the presence of at least 16 different lineages within *T. subterraneus*; however their taxonomic status remains unresolved due to lack of obvious distinguishing morphological characters. The Alabamian populations of the Southern Cavefish are of particular interest because these putative lineages may have sympatric distributions in at least one cave system. We used landmark-based geometric

morphometrics and principal component analyses to test for biologically important shape differences among these lineages. Coupling morphological data with existing and further molecular analyses will assist in the taxonomic revision of *Typhlichthys subterraneus*.

0248 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Kyra Hartog[1], Neil Hammerschlag[1], Duncan Irschick[2]

[1]*University of Miami, Miami, FL, USA,* [2]*University of Massachusetts at Amherst, Amherst, MA, USA*

An Analysis of Shark Body Morphology with Respect to Trophic Level, Species, and Habitat Usage

Morphometric measurements can be used to answer questions regarding relationships between body dimensions and life history characteristics of various elasmobranch species. This study examines a series of measurements from 242 sharks of 8 species found in the waters of South Florida, the Florida Keys, and the Bahamas. These are compared to trophic level, species, and habitat usage in order to obtain a more complete picture of why species have certain body shapes. A series of 12 measurements are taken on sharks tagged through conservation research. These measurements are then analyzed both statistically and graphically with respect to existing data on trophic level, habitat usage, of each species in the study. An index of girth has been developed based on several of these measurements as well. Preliminary results show statistically significant differences in the various metrics between trophic levels as well as between species (t-test, independent; $p < 0.01$). Though the metrics for habitat use are not as definite as the specific number of trophic level or the clear definition between species, significance was also seen when morphometric measurements were compared by habitat type (t-test, independent; $p < 0.01$). These results indicate that there may be a strong relationship between a shark's physical and behavioral characteristics. It has not been determined, however, whether the physical aspects dictate behavior or vice versa. Further examination of shark body shape is needed as well as expansion to other species and other study sites, outside of the ones examined here.

0389 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Bret Harvey[1], Rodney Nakamoto[1], Andrew Kinziger[2]

[1]USFS PSW Arcata, Arcata, CA, USA, [2]Humboldt State University, Arcata, CA, USA

Short Trips, Small Numbers: Introduced Cyprinids in the Eel River, Northwest California

Lowering the rate of species introductions depends in part on understanding invasion pathways. While global-scale introductions appropriately receive much attention, more local pathways may also deserve consideration in some areas. The fauna of the Eel River of northwestern California includes three cyprinids native to other parts of the state: speckled dace, Sacramento pikeminnow and California roach. Speckled dace have a limited distribution in the Eel Drainage, perhaps because of predation risk; Sacramento pikeminnow and California roach are both widespread and abundant in the Drainage. We used genetic analyses to identify source populations, estimate effective founding population sizes, and contrast genetic diversity in introduced versus native-range populations. All three minnows took short trips to the Eel River: in two cases the source drainages are adjacent to the Eel and the third introduction pathway was about 40 km. We have estimated effective founding population sizes for speckled dace and Sacramento pikeminnow: these were <10 individuals in both cases. For speckled dace, both allelic richness and standardized allelic richness were lower in the introduced population compared to nine native populations, but one evaluation of ecological performance indicated introduced speckled dace have similar predator avoidance capabilities to fish from native populations. Genetic diversity of introduced Sacramento pikeminnow in the Eel River was similar to two native populations we sampled and lower than two others. This study indicates nearby potential sources of introduced species deserve consideration from resource managers and supports prior observations that ecologically influential populations can be established with small numbers of founders.

0066 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Phil Hastings, HJ Walker, Grantly Galland

Scripps Institution of Oceanography, La Jolla, California, USA

Fishes: A Guide to Their Diversity

Fishes: A Guide to Their Diversity (University of California Press, Fall 2014) provides an illustrated overview of the incredible diversity of the major lineages of fishes including the jawless fishes, cartilaginous fishes, lobe-finned fishes and ray-finned fishes. The book

presents details of basic fish anatomy and descriptive accounts for all 82 orders and over 150 of the most commonly encountered fish families. Each account includes a list of distinguishing characteristics, illustrated with over 500 photographs of preserved specimens, mostly from the *Marine Vertebrate Collection* at *Scripps Institution of Oceanography*. Each account details the group's diversity, habitats, and distribution, and includes remarks on their systematics, ecology, and importance to humans, as well as a list of key references. A selection of phylogenetic trees illustrates current hypotheses of fish evolutionary relationships. The book is intended as a supplement for students of Ichthyology and as a guide for anyone with an interest in exploring the diversity of fishes.

0150 General Ichthyology III, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Malorie Hayes, Jonathan Armbruster

Auburn University, Auburn, AL, USA

Making Sense of the Confusion: A Molecular Assessment of the Genus '*Barbus*' (Cypriniformes: Cyprinidae)

The genus *Barbus sensu lato* encompasses over 800 species and is known to be paraphyletic. After splitting many genera from *Barbus*, the number still stands at over 300 species in two distinct groups: *Barbus sensu stricto* includes large, tetraploid barbs from Europe and the Mediterranean and mostly the African small, diploid '*Barbus*', which are more similar to Asian small barbs like *Puntius*, *Pethia*, and *Systomus* than to *Barbus s.s.* Although some groups have been revised and separated from '*Barbus*', such as the recognition of *Clypeobarbus* and *Pseudobarbus*, the taxonomy and phylogenetics of the small African diploid barbs remain unresolved and relatively unexplored. This is due, in part, to the high levels of morphological variation and convergence within the group that impedes morphological diagnosis and to the large number of species which are present within the genus. This study uses mitochondrial and nuclear markers to determine the relationships between current and historical members of '*Barbus*'. A monophyletic diploid '*Barbus*' is recovered, sister to a clade of African tetraploid '*Barbus*' and *Pseudobarbus*. The diploid '*Barbus*' + tetraploid '*Barbus*' and *Pseudobarbus* form a clade sister to Asian small, diploid barbs. The genus *Enteromius* Cope is resurrected to encompass '*Barbus*', but further splitting of the genus will be necessary.

0608 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Kirsten Hecht[1], Max Nickerson[1], Michael Freake[2], Phil Colclough[3]

[1]*University of Florida, Gainesville, FL, USA,* [2]*Lee University, Cleveland, TN, USA,* [3]*Knoxville Zoological Gardens, Knoxville, TN, USA*

The Potential Influence of Geology on Hellbender (*Cryptobranchus alleganiensis*) Populations

Reports of Hellbender (*Cryptobranchus alleganiensis*) larvae in the wild have historically been rare. In 2000, researchers briefly surveyed a population of *C. alleganiensis* in Great Smoky Mountains National Park and discovered that approximately half of the captured individuals were gilled larvae. Adults were also smaller relative to many sampled populations. It was hypothesized that these trends were potentially due to the influence of bedrock geology on factors such as prey abundance and habitat characteristics. This study examined three components of this hypothesis: trends in *C. alleganiensis* population structure, microhabitat use of *C. alleganiensis* stage classes within Little River, and body condition of *C. alleganiensis* in rivers with different crayfish abundances. We conducted diurnal skin diving surveys during the summer and early fall months from 2003-2010 to capture and measure individuals and their habitats. Surveys confirmed that immature individuals made up a substantial proportion of captured individuals in this stream. Larval *C. alleganiensis* utilized different habitat types than those cited in other streams, and also used significantly smaller shelters on average than larger stage classes. Abundance of crayfish, based on relative frequencies, correlated to overall body condition of Hellbenders in the three rivers examined. While more research is needed, these results help fill in knowledge gaps regarding the larval stage of *C. alleganiensis*, as well as highlight the potential impacts of stream geology on the ecology of Hellbender populations.

0656 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jennifer Heemeyer, Thomas Anderson, William Peterman, Brittany Ousterhout, Dana Drake, Raymond Semlitsch

University of Missouri, Columbia, MO, USA

Automated Analysis of Temperature Dataloggers to Determine Hydroperiods of Vernal Wetlands

Monitoring hydroperiods of wetlands is critical to understanding aquatic community structure but can be costly and labor-intensive. We tested the ability of temperature data from cost-effective Thermochron iButton dataloggers to reflect the inundation state of

constructed wetlands in central Missouri. We used a combination of experimental cattle tanks and existing wetlands to evaluate the effectiveness the iButtons to record temperature data that translated into inundation state. We confirmed that the daily temperature variances of dry iButtons were higher than the variances of wet iButtons, as expected, and determined a variance threshold which could be used to delineate whether a pond was wet or dry with a high degree of accuracy. From field observation of inundation status we optimized an automated procedure to efficiently process and analyze large amounts of iButton data. Several caveats are also provided that should be considered prior to using this method to maximize the accuracy in inundation state and hydroperiod regime.

0575 Reptile Genetics & Evolution, Banquet Room J, Saturday 2 August 2014

Matthew Heinicke[1], Aaron Bauer[2], Todd Jackman[2]

[1]University of Michigan-Dearborn, Dearborn, MI, USA, [2]Villanova University, Villanova, PA, USA

Phylogenetic Relationships in a Mini-radiation of South African Geckos

Gekkonid lizards reach a regional apex of diversity in southern Africa, where multiple independent evolutionary radiations of species occur, especially in association with rocky habitats. Eight of these rock-dwelling gecko species belong to the endemic genus *Goggia*, which is only found in the Cape region of South Africa and adjacent parts of far southern Namibia. These geckos are notably nondescript in comparison to co-occurring *Pachydactylus* species, and are in general morphologically conservative, being small-bodied, moderately proportioned, and drably patterned. We estimated a multigene phylogeny for all species in the genus in order to test for the presence of cryptic lineages and infer its biogeographic history. Results show the genus as a whole to be monophyletic, as is the *G. lineata* compex, which includes all species except for the distinctive *G. microlepidota*. Within the *lineata* complex, the earliest divergence is between an eastern and a western set of species, respectively, and continued geographic isolation has clearly played the major role in promoting speciation within *Goggia*. *Goggia lineata* is itself not monophyletic, instead consisting of at least two and probably more cryptic species. Patterns of historical biogeography and morphological change in comparison to the Cape region's other major rock-dwelling gecko lineages – *Pachydactylus* and the *Afrogecko* group – are discussed.

0243 AES Morphology & Reproduction, Banquet Room E, Sunday 3 August 2014

Jill Hendon[1], Eric Hoffmayer[2], Jeremy Higgs[1], William Driggers III[2], James Sulikowski[3]

[1]University of Southern Mississippi, Gulf Coast Research Lab, Ocean Springs, MS, USA, [2]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA, [3]Marine Science Department, University of New England, Biddeford, ME, USA

Reproductive Biology of the Blacknose Shark, *Carcharhinus acronotus*, in the Northern Gulf of Mexico

Analyses of reproductive data for blacknose sharks, *Carcharhinus acronotus*, collected off the east coast of the United States and the northern Gulf of Mexico (GOM) have shown variations in important reproductive variables. As the GOM study was conducted in a discrete region, the current study chose to examine blacknose sharks from the entire northern Gulf of Mexico to provide a more comprehensive estimate of the reproductive parameters associated with this population. Six hundred and seven blacknose sharks were captured by gillnet or longline in the northern Gulf from 2008 to 2013 (males: n = 347, 350 - 1076 mm fork length (L_F); females: n = 260, 342 - 1120 mm L_F). The size at 50% maturity was 800 and 822 mm L_F for males and females, respectively. Male gonadosomatic index (I_G) and testis dimensions reached maximum levels in May suggesting a peak in sperm production during that time. Female I_G and maximum follicle diameters were highest in June, indicating time of ovulation. Embryos ranged in size from 42.1 mm stretched total length (L_{ST}) in August, to 467 mm L_{ST} in May, with an average brood size of 3.6 ± 0.09 embryos and a male to female ratio of 1:1.05. These data indicate mating occurs in July/August, and parturition occurs in May/June, yielding an 11 month gestation period and annual periodicity. All reproductive variables were similar to those found for the Atlantic population with the exception of periodicity.

0582 Herp & Ich Genomics, Banquet Room J, Sunday 3 August 2014

Catriona Hendry[1], Frank Burbrink[2], Vincent Chou[1], Emily Lemmon[3], Alan Lemmon[3], R. Alexander Pyron[1]

[1]The George Washington University, Washington, DC, USA, [2]The Graduate School and University Center, The City University of New York, New York, NY, USA, [3]Florida State University, Tallahassee, FL, USA

Phylogenomic Data and Coalescent Species-Tree Methods for Resolving Difficult Nodes in the Phylogeny of Advanced Snakes (Serpentes: Caenophidia)

Next-generation genomic sequencing promises to quickly and cheaply resolve remaining contentious nodes in the Tree of Life, and facilitate species-tree estimation taking into account stochastic genealogical discordance among loci. Recent methods for estimating species trees bypass full likelihood-based estimates of the multi-species coalescent, and approximate the tree using simpler summary metrics. However, no studies have yet evaluated their efficacy on a large-scale phylogenomic dataset, and compared them to previous concatenation strategies. Here, we compare these approaches using Caenophidian snakes, a group with >2,500 species that contains several rapid radiations that were poorly resolved with fewer loci. We generate sequence data for 352 single-copy nuclear loci with ~100% coverage (~0% missing data) for 31 major lineages. We estimate phylogenies using neighbor joining, maximum likelihood, and three summary species-tree approaches (NJst, STAR, and MP-EST). We find that all methods yield similar resolution and support for most nodes. In contrast to some previous hypotheses, species trees strongly support non-monophyly of Colubroidea, with Xenodermatidae as the sister taxon to Acrochordidae. This demonstrates that phylogenomic species-tree estimation may occasionally overturn well-supported relationships from concatenated data, and this should be a strong consideration for future studies. In contrast, for at least two diverse and rapid radiations (Lamprophiidae and Colubridae), phylogenomic data and species-tree inference do little to improve resolution and support. Thus, while phylogenomic data may provide support for some relationships, certain other nodes in the Tree of Life may lack phylogenetic signal, and larger datasets and more sophisticated analyses may still fail to resolve them.

0615 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Jennifer Herbig, Stephen Szedlmayer

Auburn University, Auburn, AL, USA

Movement Patterns of Gray Triggerfish, *Balistes capriscus*, Around Artificial Reefs in the Northern Gulf of Mexico

Little is known about the life history of Gray Triggerfish, *Balistes capriscus*, despite its growing importance as both a commercial and recreational species in the Gulf of Mexico. The use of acoustic telemetry on Gray Triggerfish can be used to provide important information about their general ecology by assessing the importance of structured habitat for this species. To date, no data exists on acoustically tagged Gray Triggerfish. The present study tagged Gray Triggerfish (n = 17) in 2012 and 2013 on two private artificial reefs with the VR2W Positioning System (VPS, Vemco Ltd, Nova Scotia) to determine if this species could be successfully tagged and tracked. Most (84.2 %) tagged fish successfully survived and were tracked for extended periods (1 to 57 weeks), with only three fish lost within 24 hours of tagging (considered a tagging artifact). Tagged Gray Triggerfish showed diel movement patterns with home ranges (95 % KDE) and core areas (50 % KDE) significantly larger during the day than night. Fish also showed seasonal movement patterns that were positively correlated with water temperature. Gray Triggerfish showed high site fidelity (mean distance from reef = 46.3 ± 1.3 m) and residency (79 % still present after 100 days) to release site reefs. This high site fidelity to artificial reefs emphasizes the importance of structured habitat for Gray Triggerfish, and this new VPS tracking method provided an important advancement for Gray Triggerfish movement studies.

0174 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Obed Hernandez-Gomez[1], Steven Kimble[1], Jeffrey Briggler[2], Rod Williams[1]

[1]Purdue University, West Lafayette, IN, USA, [2]Missouri Department of Conservation, Jefferson City, MO, USA

The Identification of Cutaneous Microbiota on Eastern and Ozark Hellbenders Through Use of High-throughput Genetic Sequencing

Deadly pathogens currently threaten the existence of many amphibian species, including the hellbender (*Cryptobranchus alleganiensis*). The Ozark hellbender (*C. a. bishopi*), a federally listed subspecies found only in portions of Missouri and Arkansas, has been found to be in severe decline both in numbers and in overall population health. The Ozark subspecies differs from the eastern subspecies (*C. a. alleganiensis*) in that most adult Ozark hellbenders are prone to sores and necrosis of the appendages believed to

be caused by infections. We performed a sensitive method of microbe detection using next generation sequencing by which we compared directly the cutaneous microbiota between the two subspecies so that we may explain the relationship between pathogen presence and disease. From the 5 eastern and 7 Ozark hellbenders sampled for wound and control sites, and the 2 water samples from each respective river habitat, we generated 71,891,278 sequences of ribosomal rRNA segments used to identify a total of 886,880 bacteria at the operational taxonomic level. Our analysis returned bacterial community differences at the inter-subspecies level, with low support for differences between intra-subspecies wound and control sites. We expect to use the results of these investigations to direct future studies in amphibian cutaneous microbiota characterization and immunogenetics, provide valuable information to captive breeding programs in terms of microbial ecology of captive individuals, and help the efforts of translocation attempts.

0692 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Mark Herr[1], Sean Graham[2], Tracy Langkilde[1]

[1]*Department of Biology, The Pennsylvania State University, University Park, PA, USA,* [2]*Department of Biology, University of Findlay, Findlay, OH, USA*

Stressed Snakes Strike First: Hormone Levels and Defensive Behavior in Free Ranging Cottonmouths (*Agkistrodon piscivorus*)

The risk of predation is widely accepted as being one of the most significant evolutionary pressures driving selection upon wildlife species. Animals can respond to potential predation with defensive behaviors, allowing them to mitigate some of the risk of encounters with predators. In this context, understanding the factors which influence defensive behaviors is critical to expanding our knowledge of organismal response to strong selection. Predation risk is often cited as a primary contributor to ecological stress, which is believed to be an important factor mediating animal behavior. The eastern cottonmouth (*Agkistrodon piscivorus*) is an abundant, large bodied pit viper which has a reputation for commonly exhibiting intense defensive behaviors. Both the defensive behaviors and hormonal ecology of cottonmouths have been studied extensively. However, the interaction between these is not well understood. We conducted field trials to examine how levels of the stress hormone (corticosterone) affect the defensive behavior of cottonmouths. We recorded the intensity of defensive behaviors and plasma corticosterone concentrations of cottonmouths both immediately upon first encountering the snake, and after confining it for 30 minutes. We found that snakes with elevated levels of baseline corticosterone exhibited more intense defensive behaviors when we approached them in the field; snakes with higher levels were more

likely to strike. Somewhat surprisingly, this behavior was not related to how stressed snakes were following confinement. This study suggests that baseline stress levels can be important correlates of defensive behavior, providing insight into a potential consequence of environmental stress.

0662 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Kelli Herrick, Jayme Waldron

Marshall University, Huntington WV, USA

Evaluating the Effectiveness of Different Methods of Detection for the Eastern Hellbender (*Cryptobranchus a. alleganiensis*) in the Ohio River Watershed

Global amphibian declines pose a major threat to the world's biodiversity. *Cryptobranchus a. alleganiensis* (the Eastern Hellbender) is a fully aquatic giant salamander that has experienced substantial population declines in the Ohio River Watershed and throughout its range. These declines have resulted in a near threatened classification by the International Union for the Conservation of Nature (ICUN) and caused many states to label *C. alleganiensis* as a management priority. We attempted to determine which non-invasive sampling method for *C. alleganiensis* would have the highest incidence of detection in attempt to aid wildlife managers in developing more efficient management protocols. In 2013, we sampled 25 sites in the Monongahela National Forest in eastern West Virginia from May to September to test the detection success of three methods: visual encounter surveys (VES), nocturnal spotlighting, and un-baited traps. After 200 search hours and 300 trap nights, one sexually mature male was detected in September during a VES. Due to the small sample size, we did not have the statistical power to successfully determine site occupancy and detection success. We believe that above average precipitation and a short field season negatively impacted our detection success.

0714 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Brittainy Hewitt[1], Matthew G. Keevil[1], Ronald J. Brooks[2], Jacqueline D. Litzgus[1]

[1]*Laurentian University, Sudbury, Ontario, Canada,* [2]*University of Guelph, Guelph, Ontario, Canada*

The Demography of Intraspecific Aggression, Inferred From Injuries, in a Population of Snapping Turtles

Aggression is an important mediator of direct intraspecific competition. Patterns of aggression can provide insight into which life history stages are subject to the most intense competition as well as strategies used by individuals to deal with potential conflicts. Snapping Turtles (*Chelydra serpentina*) exhibit male-biased sexual size dimorphism which, combined with opportunistic behavioral observations, suggests that male-male combat may be the primary form of competition in this species. Forced copulation has been reported in Snapping Turtles and this sexual conflict could also result in injury as is the case in other chelonians. In other turtle species, resource competition results in aggressive interactions, although direct empirical observations of aggressive behaviour in aquatic turtles are difficult to obtain. To evaluate hypotheses of demographic patterns of intraspecific aggression and competition, we compiled observations of presence/absence of putative combat wounds collected from nearly 500 captures and recaptures of Snapping Turtles in Algonquin Provincial Park, Ontario. We found that both sex and body size were important predictors of risk of wounding, consistent with the hypothesis that male-male sexual competition is the primary driver of intraspecific aggression in our population. Small males were less likely to be injured, suggesting that they employ a risk-averse strategy that avoids direct mate competition. In addition, juveniles and adult females had fewer injuries than males. Patterns of aggressive interactions are important because of the strong influence they have on other ecological and life history traits such as body size, habitat selection, and dispersal.

0211 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Toby Hibbitts[1], Cory Adams[2], Daniel Saenz[2]

[1]*Biodiversity Research and Teaching Collection, Texas A&M University, College Station, Texas, USA,* [2]*Southern Research Station, US Forest Service, Nacogdoches, Texas, USA*

Distribution Surveys for the Crawfish Frog (*Lithobates areolatus*) in Texas

Crawfish frogs (*Lithobates areolatus*) are known to occur from eastern Texas, Oklahoma and Kansas on the western portion of their geographic range to Mississippi, western Tennessee and western Kentucky on the eastern range and as far north as central Illinois

and southern Iowa. The crawfish frog has suffered declines across much of its range and is currently considered for state protection in five of the states where it occurs. Declines have occurred in areas where prairies have been converted to agriculture limiting most of the extant populations of crawfish frogs to remnant prairie habitats. We canvassed museum records to construct the historic distribution of the Crawfish Frog in Texas. These museum records are mainly distributed along the gulf coastal prairies and in the counties along the eastern end of the Red River. Records along the Trinity River floodplain loosely connect these two areas in east-central Texas. Surveys in 2013 and 2014 were conducted by driving roads and stopping to listen for frog choruses. We also used automated recorders to sample sites when access was available. Here we map the current distribution of the Crawfish Frog and discuss potential causes for local extirpations.

0570 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Jeremy Higgs[1], Jill Hendon[2], Eric Hoffmayer[3], William Driggers[3], James Sulikowski[4], Dana Bethea[5]

[1]University of Southern Mississippi, Department of Coastal Sciences, Ocean Springs, MS, USA, [2]University of Southern Mississippi, Gulf Coast Research Laboratory, Center for Fisheries Research and Development, Ocean Springs, MS, USA, [3]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA, [4]University of New England, Department of Marine Sciences, Marine Science Education and Research Center, Biddeford, ME, USA, [5]National Marine Fisheries, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL, USA

Reproduction of the Finetooth Shark, *Carcharhinus isodon*, in the Northern Gulf of Mexico

Among sharks within the genus *Carcharhinus*, intraspecific variability in life history parameters is becoming well defined. While differences in growth rates and size/age at maturity could be expected to occur among conspecifics across broad clines, variations in reproductive characteristics are thought to be rare, especially within a discrete region. Finetooth sharks, *Carcharhinus isodon*, are reported to display biennial reproduction; however, from 2005 to 2007, 12 gravid female specimens from the Gulf of Mexico (GOM) region were examined and two were found to have large vitellogenic follicles, demonstrating they were capable of reproducing annually. The degree to which female finetooth sharks in the GOM are reproducing annually is presently unknown. The goal of this study was to investigate finetooth reproductive biology and determine the degree of variability in reproductive periodicity. A total of 1,490 finetooth sharks were collected from 2006 to 2013 in northern GOM coastal waters from Louisiana to Florida (females: n

= 834, 387 to 1384 mm fork length (FL); males: n = 656, 350 to 1321 mm FL). General biological parameters (fork length, weight, liver weight) and reproductive parameters (female: ovarian follicle size/state, oviducal gland width, uterus width, and for mature individuals gravid vs non-gravid; male: testis width/ length, epididymis width) were recorded from each individual. This study shows the mating period taking place during April/May, with parturition occurring in April/May/June, resulting in 11-12 month gestation period. Results also indicate that the GOM population of finetooth is exhibiting a mix of annual and biennial reproductive periodicity.

0348 Fish Systematics & Taxonomy IV, Banquet Room G, Sunday 3 August 2014

Eric Hilton

Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA

Osteology of Wolffishes (Zoarcoidei: Anarhichadidae): Historical Context and Preliminary Comparisons

The family Anarhichadidae comprises two genera: *Anarhichas*, with four currently recognized species, and the monotypic genus *Anarrhichthys*. These fishes are relatively large, benthic members of the suborder Zoarcoidei that inhabit the northern Atlantic and Pacific, and Arctic oceans. In this presentation I will review the state of knowledge of their morphology and the systematic relationships among the members of the family. Published molecular analyses suggest that the genus *Anarhichas* is monophyletic, and that *A. lupus* is sister to *A. minor*, with *A. denticulatus* intercalated between this group and *A. orientalis*, which is sister-group to all other species of the genus. The skeletons of species of *Anarhichas* are similar in most respects of their morphology, although the relative development of (e.g., coronomeckelian, retroarticular, and others) and curvature or sculpture of (e.g., dentary, supraoccipital, and others) certain elements are variable within the genus. Based on newly prepared cleared and stained and dry skeletal specimens representing all five species, I will present new anatomical comparisons among the skeletons of these fishes. This will set the stage for a better understanding the phylogenetic relationships within the family from a morphological framework and function as a test for current hypotheses based on molecular data. This study is part of an ongoing series of projects reassessing the morphology (emphasizing osteology) and systematics of the families within Zoarcoidei.

0729 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Paul Hime[1], Emily Lemmon[2], Alan Lemmon[2], Steven Price[1], David Weisrock[1]

[1]*University of Kentucky, Lexington, KY, USA,* [2]*Florida State University, Tallahassee, FL, USA*

Genomic Approaches to *Cryptobranchus* Conservation: Testing Range-Wide Species Boundaries and Searching for a Genetic Sex Assay

The genomic revolution is now permeating all areas of biology and stands to provide unprecedented resolution of several aspects of organismal biology and evolutionary history that are important for directing conservation efforts. To this end, we have developed a suite of conservation genomic resources for the hellbender salamander (*Cryptobranchus*) including genome-wide ddRAD markers at kilobase density, a large transcriptomic database of gene expression profiles and functional annotations for hundreds of thousands of gene products, and a method for targeted high-throughput sequence capture by anchored hybrid enrichment. In this talk I will describe two active projects which leverage these genomic tools to address hellbender conservation needs. One project aims to develop a genetic sex assay by identifying sex-linked genomic regions from genome scans and gonad transcript profiling. A genetic sex assay would facilitate more accurate investigation of wild sex ratios and would enable discrimination of sexes in captive assurance populations. A second project seeks to resolve species limits within this historically widespread genus by surveying genome-wide patterns of genetic differentiation across hundreds of nuclear loci in hundreds of individuals from across the full geographic range. Demographic modeling will also provide robust estimates of the rates and directions of historical gene flow, contemporary effective population sizes, and rates of population size change through time. Results of this work may help to guide *in situ* and *ex situ* conservation and management with hellbenders.

0183 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Kristin Hinkson, Stephen Richter

Eastern Kentucky University, Richmond, KY, USA

Temporal Comparisons of Genetic Variation in the Dusky Gopher Frog, *Lithobates sevosus*

Monitoring temporal changes in genetic diversity within populations can provide vital information on future viability. The dusky gopher frog, *Lithobates sevosus*, exists in isolation with an estimated population size of 100-200 individuals, and previous research has shown that low genetic variability exists as a consequence of isolation and population size reduction. However, we do not understand how genetic variation has

changed over time. Therefore our primary objective was to determine temporal trends in population genetic variation and implications for long-term viability of *L. sevosus*. To address this, egg samples collected from 1997 to 2012 were genotyped for sixteen microsatellite loci. We calculated observed (H_O), expected heterozygosity (H_E), allelic richness, and Wright's inbreeding coefficient (F_{IS}) for each year and made comparisons over the study period. Additionally, we calculated overall and pair-wise F_{ST} to determine if significant genetic differences existed temporally. These estimators indicate how inbreeding, genetic drift, and lack of gene flow caused by population isolation have affected the amount of genetic variation present in *L. sevosus* over the past 15 years. This research will aid in evaluating the effectiveness of current management strategies in terms of preserving and enhancing genetic variability.

0227 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Joshua Hittie[1], Mark Wilson[2], Terry Grande[3]

[1]Loyola University Chicago, Chicago, IL, USA, [2]University of Alberta, Edmonton, AL, Canada, [3]Loyola University Chicago, Chicago, IL, USA

Development of Patterns of Branching in Caudal Fin Rays of Northern Pike (*Esox lucius*) Based on Growth Series of Cleared and Stained Specimens

Caudal fin rays among teleosts exhibit complex branching patterns that appear to have both phylogenetic and functional significance. This study investigates the development of the caudal rays of *Esox lucius* (Northern Pike) using a hatchery-reared growth series to better understand how, and at what stage in development, fin rays begin to branch and when asymmetry in branching develops. More than 200 alcohol-preserved and cleared & stained specimens ranging in size from 10-130 mm TL were examined using light microscopy. Changes in fin-ray structure, number, and branching pattern were recorded. Results show that as *Esox lucius* grows, the caudal rays become more distinctly segmented and branching in both the upper and lower rays appears. In very small fish (less than 20 mm), the caudal fin is pointed, but it later becomes rounded and then forked at about 26 mm. Smaller specimens did not have branched rays, but branching was seen in most specimens over 70 mm TL. A line or crease on an unbranched ray showed where branching would happen later in development. Rays that branched more than once were asymmetrical, with the second branching being on the side of the ray farther from the middle of the fin. We tentatively conclude that branching of caudal rays appears late in development and increases in complexity and asymmetry with age.

0052 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Christopher Hoagstrom[1], Kathie Taylor[2]

[1]Weber State University, Ogden, Utah, USA, [2]Argenta Ecological Consultants, Salt Lake City, Utah, USA

Evidence that a Centrifugal-Speciation/Taxon-Cycle Process Produced Endemism in the Ouachita Mountains via Peripheral Isolation

High regional endemism of fishes, salamanders, and crayfishes in the Ouachita Mountains (south-central North America) may have occurred via vicariance if formation of a geographical barrier isolated a resident fauna with formerly widespread populations. If so, then unrelated and ecologically diverse endemics should have congruent spatiotemporal patterns of speciation and distribution. Alternatively, if endemics are peripheral isolates, they should exhibit independent patterns of speciation and distribution, low lineage diversification, and minimal geographical expansion. We analyzed recent phylogenetic hypotheses for endemic-producing clades of fishes, salamanders, and crayfishes to evaluate these hypotheses. There were 24 endemic lineages including 34 putative taxa. These lineages exhibited little diversification (1 ± 0.2 SE taxa) compared to sister taxa (6 ± 2.4 SE taxa) and root taxa (sister to endemic-sister pairs; 6 ± 1.4 SE taxa). Endemic clades were virtually restricted to the Ouachita ecoregion, whereas sister and root clades were commonly widespread. Sister-area relations largely reflected geographical proximity. Relations with the adjacent Central Gulf Coastal Plain were most common, followed by relations with the Ozark Plateaus, Eastern Gulf Coastal Plain, Osage Plains, and Tennessee Highlands (respectively). Endemics arose from 15 lineages, most of which produced multiple endemics over time and also included widespread taxa with peripheral (un-speciated) populations inhabiting the Ouachita region. Endemic-producing lineages were actually sub-lineages of five major taxonomic radiations centered in southeastern North America. Thus, evidence wholly favored the peripheral-isolation hypothesis. We hypothesize peripheral isolates invaded from the Central Gulf Coastal Plain via Centrifugal Speciation and then diverged via independent Taxon Cycles.

0777 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Christopher Hoagstrom[1], Thomas Archdeacon[2], Stephen Davenport [2], David Propst[3], James Brooks[2]

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Intra-fragment Riverscape Conservation for an Imperiled, Small-bodied, Pelagic-broadcast Spawning Minnow: Speckled Chub, *Macrhybopsis aestivalis*

River fragmentation threatens biodiversity, so knowledge of intra-fragment ecology is critical. Thus, fifteen annual cohorts of *Macrhybopsis aestivalis* (speckled chub) were studied throughout a fragment of the Pecos River, New Mexico. Ages 0 to 1 were dominant. Recruitment was density-independent and predicted year-class strength. The flow regime overall appeared suitable for recruitment. Density-dependent mortality in the spawning season suggested accelerated reproduction and death, perhaps due to limited habitat capacity. Each cohort used most of the study fragment, except a dewatered and degraded reach upstream. Age 0 was widespread, but rare in the degraded reach. Higher density of adults in unchannelized (centralized) habitat indicated higher survival there and, possibly, dispersal toward this reach. Five principles of intra-fragment conservation are proposed: (*i*) habitat degradation has numerous, insidious, fragment-wide effects, (*ii*) habitat integrity persists where multiple, multi-scale factors interact in pseudo-natural ways, (*iii*) habitat geography and, especially, novel habitats are critical intra-fragment features, (*iv*) proactive intra-fragment conservation must scale with life-history, and (*v*) effective conservation must be fragment-based and maximize multi-scale processes critical for intra-fragment viability.

0707 Physiology & Physiological Ecology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY

Alyssa Hoekstra, Vincent Cobb

Middle Tennessee State University, Murfreesboro, TN, USA

Timber Rattlesnake (*Crotalus horridus*) Thermoregulation in a Fragmented Environment

Fragmented environments have been shown to negatively impact reptile populations by limiting movement and causing decline in numbers due to increased mortality rates. Alteration of closed-canopied habitats into open-canopied habitats can have potential influences on the temperature variability in the environment. Because of the importance of body temperature selection in snakes, we hypothesized that these fragmented habitats might limit movement patterns due to differences in the availability of appropriate temperatures. We used radio-telemetry and temperature loggers to record body temperatures of free-ranging timber rattlesnakes during their active season. We also used operative snake models to monitor the thermal characteristics of four different habitats used by this population. Body temperatures were found below or within the range of environmental temperatures depending on the type of habitat. The environmental temperatures in open-canopied habitats were found to have much higher temperatures than the closed-canopied habitats and snakes were able to take advantage of dense vegetation within those open habitats. Snakes were also frequently found on the edges of open and closed-canopied habitats. Based on operative snake models, these edges were shown to have a steep thermal gradient. The results of this study indicate that extreme thermal habitats force snakes to choose microhabitats in a very limited environment which can have potential implications on survivorship due to becoming predictable targets for predators as well as having restrictions on movements around or within those habitats.

0713 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Alyssa Hoekstra, Vincent Cobb

Middle Tennessee State University, Murfreesboro, TN, USA

Does "One Size Fits All" Apply to Snake Body Temperature Sampling Rates?

Body temperature can obviously be an important variable to measure in studies of the behavior and physiology of reptiles. Modern technology has improved the efficiency of recording body temperature data in free-ranging individuals by miniaturizing temperatures loggers, which are commonly used today. An examination of the literature

will reveal vast difference in the sampling rates among studies. Some of the variation is clearly by design to best answer the questions being asked however, there are likely studies that chose sampling rates because of studies in the literature or perhaps haphazardly (i.e., guessing what is best). We used radio-telemetry and miniature data loggers to record the body temperatures in timber rattlesnakes, northern water snakes, and racers. We hypothesized that there may be differences in the sampling rate needed based on the different activity levels of the three species. For instance, an active forager might need a more rapid sampling rate compared to a sit-and-wait forager. Furthermore, would an aquatic active forager require a more rapid sampling rate compared to a terrestrial active forager? The results of this study indicate that sampling rates for answering general thermal biology questions that focus on overall thermoregulatory behavior may not require more frequent sampling periods regardless of foraging behavior. However, when answering specific questions about daily thermoregulatory activities or in association with physiological conditions, the foraging behavior of the species should be considered when assessing an appropriate sampling rate.

0050 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Joshua Holbrook, Nathan Dorn

Florida Atlantic University, Davie, FL, USA

Factors Influencing Wetland Reptile and Amphibian Community Composition

Purpose: To determine biotic and abiotic factors that may influence reptile and amphibian community assemblage in small wetlands in a Florida park, especially factors of wetland transience and presence of fish. Methods: Wetland herpetofauna was monitored at 20 wetland sites at Jonathan Dickinson State Park (JDSP) in southern FL over a single wet season. Community assemblages were analyzed using hierarchical clustering and ordination of Bray-Curtis dissimilarities. Results: Hierarchical clustering revealed two large groupings, which included 70% of total wetlands. One consisted primarily of wetlands containing large (>5cm) fish, and the herpetofaunal community consisted primarily of two to three snake species and small numbers of ranids; the second large cluster was dominated by fishless wetlands and most possessed an abundance of hylids and ranids. Conclusion: Though distance from other wetlands had an effect on herpetofaunal community, fish presence/absence was a larger determinant of community assemblage.

0309 Fish Systematics & Taxonomy III, Banquet Room G, Sunday 3 August 2014

Phillip Hollingsworth, C. Darrin Hulsey

University of Tennessee, Knoxville, TN, USA

Adaptive Radiation Along a Benthic/Pelagic Foraging Axis in Eastern North American Cyprinids

The theory of adaptive radiation predicts simultaneous bursts of cladogenesis and phenotypic evolution driven by differential exploitation of a set of resources. Previous studies have rarely recovered evidence for both and generally do not test for an association between phenotypic variation and resource partitioning. Building on the results of previous work that suggest a period of rapid diversification followed a major benthic to pelagic transition in open posterior myodome (OPM) cyprinid fishes, we use a multi-faceted approach to further test for evidence of an adaptive radiation along this ecological axis in this diverse clade. We recover a strong relationship between variation in an eco-morphological trait, jaw protrusion angle (JPA), and vertically segregated foraging zones within a complex OPM assemblage. We then identify a number of individual morphological traits comprising the cyprinid jaw apparatus that are highly correlated with JPA. Model fitting of morphological rate variation suggest that a number of these traits experienced periods of rapid diversification following the benthic to pelagic shift in the OPM clade. Therefore, this ecological axis likely provided the setting for an adaptive radiation of freshwater fishes that not only experienced a burst in diversification rate but also an enhanced rate of trophic evolution to better exploit the entirety of the water column.

0495 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Sarah Horsley, Gary Green

University of Georgia, Athens, GA, USA

Effects of Educational Programming on Visitors' Attitudes Towards Snake Conservation

Despite serving important roles in ecosystems and providing valuable services (e.g. pest control) to humans, snakes have a history of persecution across cultures. These persecutions often stemmed from negative biases associated with widespread misinformation. Nature centers provide educational opportunities and programs such as ‘Snake Day' and permanent live animal exhibits to combat misinformation and encourage positive attitudes toward nature. This study aims to measure the effects of two free choice learning activities on nature center visitors' attitudes about snakes, snake

conservation, and reptile-based citizen science. A nature center's 'Snake Day' will serve as an active learning treatment, while the center's permanent exhibit of native snakes will serve as a passive learning treatment. This study also aims to compare perceptions of the snake education participants with those who already participate in reptile-based citizen science. All visitors in the study will be surveyed with pre- and post-test intercept surveys which ask about their attitudes and behaviors concerning snakes, willingness to fund snake conservation, and willingness to participate in reptile-based citizen science. Results from this study will help nature centers better understand the most effective free choice opportunities and programs for enhancing visitors' perceptions toward snakes. Results of this study could also help to secure future funding for additional educational opportunities and programs concerning snakes. Data from current reptile-based citizen scientists could help conservation groups, researchers, and nature centers more fully understand what type of snake education opportunities lend themselves to visitors' participation in citizen science.

0190 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Parker House, Larry Allen

California State University, Northridge, Northridge, CA, USA

Direct and Indirect Impacts of Fishing on the Trophic Structure of Kelp Forest Fishes Off Southern California

Fishing pressure has altered community structure of marine habitats worldwide. Multiple studies have shown that overfished ichthyofauna can grow in size, abundance, and reproductive output in no-take Marine Protected Areas (MPAs). This study investigates how size and abundance of targeted predatory fish species influence lower trophic level fishes inside and outside of MPAs in Southern California's kelp forests. A factorial design was used testing the effect of MPA protection on the trophic structure biomass of fish communities by surveying inside and outside of 3 well-established MPAs located at La Jolla, Santa Catalina Island, and Anacapa Island, CA. At each site, fish were surveyed along 12, 50 x 2 x 2 m underwater SCUBA transects sampling the benthos, open water, and canopy. All conspicuous and transient pelagic fish species were counted, sized (using calibrated lasers and video to aid in size estimation bias), and assigned to trophic level. Results show secondary carnivore and herbivore fish biomass decreased significantly outside MPAs. However, zooplanktivore/primary carnivore biomass significantly increased outside of the protected areas. These results indicate that a decrease in biomass of target fish species may relieve pressure by top down control on primary carnivore fishes outside of protected areas. A structural equation model was constructed to elucidate which piscivorous species may have the greatest influence on

the diversity and abundance of the fish community. Gaining insight into the trophic role of predatory species is essential to understanding the ecology of Southern California kelp forests and providing information for fisheries management.

0479 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Jason Hoverman[1], Andrew Blaustein[2], Cherie Briggs[3], Pieter Johnson[4], Jason Rohr[5]

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Disease Risk Within Complex Communities: The Influence of Coinfection by Virulent Pathogens on an Amphibian Assemblage

Herpetologists are increasingly concerned about the potential role of infectious diseases in amphibian population declines. While previous research has largely focused on individual pathogens, there is growing evidence that highly virulent pathogens co-occur within amphibian communities underscoring the need to explore how coinfections influence disease outcomes. Our previous research has documented the widespread co-occurrence of the chytrid fungus *Batrachochytrium dendrobatidis* (Bd) and pathogenic trematodes (*Ribeiroia ondatrae* and *Echinostoma* spp.) within amphibian populations in the East Bay region of California, USA. Here, we expand on this research by examining patterns of coinfection within individual hosts from these populations. In summer 2012, we sampled 34 wetlands and 667 individuals from five amphibian species (*Pseudacris regilla*, *Anaxyrus boreas*, *Lithobates catesbeianus*, *Taricha granulosa*, and *T. torosa*) for Bd and trematode infection. Of the five species sampled, *A. boreas* was the most frequently infected with Bd and supported greater Bd loads than other species. For Bd positive animals (n=213), we used a linear mixed-effects model fit by restricted maximum likelihood with site as a random effect and host species as a fixed effect to examine the influence of total trematode load, *Ribeiroia* load or *Echinostoma* load on Bd load. In all cases, trematode load was a negative predictor of Bd load (total trematode load, p=0.003; *Ribeiroia* load, p=0.018; *Echinostoma* load, p=0.02). Although the mechanisms driving this pattern require further investigation, our results suggest that trematode infections may either ameliorate Bd disease risk or enhance mortality within coinfected individuals.

0403 Snake Ecology, Banquet Room E, Saturday 2 August 2014

Christopher Howey[2], Willem Roosenburg[1], Matthew Dickinson[3]

[1]Ohio University, Athens, OH, USA, [2]The Pennsylvania State University, University Park, PA, USA, [3]US Forest Service Northern Research Station, Delaware, OH, USA

Thermoregulation and Energy Expenditures of Black Racers (*Coluber constrictor*) in Thermally Contrasting, Burned and Unburned Landscapes

Understanding how wildlife species react to habitat changes following a controlled fire is imperative for the successful use of this management tool. In regard to reptiles, an important habitat component is the available thermal characteristics which may dictate potential body temperatures (T_b). It was the objective of this project to measure the preferred body temperature (T_{set}) of the black racer (*Coluber constrictor*) while at rest and the optimal body temperature while in motion (thermal breadth; B_{80}). These temperature ranges were compared to T_bs maintained by *C. constrictor* in the field and operative temperatures (T_e) available within each treatment. Good thermal quality habitat was defined as areas which T_e deviated less from T_{set} and B_{80} ranges. We found that burned landscapes were higher thermal quality earlier in the active season, but unburned treatments became higher thermal quality later in the field season as overall climate became warmer. Regardless of available T_es, *C. constrictor* maintained T_bs within both treatments that strongly overlapped with B_{80} ranges. This meant that *C. constrictor* would have to allocate more time and energy toward thermoregulation earlier in the field season within unburned treatments when T_es were cooler, but more time and energy toward thermoregulation in the burned landscape later in the field season when T_es became warmer. We measured activity and energy expenditures of *C. constrictor* toward the end of the active season in both treatments, and found that *C. constrictor* were more active and expended more energy in the burn treatment when thermal quality was poorer.

0497 Snake Ecology, Banquet Room E, Saturday 2 August 2014

Jennifer Howze, Lora Smith

Jones Ecological Research Center, Newton, Georgia, USA

Snake Activity Patterns Within the Longleaf Pine Forest

We conducted a 10-year study aimed at describing seasonal and annual activity patterns for nine snake species, including, *Agkistrodon contortrix*, *Coluber constrictor*, *C. flagellum*, *Crotalus adamanteus*, *Heterodon platirhinos*, *Lampropeltis getula*, *Pantherophis guttatus*, *Pituophis melanoleucus*, and *Thamnophis sirtalis*. We sampled snakes and their potential prey during the spring, summer, and fall seasons using 16 box traps set in upland *Pinus*

palustris habitat within a 12,000 ha private reserve in southwestern Georgia. We captured 2,101 snakes, 2,075 small mammals, 1,178 lizards, and 27,300 amphibians from 2003-2013. Male snakes (*A. contortrix*, *C. constrictor*, *C. flagellum*, and *P. guttatus*) were most active in spring ($p < 0.05$). Females and sub-adults, within this group, were most active during summer, with one exception; *C. constrictor* moved primarily during spring ($p < 0.05$). Male, female, and sub-adult *H. platirhinos* ($p = 0.05$) and *P. melanoleucus* ($p < 0.10$) moved more often during spring. Male and female *C. adamanteus* were more active in summer months, whereas, sub-adults tended to move more often in spring ($p = 0.05$). Movement patterns for *L. getula* and *T. sirtalis* exhibited less seasonal variation for male, female, and sub-adult categories. Annual snake captures were positively correlated with annual captures of primary prey species for *C. constrictor*, *C. flagellum*, *P. guttatus*, and *T. sirtalis*. The drivers of seasonal differences in snake movements, during active months of the year, may be more related to reproduction, whereas, annual variation for snakes with specialized diets appears to be largely influenced by prey availability in this fire maintained system.

0281 Herp Conservation I, Banquet Room F, Friday 1 August 2014

Jessica Hua[1], Devin Jones[2], Nathan Morehouse[2], Rick Relyea[2]

[1]*Purdue University, West Lafayette, IN, USA,* [2]*University of Pittsburgh, Pittsburgh, PA, USA*

A Novel Mechanism for Insecticide Tolerance: The Role of Phenotypic Plasticity in Amphibian Tolerance and Cross-tolerance to Insecticides

Understanding the contribution of anthropogenic chemicals to declining amphibian populations is an important challenge. The global use of insecticides is critical to disease control and efficient crop production, but can also pose unintended consequences to non-target organisms, such as amphibians. Through phenotypic plasticity, amphibians can rapidly induce adaptive phenotypes to novel environments. Surprisingly, the role of plasticity in amphibian responses to insecticides has been overlooked. Secondly, amphibian habitats are often exposed to many different insecticides that vary in mode-of-action yet no studies have considered the role of plasticity in allowing organisms to induce cross-tolerance to different insecticides that share and differ in mode-of-action. Using four populations of wood frogs (*Lithobates sylvaticus*) located close-to and far-from agricultural fields, we discovered that exposure to sublethal concentrations of carbaryl during the embryonic and hatchling stages induced higher tolerance to a lethal concentration of carbaryl later in life during the tadpole stage for populations far-from but not close-to agriculture. These results are the first to demonstrate inducible tolerance to insecticides in a vertebrate species and the pattern of inducible tolerance among the four populations suggests the process of genetic assimilation. Next, we found that

embryonic exposure to sublethal concentrations of carbaryl induced higher cross-tolerance to both insecticides that share and differ in mode of action. The ability to rapidly induce tolerance to different insecticides has important conservation implications potentially allowing amphibians a rapid way to persist even in the face of insecticide contaminants.

0303 Fish Behavior, Banquet Room F, Sunday 3 August 2014

Joshua Hubbell, Heidi Banford

University of West Georgia, Carrollton, GA, USA

Analysis of the Spawning Behavior and Microhabitat of the Tallapoosa Darter

The Tallapoosa darter is an endemic fish species to the Tallapoosa River basin and is a member of the subgenus *Ulocentra*, a group of darters collaboratively linked by a singular synapomorphy, the attachment of adhesive eggs by females during reproduction. Very little is known about the microhabitat of percids within this subgenus, or how these species use such microhabitat in relation to their breeding behavior. Four streams were surveyed to quantify microhabitat use and substrate utilized for egg-attachment by Tallapoosa darters within the upper Tallapoosa River basin in Carroll and Haralson Counties in Georgia. We quantified microhabitat use of Tallapoosa darters based on measurements of water velocity, depth, and percent substrate composition. How habitat use correlated with fish reproductive behavior was also examined. Tallapoosa darters primarily occurred in riffle-pool transitional areas of moderate depths (0.22-0.31 m) and slow to moderate water velocities (0.22 to 0.4 $m \cdot s^{-1}$) across all sites. Microhabitats across sites were composed primarily of gravel (13.7-34.2%) and pebble (37.4-56.5%) substrate. Females primarily utilized very coarse gravel (33-64 mm) for egg attachment. This is not consistent with other studies, where it was found that other species of *Ulocentra* utilized cobble for egg attachment. Tallapoosa darters are habitat specialists; sedimentation in streams may threaten population persistence within the Tallapoosa River basin.

0350 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Sarah Huber, Eric Hilton

Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA

The Nunnally Ichthyology Collection at the Virginia Institute of Marine Science: History, Current Status, and Future Prospects

The VIMS Nunnally Ichthyology Collection serves a broad community of basic and applied research scientists and fisheries managers, and provides an important resource for local community outreach. Through its 56-year history, the VIMS collection has grown from an uncatalogued teaching collection to become one of the largest repositories for freshwater, Chesapeake Bay, and coastal fishes in Virginia. In 2010, the VIMS received an endowment in support of the collection from the Nunnally Foundation. The VIMS collection maintains approximately 21,000 catalogued lots of fishes (c. 200,000 total specimens), with a substantial backlog (estimated at 8,600 lots). Beyond maintaining a regionally important collection that includes large holdings of Chesapeake Bay fishes (7,000+ lots), deep-sea fishes (worldwide, with strengths in the North Atlantic, 4,000+ lots), and freshwater fishes of the central Appalachians (5,500+ lots), the VIMS collection houses a number of specimens of significant general scientific interest, including two coelacanths. Additionally, VIMS maintains a large and diverse larval fish collection, including from the Chesapeake Bay, Bermuda, Sargasso Sea, the Amazon Plume, central Pacific, Antarctica, as well as other smaller collections. The larval fish collection has yet to be formally incorporated into the VIMS collection; this is the focus of a newly funded NSF grant. The VIMS collection has recently participated in a Museum Assessment Program (through the American Alliance of Museums), with the goal of better defining its mission and communicating the value and needs of the collection to the VIMS administration. Results of this review and other ongoing activities will be presented.

0312 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Carl Hutter[1], Shea Lambert[2]

[1]*University of Kansas, Lawrence, KS, USA,* [2]*University of Arizona, Tucson, AZ, USA*

The Exceptional Frog Diversity of Ranomafana National Park, Madagascar

Madagascar harbors astonishing biodiversity in all taxonomic groups, which are increasingly threatened by habitat modification and deforestation. Among the array of vertebrates within Madagascar, frogs are among the most diverse. However, a

substantial quantity of frog diversity remains undescribed (i.e. taxonomically unknown and unnamed). Vietes et al. (2009) gave a surprising estimate of 250+ species that remain undescribed in Madagascar, while more recent research has increased this number. We conducted biological surveys within Ranomafana National Park to assess the amphibian diversity while targeting potential undescribed species. We found 25+ potential new species in the park, increasing the number of known species from ~82 to potentially 107 species. From these results, Ranomafana National Park is one of the most species rich localities in Madagascar. We also present preliminary morphological, vocalizations, and genetic data for these species, and designate them as candidate species for further study and potential description. This information is vital for understanding the incredible biodiversity of Madagascar, which will aid in the conservation of these species.

0491 General Herpetology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD GENERAL HERPETOLOGY

Carl Hutter[1], Shea Lambert[2], John Wiens[2]

[1]*University of Kansas, Lawrence, KS, USA,* [2]*University of Arizona, Tucson, AZ, USA*

Explaining Andean Megadiversity: The Evolutionary and Ecological Causes of Elevational Species Richness Patterns in Neotropical Frogs (Hyloidea)

The Tropical Andes are an important global biodiversity hotspot, harboring extraordinarily high species richness and endemism. Although elevational richness and speciation have been studied independently in some Andean groups, the evolutionary and ecological processes that explain elevational richness patterns in the Andes have not been analyzed together. Herein, we elucidate the processes underlying Andean species richness patterns using Neotropical frogs as a model system. We combine species distributional data with a continent-wide, time-calibrated frog phylogeny, which is the largest to-date (70% sampled). Several families show a mid-elevation diversity peak for species richness in the Andes. Remarkably, these patterns are explained by an early colonization time in some groups (Centrolenidae, Hemiphractidae), despite the recency of the major Andean uplift. We also show that diversification rates are higher in the Andes and that the colonization of the Andes is associated with significant increases in these rates, when considering the complete phylogeny. Additionally, we show for the first time that rates of change in elevational distributions are associated with diversification rates, which supports the hypothesis that speciation in the Andes is driven by changes in elevational distributions. We also show that nearly half of Amazonian frog richness is derived from Andean ancestors. Herein we emphasize the importance of assessing ecological and evolutionary patterns using large-scale phylogenies, as they may reveal patterns that cannot be detected on smaller

phylogenetic scales. These results may be relevant to other Andean clades and montane systems globally.

0649 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Johanna Imhoff, Alejandra Mickle, Cheston Peterson, R. Dean Grubbs

Florida State University, Tallahassee, FL, USA

The Effects of Sample Processing Methods on Light Stable Isotope and Mercury Analyses of Fish Muscle

When using fish white muscle samples for trophic and mercury contamination studies, it is important to consider the effects of sample processing protocols on δ13C and δ15N values. This is particularly true for elasmobranch fishes which retain isotopically light nitrogenous wastes, including urea, in their muscles, confounding δ15N results and their interpretation. While lipid extraction can remove some nitrogenous wastes from elasmobranch muscle, an additional water rinse step may be necessary to thoroughly extract urea. The objective of this study was to investigate the effects of lipid and urea extraction on stable carbon and nitrogen isotope ratios and mercury concentrations in fishes caught in coastal and deepwater longline surveys in the northern Gulf of Mexico. The effect of lipid and urea extraction was determined for coastal (*Rhizoprionodon terraenovae*) and deepwater (*Centrophorus* sp.) elasmobranchs, and the effect of lipid extraction was determined for coastal (*Ariopsis felis*) and deepwater teleosts (*Urophycis cirrata*). Lipids were extracted using a chloroform-methanol solution and urea was extracted by rinsing tissue with DI water. Results of this study will be used to determine appropriate tissue processing methods for elasmobranch and teleost fishes, determine if muscle can be processed the same way for both coastal and deepwater fishes, and determine if bulk muscle can be processed once for both stable isotope and mercury analyses.

0639 Herp Development, Morphology & Histology, Banquet Room H, Sunday 3 August 2014

Carlos Infante, Sungdae Park, Alexandra Mihala, Douglas Menke

University of Georgia, Athens, GA, USA

The Evolution of Limb Enhancers in Lizards and Snakes

Enhancers are short regions of DNA in the genome that interact with transcription factors to activate gene expression. During embryonic development, enhancers contribute to the complex spatial and temporal regulation of genes that pattern morphology. Our research focuses on the regulatory network active in the developing vertebrate limb, a classic model for studies of signaling and patterning, and the evolution of this network in tetrapods. In particular, we are interested in the fate of enhancers that are involved in limb patterning in species that no longer have limbs. Squamates are an excellent group to study the evolution of the limb cis-regulatory network because of the frequent occurrence of limb-loss throughout their history. To identify enhancers active in the developing limbs, we performed chromatin immunoprecipitation followed by massively parallel DNA sequencing (ChIP-Seq) on embryonic tissues from the lizard *Anolis carolinensis* using antibodies against the acetylated histone mark H3K27ac, which marks active enhancers and promoters, and the hindlimb transcription factor Pitx1. Comparisons between ChIP-Seq datasets enabled us to identify enhancers active only in the forelimb, only in the hindlimb, only in the genital tubercle, or that are shared between various tissues. We then compared the rate of conservation of these enhancer categories in different snake genomes. We found a surprising pattern of conservation, perhaps reflecting extensive overlap between the regulatory systems of the developing limbs and the external genitalia.

0730 Herp Development, Morphology & Histology, Banquet Room H, Sunday 3 August 2014

Frances Irish, Jennifer Kober

Moravian College, Bethlehem, PA, USA

Sand Boa Jaws are Specialized for Snagging Prey.

Sand boas of the genus *Eryx* are reported to ambush prey from just beneath the substrate surface. Assuming the prey is not always visible to the snakes, how do they snag prey without seeing it? Even when exposed, *Eryx* species typically do not stalk their prey, but remain immobile when approached. They usually strike sideways from close proximity, often in response to touch, rolling the head to lift the side nearest the prey while simultaneously dropping the mandible on the same side, producing a rapid,

asymmetrical strike. High speed video records of strikes to mice in 27 specimens of 6 species of *Eryx* reveal that when the snout is maximally elevated at peak gape, the anterior ends of the maxillae and palatines are strongly depressed and rotated outward, so that the mouth appears to be bristling with teeth. Prey are often snagged by anterior mandibular teeth and carried upward by the momentum of the strike. The problem then becomes securing the prey with the upper jaws before it flies off the mandibular teeth. We suggest that the extreme depression and rotation of the jaws during prey capture results in maximum tooth exposure and increases the likelihood that prey will be snagged successfully. Although it has been suggested that snout movements are constrained in these burrowing boas, our data suggest that upper jaw movements do not closely track the snout----in fact, at peak gape, snout and upper jaws move in opposite directions.

0253 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Ryo Ito[1], Akira Mori[2]

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Non-vocal Lizards in Madagascar Eavesdrop on Avian Alarm Calls.

Most species of lizards, except for Gekkota, do not vocalize, but neurophysiological studies have revealed that most lizard groups possess well-developed ears. However, only a limited number of studies have presented the concrete ecological usage of hearing sense in lizards because few lizards utilize auditory intraspecific communication. We focused on predator detection by auditory information and hypothesized that non-vocal lizards have the ability to eavesdrop on heterospecific alarm calls, as do mammals and birds. To examine this hypothesis we utilized three Malagasy lizards: the Madagascan giant day gecko, *Phelsuma kochi*, the Madagascan spiny-tailed iguana, *Oplurus cuvieri*, and a wide-tailed zonosaur, *Zonosaurus laticaudatus*. All of them are diurnal, non-vocal or nearly non-vocal lizards with well-developed ears. We experimentally tested whether these lizards discriminate alarm calls of a syntopic passerine bird, *Terpsiphone mutata*, from its songs. We played back alarm calls and songs of the bird to wild lizards and recorded their responses with a video camcorder. The analyses of the video records showed that *P. kochi* changed its body color quicker and darker, *O. cuvieri* exhibited vigilance behaviors more frequently, and *Z. laticaudatus* stopped foraging longer, in response to the alarm calls than the songs. These results demonstrate that the three lizard species have the ability to discriminate the avian alarm calls from the songs. This indicates that non-vocal lizards have the ability to eavesdrop on heterospecific alarm calls. Our results suggest the possibility that eavesdropping on heterospecific auditory information may be a widespread phenomenon in lizards.

0035 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Zeehan Jaafar, Lynne Parenti

Smithsonian Institution, Washington, DC, USA

Phylogenetic Analysis of the *Oxuderces* Clade: Morphology Meets Molecules

The Oxudercinae is one of five recognized subfamilies within the fish family Gobiidae, and comprises 10 genera of amphibious mudskippers and allied groups broadly distributed from western Africa to southern and eastern Asia, northern Australia and islands in the south Pacific. Fishes in the type genus, *Oxuderces* Eydoux & Souleyet, 1848, live in inter-tidal and shallow coastlines with a muddy substrate. Two species are traditionally recognized in this genus: *O. dentatus* Eydoux & Souleyet, 1848 and *O. wirzi* Koumans, 1937. Morphological examination of the type specimens revealed another valid species, *O. nexipinnis* Cantor, 1850, which had been synonymized with *O. dentatus*. Monophyly of the *Oxuderces* clade, which includes the genera *Apocryptodon* Bleeker, 1874 and *Parapocryptes* Bleeker, 1874 is well supported by morphology, but has been rejected in recent molecular analyses. We present findings on the comparative morphology of *Oxuderces* and close relatives to re-assess its monophyly, propose relationships among the included species and evaluate relationships based on molecules. Our goal is an informative and well-supported classification of the oxudercine gobies.

0650 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Todd Jackman[1], Aaron Bauer[1], Ross Sadlier[2], Ian Brennan[1], Titian Ghandforoush[1], Kevin Neal[1]

[1]*Villanova University, Villanova, PA, USA,* [2]*Australian Museum, Sydney, Australia*

Conservation Priorities for Endemic Geckos and Skinks in Southern New Caledonia Using Mitochondrial and Nuclear Sequence Data

We have sampled 25 species of diplodactylid geckos and lygosomine skinks using 1009 individuals from southern New Caledonia (Province Sud) in order to examine both within and between species genetic diversity and to establish conservation priorities. For nearly all samples, the mitochondrial gene ND2 (1430 bases) and the nuclear gene RAG1 (1017 bases) were analyzed. For smaller subsets, additional nuclear genes were also examined (APOB, KIF24, KIAA1549). Nuclear haplotype networks and mitochondrial phylogenetic trees were used to qualitatively assess and prioritize five regions of endemism. Gene flow and phylogenetic diversity indices were also used for the same

five regions. Within and between species measures were largely congruent with more recently colonized areas having lower species diversity and higher levels of recent gene flow compared to established regions with higher species diversity and greater levels of fragmentation and structuring within species. Mitochondrial and nuclear markers were largely congruent with some notable exceptions. We discuss the challenges of assigning conservation priorities as it applies to the threats facing endemic lizards on New Caledonia.

0020 Herp Behavior, Banquet Room I, Saturday 2 August 2014

Leah Jacobs, Jeanne Robertson, Andres Vega

California State University, Northridge, Northridge, CA, USA

Female Mate Choice in Divergent Populations of Red-Eyed Treefrog

Behavioral isolation can reinforce the divergence of natural populations. The Red-Eyed Treefrog (*Agalychnis callidryas*) of Central America exhibits regional population genetic divergence as well as strong differentiation in color pattern and body size, skin antimicrobial peptides across Costa Rica and Panama. The largest phenotypic and genetic differentiation occurs among allopatric populations. To test behavioral isolation we chose two allopatric populations to determine whether their genetic and phenotypic differences have consequences for mate recognition and choice. At each site, we introduced a gravid female into an enclosure that contained one local and one non-local male. We determined that a 'choice' was made when the female approached and displayed to a male. We also documented whether male calling had an effect on female choice. We conducted 20 trials at each site. Females from one site preferred local mates (Gtest, $P = 0.005$) while the other did not (Gtest, $P = 0.176$). Male advertisement calls only occurred in 11/40 trials illuminating the importance of other (non-acoustic) cues for this species. Our study did not explicitly test for the mechanisms that underlie female choice. However, we explore multi-modal signaling in this system and discuss how population divergence in body size, color pattern and behavior could contribute to female choice. Our mate choice trials provide evidence that population divergence could be mediated (in part) by social interactions and that these divergent populations could be in the early stages of incipient speciation.

0289 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Kortney Jaworski, Cari-Ann Hickerson, Carl Anthony

John Carroll University, Cleveland, OH, USA

Male Mate Choice as a Potential Mechanism for Assortative Mating in a Polymorphic Salamander (*Plethodon cinereus*)

Color polymorphism is often associated with variation in ecological and behavioral traits which may affect individual fitness. For traits involved in mate acquisition, this association could promote non-random mating and isolation among morphs. The red-backed salamander (*Plethodon cinereus*) exhibits a color polymorphism that involves two discrete dorsal-pattern morphs, striped and unstriped. Both morphs co-occur across much of the species' range, and several studies have revealed ecological and behavioral differences between morphs. Additionally, recent studies suggest that male and female *P. cinereus* associate assortatively by color, suggesting that they may also mate non-randomly. However, the mechanisms contributing to this behavior remain unclear. Although many studies focus on female mate choice, male mate choice may be a more appropriate candidate for driving assortative mating in this species, particularly because males of this species display a swollen vomeronasal organ during the breeding season and striped males tend to associate with large, striped females. Here we sought to determine 1) whether males preferentially associate with females with respect to color, body size, or both, during the breeding season and 2) whether female traits are evaluated via visual or chemical cues. To investigate these questions, we conducted two experiments which examined striped male behavior toward olfactory and visual cues of striped and unstriped females. We used a Bradley-Terry tournament-style model to reveal that female morph and body size predicted male mate-preference. These results provide evidence for a role of assortative male preference in the non-random mating associations observed in this population of *Plethodon cinereus*.

0233 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Mallory Jeffers, Marlis Douglas, Brooke Beckwith, Max Bangs, Dustin Lynch, Brenna Levine, Michael Douglas

University of Arkansas, Fayetteville, AR, USA

Effects of Environmental Barriers on Population Structure of Orangethroat Darter and Cardinal Shiner on the Ozark Plateau

Freshwater ecosystems are increasingly threatened by anthropogenic modifications. Although aquatic environments in Ozark Plateau are amongst the most pristine in the

nation, they are impacted by land use changes, primarily large-scale operations of animal farms. This in turn impacts the diverse ichthyofauna of this region, including darters and shiners. Darters exhibit relatively sedentary life styles, are habitat specialists and require clean, flowing water. Because of their limited dispersal abilities, they are good indicators of habitat quality. In contrast, shiners are more pelagic and exhibit good dispersal abilities, but also require clear, silt-free creeks with moderate currents. We compared genetic population structure of Orangethroat Darter (*Etheostoma spectabile squamosum*) and Cardinal Shiner (*Luxilus cardinalis*), two species with contrasting dispersal abilities, but similar dependence on undisturbed habitat. Eight individuals of each species were collected at three sites each from the Elf River and Illinois River in the Ozark Plateau. Sites were selected to represent either relatively unaltered or heavily modified habitat. Sequences were generated for two mitochondrial DNA genes (ATP6 and ATP8). An AMOVA was conducted to characterize genetic diversity within and among sites and rivers. Strong population structure was detected for Orangethroat Darter, and to a lesser extent in Cardinal Shiner. Mantel tests were conducted to identify associations between genetic structure, geography and land use features to infer if stream modifications represent barriers to gene flow.

0415 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Benjamin Johnson, Kelly Zamudio

Cornell University, Ithaca, NY, USA

Range-Wide Variation in Physiological and Transcriptomic Response to Thermal Challenge in the Spotted Salamander (*Ambystoma maculatum*)

Temperature is a ubiquitous selective agent affecting multiple life history processes in ectotherms. Thermal selection impacts function from the molecular to the organismal level, influencing phenotypes including larval development, locomotor and physiological performance, and thermal tolerance. In broad-ranging species, variant environmental temperature regimes place differential thermal selection pressures on distant populations. These differences can be met across species distributions via phenotypically plastic responses in organismal performance or adaptation to local selection regimes. Differential gene expression and regulation can play an integral role in driving local adaptation in functional phenotypes including thermal tolerance. Thus identifying regulatory networks associated with thermal tolerance phenotypes can help understand the mechanisms underlying patterns of thermal adaptation across environmental temperature regimes. We measured physiological and genetic response to thermal stress in distant populations of the spotted salamander (*Ambystoma maculatum*), which ranges broadly across eastern North America. We exposed larval salamanders from northern range, southern range, and mid-latitude populations to

differential thermal selection regimes, measuring development rate, oxygen metabolism, and critical thermal maximum. We additionally quantified mRNA transcript expression under thermal stress to identify genomic pathways associated with thermal tolerance within and among populations. Our results shed light on genetic and geographic patterns of thermal tolerance across this species' broad and climatically variable range.

0057 Herp Reproduction, Banquet Room I, Sunday 3 August 2014

Olivera Joksimovic, Stephen De Lisle

University of Toronto, Toronto, ON, Canada

Static Allometry and the Evolution of Sexual Dimorphism in the Green Frog (*Lithobates clamitans*)

A long standing empirical adage is that the relative size of sexually selected traits increases with body size across individuals (positive static allometry). Recent criticisms have pointed out that, in theory, sexually selected traits can exhibit any type of allometry, and the generality of positive static allometry is an open empirical question. In this study, we examine how allometry covaries with sexual dimorphism across traits and differs between the sexes in the green frog (*Lithobates clamitans*). We find that both male and female green frogs from two populations show a positive relationship between trait sexual dimorphism and trait allometry, with traits that are relatively larger in males having steeper allometric slopes in both sexes. In addition, males generally have steeper allometries than females for most traits. These results are counter to recent suggestions that positive allometry may be no more common in sexually selected traits than in other traits, and is consistent with the empirical adage that traits under sexual selection often do exhibit steeper allometries. Because the relationship between trait size and body size across individuals reflects the action of selection on the resource allocation tradeoff between trait and body growth through ontogeny, predictions generated from simple models of allometry may not apply to long-lived organisms with indeterminate growth and complex life histories.

0661 Herp Conservation I, Banquet Room F, Friday 1 August 2014

Devin Jones, Rick Relyea

University of Pittsburgh, Pittsburgh, PA, USA

Lasting Effects of Pesticide Exposure: How Early Exposure to a Pesticide Influences Tolerance of Later Life Stages in Gray Treefrogs (*Hyla versicolor*)

Phenotypic plasticity, or the ability of an organism to respond behaviorally, morphologically, or physiologically, to an environmental stressor, enables species to persist in heterogeneous environments. Environmental stressors are ever-present within natural ecosystems, and can be produced through either natural (e.g., competition, predation, etc.) or anthropogenic activities (e.g., habitat destruction, pollution, etc.). One anthropogenic activity, for example, is the use of pesticides, which has increased dramatically since the 1940s, and can potentially affect natural systems through multiple pathways. The evolutionary response to pesticides by both targeted and non-target species has been historically thought of as a genetic response in populations following the selection on the constitutive expression of a trait that confers pesticide tolerance. Recent novel research, however, has shown that some species are able to respond plastically, within one generation, to increase pesticide tolerance. Building on this novel research, we investigated the induction and retention of increased pesticide tolerance in gray treefrogs (*Hyla versicolor*) exposed to one of three sublethal carbaryl (Sevin®) concentrations (0.0, 0.5, 1.0 mg ai/L). Gray treefrog hatchlings that were exposed to sublethal carbaryl concentrations were 38-44% more tolerant to a lethal concentration of carbaryl 1 d post-induction than those without previous carbaryl exposure (0 mg/L). However, 18 d post-induction, there was little difference (< 5%) in tolerance among the three sublethal exposure treatments, indicating the loss of induced pesticide tolerance. Gray treefrogs are the second vertebrate species to exhibit induced pesticide tolerance, and the loss of induced tolerance has important management and conservation implications.

0648 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

James Julian[1], Robert Brooks[2], Gavin Glenney[3], John Coll[3]

[1]Penn State University - Altoona College, Altoona, PA, USA, [2]Penn State University - University Park, University Park, PA, USA, [3]United States Fish and Wildlife Service, Lamar, PA, USA

Surveys of Amphibian Emergent Infectious Diseases in Human-Created and Natural Wetlands in Pennsylvania

In 2013, we initiated a study to compare the rates of emergent infectious disease in amphibians from human-created "mitigation" wetlands, and natural "reference" wetlands. We documented the occurrence of *Ranavirus* and chytrid fungus (*Batrachochytrium dendrobatidis*) in populations of green frog (*Lithobates clamitans melanota*) tadpoles from 10 reference wetlands, and 10 mitigation wetlands throughout four ecoregions in Pennsylvania. *Ranavirus* was the least common of the two diseases, only occurring in one reference wetland and one mitigation wetland. Tadpoles infected with chytrid fungus were detected in 60% of mitigation wetlands and 100% of all reference wetlands. Among populations infected with chytrid fungus, the prevalence of infection was similar between reference wetlands (14.5%) and mitigation wetlands (18.9%), but prevalence in some populations was as high as 83%. The intensity of infection (number of zoospore equivalents/infected individual) did not differ between reference and mitigated wetlands, but they appear to have different relationships between the intensity of infection and the proportion of forested land surrounding them. In reference wetlands, the intensity of infections decreased as forest cover increased, while the opposite trend was observed in mitigated wetlands. Amphibian populations in mitigation wetlands do not appear to harbor disease at higher prevalence or intensity than reference wetlands, but additional monitoring would be necessary to determine if disease-associated mortality differs between mitigation and reference wetlands.

0116 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Eric Juterbock

Ohio State University, Lima, OH, USA

Does Size Really Matter? The Relationship Between Size and Water Loss of Model Plethodontids in Typical Activity Sites

How much water does an individual salamander lose during a night's activity? Plaster models lose water at the same rate as live salamanders, and models placed up on tree branches lose water faster than those on the litter surface. Due to surface area/body mass relationships, I hypothesized that smaller models would lose water at a greater rate than

larger models, in situ. I tested this hypothesis in microhabitats at three locations: Great Smoky Mountains N.P., TN, and Nantahala N.F., NC, where salamanders climb frequently, and Logan Co., OH, where climbing is rare. Models were made of five specimens covering the size range of *Plethodon glutinosus* group salamanders from yearling size (0.72 g) to larger adult size (6.85 g). Models were soaked in water, weighed, placed overnight in microhabitats typically used by plethodontids, and reweighed to obtain raw water loss data. Weight-specific rates of loss (g/hr/g) and percent of body mass lost (both based upon molded specimen weights) comprised the data, which were compared using Wilcoxon Rank Sum procedures. I conducted 12 tests comparing water loss in samples of the smallest and the largest models. In all 12 tests, the percent of body mass lost as water overnight was significantly greater for the smaller models; in 11 of the 12 tests the rate of water loss was greater as well. Results of comparisons of models of more similar size were mixed. Conclusion: the hypothesis is supported, thus nighttime activity by smaller salamanders increases risk of desiccation, unless rehydration is possible.

0108 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Ingrid Kaatz

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How Common is the "Singing Fishes" Phenomenon?: Assessing Vocal Diversity Within Families and Using Callichthyid Catfishes as a Test Case

Aquatic ecosystems provide refuge for a biological global heritage, “singing fishes”, sound producing fishes that vocally display in reproduction, agonism or disturbance. Assessing distribution of vocal behaviors and specialized morphology within families provides insight into vocal evolution and directs attention to protecting “singing fishes” from habitat disruptions such as noise pollution. A survey of vocal behavior or mechanisms in teleost families (n = 51) compared numbers of species with known vocal ability to those established to lack it. Vocal ability per family (% vocal species) was 83 +19 SD (33 - 100 %, CI 5). Vocal species numbered 1,172 (23 +25 SD per family). Nonvocal species numbered 107 (2 +3 SD per family). Difficulty identifying vocal and nonvocal fishes indicates these values as preliminary, requiring more intensive surveys and phylogenetic sampling for most families. Assessing callichthyid catfishes (n = 7 genera, 49 species) estimates that 7 genera and 48 species are potentially vocal (8 genera, 177 species per family; Nelson 2006). Pectoral stridulation is potentially present in derived Callichthyinae *Hoplosternum*, *Dianema, Megalechis* and *Callichthys* (n = 1,3; 1,2; 1,2; 1,2; vocal species, species per genus). Pectoral stridulation with linear ridges could be a synapomorphy for the Corydoradinae, as basal and derived genera include vocal species: *Scleromystax* additional new genus + *Aspidoras*, *Corydoras* and *Brochis* (n = 1,new

genus; 1,18; 40,143; 2,3); eight of ten clades in Britto (2003) include vocal species. One hypothesized nonvocal *Aspidoras* emphasizes that understanding vocal reversal is required for determining a true estimate of vocal diversity.

0626 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

Edward Kabay[1], Graziella DiRenzo[1], Julie Ray[2], Karen Lips[1]

[1]*University of Maryland, College Park, Maryland, USA,* [2]*La MICA Biological Station, El Cope, S.A., Panama*

Sorting a Neotropical Snake Community into Groups Using Morphological Relationships

Few studies exist of tropical snake communities because of the difficulty in capturing sufficient numbers of these cryptic and low abundance species. Between 1999 and 2012 we captured 1310 snakes of 46 species from terrestrial and riparian transects from a mid-elevation site in El Cope Panama, Parque Nacional Omar Torijos. Prior analysis of the snake community in a low elevation Neotropical forest found 4 guilds, suggesting a wide variety of ecological niches utilized by the snakes. Morphological analysis provides insight into habitat use by snakes and differences between low elevation and pre-montane communities. To understand community diversity, we categorized these species into morphological guilds by using ANOVA and the Tukey Honest Significant Differences test ($p<.05$) for length/mass comparisons. We identified two primary morphological groups within the El Cope snake community: the light bodied, long tailed, arboreal species and the small terrestrial species. Large bodied and long-tailed terrestrial snakes, which previous analyses found in the snake community at La Selva Biological Station in Costa Rica, are not present in El Cope. However, we acknowledge the presence of *Bothrops asper*, a large pitviper. Yet, due to the risks of handling this venomous snake, adults are not captured and are thus, excluded from our analyses. This study is the first to describe the snake community at El Cope and will be an important baseline for assessing the ecological impacts of environmental change in the future.

0673 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Dovi Kacev[1], John Hyde[2], Andrew J Bohonak[1], Russ Vetter[2], Rebecca Lewison[1]

[1]San Diego State University, San Diego, California, USA, [2]Southwest Fisheries Science Center, La Jolla, California, USA

Combining Genetics and Tagging Data to Test for Sex Biased Dispersal in Shortfin Mako Sharks (*Isurus oxyrinchus*)

Mako sharks are highly migratory predators that are caught in recreational, commercial, and artisanal fisheries throughout the Pacific. Understanding their population structure is vital for designing efficient management for the species. Previous mitochondrial DNA studies have shown that the equator acts as a barrier to gene flow in the Pacific. Here we use 13 microsatellite loci to test for nuclear genetic population structure in mako sharks across the Pacific Basin. Samples were collected from California, Taiwan, Australia, New Zealand, and Chile. Unlike the previous mitochondrial studies, our results do not show statistical population differentiation. We then compared the genetic structure to conventional tag data to test if male mediated dispersal explains differences in genetic patterns between nuclear and mitochondrial markers. We also tested to see if genetic patterns could be explained by ocean bathymetry. Analysis of conventional tag data suggests that males are more likely to disperse long distances, which could explain the difference between our results and those from previous mitochondrial studies.

0593 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Nehir Kaymak[1], Kirk O. Winemiller[2], Senol Akin[3], Zekeriya Altuner[4], Fatih Polat[5], Tarik Dal[6]

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Trophic Ecology of Omnivorous Fishes in the Yeşilırmak River Basin, Turkey, in Relation to Seasons and a Hydroelectric Dam

River impoundments change flow regimes, habitats, and both longitudinal and lateral fluvial gradients that determine how primary production sources are transferred to higher consumers in aquatic food webs. We analyzed carbon and nitrogen stable isotope ratios to examine spatial and seasonal variations of primary production sources

supporting two common cyprinid fishes (*Capoeta banarescui* and *Squalius cephalus*) in the upper Yeşilırmak River, Turkey. Seven sites in the basin were surveyed during three seasons. We hypothesized that assimilation of alternative basal production sources would be influenced by seasonal flows and location in relation to a dam. Overall, isotopic ratios of basal production sources and fish did not vary significantly between seasons. Assimilation of material derived from riparian vegetation was greater during spring for fish at sites within and downstream from the reservoir. Isotopic ratios of both basal resources and fishes varied significantly in relation to location. Terrestrial plants were the most important sources supporting fish biomass at the upstream sites and the site below the reservoir. Within the reservoir, biomass of both fish species was derived mostly from autochthonous production sources. Vertical trophic positions of both species varied significantly among sites, and seasonal differences in trophic position were observed in *Squalius cephalus*. Findings are generally consistent with predictions of the River Continuum Concept; however, lentic conditions within the reservoir, where autochthonous production is predominant, interrupt the natural gradient.

0493 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Benjamin Keck[1], Phillip Hollingsworth[1], Thomas Near[2]

[1]*University of Tennessee, Knoxville, TN, USA,* [2]*Yale University, New Haven, CT, USA*

Geologic Stability and the Diversification of Fishes within the Eastern Highlands

Hypothesized mechanisms of diversification for North American freshwater fishes focus on dramatic geologic events such as glaciations and river re-arrangement. However, these vicariant events do not explain all of the standing diversity and ignore the requirement of dispersal. For instance, there are groups of endemic species within the Cumberland and Tennessee rivers, in the Eastern Highland region, that diversified within these drainages without the influence of dramatic geologic events. Hypotheses of the mechanism/s of speciation within such drainages are vague at best and usually are limited to references about the long-term geologic stability of the highland regions. We discuss likely mechanisms of within drainage diversification based on time-calibrated, interspecific phylogenies of percids and North American cyprinids, as well as an intraspecific phylogeny of *Nothonotus chlorobranchius*. Specifically, we outline expectations of phylogeographic patterns resulting from the erosional differences of underlying geology and epeirogeny acting within these drainages. We propose that stochastic rates of erosion and epeirogeny have resulted in on-going cycles of dispersal and isolation of fishes within these otherwise geologically stable rivers.

0558 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

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[1]*University of Nevada, Reno, Reno, NV, USA,* [2]*No current affiliation, Corvallis, OR, USA*

Geographic Variation in the Demography and Life History of a Cryptic Snake (*Contia tenuis*)

Life-history analyses are uncommon for snakes-vertebrates that are often rare and hard to detect. Studies that do report life history parameters often assume that estimates generated at one locality are equally accurate for distant populations; however, many snakes are wide-ranging. We might expect life history to vary geographically in response to abiotic and biotic differences across landscapes. Here, we examine snake capture-recapture data to compare demography and life-history traits between disparate populations. We target an Oregon population of the sharp-tailed snake (*Contia tenuis*; a secretive, semi-fossorial dipsadid with a broad range from central California to southern British Columbia (BC)). Prior work in BC has established baseline data in this species from the northern end of the range where populations are in decline. Preliminary comparisons between BC and Oregon show no difference in reproductive traits (timing of reproduction, number of ova, and female reproductive size), activity periods, and body sizes (SVL, males: 79-264 mm, females: 73-318 mm). However, Oregon snakes grow at twice the rate of BC populations (44.9 and 10.1 mm/year for large juveniles and adults, respectively). Daily survival is more variable in Oregon populations (96.83 to 99.82%), resulting in a consistent, sharp decline in apparent survival (and recapture probability) during mid-October. In all, faster growth rates may enable Oregon populations to thrive in the face of higher fall mortality rates. Thus, geographic variation in life-history may be a key factor behind the robust state of southern populations, and the more vulnerable state of northern populations.

0710 SSAR SEIBERT ECOLOGY AWARD, Banquet Room J, Friday 1 August 2014

Matthew G. Keevil[1], Shawna Sanders[1], Ronald J. Brooks[2], Jacqueline D. Litzgus[1]

[1]Laurentian University, Sudbury, Ontario, Canada, [2]University of Guelph, Guelph, Ontario, Canada

Density-dependence and Phenology of Juvenile Somatic Growth in Snapping Turtles and Painted Turtles

Juvenile growth rate is an important life history parameter in long-lived species because of its effect on age and size at maturity, and in turn, recruitment probability and fecundity. In long-lived species, density-dependent population processes often operate primarily through effects on juvenile stages. Here we investigate the relationship between juvenile growth and population density in populations of Snapping Turtles (*Chelydra serpentina*) and Painted Turtles (*Chrysemys picta*) in Algonquin Provincial Park, Ontario. Using a Bayesian framework, we combine two types of growth data: repeated morphometric measurements and position of scute growth lines, into a single analysis. We present a flexible method to incorporate seasonal growth phenology into standard growth functions and we demonstrate how growth line measurements can be informative even when scute line counts cannot be used directly to infer age. Growth phenology was similar for both species and we estimate that 95% of seasonal growth in carapace length occurs during a brief two month interval of the active season. This result suggests stronger than expected abiotic constraints and provides a potential explanation for the limited potential of juvenile growth rate to compensate for changes in density.

0280 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Crystal Kelehear[1], Gregory Brown[2], Mark Torchin[1], Kristin Saltonstall[1], Richard Shine[2]

[1]Smithsonian Tropical Research Institute, Panama City, Panama, Panama, [2]The University of Sydney, Sydney, NSW, Australia

A Novel Host Facilitates the Spread of an Invasive Parasite in Tropical Australia and Panama

The success of a biological invasion depends upon a multitude of factors, including interactions with other invaders. This study reveals that a novel host can facilitate the spread of a novel parasite. The blood-feeding lung parasite *Raillietiella frenata* was introduced to the port city of Darwin in tropical Australia at least 20 years ago with its invasive host, the Asian house gecko (*Hemidactylus frenatus*). This host strongly favors urban habitats and is generally patchily distributed throughout the landscape – thus,

their parasites have also remained patchily distributed, primarily restricted to the immediate surrounds of Darwin. The recent arrival of the invasive cane toad *Rhinella marina* in the Darwin area has provided an alternative host for this parasite. Our results show that the cane toad is a competent novel host for this parasite, and that this parasite is now expanding its range through the cane toad's distribution in Australia. Because cane toads are abundant and widely distributed through urban and rural habitat the toad invasion is likely to facilitate the parasite's spread across the tropics, into areas that were previously inaccessible to it. Our follow up studies reveal a similar pattern in the cane toad's native range in Panama where the Asian house gecko and its pentastomid parasite are also introduced. This study highlights the importance of ports in new species invasions and reveals pathways through which one invader can facilitate another.

0286 Ecology and Ethology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD ECOLOGY AND ETHOLOGY

Bryan Keller[1], Jean Sebastien Finger[1], Tristan Guttridge[1], Samuel Gruber[1], Daniel Abel[2]

[1]Bimini Biological Field Station Foundation, Bimini, Bahamas, [2]Coastal Carolina University, Conway, South Carolina, USA

Partner Preference and the Mechanism of Group Formation in Lemon Sharks, *Negaprion brevirostris*, During the Introduction of Strangers to Familiar Groups

Groups of sharks have been observed for centuries, however there is a dearth of quantitative analyses on the mechanisms that drive their formation. In this study we use controlled semi-captive behavioral experiments to assess the potential role that familiarity has in group formation and social behavior in a large marine vertebrate. Juvenile lemon sharks, *Negaprion brevirostris*, (n =23) in Bimini, Bahamas were captured, measured and tagged with external color codes for individual recognition and housed in pens that exposed them to ambient conditions. Sharks were separated by size class into four holding pens and given 14 days to familiarize themselves with their cohort. Following familiarization, pairs of sharks were taken from two holding pens and introduced in a social network for a total of 32 replicates. An overhead video system recorded behaviors for one hour and tracking software transformed the movement patterns into a coordinate system. Multiple algorithms analyzed these coordinates and produced a matrix of interactions between familiar and unfamiliar individuals, whilst accounting for individual variation in social behavior. Preliminary results show that that juvenile lemon sharks prefer familiar individuals and exchange social information more often with familiar than with unfamiliar sharks. This research will advance our

understanding of the mechanisms driving group formation in lemon sharks, a model species for large marine predators. Group formation holds relevance in conserving taxa because with fragmentation and habitat loss the interaction between familiars will decline and thus, group living will decrease and negatively impact predator avoidance, foraging success, and indirect fitness.

0670 Turtle Ecology, Banquet Room H, Sunday 3 August 2014

Meghan Kelley

John Carroll University, University Heights, OH, USA

Maternal Midland Painted Turtle (*Chrysemys picta marginata*) Cues Attracting Olfactory Mammalian Predators to Nests

The majority of predation on turtle nests has been shown to occur within the first 24 hours after egg-laying, and the majority of this predation occurs during the night, when visual cues are limited. Olfactory cues left at the site of the nest have been found to be important for olfactory-dominant mammalian predators in most cases. In this study, the three natural olfactory cues (adult female scent, oviposit scent, and egg scent) left by adult female turtles during nesting were examined and compared in an open field study using artificial nests. The purpose of this study was to compare rates of predation (i.e., assessed by nest-disturbance) on nests in which different cues had been placed; three control treatments (no scent application, deionized water, and human scent with deionized water) were also included in this study. All treatments included ground disturbance. It was predicted that the female scent treatment would receive the highest predation because of the abundance of adult female scent cues left across the landscape by females moving to nesting sites, creating trails to nests; the oviposit treatment was expected to receive the least predation because this solution is known to create cement-like soil compaction over nests when dried. Frequencies of nest predation suggested a trend that rejected both of these hypotheses. Binary logistic regression was performed to assess hierarchical trends among treatments, regarding the potential of predator preference for certain olfactory cues.

0749 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Christopher Kenaley, George Lauder

Harvard University, Cambridge, MA, USA

Robotic Modeling of Prey-capture Mechanics in Fishes: The Role of Hyoid Musculature

Feeding in the vast majority of teleost fishes involves the generation of oral suction to draw prey into the mouth and subsequent rapid compression of the oral cavity to trap and process prey. Our current understanding of how fishes generate suction and compression is based on decades of research using a combination of techniques including high-speed videography, electromyography, sonomicrometry, and computational kinematic models. This body of research has culminated in widely accepted models of how each of the musculoskeletal and linkage elements in the teleost feeding system facilitate oral expansion and compression. Using data generated from a biorobotic model of the teleost feeding system based on the largemouth bass (*Micropterus salmoides*) and electromyography of live specimens, we show that the protractor hyoideus (PH), a muscle long associated with compression kinematics, plays an important role in expansion. Specifically, we suggest that active stiffening of the PH through eccentric contraction limits retraction of the hyoid during oral expansion and thus permits effective transfer of laterally directed forces to the suspensorium. This, in turn, permits lateral expansion of the oral cavity and enhances suction. Our results demonstrate that the functional role of motor components of the teleost feeding system may be multifaceted, and that a more thorough understanding of the contributions of specific mechanical linkages may be uncovered when robotic experimental systems are utilized.

0461 General Herpetology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD GENERAL HERPETOLOGY

Erin Kenison[1], Andrea Litt[1], David Pilliod[2], Tom McMahon[1]

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Investigating Direct and Indirect Effects of Introduced Fish Predators on Long-toed Salamander Larvae

Predators can influence prey directly through consumption or indirectly by altering behavior, morphology, and life history. In many historically fishless lakes in western

North America, trout have been introduced for recreational fishing and are associated with reducing and extirpating populations of long-toed salamanders (*Ambystoma macrodactylum*). Salamanders and trout may coexist in some lakes, as larvae are able to alter foraging behavior, use of open water, and time in refugia in response to predatory cues. However, salamanders may experience indirect effects due to these changes in behavior. We sought to estimate direct effects of fish on abundance of long-toed salamanders and indirect effects of fish on salamander morphology. We sampled lakes with and without fish in northwestern Montana during the summers of 2012 and 2013. We caught salamander larvae using minnow traps and compared capture rates, densities, and morphological measurements between lakes with and without fish. We captured more salamanders/trap in lakes with fish (1.3 salamanders/trap, 95% CI = 0.65–2.19), compared to lakes without fish (0.46, 0.05–1.03), but detected no difference in densities, which could reflect higher population sizes and evidence of predator avoidance strategies if salamanders used traps as refugia. However, salamanders in lakes with fish were smaller: they weighed less, had shorter body lengths, and had shorter and narrower tails. Even if salamanders are more abundant in lakes with fish, growth may be reduced. Indirect effects on salamander larvae can influence adult survival and reproduction, which may be more important for population persistence than direct, consumptive effects.

0118 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Kayla Key[1], Andy Gluesenkamp[2], John S. Placyk, Jr.[1]

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Using Maxent to Predict Habitat Suitability for a Species of Conservation Concern, the Texas Gartersnake, *Thamnophis sirtalis annectens*

The common gartersnake, *Thamnophis sirtalis*, is known for its extensive geographic distribution that ranges farther north than any other snake species in the Western Hemisphere and from the Atlantic Coast to the Pacific Coast of the USA. Although there is much information on the behavior, physiology, evolution, ecology, and life-history of *Thamnophis sirtalis,* as a species, information on specific subspecies can be vague or non-existent. The Texas gartersnake, *T. s. annectens,* for example, was initially described in 1950 based on morphology and geographic distribution, but no further work has been conducted to verify its taxonomic status or explore its natural history in the 63 years following its description. As a result, we know very little about the evolution, ecology, and behavior of *T. s. annectens* and to compound this paucity of data, *T. s. annectens* is also considered a species of conservation concern in the state of Texas, being recently

listed as state imperiled. By using ecological niche modeling (Maxent software), we can better understand how to conserve this subspecies.

0166 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Katie Kierczynski, Thomas Luhring, Michael Wagner

Michigan State University, East Lansing, Michigan, USA

The Effect of Alarm Cue on Sea Lamprey Larvae Behavior

Olfactory information is important to many aquatic organisms for identifying risks and opportunities in their environment. Responses to these cues can be age- or context-specific based on the internal state and external circumstances. One type of olfactory molecule, alarm cue, is emitted from injured and/or dead individuals and often alerts conspecifics to the presence of risk (e.g., predation) and triggers an alarm response. The sea lamprey (*Petromyzon marinus*) is known to produce an alarm cue, and adults respond to cues collected from the tissue of larvae. A single laboratory test suggested that larvae may also respond to the alarm cue. However, lab and field experiments with fish alarm cues frequently result in different responses. In this study, we will report the results of field and mesocosms tests of larval sea lamprey responses to a conspecific alarm cue. We will examine whether exposure to the alarm cue will (1) induce short-term cessation of nocturnal feeding behavior, and/or (2) induce larvae to abandon the substrate and drift downstream. The ability to drift into low-risk environments may be adaptive for this vulnerable life stage and may also reveal an opportunity to facilitate control on invasive populations through behavioral manipulation.

0630 Herp Conservation I, Banquet Room F, Friday 1 August 2014

Steven Kimble, Ajit Karna, April Johnson, Jason Hoverman, Rod Williams

Purdue University, West Lafayette, IN, USA

Mosquitoes as a Potential Vector of Ranavirus Transmission in Chelonians

Ranaviruses are significant pathogens of amphibians, reptiles and fishes, contributing to mass mortality events worldwide. Despite an increasing focus on ranavirus ecology, our understanding of ranavirus transmission, especially among reptilian hosts, remains limited. Experimental studies involving Chelonians have failed to demonstrate infection following oral inoculation of the virus. Consequently, vector-borne transmission has been hypothesized in Chelonian populations. To test this hypothesis, mosquitoes trapped during a 2013 ranavirus outbreak in captive box turtles were pooled by genus

and tested for ranavirus DNA using qPCR. Two of 30 pools tested positive for ranavirus (frog virus 3, FV3). Additionally, an individual *Aedes* sp. mosquito observed engorging on a box turtle also tested positive for ranavirus. This suggests that mosquitoes may be involved in virus transmission as a mechanical or biological vector. While additional studies are needed to elucidate the exact role of mosquitoes in ranavirus ecology, our study suggests that a greater focus on vector-borne transmission may be necessary to fully understand ranaviral disease dynamics in herpetofauna.

0203 Ecology & Ethology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Rachel King[2], Lora Smith[2], Alan Covich[1]

[1]University of Georgia, Athens, Georgia, USA, [2]Joseph W. Jones Ecological Research Center, Newton, Georgia, USA

Spatial Ecology and Wetland Habitat Selection of Common Snapping Turtles (*Chelydra serpentina*) and Yellow-bellied Sliders (*Trachemys scripta*) in a Longleaf Pine Ecosystem

Isolated depressional wetlands within the Coastal Plain of the Southeastern United States coastal plain have been shown to support high herpetofaunal diversity. These wetlands vary in size, depth, vegetation, and surrounding landscape characteristics, and although the influence of these wetland characteristics on amphibians has been well described, their influence on reptiles, aquatic turtles in particular, is less well known. Determining the degree to which turtles use these wetlands and their surrounding habitat will provide information on wildlife linkages in these geographically isolated habitats and help identify priority conservation areas. We conducted a telemetry study on common snapping turtles (*Chelydra serpentina*) and yellow-bellied sliders (*Trachemys scripta*) in a longleaf pine (*Pinus palustris*) dominated landscape to examine aquatic habitat use with an emphasis on isolated depressional wetland use. We also examined overland movements by the two species and modeled potential movement corridors between aquatic habitats. Our results suggest that common snapping turtles are more selective of aquatic habitat than yellow-bellied sliders and both species selected for deep areas in isolated depressional wetlands. Individuals of both species moved overland extensively, often > 1 km, and travelled to as many as five unique aquatic areas during the study period. The movement corridor models identified potential areas of turtle movement between aquatic habitats; however, more research is needed to examine the accuracy of these models.

0535 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Tim King[1], Jay Stauffer[2], Matthew Kulp[3], Jacob Rash[4], Jeb Wofford[5], Ray Morgan[6], Barbara Lubinski[1]

[1]U.S. Geological Survey, Kearneysville, WV, USA, [2]The Pennsylvania State University, University Park, PA, USA, [3]National Park Service, Gatlinburg, TN, USA, [4]North Carolina Wildlife Resources Commissiion, Marion, NC, USA, [5]National Park Service, Luray, VA, USA, [6]University of Maryland, Frostburg, MD, USA

Islands in the Stream: Genetic Analysis of Brook Trout (*Salvelinus fontinalis*) Population Structure and Demographics Reveals a High Degree of Population Fragmentation and Prodigious Differentiation Within and Among Streams.

Allelic variation in over 17,000 Brook Trout (*Salvelinus fontinalis*) from 400 collections comprising the native range indicate that the individual stream or collections within a stream should be considered the fundamental management unit contrary to the current paradigm. Coalescence-based demographic analyses provided previously undetected demographic histories [e.g., time to most recent common ancestor (T), population trajectory (r), and effective population size (N)] and evolutionary relationships among populations. These research findings create somewhat of a management conundrum - does genetic divergence observed among Brook Trout reflect adaptive significance (natural selection), drift-induced differentiation, or a combination of the two processes? Given that natural selection ultimately acts on the genetic variation underlying character variation of the individual, identifying the genes associated with parallel evolutionary changes among recently diverged lineages is essential to uncovering candidate genes implicated in adaptive phenotypic variance. Establishing whether fisheries managers should focus their resources on identifying and characterizing genetic relatedness (e.g., from morphological comparisons to gene expression profiling), or determining if the number of fish needed to establish population persistence is a high priority research need (i.e., a new research paradigm). The degree to which research and management paradigm shifts may be warranted will be discussed.

0440 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Bruce Kingsbury[1], Evin Carter[2]

[1]Indiana-Purdue University Fort Wayne, Fort Wayne, IN, USA, [2]University of Tennessee, Knoxville, Knoxville, TN, USA

Copperheads, Invasive Plants, and Ecological Traps

Invasive plants have been identified as a potential factor in the decline of many forms of wildlife. Nevertheless, there is a paucity of clear evidence regarding causative

mechanisms. We investigated the effects of invasive plant species on resource selection and thermoregulation by monitoring radio-tagged Northern Copperheads (*Agkistrodon contortrix mokasen*) in Clifty Falls State Park in southern Indiana. Copperheads exhibited clear avoidance of most exotic invasive plant species at multiple spatial scales, with exotic shrubs having the greatest influence on copperhead habitat selection. Avoidance of most exotic plants appears to be at least partially attributable to limited thermoregulatory opportunities within exotic-dominated habitats relative to native habitats, with exotic shrub habitats providing the lowest thermal quality as a group. Additional mechanisms underlying avoidance may include lack of suitable cover and/or decreased prey availability, but their significance is currently unknown. In many cases, shrub control in parks relates to maintenance of areas for visitors and is conducted in a manner that is cost-effective and aesthetic rather than implemented with wildlife in mind. This creates the potential for ecotraps as a major source of mortality for copperheads in the park, as well as increasing the chances of snake-human interactions. Consideration of the timing of maintenance activities may resolve many issues. Creating additional clearings away from human activity may also be a cost-effective means of promoting suitable habitat for snakes and other ectotherms impacted by invasives.

0494 Herp & Ich Genomics, Banquet Room J, Sunday 3 August 2014

Kevin Kingsland[1], Matthew Geisler[2], Brian Small[3], Jennifer Eichelberger[1], Timothy King[4], Edward Heist[1]

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[3]*College of Agricultural Sciences, Southern Illinois University, Carbondale, IL, USA,*
[4]*Leetown Science Center, United States Geological Survey, Kearneysville, WV, USA*

Transcriptome Annotation in *Scaphirhynchus* Sturgeons

Pallid sturgeon (*Scaphirhynchus albus*) is an endangered species native to the Mississippi and Missouri rivers. Pallid sturgeon hybridize with shovelnose sturgeon (*S. platorhynchus*) and the two species may form a hybrid swarm in parts of their shared range. The primary objective of this study was to utilize multiple bioinformatics algorithms to annotate a set of next-generation DNA sequencing data from pallid and shovelnose sturgeons. 18,101 contiguous sequences were assembled and compared to reference sequences from six other species. Transcriptome assembly in *Scaphirhynchus* sturgeons is challenging because their polyploid ancestry and slow rates of evolution make it difficult to discriminate between orthologous and paralogous gene copies. Approximately 2,000 unique orthologs were identified. A database of annotations for each *Scaphirhynchus* ortholog is currently under construction. When finished, this annotation will serve as a database for developing gene expression assays for pallid and

shovelnose sturgeons. We hope to use the gene expression assays for identifying functional genetic differences between the two species and their hybrids, and for identifying intraspecific phenotypic differences across their broad latitudinal ranges. A fundamental understanding of gene expression within and between these species may provide useful tools for pallid sturgeon conservation.

0381 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR
ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Sarah Kitson, Willem Roosenburg

Ohio University, Athens, Ohio, USA

Performance of *Malaclemys terrapin* Hatchlings: Variation in Seasonal Emergence and Investigation into Hatchling Environmental Preference

In temperate regions, the emergence timing of hatchling turtles varies among species and generally follows one of two patterns: fall emergence or delayed spring emergence. Many species also have terrestrial juveniles and hatchlings, even though the adults are entirely aquatic. These tendencies of the hatchling life stage are under-studied in numerous species. *Malaclemys terrapin*, the Diamondback terrapin, is an ideal focal organism to address the questions involved with both of these systems. *M. terrapin* displays both emergence strategies as well as an ontogenetic change in habitat preference. The goal of this study is to discover if there is a difference in terrapin spring and fall hatchling performance and if so, which emergence time is more advantageous for survival. In addition, aquatic and terrestrial performance metrics will be compared to determine if locomotion takes part in terrapin hatchling habitat choice. Locomotor metrics include aquatic and terrestrial burst speed, aquatic and terrestrial speed through cord grass, *Spartina spp.*, aquatic and terrestrial endurance, and righting behavior. Physiological performance includes water loss rates, respiratory recovery after exhaustion, and shell strength. Terrapin hatchlings will be collected from Poplar Island, an environmental restoration site in Maryland. Preliminary performance data will be collected from the 2013 spring cohort. I will evaluate performance metrics that will be used to refine methodology for 2014 data collection. Our project will lead to a greater understanding of hatchling ecology which can be applied to conservation of the study species, *M. terrapin*, as well as other temperate turtles.

0607 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Page E. Klug[1], Robert N. Reed[1], Frank J. Mazzotti[2], Michelle A. McEachern[1], Joy J. Vinci[2], Katelin Craven[1], Amy A. Yackel Adams[1]

[1]U.S. Geological Survey, Fort Collins, CO, USA, [2]University of Florida, Fort Lauderdale, FL, USA

Spatial Ecology and Habitat Use of the Argentine Tegu (*Tupinambis merianae*), a Recent Invader in the Everglades Ecosystem (Florida, USA)

The threat of invasive species is often intensified in disturbed habitat. To optimize control programs, it is necessary to understand how degraded habitat influences the behavior of invasive species. We conducted a radiotelemetry study to characterize spatial ecology and habitat use of the introduced Argentine Tegu (*Tupinambis merianae*) in the Everglades ecosystem of southern Florida. We monitored male *T. merianae* from May to August 2012 at the core and periphery of the introduced range in Miami-Dade County. Tegus at the edge of the range moved farther per day (mean = 131.7 ± 11.6 m, n = 6) than did tegus at the core (mean = 50.3 ± 12.4 m, n = 6). However, size of activity ranges were not smaller in the core (mean = 19.4 ± 8.4 ha, n = 6) compared to periphery (mean = 29.1 ± 5.2 ha, n = 6). Peripheral activity ranges were more linear due to activity being largely restricted to levee habitat surrounded by open water or marsh. Tegus were located in shrub or tree habitat (mean = 96%) more often than expected based on random locations (mean = 58 %), and the percent cover of trees and shrubs was higher in activity ranges (mean = 61%) than the general study area (17%). Our results highlight the ability of tegus to spread across the Florida landscape, especially in linear disturbed habitats. If ecological integrity was restored in disturbed conservation areas, then tegu density and rate of spread might be reduced.

0369 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Ryan Knotek[1], David Rudders[2], John Mandelman[3], James Sulikowski[1], Hugues Benoit[4]

[1]University of New England, Biddeford, Maine, USA, [2]Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, USA, [3]John H. Prescott Marine Laboratory, New England Aquarium, Boston, Massachusetts, USA, [4]Gulf Fisheries Centre, Fisheries and Oceans Canada, Moncton, New Brunswick, Canada

The Survival of Rajids Discarded in the New England Scallop Dredge Fisheries

Due primarily to regulatory factors, skates (family Rajidae) account for nearly half the total bycatch discarded during commercial fishing operations in the U.S. portion of the Northwest Atlantic Ocean. Although the New England scallop dredge fishery has the second highest skate discard rate, no information regarding their resiliency to interaction with this gear type exists. To gain insight into species-specific mortality rates, 295 tows were conducted across six research trips (2012-2013 fishing season), with a total of 4020 skates (little, *Leucoraja erinacea*, winter, *Leucoraja ocellata*, and barndoor, *Dipturus laevis)* evaluated and scored on vitality (i.e. reflex impairment) and condition (i.e. overt physical trauma) indexes. To quantify mortality rates associated with these indexes, 290 skates were maintained in a novel on-deck refrigerated flow-through seawater system for 72-hours. This study also assessed the effect of fishing conditions and practices on post-release mortality. Preliminary data based on condition and vitality indexes, suggests species-specific differences in post-release mortality exist. For example, highest mortality (up to 100%) was observed in barndoor skates while winter skates were most resilient (up to 23.5%). As such, a species-specific management plan may be more appropriate for skates in this fishery. A more extensive analysis of the data is underway.

0049 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; AES CARRIER AWARD

Matthew Kolmann

University of Toronto, Toronto, Canada

Functional Anatomy of the Ocellated Freshwater Stingray, *Potamotrygon motoro*

The evolution of the vertebrate head has a complicated history of functional reorganizations, exhibiting morphological patterns of both modularity and decoupling among musculoskeletal units. The evolution of jaws and hyoid suspensorium from branchial arches, and the resulting variations of these structures in major clades of

vertebrates is a notable example. Although the gill arch to jaw transition is a well accepted theory regarding gnathostome evolution, more direct examination of how this repurposing of the arches has affected cranial muscle physiology and function has been overlooked. To this end, I examined patterns of conservation in how physiological and morphological characteristics contributing to muscle function have changed between the gill arches, jaws and hyoid suspension in the ocellated freshwater stingray, *Potamotrygon motoro*. Based on prior comparative anatomy and behavioral research, we hypothesize that aspects of muscle fiber physiology will be most divergent between jaws and branchial musculature, with hyoid muscle function showing an intermediate condition. We also hypothesize that hypaxial muscle function is a strong covariate with suction feeding performance, as evidenced by studies of other fishes. As a necessary first step, we describe the cranial anatomy of this taxon with a focus on functional morphological characters. We find that *Potamotrygon*, like other stingrays, exhibits a highly mobile hyoid apparatus, allowing for rapid jaw protrusion. We also present preliminary data on behavioral trials examining the putative muscle groups driving suction performance in this taxon, as well as characterization of contractile muscle physiology across cranial muscles integral to certain feeding behaviors.

0362 Fish Systematics & Taxonomy IV, Banquet Room G, Sunday 3 August 2014

Peter Konstantinidis[1], G. David Johnson[2]

[1]*Virginia Institute of Marine Science, Gloucester Point, VA, USA,* [2]*Smithsonian Institution, National Museum of Natural History, Division of Fishes, Washington DC, USA*

From Rosaura to Gigantura: An amazing Ontogenetic Journey

The family Giganturidae comprises two species, *Gigantura indica* and *G. chuni*, which undergo one of the most drastic developmental transformations known among teleostean fishes. The transformation is so radical that in 1954, Tucker described an 8.4 mm giganturid larva as a different genus and species, *Rosaura rotunda* and placed it in a separate family, Rosauridae. The relationship between *Rosaura* and *Gigantura* remained undiscovered until the mid-1960's. Throughout the developmental journey to the adult stage, the larvae change dramatically. In addition to striking external changes in body shape and eye orientation, the jaws, gill arches, and pectoral girdle undergo radical reductions as well as topographic and structural changes that make them challenging to identify and homologize. Robert K. Johnson, well known for his work on aulopiform fishes, intended to describe the osteological transformation of *Gigantura*, but he abandoned the project prior to his untimely death. Inspired in part by specimens we identified at a larval fish workshop in Tokyo we decided to revive Johnson's planned

project. We have located most of the transforming specimens R.K. Johnson pictured in the 1991 DANA report at their respective institutions but were unable to find his notes. Here we present the osteology of adult giganturids and support our conclusions with data of the transformational larvae and juveniles. Further, we compare our findings with potential sister taxa to discuss their phylogenetic placement within the Aulopiformes.

0540 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Kristin Kopperud, Michael Grace

Florida Institute of Technology, Melbourne, FL, USA

Temporal Changes in Retinal Architecture of the Atlantic Tarpon, *Megalops atlanticus*

Biological clocks and the physiological and behavioral rhythms they produce enhance survivability by allowing organisms to anticipate change in their environments. While many processes change in direct response to external influence, most also change over time because of internal timekeeping mechanisms - biological clocks. The cellular machinery and molecular mechanisms of clocks has been intensely studied in people and some lab animals, but we understand very little about how they affect organisms in their natural environments. Further, biological clock operation in lower vertebrates-especially in fish-is extremely complicated, much less straightforward than that in mammals. This research aims to shed insight into these areas by examining clock operation in the Atlantic tarpon (*Megalops atlanticus*), one of the most sought-after game fish on Earth. Tarpon are exceptional models for studying how retinal structure and function adjust to a changing light environment because they undergo particularly dramatic shifts in ecological niche as they mature, accompanied by dramatic alterations in retinal photoreceptor cell type and distribution. Further, there is evidence that rods and cones actually reposition within the retina in response to light availability and/or an internal biological clock (a phenomenon called "retinomotor movement"). The aims of my research are to elucidate the biological rhythms of visual function and to define the roles of endogenous clocks in driving retinomotor movement. This work is ultimately aimed at promoting a better understanding of how changing visual function may support survival of this important species in the face of continuing, rapid coastal development and climate change.

0355 Herp & Ich Genomics, Banquet Room J, Sunday 3 August 2014

Trevor Krabbenhoft[1], Thomas Turner[2]

[1]Wayne State University, Detroit, MI, USA, [2]University of New Mexico, Albuquerque, NM, USA

Comparative Transcriptomics as a Tool for Fish Ecology: Functional Genetic Variation in Cyprinid Fishes

Advances in DNA sequencing technology have revolutionized many areas of biological research. However, with many of the key mechanistic details of fish biology still wrapped tightly in genomic complexity, molecular ecology remains an exciting frontier for research. Fish genomic research faces special challenges, in part due to several rounds of whole genome duplication in the evolutionary history of fishes. As DNA sequencing technology has revolutionized genetic research, much of the effort has shifted from generating DNA sequences to processing, analyzing, and interpreting sequence data. We review some of the salient challenges in *de novo* assembly and annotation of fish transcriptomes and discuss possible solutions for assessing and improving their quality. We discuss these ideas in the context of a comparative dataset for five co-occurring cyprinid fishes illustrating some of the rich functional diversity of this family. Finally, we highlight the broad utility of comparative transcriptomics for complementing existing methodologies and advancing our mechanistic understanding of fish life history, physiology, immune and stress response, and trophic relationships.

0617 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Michelle Kraczkowski, Barry Chernoff

Wesleyan University, Middletown, CT, USA

Post-glacial Recolonization History of the Eastern Blacknose Dace, *Rhinichthys atratulus*

A large gap exists in our understanding of postglacial recolonization of flora and fauna in the northeast region of the United States and adjacent Canada. This study determines the glacial refugium or refugia responsible for harboring the populations of *Rhinichthys atratulus*, Eastern Blacknose Dace, that recolonized the northern parts of its current distribution. The eastern seaboard of North America from New Brunswick Province, Canada to Virginia, United States (47 - 37° N), encompassing the Appalachian Mountain range. Two mitochondrial genes and nine microsatellites generated phylogenies using maximum likelihood, Bayesian, and maximum parsimony models, and AMOVAs were used to test hypothesized refugial localities and recolonization patterns. There are two dominant haplotypes each with a unique geographical distribution in New England.

Each geographic region has populations with low nucleotide diversity. These genetically distinct populations rarely mix, illustrating an east-west divide that aligns with the Appalachian Mountain Discontinuity theory. We conclude that *R. atratulus* recolonized northern regions from multiple refugia. Refugia were likely in Pennsylvania and New Jersey, supporting the Pleistocene refugia theory that southeastern regions harbored populations close to the glacial maximum during the last ice age. The results further support the recolonization scenario that *R. atratulus* dispersed through the temporary glacial river in Long Island Sound before it was inundated by seawater (Stone et al. 2005; Tipton et al. 2011) to recolonize eastern New England and Canadian rivers. This was paralleled by a genetically different population of *R. atratulus* traveling from the western Pennsylvania refugia to New York State's Rivers.

0135 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Erika R. Krahl, Malorie M. Hayes, David C. Werneke, Carla C. Stout, Jonathan W. Armbruster

Auburn University, Auburn, AL, USA

Genetic Structure and Dispersal Potential of the *Pteronotropis euryzonus* (Suttkus, 1955)

The Broadstripe Shiner, *Pteronotropis euryzonus* (Suttkus, 1955), is a cyprinid endemic to the tributaries of the middle Chattahoochee River in Alabama and Georgia. *Pteronotropis euryzonus* populations appear fragmented, as individuals have not been detected in the main channel of the Chattahoochee. This suggests limited dispersal potential and low gene flow between populations, which is supported by other studies of this species. Samples of *P. euryzonus* were collected from 10 sub-basins of the Chattahoochee River in Alabama and Georgia. The mitochondrial markers COI and cytochrome b were used to examine the genetic structure of *P. euryzonus* throughout its range. Preliminary data resolved two groups that appear to be physiogeographically distinct. These results support previous hypotheses that more than one form of *P. euryzonus* exists in the Chattahoochee River basin. The Broadstripe Shiner is currently listed as imperiled in both Georgia and Alabama. The presence of two genetically distinct populations has significant conservation implications, and this genetic structure should be considered in the development of future management strategies for this species. Population fragmentation, a restricted range, and low tolerance to disturbance from local infrastructure may necessitate further protections to prevent extirpation of *P. euryzonus* from its native range.

0295 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Leos Kral, Patricia Bartlett, Rebecca Pace, Shelby Phan, Ariel Williams, Leslie Willis

University of West Georgia, Carrollton, GA, USA

Current State of Assembly and Annotation of the *Etheostoma tallapoosae* Genome

The family Percidae contains over 200 species, most of which are within the subfamily Etheostomatinae. This subfamily (the darters) represents a species rich radiation of freshwater fishes in North America. Evolutionary relationships between the various species have been deduced from morphological, mitochondrial DNA sequence and limited nuclear DNA sequence comparisons. However, a thorough understanding of the evolution of darter species will require comparisons at the whole genome level. As a first step, a draft genome of the Tallapoosa darter (*Etheostoma tallapoosae*) has been assembled from whole genome sequences. A BLAST server and a WebApollo server have been set up to facilitate the identification and annotation of genes in the Tallapoosa darter genome. A web site has been developed that gives public access to both the BLAST and WebApollo servers to spur interest in darter genomics and to enable annotation of the Tallapoosa darter genome by any interested darter researchers (www.dartergenomics.org). Annotation of the Tallapoosa darter genome is currently being carried out by students at the University of West Georgia to demonstrate that the assembly is of sufficiently high quality that genes for known proteins can be identified. Projects are also under way to identify and annotate specific genes of interest in the Tallapoosa darter genome that may undergo adaptive variation during darter evolution. Orthologs to these genes will then be identified and annotated in other darter species genomes as these become available so that tests of adaptive variation can be carried out.

0106 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Matthew Kramer[1], Enrique Font[2], Gordon Burghardt[3]

[1]Agricultural Research Service/USDA, Beltsville, MD, USA, [2]University of Valencia, Valencia, Spain, [3]University of Tennessee, Knoxville, TN, USA

Tongue-flick Attack Scores Revisited: A Decomposition and a Reconstitution Using Canonical Discriminant Analysis

Tongue-flick attack scores (TFAS) have been successfully used to investigate perceived interest or response strength by squamate reptiles to various chemical stimuli presented on a cotton swab. We analyzed the three components of TFAS (whether or not the

subject attacks the swab, latency to attack, and tongue-flicks) from 1248 trials on neonatal garter snakes (*Thamnophis sirtalis*) responding to worm and fish extract in a repeated measures design. We found attacks to be non-randomly distributed (some subjects had a consistently high probability of attacking), latency to attack inconsistent (giving different results depending on the trial time cutoff), and that tongue-flick rates predict which subjects will attack. A composite score, created using canonical discriminant analysis (CDA), which optimizes the coefficients of the component variables to best distinguish among stimuli, was compared to the TFAS. The composite score was a marked improvement, explaining about four times the variability due to stimuli differences. Signs of coefficients on some variables were reversed, and optimal weightings on each variable could differ greatly from that in TFAS. We also identified an important interaction term missing in the traditional TFAS. Analyses were also performed for two experiments using similar stimuli but different lizard species. Again, the CDA scores were a large improvement on the traditional TFAS. Interestingly, the CDA signs and weightings were dissimilar for the two lizard species, suggesting that TFAS should be constructed differently for different species, something the CDA methodology can do.

0182 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Chelsea Kross, Stephen Richter

Eastern Kentucky University, Richmond, KY, USA

Effects of Interactions Between Species in an Anthropogenically Altered Ridge-Top Wetland Ecosystem

Hundreds of wetlands have been constructed as permanent water sources in a ridge-top ecosystem in eastern Kentucky where there were naturally only ephemeral wetlands. Consequently, the ecosystem was colonized by amphibian species with a larval period requiring a long hydroperiod, many of which are top amphibian predators (e.g., Eastern Newts). In contrast, the natural ephemeral wetlands support amphibians with a shorter larval period (e.g., Wood Frogs). Some ephemeral wetland species will breed in constructed wetlands. Thus, there could be negative impacts on these species. Our objectives were to determine if species of the two communities interact, outcomes of these interactions, and impacts on the communities. We selected Eastern Newts (*Notophthalmus viridescens*) and Wood Frogs (*Lithobates sylvaticus*) to represent the constructed and natural communities, respectively. We sampled six constructed and six ephemeral wetlands throughout 2013 and 2014. We counted Wood Frog egg masses and estimated survival biweekly throughout the breeding season (February-May) at each wetland and sampled newt populations bimonthly May-November 2013 and monthly

January-May 2014. Newts were measured and weighed to determine body condition and individually marked using visual implant elastomer. Wood Frog reproductive success was negatively impacted when eggs were laid in constructed wetlands, and newts in constructed wetlands with Wood Frog eggs present had higher body condition. The constructed wetlands might be acting as population sink for amphibians of the natural community. Understanding the impacts of how amphibian species interact as habitat loss and modification increase will continue to be critical for amphibian conservation.

0556 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Kole Kubicek[1], Rafael García[2], Carlos González[2], Kevin Conway[1]

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Early Development of the Mexican Snook, *Centropomus poeyi* (Teleostei: Centropomidae)

The family Centropomidae is a small group (1 genus, ~12 species) of inshore marine percomorphs that are both recreationally and commercially important in the US and Mexico. Despite this importance, detailed information on early development is currently available only for a single species, the common snook (*Centropomus undecimalis*). A fledgling captive propagation program for Mexican Snook (*Centropomus poeyi*) at the Laboratorio de Acuicultura Tropical (Universidad Juárez Autónoma de Tabasco) has provided access (for the first time) to early developmental material for this species and also an opportunity to further our knowledge of centropomid early development. Based on this material (168 specimens; 0-21 days post hatch), we provide precise data on the age (DPH) and the size (notochord and standard length) at which major developmental landmarks occur in the development of *C. poeyi*, including: yolk-sac absorption, flexion, completion of median and paired-fin development, and larval fin-fold regression. We also document changes in pigmentation over the first 21 days of development for *C. poeyi* using high quality photographs.

0700 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Banquet Room J, Friday 1 August 2014

Arianna L. Kuhn, Aaron M. Bauer, Todd R. Jackman

Villanova University, Villanova, PA, USA

Molecular Phylogeny and Historical Biogeography of *Trachylepis* Skinks (Reptilia: Scincidae) and the Evolution of Viviparity

The lygosomatine genus *Trachylepis* is one of the largest and most ecologically diverse lizard genera in Africa. Previous phylogenetic studies have looked at only a few of the many unresolved taxonomic issues in the genus and to date, no large-scale phylogenetic analyses sampling many taxa and characters have been published. We estimated phylogenetic relationships for 58 of the 79 recognized species of *Trachylepis* using 1612 bp of mitochondrial DNA (12S, 16S, CYTB) with additional nuclear sampling (3303 bp; MXRA5, RAG1, EXPH5, KIF24) for a reduced-taxon dataset. We find support for a large, monophyletic southern African radiation accounting for 29% of the taxonomic diversity in *Trachylepis,* encompassing several deeply divergent sublineages, an East Africa-Malagasy clade, a chiefly West and Equatorial African clade, and a North African clade that extends into the Middle East. Using a time-calibrated species-level phylogeny, we reconstructed the biogeographic history of the group. We find evidence for at least three trans-oceanic crossings in *Trachylepis* and confirm that all insular radiations (Fernando de Noronha, Seychelles, Socotra, Gulf of Guinea Islands, and Madagascar) of *Trachylepis* are independently derived. Our data suggest at least 5 independent origins for viviparity within the clade comprised of *Trachylepis*, *Mabuya* and their relatives, including an independent origin for the rare mammalian-type placentotrophy seen in *T. ivensi*. This study fills a critical gap in the available phylogenies for major sub-Saharan African fauna, and facilitates future comparative studies of skink evolution.

0024 Fish Ecology I, Banquet Room F, Saturday 2 August 2014

Gen Kume

Kagoshima University, Kagoshima, Japan

Oogenesis Without Vitellogenesis by *Apogon lineatus* Females: A Reproductive Constraint or Strategy?

The family Apogonidae is the most abundant and diverse taxonomic unit in the Indo-Pacific reefs. Members of this family are all known as paternal mouthbrooders. The subject species, *Apogon lineatus*, is distributed from Japan to the South China Sea and the Indo-West Pacific. The species inhabits sandy or muddy bottoms deeper than most of the congeneric species that live in shallow coastal reefs. Therefore, it has been

considered almost impossible to observe their behavior directly underwater. Using specimens collected by bottom trawlers, various life history traits such as growth, reproductive cycles, and feeding habits of this species in several local populations have been investigated. In addition, studies have shown that approximately 18% of each brood comprises abnormal eggs lacking yolk, which are hydrated without the vitellogenesis phase and which eventually ovulate with other normal eggs as a single egg mass. The adaptive significance of this particular process remains to be understood. I have identified a location (Omura Bay, Nagasaki Prefecture) in the western part of Japan, where the species emerges in shallow zones (less than 10 m in depth) only during the summer months, which correspond to the reproductive season, thus facilitating SCUBA diving investigations on its behavior in greater detail. Since August 2012, I have examined ecological aspects such as aggregation patterns through SCUBA diving. Here, I review previous reports on *A. lineatus* and introduce the latest ecological findings in relation to congeneric species.

0225 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Jennifer Lamb[1], Hardin Waddle[2], Carl Qualls[1]

[1]*The University of Southern Mississippi, Hattiesburg, MS, USA,* [2]*United States Geological Survey, Lafayette, LA, USA*

Asymmetric Interactions among Brook Salamanders (Genus *Eurycea*, Family Plethodontidae) in the Gulf Coastal Plain

Environmental gradients and species interactions influence the structure of assemblages of lungless salamanders (Family Plethodontidae), and it is likely that these associations will differ among regions due to unique combinations of species and habitats. Multiple species of brook salamanders occur syntopically within the Gulf Coastal Plain (i.e., *Eurycea cirrigera*, *E. guttolineata*, and the *E. quadridigitata* complex). These species share similar diets, but differ in larval size and the duration of their larval periods. Of the three, *E. cirrigera* attains the largest sizes as larvae, and typically has a larval period of greater than one year. Consequently, the presence of *E. cirrigera* could affect the occurrence of the other two *Eurycea* through interference competition and or intraguild predation during the larval period. We used leaf-litter bags to sample salamanders from 60 sites in South Mississippi. We used hierarchical Bayesian occupancy models to determine whether the presence of the hypothesized dominant species (*E. cirrigera*) affected the probabilities of occurrence and detection of either of the two subordinate species (*E. guttolineata* and *E. quadridigitata*). We also included stream permanence and drainage area as covariates for occupancy. Our results indicate that the presence of *E. cirrigera* has a significant, negative effect on the probability of occurrence of *E.*

guttolineata, but no effect on occurrence of *E. quadridigitata*, or on the probability of detecting either species. These salamanders respond differently to stream permanence, and future work should include both field and mesocosm studies to disentangle the effects of species interactions and environmental gradients.

0525 Herp Behavior, Banquet Room I, Saturday 2 August 2014

Tracy Langkilde, Lindsey Swierk, Courtney Norjen

Pennsylvania State University, University Park, PA, USA

Bearded Ladies: Female Lizards Suffer Fitness Consequences When Bearing Male Traits.

A central assumption in evolutionary biology is that females of sexually dimorphic species suffer costs when bearing male secondary sexual traits, such as ornamentation. Nevertheless, it is common in nature to observe females bearing rudimentary versions of male ornaments (e.g. 'bearded ladies'), as ornaments can be under similar genetic control in both sexes. Here, we provide evidence that masculinized females incur both social and reproductive costs in nature. Male fence lizards (*Sceloporus undulatus*) discriminated against ornamented females during mate choice. Ornamented females had lower reproductive output, and produced eggs that were laid and hatched later than those of non-ornamented females. Females with experimentally elevated T levels had lower hatching success of eggs, and produced smaller offspring that survived less well. These findings support established theories of the evolution of sexual dimorphism and intralocus sexual conflict, and raise questions regarding the persistence of masculinizing ornamentation in females.

0113 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Banquet Room J, Friday 1 August 2014

Thornton Larson, Eli Greenbaum, Delilah Castro

University of Texas at El Paso, El Paso, TX, USA

Systematics of the African River Frog Genus *Amietia* (Anura: Pyxicephalidae) in Eastern Democratic Republic of the Congo

The genus *Amietia* currently includes 16 species of frogs that occur in an array of habitats from lowland rainforest to montane grassland in sub-Saharan Africa. In an ongoing study to evaluate evolutionary relationships and identify cryptic species within the genus, one nuclear (RAG1) and three mitochondrial (16S, 12S, cyt b) genes were

sequenced from 44 samples of *Amietia* and two outgroups in the genus *Phrynobatrachus* and *Aubria*; 26 additional 16S sequences (eastern and southern Africa) were included from GenBank. Data were analyzed with maximum-likelihood and Bayesian inference criteria with the programs RAxML v.7.2.6 and MRBAYES v. 3.1.2 after appropriate models of nucleotide substitution were identified in the program jModelTest v.2.1.3. Species trees and divergence times were generated in BEAST v.1.8.0. Results support the monophyly of the genus *Amietia*, and 15 well-supported clades were identified, of which nine occur within Democratic Republic of Congo (DRC). Described species in some clades will require careful comparison to type material to confirm their identity, but the nine lineages identified from eastern DRC (with only five species currently recognized from DRC) suggest the taxonomic diversity of *Amietia* is underestimated.

0451 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Matthew Lattanzio

Ohio University, Athens, Ohio, USA

From Disturbance to Fitness: Selective Consequences of Prescribed Fire for Tree Lizards

Anthropogenic disturbances can have profound effects with respect to the distribution of available vegetation and structural resources. These changes in resource availability should perturb how organisms interact with each other and with their environment. Two consequences of this perturbation are increased competition for preferred resources (diet, microhabitat) and exposure to predators, potentially leading to differences in morphology and fitness among individuals in habitats differing in disturbance history. Here I ask two questions. First, does anthropogenic disturbance affect male or female survival? And second, do patterns of selection on lizard morphological traits differ by site, sex, or morph? I address these questions using three years of recapture, ecological, and morphological data from tree lizard (*Urosaurus ornatus*) populations at three sites differing in prescribed fire history. Tree lizards are polymorphic in dewlap coloration, and color differences among males have been linked to alternative mating strategies: blue males are territorial and aggressive, yellow males are satellite and less-aggressive, and orange males are nomadic. Preliminary data at our site suggest that male lizards in particular are larger in burned sites, and exhibit more combat-related injuries (bite-marks) than lizards in unburned areas. In contrast, aside from differences in mating behavior, little is known regarding the effects of disturbance on the ecology, morphology, or fitness of female *U. ornatus* lizards. My goal is to provide insight into the selective consequences of disturbance and whether morphs differing in reproductive

behavior (male and female) differ in their ability to respond to changes to their environment.

0697 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Matthew Lattanzio, Donald Miles

Ohio University, Athens, Ohio, USA

Disturbance, Microhabitat Use, and the Thermal Ecology of Male Tree Lizards

In arid environments, one of the major outcomes of anthropogenic disturbances is a shift in the thermal quality of a habitat, which should affect the ability of ectotherms (such as lizards) to exploit disturbed habitats. In this study we address these considerations for tree lizard (*Urosaurus ornatus*) populations at three sites differing in burn history (unburned, low-burned, and high-burned). Tree lizards are polymorphic in dewlap coloration, and color differences reflect alternative mating strategies: blue males are territorial and aggressive, yellow males are satellite and less-aggressive, and orange males are nomadic. Specifically, we aim to evaluate whether 1) historical disturbance (fire) alter the thermal quality of the habitat and 2) male lizards differing in social dominance differ in their ability to exploit higher-quality microhabitats. We combine laboratory thermal preference and critical thermal limit data with field data on lizard microhabitat use, body temperatures, and operative temperature data to address our questions. Using these data and predicted body temperatures from a statistical model, we show that disturbance may reduce environmental quality, and that lizard behavior and environmental variation may jointly affect the ability of each morph to exploit microhabitats varying in thermal quality. Specifically, less-aggressive morphs exploited poor-quality habitats, whereas more-aggressive morphs usurped live trees, which are associated with greater structural heterogeneity as well as more time that a non-regulating lizard would fall within their preferred body temperature range in the laboratory. We discuss these findings with respect to how environmental change may affect maintenance of color polymorphism in *U. ornatus*.

0194 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Katie May Laumann, Alison Deary

Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA, USA

Ichthyology and Marine Science in Inquiry-Based Learning: How Researchers Can Contribute to Middle and High School Education

Traditionally, middle and high school science education is limited to lessons and activities that can easily be carried out in a classroom, and to what can be learned through occasional field trips. Lab activities for students are restricted to the materials available to teachers. This educational plan can be supplemented by bringing researchers into the classroom. Researchers can provide students with new perspectives on science, introduce them to the most recent research, and provide for lab activities using materials common in research but not readily available to public school teachers. As Fellows in the NSF's Graduate STEM Fellows in K-12 Education Program, we have had the opportunity to bring science into the classroom and to observe the impact this has on students. Here, we present data illustrating the importance of exposure to "inquiry based learning" during middle and high school, as well as examples of ichthyology and ocean-science based lessons and labs.

0185 Fish Systematics & Taxonomy II, Banquet Room G, Sunday 3 August 2014

Katie May Laumann[1], Eric J. Hilton[1], Casey B. Dillman[1], Tetsuya Sado[2], Masaki Miya[2]

[1]*Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA, USA,* [2]*Natural History Museum & Institute, Chiba, Japan*

Sturgeon Phylogenetics: A Whole Mitogenomic Approach

Although historically a great deal of interest and work has been focused on sturgeon evolutionary history, many aspects of the systematic relationships of the sturgeons (Acipenseridae) and their evolution are still unclear. Sturgeons have traditionally been classified in four genera (*Acipenser, Huso, Scaphirhynchus*, and *Pseudoscaphirhynchus*), with morphological studies recovering *Huso* as basal to and separate from the other three genera. *Scaphirhynchus* and *Pseudoscaphirhynchus* have been considered sister genera. Recent studies using morphological and molecular data have suggested different arrangements of the sturgeon family tree, generally proposing a paraphyletic "*Acipenser*", with both *Huso* and *Pseudoscaphirhynchus* nested deeply within *Acipenser*.

Despite these broad trends across studies, the details of phylogenetic relationships (i.e., sister species configurations) vary from study to study, leaving much of sturgeon phylogeny unresolved. Previous studies of molecular data have been limited to the use of various partial sequences from the mitochondrial DNA, rather than the whole mitochondrial genome, to investigate the evolutionary relationships among sturgeons. There are variable levels of polyploidy found within the family, making nuclear genome data problematic for systematic analysis. Therefore, in an effort to help resolve conflicting hypotheses among previous studies, we introduce novel data derived from whole mitogenomic sequences (ca. 16,500 base pairs) of >12 sturgeon species. We present a phylogenetic hypothesis based on these sequences and discuss the implications of the proposed relationships.

0563 AES Behavior, Banquet Room E, Thursday 31 July 2014

Andrea Launer[1], Richard Starr[2], David Ebert[3]

[1]Moss Landing Marine Labs, Moss Landing, CA, USA, [2]California Sea Grant Extension Program, San Diego, CA, USA, [3]Pacific Shark Research Center, Moss Landing, CA, USA

Sex-specific Differences in Residency and Movement of Leopard Sharks (*Triakis semifasciata*) in a California Estuary

Estuaries are ecologically important interfaces of marine, freshwater, and terrestrial habitats which contain high habitat heterogeneity, making them important habitats for many resident and migrant species. Many shark species are seasonally abundant in estuaries, utilizing the habitat for reproduction and as nurseries. Habitats in estuaries are susceptible to alteration from anthropogenic and environmental effects such as global climate change, agricultural runoff, and dredging activities. These changes may have different impacts on groups within a shark population because sex-specific segregations are common for many shark species including Leopard Sharks (*Triakis semifasciata*). Movements of Leopard Sharks (n=17) were recorded using acoustic receivers (n=9) moored in Elkhorn Slough, CA, an important coastal estuary for Leopard Sharks, from March to September 2013. Residency was assessed by individual shark and compared by sex. Using proportion of detections per region of Elkhorn Slough, similarity of movement was compared using a Bray Curtis similarity plot. These data will be used to determine differential habitat use of Leopard Sharks within estuarine habitats and will help to predict how the population will be affected by future habitat changes.

0016 Herp Biogeography & Phylogeography, Banquet Room J, Sunday 3 August 2014

Adam Leache, Rebecca Harris, Max Maliska, Charles Linkem

University of Washington & Burke Museum of Natural History and Culture, Seattle, WA, USA

Comparative Species Divergence Across Eight Triplets of Spiny Lizards (*Sceloporus*) Using Genomic Sequence Data

Species divergence is typically thought to occur in the absence of gene flow, but many empirical studies are discovering that gene flow may be more pervasive during species formation. Although many examples of divergence with gene flow have been identified, few clades have been investigated in a comparative manner, and fewer have been studied using genome-wide sequence data. We contrast species divergence genetic histories across eight triplets of North American *Sceloporus* lizards using a maximum likelihood implementation of the isolation–migration (IM) model. Gene flow at the time of species divergence is modeled indirectly as variation in species divergence time across the genome or explicitly using a migration rate parameter. Likelihood ratio tests (LRTs) are used to test the null model of no gene flow at speciation against these two alternative gene flow models. We also use the Akaike information criterion to rank the models. Hundreds of loci are needed for the LRTs to have statistical power, and we use genome sequencing of reduced representation libraries to obtain DNA sequence alignments at many loci (between 340 and 3,478; mean = 1,678) for each triplet. Interrogating the genome using the triplet method expedites the comparative study of species divergence history and the estimation of genetic parameters associated with speciation.

0270 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Arianne Leary[1], Jim Gelsleichter[1], Dean Grubbs[2]

[1]*University of North Florida, Jacksonville, FL, USA,* [2]*Florida State Marine and Coastal Lab, St. Teresa, FL, USA*

Oil Related Biomarkers in *Centrophorus* and *Squalus* Species in the years following the Deepwater Horizon Oil Spill

The Deepwater Horizon Oil Spill released nearly 50 million barrels of liquid petroleum into the Gulf of Mexico. This was the largest oil spill in U.S. history. At depth of about 1,500 meters, this spill created a unique yet challenging research opportunity. It is vital to determine the effects on Gulf wildlife from oil-related pollutants, particularly the polycyclic aromatic hydrocarbons (PAHs), which are the most toxic components of oil.

Due to the rapid metabolism of these compounds, a variety of PAH biomarkers have been used to evaluate health effects from the oil spill, such as detoxification enzymes and biliary metabolites. Deep sea sharks, primarily *Squalus* and *Centrophorus* species, were collected from 2011-2013. Animals were evaluated for PAH biomarkers, specifically cytochromeP4501a1 and gultathione-S-transferase in the liver as well as PAH metabolites in the bile. Thus far the results suggests that species residing closer to Deepwater Horizon spill site show continuous exposure, whereas species that reside further away show exposure followed by recovery.

0272 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Arianne Leary[1], Jim Gelsleichter[1], Dean Grubbs[2]

[1]*University of North Florida, Jacksonville, FL, USA,* [2]*Florida State Marine and Coastal Lab, St. Teresa, USA*

The Deepwater Horizon Oil Spill Impacts on Deep Sea Gulf Fishes

The Deepwater Horizon Oil Spill (DWH) was the largest oil spill in United States' history, releasing nearly 50 million barrels of oil into the Gulf of Mexico. This incident occurred at about 1,500 meters providing a unique yet challenging research opportunity. The DWH affected an ecosystem that was not well known due to the many difficulties of deep sea research. Among many pollutants in oil, polycyclic aromatic hydrocarbons (PAHs) are of major concern due to their toxicity and carcinogenic characteristics. PAHs are quickly metabolized; therefore biomarkers of exposure are typically used to assess effects Liver enzymes that break down PAHs and biliary PAH metabolites have been frequently used to examine oil exposure. PAHs are lipophilic, hence associating with sediment, increasing exposure risks for bottom dwelling organisms. Therefore the purpose of this study was to characterize PAH biomarkers in resident, demersal teleost species such as the tilefish *Lopholatilus chamaeleonticeps*, and the hakes *Urophycis cirrata* and *Urophycis floridana*. Specifically liver enzymes and biliary PAH metabolites were examined. The trends for each species in regards to time since the occurrence of DWH as well as distance from the origin of the spill will be discussed.

0139 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Emma Lehmberg, Nathan Lovejoy

University of Toronto, Toronto, Ontario, Canada

Never the 'Twain Shall Meet: Genetic Divergence Between Highland and Lowland Populations of *Gymnotus* Electric Knifefishes

The electric knifefishes (Gymnotiformes) are widely distributed across South and Central America, with the highest species concentrations occurring in the Amazon and Orinoco basins. Riverine features such as waterfalls and rapids can cause disjunct populations to form between highland and lowland areas in these basins. Guyana and Suriname provide good models to study the genetic differences between populations precisely because they have upland and lowland areas with extant populations of Gymnotiformes. To examine genetic divergence between highlands and lowlands, mitochondrial (cytochrome b) and nuclear (S7) DNA was sequenced from for members of the *Gymnotus carapo* species complex (Gymnotidae). Population and phylogenetic analysis indicate a distinct split between upland and lowland populations, with those species in the highlands showing greater genetic similarity to populations from the Amazon basin.

0156 General Ichthyology II, Banquet Room G, Friday 1 August 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Edwin Leung, Larry Allen

California State University, Northridge, Northridge, CA, USA

The Influence of Environmental Variation on Year-Class Strength in White Seabass (*Atractoscion nobilis*) off Southern California

During warm climate events, growth rates can increase in fish, suggesting that they benefit from the increase sea surface temperatures. In Southern California, climate events such as El Niño Southern Oscillation and Pacific Decadal Oscillation can greatly influence the growth of a species. Previous studies have shown that species of fish can either thrive or dramatically decline during these shifts between warm and cool phases. Otoliths are the calcium carbonate ear stones found in fish. During the formation of an otolith, distinct bands are seen within the structure, each representing annual and seasonal variation at a point in time. White seabass (*Atractoscion nobilis*) was a prominent commercial and recreational fishery species in Southern California but had declined substantially by 1982, largely attributed to overfishing. Recent studies have shown signs that the native population is in recovery and may benefit from El Niño events through increased growth rates. The purpose of my study is to determine if year-class strength in

white seabass is influenced by climate induced changes in sea surface temperature, where year-class strength will be stronger in the years following a warm period. Otoliths collected as part of the fisheries independent assessment of white seabass were used to estimate year-class strength for the species from 1996-2001. The results from this study will determine the impact of environmental variation on year-class strength in white seabass and ultimately improve recovery and management recommendations during periods of environmental change.

0186 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Nicholas Levis, Jarrett Johnson

Western Kentucky University, Bowling Green, KY, USA

Level of UV-B Radiation Influences the Effects of Glyphosate-based Herbicide on Fitness of the Spotted Salamander (*Ambystoma maculatum*)

Numerous causes have been implicated in contributing to amphibian population declines since the 1980's, with habitat modification, ultraviolet radiation (UV-B) and environmental contaminants (such as glyphosate-based herbicide) being among the most common. This study identifies the effects of a generic glyphosate-based herbicide (GLY-4 Plus) on the spotted salamander (*Ambystoma maculatum*) under conditions that reflect open and closed canopy light regimes. Larval salamander responses to glyphosate-based herbicide varied depending on UV-B conditions. In general, it appears that an open canopy (i.e. greater UV-B exposure) may confer fitness benefits. In the presence of herbicide, survival was higher in an open canopy UV-B regime and pooled open canopy survival was higher than that of closed canopy treatments. Additionally, in the absence of herbicide, body condition and immune function were positively related with amount of UV-B. Finally, herbicide presence appeared to affect morphology under low UV-B conditions. UV-induced breakdown of surfactant or a complex interaction between temperature stratification and trophic relations is potentially responsible for the observed patterns in survival and body condition. However, the mechanistic underpinnings of improved immune function and morphological differences are less clear. Combined with the knowledge that some amphibians can become locally adapted to UV exposure and develop pesticide tolerance, the probability of surviving exposure to this herbicide may increase with the formation more open canopy ponds. These results emphasize the complexity of natural systems and the importance of including multiple factors in experiments.

0733 AES Ecology, Banquet Room E, Saturday 2 August 2014

Justin Lewis[1], William Patterson III[1], Katherine McLachlin[2], John Carlson[3]

[1]Department of Marine Sciences, University of South Alabama, Mobile, Alabama, USA, [2]Electro Scientific Industries, Bozeman, Montana, USA, [3]National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, Florida, USA

Distinguishing Blacktip Shark, *Carcharhinus limbatus*, Nursery Areas in the Northern Gulf of Mexico with Vertebral Chemical Signatures

Understanding connectivity between juvenile and adult populations is critical for the conservation of exploited and non-exploited species. The analysis of trace metals incorporated into calcified structures of bony fishes (e.g., otoliths) has emerged as a powerful tool for estimating the proportion of adults derived from specific nursery areas. For coastal elasmobranchs, it may be possible to infer natal origin based on nursery-specific biogeochemical signatures in their vertebrae. To assess the efficacy of this approach, we collected neonate and young of the year blacktip sharks, *Carcharhinus limbatus*, (n = 41) from three regions (Florida, Alabama/Mississippi, and Texas) in fall 2012 and analyzed their vertebral centra with laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). Three parallel ablation transects were assayed to construct trace metal maps and estimate nursery-specific biogeochemical signatures. Of the ten elements assayed, Ba, Ca, Cu, Mg, Mn, and Sr were consistently above detection limits. Maps of trace metal concentrations indicate Mn concentrations peaked and Sr concentrations dropped following birth. Biogeochemical signatures (element:Ca ratios) were significantly different among regions (Pillai's Trace = 1.032, $p < 0.001$), and quadratic discriminant function analysis yielded a mean regional classification accuracy of 69.3%. Texas had the lowest classification accuracy (54%); however, ablating greater vertebrae mass may increase the number of elements above detection limits, thus increasing discriminatory power. This is the focus of ongoing research, along with examining interannual variability in nursery signatures.

Craig Lind, Steven Beaupre

University of Arkansas, Fayetteville, AR, USA

The Relationship Between Stored Energy, Steroid Hormones, Movement, and Behavior During the Breeding Season in Male Timber Rattlesnakes, *Crotalus horridus*

We examined the relationship between individual energetic status, steroid hormones, and time and energy allocated toward mate search/reproductive behavior in male timber rattlesnakes, *Crotalus horridus,* in northwest Arkansas. Life history theory predicts that long-lived vertebrates will tradeoff current reproductive success in favor of increased survivorship and future fecundity. However, males have largely been ignored in studies of the mechanisms that underlie such tradeoffs. We monitored male body condition, steroid hormone concentrations, behavior, and mate search effort (estimated by breeding season minimum convex polygons) over four active seasons in order to test two hypotheses: (1) male timber rattlesnakes adjust the amount of time and energy allocated toward reproduction according to the level of individual energy stores, and (2) allocation "decisions" are mediated by steroid hormones known to regulate reproductive physiology and behavior. Our results show a strong positive relationship between body condition and plasma testosterone (T) concentrations at the onset of the breeding season in both the field and the lab (field: $F_{1,11}$=64.98, $p<0.001$; lab: $F_{1,15}$=28.38, $p<0.001$), and that male mate search effort is positively correlated with both body condition ($F_{1,16}$=34.22, $p<0.001$) and T concentrations ($F_{1,15}$=18.72, $p<0.001$). Body condition and T concentrations were negatively related to time allocated toward foraging during the breeding season (condition: $F_{1,16}$=11.78, $p=0.003$; T: $F_{1,15}$=18.72, $p<0.001$). Corticosterone was not related to any measured variable. Our results indicate testosterone may play an important role in modulating time-energy allocation according to energetic status in *C. horridus*.

0382 SSAR SEIBERT CONSERVATION AWARD, Banquet Room J, Friday 1 August 2014

Luke Linhoff

Florida International University, Miami, FL, USA

The Role of Husbandry in Amphibian Conservation: A Review and Meta-analysis

In the last decade, dozens of new *ex situ* conservation programs have been created around the world to combat widespread amphibian declines. *Ex situ* conservation methods, including captive breeding and reintroduction programs, have been cited as important tools to prevent the imminent extinction of hundreds of amphibian species. However, a lack of available amphibian husbandry information may be a major limiting factor for many conservation initiatives. I will present the first results of an extensive systematic literature review of over 50 years of published species-specific husbandry information for all 296 species of native amphibians found in the United States and Canada. My research has also resulted in the first amphibian husbandry database, which will be made available to the public. Results indicate that the majority of all reviewed species considered threatened with extinction or data deficient by the IUCN Red List do not have any published husbandry records. Possible reasons for the apparent lack of amphibian husbandry information, and the resulting conservation implications will be discussed.

0239 Herp & Ich Genomics, Banquet Room J, Sunday 3 August 2014

Charles Linkem, Adam Leaché

University of Washington, Seattle, WA, USA

Resolving Rapid Diversification Events in Scincidae Using Lizard-specific Sequence Capture Probes

Rapid diversification events deep in the Genealogy of Life represent the most challenging phylogenetic problems. Based on coalescent theory, we know that rapid diversification and large ancestral population sizes will exacerbate incomplete lineage sorting and lead to gene tree conflict. Under extreme conditions, the most probable gene tree topology will not reflect the diversification history of the species, a region of tree space known as the anomaly zone. The family Scincidae, with over 1550 species, is the largest family of lizards on Earth, and rapid diversification early in the history of the major groups of skinks make resolution of the tree a challenge. Previous studies have provided conflicting phylogenies for early skink relationships, and some have resulted

in new taxonomies. Using a new set of lizard-specific sequence capture probes, we sequenced 585 genes from across the genomes of 15 species in the family Scincidae to resolve the base of the skink phylogeny. We use coalescent-based species tree inference, which our computer simulations suggest can recover the correct tree despite the anomaly zone. Our new phylogenomic study provides (1) an empirical example of an anomaly zone problem, (2) use of new genomic resources for lizard phylogenetics, (3) and a new and robust tree for higher-level skinks.

0096 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Richard Lizotte, Scott Knight, Jason Taylor, Terry Welch

USDA-ARS, Oxford, Mississippi, USA

Factors Influencing Fish Diversity in Lake Habitats of Three Mississippi Delta Agricultural Bayous

Stream bayous are a dominant freshwater feature of the Mississippi Delta landscape that provide important fish habitat. Three agricultural bayou watersheds were electrofished within lake habitats from 2011-2013 to compare fish species populations, diversity, and richness. A total of 909 specimens representing 20 species were collected. *Dorosoma cepedianum* was the dominant species collected (by number), and combined with *Lepisosteus oculatus*, *Ictiobus bubalus*, *Pomoxis annularis*, and *Lepomis macrochirus* comprised 90%, 79%, and 83% of the specimens collected in Cow Oak, Howden, and Roundaway, respectively. Analysis of variance (ANOVA) assessments showed only *I. bubalus* and *L. macrochirus* varied across watersheds with Roundaway=Howden>Cow Oak and Roundaway>Cow Oak=Howden, respectively. ANOVA of Simpson's alpha-biodiversity index showed variation across watersheds with Roundaway=Howden>Cow Oak. Linear and multiple linear regression analyses of the five dominant species showed depth and dissolved organic carbon associated with *L. oculatus*; conductivity associated with *D. cepedianum*; conductivity, Secchi visibility, and chlorophyll *a* associated with *I. bubalus*; pH and total nitrogen associated with *P. annularis*; and Secchi visibility and total phosphorus associated with *L. macrochirus*. Regression analyses for diversity and richness showed Secchi visibility and chlorophyll *a* associated with Routledge beta-biodiversity index and conductivity associated with Margalef's species richness index. Study results indicate higher fish population sizes and diversity with decreased nutrients and algae and increased water clarity. All three watersheds have the potential to improve water quality and concomitant fish populations and diversity with implementation of agricultural conservation practices aimed at improving and protecting ecological resources.

0062 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Andrea Long[1], Lora Smith[2], Mike Conner[2], Robert McCleery[1]

[1]*University of Florida, Gainesville, FL, USA,* [2]*Joseph W. Jones Ecological Research Center, Newton, GA, USA*

The Effect of Red-imported Fire Ants on Eastern Fence Lizard Recruitment and Survival

The red-imported fire ant (*Solenopsis invicta*) is an invasive predator found throughout the southeastern United States. Few studies have assessed how fire ants influence reptile populations although many species exhibit life history traits that may increase vulnerability to fire ant predation (e.g. oviparous). We used eastern fence lizards (*Sceloporus undulatus*) as a model species to determine the influence of fire ants on reptiles. Our objective was to quantify the effects of fire ants on fence lizard recruitment and survival. We completed the study on Ichauway, the research site of the Joseph W. Jones Ecological Research Center in Newton, GA. We stocked populations of fence lizards into eight 0.2 ha enclosures either with ambient or reduced fire ant numbers. From May 2012 to November 2013, we completed monthly mark-recapture sessions (14 total). Using Program Mark, we fit Link-Barker models to estimate fence lizard recruitment (f) and survival (Φ). We found that the model with fire ant treatment affecting recruitment was approximately 3 times more likely than the model including fire ant effects on survival and 6 times more likely than the base model with no treatment effects. Recruitment was approximately 1.5 times greater in the enclosures with reduced numbers of fire ants ($f = 0.69 \pm 0.10$) than those with ambient numbers ($f = 0.44 \pm 0.08$). Survival did not differ between treatments ($\Phi = 0.91$). Our results indicate that fire ants are having a negative effect on recruitment of fence lizards via depredation of eggs or hatchlings.

0747 Fish Ecology I, Banquet Room F, Saturday 2 August 2014

Henan J. López-Corrales, César Medrano-de la Hoz, Charles W. Olaya-Nieto

Laboratorio de Investigación Biológico Pesquera-LIBP, Departamento de Ciencias Acuícolas. Universidad de Córdoba, Lorica, Cordoba, Colombia

Reproductive Ecology of Liseta *Leporinus muyscorum* in the Sinu River, Colombia

Reproductive ecology of Liseta in the Sinu River, Colombia, was studied. Individuals with total length (TL) ranged between 20.5 and 41.0 cm and total weight (TW) ranged between 97.6 and 728.0 g 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. 244 females, 72 males and 18 undifferentiated were found, with sexual proportion female: male 3.4:1, differently than expected. Length at first maturity was estimated in 29.3 cm TL for both sexes, oocites's diameter were 763 μm and average fecundity estimated was 32685 oocites. The results achieved in this study suggest that Liseta is a fish whose spawning season extends from February to November, with annual spawning in the rainy season and high fecundity.

0689 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Nathan Lovejoy[1], Kristen Brochu[2], Javier Maldonado-Ocampo[3], William Crampton[4]

[1]University of Toronto Scarborough, Toronto, ON, Canada, [2]Cornell University, Ithaca, NY, USA, [3]Pontificia Universidad Javeriana, Bogota, Colombia, [4]University of Central Florida, Orlando, FL, USA

The Biogeography of Electro-crypsis in *Gymnotus* Electric Fishes

Neotropical weakly-electric fishes produce electric signals for navigation and communication. However, these signals are susceptible to eavesdropping by electro-receptive predators. It has been hypothesized that electric signals in some species of the genus *Gymnotus* have evolved to reduce detection by electro-receptive predators (electro-crypsis). We conducted a biogeographic and phylogenetic analysis of this hypothesis, by sampling electric signals from *Gymnotus* species within and outside the ranges of most electro-receptive predators. Our results support a correlation between geographic variation in predation pressure and *Gymnotus* electric signals. Thus, biogeographic patterns of species associations appear to affect the evolution of electricity-based communication and navigation systems.

0764 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Robert Lovich[1], Chris Petersen[2], Sarah Stallings[2]

[1]U.S. Navy, San Diego, CA, USA, [2]U.S. Navy, VA, USA

Herpetofauna on Department of Navy Lands in the Continental United States

Accurate and comprehensive biotic inventories are important for effective management and conservation of natural resources. Complete lists of fauna and flora are essential to

both the management of biological diversity and the formation of natural resource policies at any particular site. The U.S. Navy and Marine Corps owns and leases several million acres within the United States. To date, no comprehensive investigation of the amphibian and reptile (herpetofauna) diversity has been conducted on Navy lands. This study analyzed data from 56 major Navy installations (including 130 distinct parcels) and 18 Marine Corps Installations in the continental United States. The data showed that there were a total of 266 confirmed species and 101 potential species on Navy lands (367 species among all of the installations analyzed). Compared to the total number of native and invasive herpetofauna species in the United States (617 species) and based on the size of the total land holdings of the Navy, species diversity is generally high on Navy installations within the continental U.S. Species types (frogs, toads, salamanders, alligators, snakes, lizards, and turtles) confirmed or potential at each installation varied among the ecoregions and generally followed that of species diversity found within the U.S. The data presented in this report can be used by natural resource managers at respective installations to identify data gaps and also by federal leadership for an overall view of herpetofauna diversity on military federal lands.

0770 Plenary Session, Banquet Rooms E-F-G, Thursday 31 July 2014

Christopher Lowe

California State University Long Beach, Long Beach, CA, USA

Is "The-Sky-is-Falling" Science Really the Only Solution for Elasmobranch Conservation?

Some scientists estimate that over 100 million elasmobranchs are killed in fisheries globally every year, and while some may argue about the validity of this number, statistics like these get the public's attention. A few decades ago these statistics would not have caused any concern since sharks were considered a threat to humans, and therefore, readily dispensable. However, it seems that we have entered an age when doom & gloom science is far more pervasive and the only way to get the public's attention is to scare them into thinking that populations and the environment are at imminent risk. While it is encouraging to see public attitudes change about sharks, will trending "the-sky-is-falling" science ensure conservation? Are all elasmobranch populations in trouble? Considering all of the legislation and regulations put in place in some locations to help restore fisheries and environmental health over the last 40 years, shouldn't some elasmobranch populations be showing signs of recovery? If some populations are recovering, why don't we ever read or hear about them more often? Some may argue that "the-sky-is-falling" science is now necessary to promote action, but without occasional signs of recovery, then why should the public continue to support conservation measures? There is little doubt that this type of science sells, but

we may need to work harder to ensure that science indicating signs of population recovery get attention as well.

0288 Herp Development, Morphology & Histology, Banquet Room H, Sunday 3 August 2014

Thomas Lozito, Rocky Tuan

University of Pittsburgh, Pittsburgh, PA, USA

Lizard Tail Regeneration, a New Model to Study Cartilage Regeneration: Role of Indian Hedgehog

Lizards capable of autotomy exhibit the amazing ability to "drop" and then regenerate their tails. However, the regenerated lizard tail (RLT) is known as an "imperfect replicate" due to several key anatomical differences compared to the original tail. Most striking of these "imperfections" concern the skeleton; rather than the vertebrae of the original tail, the skeleton of the RLT takes the form of an unsegmented cartilage tube (CT). Here we have performed the first detailed staging of skeletal development of the RLT CT, identifying two distinct mineralization events. CTs isolated from RLTs of various ages were analyzed by micro computed tomography to characterize mineralization and to correlate skeletal development with expression of endochondral ossification markers evaluated by histology and immunohistochemistry. During early tail regeneration, shortly after CT formation, the extreme proximal CT in direct contact with the most terminal vertebra of the original tail develops a growth plate-like region that undergoes endochondral ossification. Proximal CT chondrocytes enlarge, express hypertrophic markers, including Indian hedgehog (Ihh), apoptose, and are replaced by bone. During later stages of tail regeneration, the distal CT mineralizes without endochondral ossification. The perichondrium of the distal CT expresses Ihh and directly calcified without growth plate formation. Treatment with the specific Ihh inhibitor cyclopamine inhibited both proximal CT ossification and distal CT calcification. Thus, while the two mineralization events are spatially, temporally, and mechanistically very different, they both involve Ihh. Taken together, these results suggest that Ihh regulates CT mineralization during two distinct stages of lizard tail regeneration.

0536 General Ichthyology II, Banquet Room G, Friday 1 August 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

William Ludt[1], Prosanta Chakrabarty[1], Luiz Rocha[2]

[1]*Louisiana State University, Baton Rouge, LA, USA,* [2]*California Academy of Sciences, San Francisco, CA, USA*

Crossing the Tropics: Insights from Temperate-restricted *Prionurus* Surgeonfishes

The majority of reef fishes occur within warm tropical latitudes; however, a small subset is restricted to habitats in cooler subtropical and temperate waters. Many of these temperate forms have disjunct distributions on either side of warmer equatorial (or tropical) environments. How and when these taxa became restricted is not clear. These disjunctions may have formed via dispersal events during glacial periods, ancient vicariance, or competitive exclusion by younger species. Here we test these hypotheses in the surgeonfish genus *Prionurus* and use it as a proxy for understanding temperate-restricted and disjunctly distributed fishes in general. We present the results of a six-gene dataset analyzed using both maximum likelihood and Bayesian approaches and produce fossil calibrated divergence time estimations and ancestral range reconstructions. In all analyses *Prionurus* was found to be monophyletic and composed of two major clades representing the western Pacific and eastern Pacific/Atlantic species respectively. However, the systematic relationship of one species, *P. microlepidotus* (from Australia), is uncertain, and acts as a "rogue taxon" consistently grouping with one or the other of these two different clades. While the uncertainty surrounding this species does impact ancestral range reconstructions we have found that it has little bearing on the divergence dating for equatorial crossing events. Our data suggests that equatorial crossing events occurred during Pliocene and Pleistocene glacial periods, depending on the temperate sister-species pair examined, as sea surface temperatures cooled. This result increases our understanding of the mechanisms restricting temperate fishes in general.

0126 AES Morphology & Reproduction, Banquet Room E, Sunday 3 August 2014

Carl Luer[1], Cathy Walsh[1], Jennifer Wyffels[2], Laura Edsberg[2]

[1]Mote Marine Laboratory, Sarasota, FL 34236, USA, [2]Daemen College, Center for Wound Healing Research, Amherst, NY 14226, USA

Experimental Wounding of Atlantic Stingrays, *Dasyatis sabina*: Correlating Gross Physical Changes with Wound Bed Histology in the Healing Response

Anecdotal reports of relatively rapid and infection-free healing of wounds in sharks and rays are common, yet controlled experimental wounding studies to characterize the healing process are rare. In ongoing studies to identify mucus-associated antimicrobial compounds and their potential role in the infection-free healing of wounds, experimental wounds were inflicted on pectoral fins of Atlantic stingrays, *Dasyatis sabina*, by excising the epidermal and dermal layers of skin and exposing the epaxial musculature. A reproducible timetable of gross physical changes in the wound bed during the healing process has been established. Following the initial formation and breakdown of superficial clotted blood (day 0-7), the bed appears to be covered by a thin layer of connective tissue (day 10-17), with the emergence after 20-22 days of a central raised area that gradually flattens and spreads to the wound margin by day 28, with uniform healing by 6-8 weeks. Histology of biopsied wound beds reveals that the restructuring of epidermal and dermal layers occurs much earlier than expected. Wounds biopsied over the range of 2 to 28 days indicate that the day 2 wound bed is covered already with a thin epidermis containing mucus cells and a clearly identifiable basal layer. Wounds biopsied at 8, 16, and 24 hours confirm that migration of epidermal cells from the wound margin onto the bed is well underway by 24 hours. The raised area at 3 weeks is associated with epidermal and dermal restructuring events.

0521 Fish Behavior, Banquet Room F, Sunday 3 August 2014

Thomas Luhring, Michael Wagner

Michigan State University, East Lansing, MI, USA

Chemical Risk Information Guides Migratory Movements of Semelparous Sea Lamprey: Implications for Control and Conservation.

The nocturnal sea lamprey, *Petromyzon marinus*, relies heavily on olfactory cues to inform movement decisions. Cues associated with reproductive success (pheromones) and risk (alarm cues) likely mediates habitat selection at discrete decision points along their migratory route from open water into rivers (at river mouths), and into spawning habitat (at tributary confluences) located in upstream reaches. Dendritic river systems

provide several points in space where their hydrographies establish good templates for olfactory decision-making processes. While positive and negative cues are often present simultaneously in different upstream branches and overlap downstream from their sources, confluences can present decision points between cues that represent opportunity or risk. We hypothesize that risk cues can be used to manipulate the migratory decisions of sea lamprey at these decision points when there is contrasting information (e.g., navigational choice between alarm cue and a control). We investigate a set of three dendritic network decision points in the sea lamprey spawning migration by manipulating the presence of risk cues at the 1) lake-river interface, 2) river to stream branch, and 3) between stream branches. Results from this study are being adapted for management approaches for either increased control efficacy in the Laurentian Great Lakes or improving future repatriation and conservation efforts in analogous systems (Europe, Pacific Lamprey in the Western United States).

0258 Fish Systematics & Taxonomy III, Banquet Room G, Sunday 3 August 2014

Nathan K. Lujan[1,4,5], Jonathan W. Armbruster[2], Nathan R. Lovejoy[3], Hernán López-Fernández[1,4]

[1]Royal Ontario Museum, Toronto, ON, Canada, [2]Auburn University Museum, Auburn, AL, USA, [3]University of Toronto Scarborough, Scarborough, ON, Canada, [4]University of Toronto, Toronto, ON, Canada, [5]Academy of Natural Sciences, Philadelphia, PA, USA

Multilocus Molecular Phylogeny of the Suckermouth Armored Catfishes (Siluriformes: Loricariidae) with a Focus on the Subfamily Hypostominae

With over 400 valid species and at least 50 genera, Hypostominae is the most species rich, geographically widespread, and ecomorphologically diverse subfamily of the neotropical endemic suckermouth armored catfish family Loricariidae. Here, we provide the first comprehensive molecular phylogenetic analysis of the Hypostominae, using two mitochondrial and three nuclear genes to build a well-resolved and robust model of genus-level relationships. The most striking large-scale systematic result of our analysis is the finding that tribe Hypostomini is nested within tribe Ancistrini. This caused us to recognize seven additional tribe-level clades: the *Chaetostoma* Clade, the *Pseudancistrus* Clade, the *Lithoxus* Clade, the "*Pseudancistrus*" Clade, the *Acanthicus* Clade, the *Hemiancistrus* Clade, and the *Peckoltia* Clade. We also reevaluated and restricted the historically problematic genera *Baryancistrus*, *Cordylancistrus*, *Hemiancistrus*, and *Peckoltia* based on our analysis of type- and non-type species for each genus. Results of this study reshape our understanding of the biogeographical and ecomorphological diversification of the Hypostominae. Many genera and some tribes are restricted to northern South America, supporting this region as an early center of diversification with subsequent

radiations along the Andes and in the Brazilian Shield. Globally unique and strikingly convergent morphological specializations for wood-eating (e.g., unicuspid, adze-shaped teeth, highly angled tooth rows, wood diets), evolved independently at least three times in Hypostominae. The evertible cheek spine mechanism that distinguishes many members of the Hypostominae likely evolved only once, with several subsequent losses. Body size in some tribes can vary up to twelve-fold.

0679 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Lani Lyman-Henley, Jerrod Tynes

Texas A&M University-Commerce, Commerce, TX, USA

Effects of Experience on Responses to Standard Testing Procedures in Colubrid Snakes

Gordon Burghardt has been involved in developing some of the most widely used standardized testing methods for studies of snake behavior. Best known is the Tongue-Flick Attack Score (TFAS) used to measure predatory interests via responsiveness to chemical cues. Another testing regime honed in his lab targeted defensive responses in snakes. Such tests performed with naïve snakes are useful in measuring innate preferences and tendencies, allowing investigation into the effects of various types of experience upon those behaviors. One thing noted, and carefully controlled in experiments, is the effect of experience within the testing regime itself as frequently animals show signs of habituation during the span of testing, and sometimes heightened attention following a preferred stimulus. That is, what might be the effect of handling experience not directly related to the behaviors being measured? The current study investigates the effects of everyday experience and handling upon the tested behavior of several species of colubrid snakes by comparing responses to standardized testing regimes (TFAS, defense) after passage of time without differential experience regarding the test stimuli. Predatory interest in chemical prey cues was measured using a TFAS as described in Cooper & Burghardt (1990). Defensiveness was scored based on the defensive behavior testing methods of Herzog & Burghardt (1986) in which subjects are presented with a human finger as a stimulus (both non-moving and oscillating). Subject groups include corn snakes, rat snakes, and their intergrades and hybrids, as well as trinket snakes and checkered garter snakes.

0681 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Lani Lyman-Henley, Jerrod Tynes

Texas A&M University-Commerce, Commerce, TX, USA

Ontogenetic Color Change and Growth of Corn and Rat Snakes, Their Intergrades and Hybrids

The North American Rat snakes (*Scotophis* sp.) and their close relatives the corn snakes (*Pantherophis* sp.) have been subject of repeated taxonomic revisions in recent years. Despite distinct regional appearances and not always agreeable molecular data regarding phylogenetic affiliations, this group of snakes is capable of widespread interbreeding. There are naturally occurring intergrade zones between *Scotophis* species in the southeastern region of the US, and many morphs found in the pet trade are based on cross breeding between members of these species producing fertile hybrids across not only species but genera. As snakes expand ranges naturally, with climate change, or with human intervention, the likelihood of increased incidences of intergrades and hybrids in the wild seem high. It would be useful then to increase our understanding of the behavior and physiology of such animals. Our lab has produced several litters of intergrades and hybrids among the North American Rat snakes, and in 2012 - 2013 produced inter-generic hybrids between rat snakes and corn snakes. Intergrades seemed to be highly variable in appearance, leading us to record ontogenetic changes in appearance of several litters of such snakes. Starting approximately one week after hatching, young snakes were weighed, measured, and photographed at approximately 4 month intervals. Growth rates and ontogenetic color changes for the documented period will be illustrated, comparing parent species and assorted intergrade and hybrid combinations.

0019 AES Conservation & Physiology, Banquet Room E, Sunday 3 August 2014

Kady Lyons[1], Ramon Lavado[2], Daniel Schlenk[2], Christopher G Lowe[1]

[1]California State University Long Beach, Long Beach, California, USA, [2]University of California Riverside, Riverside, California, USA

Bioaccumulation of Organochlorine Contaminants and Response to Exposure in Male and Female Round Stingrays (*Urobatis halleri*) from Southern California

While contaminant concentrations have been reported for elasmobranchs around the world, none have examined bioaccumulation patterns across male and female age classes. The round stingray (*Urobatis halleri*) is a local benthic species that forages near

areas of high organochlorine contamination and represents a good elasmobranch model. PCBs, DDT, and chlordanes were measured in juvenile and adult male and female stingrays from areas in southern California and a nearby offshore island, Santa Catalina. After maturity, summed contaminant concentrations significantly increased with size for adult males and females. Male and female stingrays collected from Santa Catalina Island had significantly lower concentrations that were approximately five times less than mainland animals. Potential toxicity effects mediated through activation of the Aryl-hydrocarbon receptor were explored through ethoxyresorufin-O-deethylase (EROD) activity assays. Mainland male stingrays exhibited significantly greater EROD activities than Catalina males while female stingrays from both locations were comparable and lower than mainland males. Our results suggest that PCBs and/or other structurally-related contaminants may be inducing a biological response in mainland males but not females possibly due to a dampening effect of estradiol; however, exact physiological repercussions of exposure remain to be determined.

0407 AES Conservation & Physiology, Banquet Room E, Sunday 3 August 2014

Catherine Macdonald

University of Miami, Coral Gables, Florida, USA

Risky Business: Shark Conservation and Limits on the Potential Global Expansion of Shark Tourism

In recent years, economic valuation, which assigns dollar values to specific aspects of environmental quality and function, has become a popular and influential justification among conservationists for protecting ecosystems and wildlife, including large predatory sharks. Although there are clear benefits to communicating about the "value" of the natural world in ways that are widely comprehensible to policy makers and the public, there are potentially significant limitations to shark tourism as a driver of conservation, including associated opportunity costs. These factors are likely to be significant in economic assessments of the value of potentially dangerous wildlife, particularly large predators. An analysis of published expenses related to shark control and "bather protection" measures worldwide suggests that the economics of shark tourism may not be as straightforward (or favorable to sharks) as previously imagined, while geographical mapping of many shark tourism sites in the developed and developing world indicate that shark tourism is likely to be excluded to increasingly marginal areas as developing countries generate broader tourism bases. Accordingly, this research also assesses potential implications for policy making and elasmobranch conservation and management.

0724 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

John Maerz, Katharine Servidio, Kira McEntire, Jillian Howard, Rachel Mahan, Vanessa Kinney Terrell

University of Georgia, Athens, GA, USA

Climate and *Plethodon* Ecology at the Coweeta LTER

Forecasting species' responses to climate change is often limited by knowledge gaps of the relationships between vital rates and weather, or the evolutionary potential within populations. These gaps exist primarily because such knowledge requires long-term data. Since 2008, the Coweeta LTER has focused on developing mechanistic understanding of individual responses to weather and biotic interactions that drive population, community, and ecosystem responses to land use and climate change. In 2010, we established 6, 100 m^2 long-term, robust capture-mark-recapture plots in a *Plethodon shermani-Plethodon teyahalee* hybrid zone to measure the effects of weather and phenotype on salamander surface activity, diet, growth, survival, and dispersal. We sampled 23 primary occasions each consisting of three consecutive nights (secondary periods) spanning more than three years. We marked 1226 individuals, 694 of which were recaptured at least once. Capture probability and surface immigration varied among primary occasions, likely in response to weather, and as a function of hybrid phenotype. Foraging success was positively correlated with precipitation, but did not differ between phenotypes. Recruitment and growth appeared consistent among years, though we detected a trend in declining abundance over the latter two years following extremely warm and dry conditions in 2012. Phenotypic effects on surface activity and capture probabilities may confound inferences using phenotype ratios as indications of population responses to climate change. Nonetheless, weather constraints on surface activity may affect population growth, and phenotypic differences in activity create evolutionary potential that may influence population responses to climate change.

0748 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

John Maerz[3], Vanessa Terrell[3], Michael Lannoo[1], Nathan Engbrecht[1], Rochelle Stiles[2]

[1]Indiana University School of Medicine, Terre Haute, Indiana, USA, [2]Indiana State University, Terre Haute, Indiana, USA, [3]University of Georgia, Athens, Georgia, USA

Population Dynamics of Threatened Crawfish Frogs Informs Management Decisions

The management of species with complex life cycles requires attention to integrated management of complementary habitats, and must be informed by estimates of the importance and management potential of different life stages on population growth. *Nenirana* is a clade of North American frogs that includes several species (crawfish frogs, *Lithobates areolatus*; gopher frogs, *L. capito*; and dusky gopher frogs, *L. sevosa*) experiencing range wide population declines. We use data from a 5-year intensive drift-fence, mark-recapture study to generate estimates of larval, juvenile and adult survival, age at first breeding, and fecundity for a single crawfish frog population using multiple breeding sites. We then used those demographic estimates in a female-only, stage-based matrix model used to estimate population growth, elasticities of demographic rates, and the management potential for interventions targeted at different terrestrial and aquatic stages. Tadpole and juvenile survival had the highest elasticity values, however, only larval survival exhibited significant variation between breeding sites and among years. Our results suggest that, as with many anurans, crawfish frog population growth is dependent on survival rates in both aquatic and terrestrial habitats, but fluctuations are largely driven by periodic high larval survival to generate positive population growth. Recognizing that adult life stages are critical for sustaining populations through episodic larval failure, we advocate for a more integrative management strategy that includes a greater focus on wetland management tied to the concurrent upland management. We discuss specific ways to address wetland management for crawfish frogs and other similar amphibian species.

0048 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Peter J. Mahoney, Karen H. Beard, Andrew M. Durso, Aimee G. Tallian, A. Lexine Long, Ryan J. Kindermann, Nicole E. Nolan, Daniel Kinka, Harrison E. Mohn

Utah State University, Logan, Utah, USA

Introduction Effort, Climate Matching, and Species Traits as Predictors of Global Establishment Success in Non-native Reptiles

Worldwide, about 50% of non-native reptile introductions result in established populations. We assessed three hypotheses describing possible contributors to the successful establishment of non-native reptiles: an event-level hypothesis (e.g., propagule pressure), a location-level hypothesis (e.g., native range climate matching), and a species-level hypothesis (e.g., fecundity). We considered each hypothesis individually, and collectively, to test their relative importance. We analyzed reptile invasion data (1307 introductions of 398 species) using Bayesian generalized linear mixed models with a binary response for establishment success or failure. We combined all supported covariates from the individual hypotheses in an overall analysis. The factors that positively influenced establishment success include: 1) Event-level: longer time since initial introduction, greater number of introduction events, and intentionality of introductions; 2) Location-level: smaller differences between native and introduced ranges in latitude and potential evapotranspiration, congener presence in the introduced range, and larger native range size; 3) Species-level: smaller body size, herbivory, and parthenogenesis. We found that event-level and location-level factors were equally important in explaining reptile establishment success, and that species traits played a relatively minor role. However, the importance of species traits may be underestimated considering both the plasticity in reptile life-history traits and that most life history data were collected in native ranges. We encourage more detailed data collection oriented specifically at comparing life history parameters between native and introduced populations to determine more accurately the relative importance of species traits in non-native establishment.

0383 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Nicholas Mandrak

University of Toronto Scarborough, Toronto, Canada

Fish Communities of the Great Lakes Have Changed, but not Homogenized.

As a result of the loss of native species and the spread of non-native species, fish communities are becoming increasingly homogenous globally. The native fish species richness in the Great Lakes exhibits a latitudinal gradient that reflects postglacial history and current climate. Since the 1800s, 21 native fish species have been extirpated in one or more of the Great Lakes basins as a result of habitat alteration and destruction, overexploitation, and invasive species. Over the same time period, 35 non-native species have become established in one or more of the basins as a result of authorized and unauthorized introductions. These changes to the Great Lakes fish fauna were used to develop species lists by decade for each of the Great Lakes basins. Changes in the fish fauna over time were measured within and between basins using Jaccard's similarity coefficient. Fish communities in Erie, Huron, and Superior basins have changed the most (~20%) and in the Ontario basin the least (~12%) since 1870. The similarity of fish communities among basins has averaged 66-69% per decade; however, the fish communities have not become more similar to one another over time; hence, they have not homogenized.

0274 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Sarah Manka, Peter Zani

University of Wisconsin- Stevens Point, Stevens Point, Wisconsin, USA

Predation Risk Affects Escape Responses of Side-Blotched Lizards

Prey species will often contextually differentiate their escape behavior with respect to predator risk and location differences. Optimal escape theory predicts that lizards and other prey species should modify flight behavior based on differences in predation risk. Previous studies also demonstrated that predation risk and geographic differences have separate effects on escape behavior. This study examines how the combination of predation and geographic variation affect pre- and post-escape behavior of Side-blotched Lizards. We hypothesized that individuals will maximize their survival by differentiating flight responses. Further we predicted that flight behavior should vary based on predator type and local density of predators. At each of nine sites, we studied behavioral responses of Side-blotched Lizards to the approaches of two different types

of predators. Pre- and post-escape behavior was recorded for each trial. Although we did not detect differences in lizard behavior prior to escape, we did find that flight distance increased when a subject was approached by a snake vs. when approached by a predatory lizard. Lizards also used refuges more often when approached by a lizard. Geographic variation, in predator densities at each site explained behavioral differences such that predatory lizard densities were correlated with enhanced escape behavior. At areas with high densities of predatory lizards, side-blotched lizards selected higher perches. From these results, we conclude that side-blotched lizards differentiate between types of predators, assess predation risk, and respond to maximize survival.

0657 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Justin Mann, Henry Bart

Tulane University, New Orleans, LA, USA

Population Trends and Conservation Status of Louisiana's Rare Freshwater Fishes Using Data from Natural History Collections

Establishing conservation priorities for aquatic habitats in Louisiana has been difficult due to an overall lack of available ecological and biological information. Natural history collection computerization and networking efforts are giving researchers unprecedented access to the wealth of species occurrence data found in biodiversity research collections. The premise of this study is that data available in research collections can be effectively used to identify and protect rare and endangered species. The Louisiana Natural Heritage Program lists 28 species of fish as rare in Louisiana. We use historical catch data harvested from Fishnet 2 to determine if 20 of the 28 species are showing signs of population declines or other threats. Data used in the study were cleaned and assessed for sampling adequacy. A Mann-Kendall trend analysis was performed on mean abundances computed for fixed time blocks to assess population trends over time. The data were also subjected to multiple probabilistic models, including the Solow equation (Solow 1993), a modified version of the Solow equation (McCarthy 1997), which accounts for collection effort, and a non-parametric version (Solow and Roberts 2003) to assess extinction threats. The same battery of tests were also performed on an assortment of other fish species that are not presently on Louisiana's protected species list. Half of the listed species tested, and a surprising number of the non-listed species, exhibited evidence of significant population declines or possible extinction. The results demonstrate the value of natural history collection data for conservation threat assessment.

0169 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Ashley Marranzino, Jacqueline Webb

University of Rhode Island, Kingston, RI, USA

The Lateral Line System of Deep-Sea Fishes: Preliminary Observations on Stomiiform Fishes

A recent review of the mechanosensory lateral line system in teleosts reveals a large gap for many deep-sea fishes. Several deep-sea taxa, such as melamphaeids, macrourids, morids, and cetamimids have obvious widened cranial lateral line canals and large neuromasts, and deep sea ceratiids have reduced (no) canals accompanied by a proliferation of superficial neuromasts, all of which have been well illustrated. However, the lateral line system of the Stomiiformes is relatively unknown. There is only one published description of the lateral line system in the hatchetfish *Argyropelecus hemigymnus* (Handrick, 1901) and none for *Cyclothone* spp. to our knowledge. The current study examines the morphology of the lateral line system of representatives of two stomiiform families: hatchetfishes (*Argyropelecus*: Sternoptychidae) and bristlemouths (*Cyclothone:* Gonostomatidae). Species of *Argyropelecus* and *Cyclothone*, as well as a small number of other stomiiform fishes, were examined with one or more traditional morphological methods (e.g. clearing and staining, nerve staining, histology, microCT imaging). Preliminary observations suggest that these fishes have a reduced canal system with few (if any) canals and an unusually small number of neuromasts. Thus, it appears that deep-sea fishes demonstrate different evolutionary strategies with reference to the morphology and presumably the functional role of the lateral line system. Funded by NSF Graduate Research Fellowship to ANM.

0265 Fish Ecology I, Banquet Room F, Saturday 2 August 2014

Edie Marsh-Matthews[1], Alejandro Molina Moctezuma[2], Rosemary Knapp[1]

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Effects of Cortisol on Brood Characteristics of Western Mosquitofish, *Gambusia affinis*

Stressful conditions and direct exposure to the stress hormone cortisol have been shown to affect offspring characteristics in oviparous fishes but effects are not well-studied in livebearing fishes. Pregnant female mosquitofish were exposed to various doses of cortisol (added directly to holding water) in a series of experiments designed to examine stress effects on brood characteristics including brood reduction and offspring size. Cortisol exposure resulted in increased levels of embryo abortion and re-absorption and

decrease in offspring size. The magnitude of the effect was dose-dependent. To explore the mechanism of elevated maternal cortisol on offspring, gravid females were injected with radiolabeled cortisol and euthanized two hours post-injection. Ovaries were dissected and individual offspring were prepared for scintillation assay. Analyses of radioactivity in embryos confirmed that cortisol injected into the mother was transferred to developing embryos. These results suggest that embryo exposure to cortisol explains at least some the effects of maternal stress on brood characteristics.

0755 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Bradley T. Martin[1], Isaac M. Hemby[2], Larrimy B. Brown[2], John S. Placyk, Jr.[2]

[1]University of Arkansas, Fayetteville, AR, USA, [2]University of Texas at Tyler, Tyler, TX, USA

Molecular Phylogenetics of the Ribbonsnakes (*Thamnophis proximus* and *T. sauritus*)

The phylogenetic relationships between and within the western and eastern ribbonsnakes (*Thamnophis proximus* and *T. sauritus*, respectively) are in need of a molecular reassessment in order to better understand their evolutionary history and classification. Thus, we have examined the inter- and intraspecific relationships of these taxa using one mitochondrial (mt) and one nuclear (nuc) DNA locus. The mtDNA NADH dehydrogenase-2 (ND2) gene and the nucDNA neurotrophin-3 (NTF3) gene were sequenced for several individuals of each of the five *T. proximus* and four *T. sauritus* subspecies: *T. proximus proximus*, *T. p. diabolicus*, *T. p. rubrilineatus*, *T. p. orarius*, *T. p. rutiloris*, *T. sauritus sauritus*, *T. s. nitae*, T. *s. sackenii*, and *T. s. septentrionalis*. Maximum likelihood (ML) and Bayesian molecular phylogenies were generated and AMOVAs performed for each gene, and a haplotype network was generated for the NTF3 gene. A species delimitation test was performed using the software package Bayesian Phylogenetics and Phylogeography (BPP), which assigns Bayesian posterior probabilities (PP) to each species in a user-defined species tree. PP above 0.95 indicate that the clade is supported and that it represents a unique species. The data suggest that 1) *T. proximus* and *T. sauritus* are unique species, 2) *T. proximus* consists of just one species, and 3) *T. sauritus* consists of multiple species. These results provide knowledge on the evolutionary history of two ribbonsnake species. However, additional molecular markers need to be sequenced in order to more confidently resolve their phylogenetic relationships.

0292 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Jennifer Martin, Eric Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Ontogeny and Biogeography of the Ribbonfish Genus *Zu* (Lampridiformes: Trachipteridae): a Revision

The family Trachipteridae, the ribbonfishes or dealfishes, is a putatively monophyletic group that includes three genera (*Desmodema*, *Trachipterus* and *Zu*). The genus *Zu*, commonly known as the scalloped ribbonfishes, is circumglobal throughout temperate and tropical waters of all major ocean basins. Though juveniles are widespread and not uncommon, adult specimens of *Zu* are extremely rare in systematic collections. As such, current diagnoses of the genus are incomplete, since they are based on the more common juvenile stage, and fail to incorporate ontogenetic descriptions. Additionally, diagnoses are geographically limited, as only a few regional descriptions have been published. While working through global material for a genus-level phylogenetic analysis of the family Trachipteridae, new morphological and biogeographical observations were obtained from larval, juvenile and adult stages of *Zu*. We present a revision of the ontogeny and biogeography of *Zu* and provide an updated differential diagnosis for the genus.

0550 Fish Behavior, Banquet Room F, Sunday 3 August 2014

Karen Martin

Pepperdine University, Malibu, CA, USA

A Leap of Faith: Beach Spawning in Fishes has Multiple Independent Origins

Beach spawning behavior is relatively unusual for teleost fishes, as they are fundamentally aquatic organisms. Of the nearly 500 families of fishes, only 21 are known to include species with beach spawning behavior. Fishes that spawn at the water's edge may leave their eggs high and dry for intervals during tidal or evaporative emergence. This confers advantages of high oxygen and warm temperatures but imposes risk of desiccation to the developing embryos. Beach spawning fishes occur worldwide, from North and South America to Australia, New Zealand, Japan, China, Iceland, the Mediterranean Sea, and Egypt. Beach spawning fishes reproduce with large demersal eggs that require incubation periods of days or weeks. Spawning behaviors vary between close relatives across clades that include beach spawning species. Closely related species may spawn in subtidal waters, estuaries, or tidepools, or make

anadromous migrations. Some show parental care; others do not. Even within one species, different individuals may spawn in different habitats. Fishes that spawn on beaches show relatively plastic behavior during reproduction and tolerate, at least temporarily, rapid changes in the environment. Between and within many different lineages of teleost fishes, beach spawning behavior appears to have had multiple independent origins. Phylogenetic comparisons may reveal clues to the evolution of this remarkable leap of faith.

0434 Fish Systematics & Taxonomy III, Banquet Room G, Sunday 3 August 2014

Richard L. Mayden[1], Brooks M. Burr[2], Lourdes Lozano-Vilano[3]

[1]Saint Louis University, St Louis, Missouri, USA, [2]Southern Illinois University Carbondale, Carbondale, Illinois, USA, [3]Universidad Autónoma de Nuevo León, Nuevo León, Mexico

A New Species of *Cycleptus* (Cypriniformes: Catostomidae) from the Rio Grande Drainage

Species of *Cycleptus* inhabit large rivers across eastern and southern United States and northern Mexico. For over 175 years *Cycleptus* was considered monotypic as the Blue Sucker, *Cycleptus elongatus*. Between 1991 and 2006 considerable data obtained from morphology, allozymes and DNA sequence variation identified variation in this species. In 1999, *Cycleptus meridionalis*, Southeastern Blue Sucker, was described as endemic to southeastern Gulf Slope. Data from the above allozyme and morphological investigations also provided information as to a high likelihood of additional diversity across the range of remaining populations then identified as *C. elongatus*. Subsequent examination of additional morphological data and mtDNA sequences across *C. elongatus* provided significant information on variation in this single species. An independent molecular study by Bessert (2006) with analysis of control region (920 bp; 115 specimens) and cytochrome b (1140; subset of 48) provided additional corroboration of lineage delineation and divergences. The combined findings provided further clarification and corroboration as to geographic structuring within *C. elongatus*. Any/all of the datasets strongly support individuals/populations from the Rio Grande as a distinct lineage and a new species currently masquerading under the name *C. elongatus*.

0305 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Ross Maynard, Matthew Kwiatkowski

Department of Biology, Stephen F. Austin State University, Nacogdoches, TX, USA

Edge Effects on Herpetofauna in a Lowland Amazonian Rainforest

Seemingly small anthropogenic disturbances in pristine habitat may have negative impacts on herpetofauna through habitat fragmentation and edge effects. We investigated the effect of a primitive dirt road on the abundance and richness of herpetofauna in a lowland Amazonian rainforest outside the community of San Jose de Payamino, Ecuador. After establishing 18 transects perpendicular to the road, we surveyed amphibian and reptile species in three 20 m diameter plots placed along each transect that varied in distance from the road, including an edge plot (beginning at the forest edge), an intermediate plot (50 m from road), and an interior plot (100 m from road). For each plot, two 30-minute visual encounter surveys were conducted. Eight habitat variables were quantified at each plot. Additionally, 10 drift fences with a central pitfall and terminal funnel traps were set up at both the edge and interior distances. Using permutation tests with 10,000 iterations of data shuffling, we compared habitat variables and herpetofauna abundance and richness for all pairwise comparisons of the three distances from the road. There were no differences in habitat variables between the intermediate and interior plots whereas many habitat variables were significantly different for the edge-intermediate and edge-interior comparisons. This suggests the edge effect of the road attenuated by the intermediate plot. However, the edge effect appeared to have an impact on herpetofauna beyond the intermediate plot; herpetofauna abundance and richness was significantly higher in the interior plots, but there were no significant differences between the edge and intermediate plots.

0339 Genetics, Development, & Morphology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Evan McCartney-Melstad, H. Bradley Shaffer

University of California, Los Angeles, Los Angeles, CA, USA

Exon Capture Optimization for a Large-Genome Amphibian

Many amphibians present challenges for high-throughput sequencing because of their large genomes. One attractive approach is the sequencing of target regions that have been enriched using complementary probes. Few genomic resources exist for large-genome amphibians to construct these complementary probes, but several species now

have published transcriptomes. I present results from an experiment that attempts to optimize target region design and laboratory protocols for targeted exon sequencing in the California Tiger Salamander (*Ambystoma californiense*). I developed a probeset targeting 2.5mb using the transcriptome of a closely related salamander and a new approach to minimize the chances that targets will span intron/exon boundaries. Additionally, I employed multiple methods to attempt to block repetitive sequences from being captured during the enrichment process, and tested several different probe concentrations. I will discuss which strategies work best for generating reliable and cost-effective target capture data in large-genome salamanders.

0344 Snake Ecology, Banquet Room E, Saturday 2 August 2014

Ryan McCleary, Hun Kiat Tan, David Bickford

National University of Singapore, Singapore, Singapore

Temporal Comparisons of the Homalopsid Snake Assemblage at Pasir Ris Park Mangrove, Singapore

Homalopsid snakes are found from Southeast Asia to northern Australia and can be important predators and prey in aquatic systems. The mangrove of Pasir Ris Park (PRP), Singapore contains an assemblage of homalopsid snake species, including *Cantoria violacea*, *Cerberus schneiderii*, *Fordonia leucobalia*, and *Gerarda prevostiana*. This assemblage was examined in 2001 and we were interested in any changes that might have occurred since that time whether due to anthropogenic factors or active management. We conducted nighttime visual surveys over a 400 m transect, collecting every homalopsid snake encountered. Each animal was processed by noting location (GPS), mass, SVL, total length, sex, and other measurements. We also marked each animal by ventral scale clipping to estimate population sizes. Over the course of the study, we collected 381 unique individual snakes, the majority of which were *C. schneiderii* (n = 315) and 54.9% of *C. schneiderii* were recaptured at least once. When compared to the 2001 study, the current study found a similar assemblage in terms of species, but with a lower diversity. The estimated population size of *C. schneiderii* in the ~0.92 ha mangrove area studied is 369, but too few other snakes were found and/or recaptured to make useful estimates. Relative abundance has decreased over time, biomass has not changed, and average *C. schneiderii* SVL and mass have increased. These data indicate that PRP mangrove continues to be an important habitat for homalopsid snakes.

0378 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Eric McCluskey, Thomas Hetherington

Ohio State University, Columbus, OH, USA

Historical Analysis of Eastern Massasauga Rattlesnake Habitat in Northeastern Ohio

Historical processes play an important role in the spatial patterns of biodiversity we observe today. Of particular interest to conservation biologists and ecologists are the roles of prior land use and land cover change in influencing the present day distribution of rare species and ecosystems. We conducted an analysis of historical aerial photographs (covering ~75 years) to quantify anthropogenic land use and successional transitions in land cover to gain a better understanding of how these processes have influenced the present day distribution of a threatened species, the eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*) in northeast Ohio. We observed a decrease in open areas (crop land, pasture, and grassland) and an increase in tree cover. Reduced agricultural activity would seemingly benefit massasauga because there would be less habitat conversion. The increase in tree cover, however, likely has crowded out massasauga grassland habitat. Many current massasauga sites are located in areas that were previously utilized for agriculture 50-75 years ago. In the absence of natural disturbance agents, agricultural fields that were allowed to go fallow represent an important source of early successional habitat vital to massasauga in this part of their range. However, the natural successional conversion of these areas to forest appears to have constricted and further isolated massasauga populations. We are further investigating the relationship between prior agricultural use and presence of massasauga habitat by comparing the extent of suitable habitat predicted by species distribution models to our historical imagery.

0621 Conservation, Banquet Room F, Friday 1 August; ASIH STOYE AWARD CONSERVATION

Eric McCluskey, Thomas Hetherington

Ohio State University, Columbus, OH, USA

Species Distribution Modeling for the Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*) in Northeastern Ohio

The eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*) is a rare species across its range and is thought to be experiencing widespread population declines. Application

of conservation oriented management practices to this species is hindered by incomplete knowledge of the spatial distribution of populations and suitable habitat. To ameliorate this obstacle to conservation efforts we constructed species distribution models for the massasauga in northeastern Ohio. Our models were generated using the software program Maxent incorporating a mix of geographic information systems (GIS) and remote sensing derived data layers. Modeling efforts are complicated by the limited number of known massasauga sites in northeastern Ohio as both spatial autocorrelation and overfitting can inflate model performance and potentially underpredict the extent of suitable habitat. To address these concerns we compared two approaches, one using only occurrence data from northeastern Ohio and the other incorporating data from other Ohio populations. We identified multiple patches of predicted suitable habitat within the expected distribution for massasauga in northeastern Ohio. Regional modeling for conservation purposes may require a modified approach from traditional niche modeling methods where transferability across a species range is often a desired outcome.

0332 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Hannah McCurdy-Adams[1], Jeff Hathaway[2], Jacqueline Litzgus[1]

[1]Laurentian University, Sudbury, Canada, [2]Scales Nature Park, Orillia, Canada

Anthropogenic Influences on Chronic Stress and Patterns of Nest Predation in Freshwater Turtles

Turtles and their populations face many threats, both indirect and direct. Indirect threats affect physiology by re-directing resources from production to maintenance, while direct threats cause mortality. The objective of our study is to investigate the indirect and direct impacts of human development on turtles by examining chronic stress levels and nest predation patterns in areas that differ in human influence. Animals near human-altered landscapes exhibit high levels of stress hormones that have been associated with decreased fitness. A new non-invasive technique for measuring stress hormone levels has been developed using enzyme immunoassays on human nail samples and a pilot study using similar assays on turtle claws showed that stress hormones can be accurately measured from claws. We hypothesize that if human presence increases the long-term stress levels of turtles, then turtles at field sites closer to anthropogenic structures will display higher levels of corticosterone in their claws than turtles from more pristine field sites. A number of studies have found that the highest predation risk to turtle nests is within the first week after the eggs are laid, however, other studies have found that predation occurs throughout the incubation period. Predator abundance is higher where anthropogenic sources of food subsidize mesopredators populations. We

hypothesize that if human presence increases predator abundance, then the frequency of predation events on turtle nests will be greater at field sites closer to anthropogenic structures than at more pristine field sites. Understanding these effects will aid in the recovery and conservation of turtle populations.

0422 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Lisa A. McDonald[1], Caroline J. France[1], Sharon E. Hopper[1], Kerry A. Hansknecht[2]

[1]Greenville Technical College, Greenville, SC, USA, [2]Lander University, Greenwood, SC, USA

Characteristics of Voluntary Dives by Captive Saltmarsh Watersnakes

To add to the limited data on dive duration in natricine snakes, we observed 24 Mangrove Saltmarsh Watersnakes (*Nerodia clarkii compressicauda*) foraging for guppies (*Poecilia reticulata*) in an indoor arena. Thirty-two feeding trials of 12 minutes each were analyzed, and the duration of each dive was recorded (58% of the snakes dove at least once during trials). Dive duration ranged from less than 1 s to longer than 9 minutes. Dives that were conducted merely to execute a strike at prey averaged 0.6 s (n=13). Longer dives that were a continuation of a strike-initiated dive averaged 20 s (n=9). Dives initiated while searching for prey, not following a strike for prey, averaged in excess of 200 s (n=7). Considerable variation in dive tendencies among individuals existed, with many snakes diving briefly and only when striking at prey, several executing dives of 10 - 90 s, and some remaining submerged for several minutes. These findings agree well with those involving natricine snakes in the wild.

0773 Herp Ecology & Phylogeography, Banquet Room E, Sunday 3 August 2014

Matt McElroy

University of Washington, Seattle, WA, USA

Phylogeographic Structure and Reduced Gene Flow Reveal the Potential for Local Thermal Adaptation in the Puerto Rican Crested Anole (*Anolis cristatellus*).

New phylogeographic approaches and next-generation sequencing offer the exciting potential to better understand the demographic histories that shape adaptive divergence. When gene flow homogenizes the genomes of diverging populations, lineage divergence and local adaptation is still possible if selection prevents some alleles

from passing between populations. My research aims to illuminate the link between natural selection, lineage divergence, and local thermal adaptation. I combine physiological field studies with genome-wide SNP data (RADseq) to investigate divergent selection and gene flow in geographically structured lineages of *Anolis cristatellus* in Puerto Rico. I find that phylogeographic structure correlates with a climatic gradient in SW Puerto Rico, and that there is reduced gene flow between xeric and mesic populations, indicating that divergent selection on thermal traits may be responsible for local adaptation and lineage divergence in *A. cristatellus*.

0133 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Kira McEntire[1], Martin Gonzalez[2]

[1]*University of Georgia, Athens, GA, USA,* [2]*Southwestern University, Georgetown, TX, USA*

Cutaneous Microbial Diversity of *Eurycea naufragia* at Two Sites

Several studies have documented impressive cutaneous bacterial diversity on amphibians. Studies on salamanders with parental care suggest some of the microbial diversity exists as a symbiotic relationship: anti-fungal bacteria on parent's skin protect eggs from fungal infection while the bacteria feed on salamander's skin secretions. The microbial diversity of many species has not yet been documented, especially for permanently aquatic salamanders. We started to document the microbial diversity of two populations of *Eurycea naufragia,* a spring- and cave-dwelling species. We streaked dorsal swabs of salamanders and plated water samples from both populations on tryptic soy agar (TSA) plates. The plates were cultured at room temperature for 48 hrs, and then unique colonies were streaked for isolation. We observed 19 distinct bacterial colonies from the skin of 6 salamanders at Swinbank Spring and 7 unique colonies from water samples. At Twin Springs, we observed 12 distinct colonies from the skin of 4 salamanders and 12 different colonies from water samples. Some bacterial colonies appeared similar between populations, but overall the sites seemed to have unique microfloral communities. More information is needed to determine how different these populations are, the potential reasons for observed differences, and the possibly ecological implications of these differences. Some future studies that may aid in answering these questions include taking additional samples from salamanders and sediment at each population; identifying the bacteria and fungi to species using standard sequencing methods, and investigating the potential anti-fungal properties of these bacteria (as parental care is unknown for this species).

0776 SSAR Infrared Imaging Symposium, Banquet Room J, Sunday 3 August 2014

William T. McLamb, Michael S. Grace

Florida Institute of Technology, Melbourne, FL, USA

TRPA1 Ion Channels Mediate Thermal Targeting Behavior in Pit Vipers

The cellular and neural mechanisms underlying snake infrared imaging systems provide important insight into the evolution and function of thermoreceptors in snakes and other animals (including people). For the snakes, though, infrared imaging is an important component of decision-making that underlies behavior. Thus, analyses of the behavioral correlates of infrared imaging provide insight into snake (and other animal) behavior in general, and with appropriately-designed experiments, behavioral analyses also provide an important means to investigate the mechanisms of infrared imaging. The molecular mechanisms of infrared thermosensation are not completely understood, but thermosensitive proteins of the transient receptor potential (TRP) ion channel family are believed to play a prominent role. In this study, a combination of *in vitro* and *in vivo* methods were used to test the hypothesis that the thermosensitive ion channel TRPA1 is the mediator of infrared thermosensation in the crotaline snake, *Agkistrodon contortrix*. Immunofluorescence microscopy provided the first demonstration of TRPA1 channel expression in nerve terminals of the pit membrane. In addition, established behavioral paradigms for snake thermal targeting were used in conjunction with selective pharmacological inhibition of TRP channels to temporarily attenuate thermal targeting behavior. Together, these results provide the first direct evidence for the presence and function of TRP channels as a molecular thermosensor in the snake pit organ.

0079 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Caleb McMahan[1], Lauren Cooper[1], Wilfredo Matamoros[3], Kyle Piller[2], Prosanta Chakrabarty[1]

[1]LSU Museum of Natural Science, Baton Rouge, LA, USA, [2]Southeastern Louisiana University, Hammond, LA, USA, [3]Universidad Nacional Autonoma de Mexico, Mexico City, Mexico

Systematics of the Genus *Poeciliopsis* (Cyprinodontiformes: Poeciliidae)

The genus *Poeciliopsis* includes 24 currently recognized species distributed primarily in Mexico and Central America, with two species extending to the United States and Colombia. Past morphological and molecular work has identified two main clades within the genus. The purpose of this study is to utilize mitochondrial and nuclear

markers to re-assess the monophyly of the genus by emphasizing the inclusion of more potential sister taxa and closely related lineages than sampled in the past. In addition, we aim to increase species-level geographic coverage, to have a better understanding of geographic variation within some of the more widespread species of *Poeciliopsis*. We will also discuss observations on species-level geographic variation regarding morphology and distributions, and investigate the morphological characters diagnosing the two major clades of *Poeciliopsis*. Finally, all of this will be examined in the context of a larger more taxonomically-inclusive phylogeny of the subfamily Poeciliinae.

0638 General Ichthyology, Banquet Room G, Sunday 3 August 2014

Mark Meade, Lindsay White, Megan Meade

Jacksonville State University, Jacksonville, AL, USA

Occurrence of Asiatic Weatherfish, *Misgurnus anguillicaudatus*, in Northeast Alabama

The Asiatic weatherfish, *Misgurnus anguillicaudatus* (Cantor, 1842), is a potentially invasive species that has been reported in US watersheds since the 1960s. Weatherfish are considered a hardy species and have been observed to survive in conditions of low oxygen, drought, and starvation. Weatherfish were first reported in Alabama in 2009 at Poorhouse branch near Goray Spring (Talladega AL). Poorhouse branch, a relatively small stream, is a tributary of the Coosa River and is located near Choccolocco creek, one of the more biodiverse subwatersheds of the Coosa River. We reported another population of weatherfish in 2012 at Blue Eye spring near Blue Eye creek (Lincoln AL), another small Coosa River tributary. Goray and Blue Eye springs are located only a few miles from one another. In the winter of 2013, we began extensive surveys for weatherfish searching mainly in and around the Lincoln/Talladega AL areas, focusing primarily on springs and lower Choccolocco creek. Springs surveyed included Kelly, Flynn, Plumb, Everett's, and Dills. Although several of these springs are linked via Blue Eye creek, no weatherfish were observed. In several small, unnamed tributaries of Choccolocco creek and in the lower sections of Choccolocco creek near its confluence with the Coosa River, weatherfish were observed. Weatherfish were not observed in and around Jackson Shoal, a pristine area of lower Choccolocco creek. Overall, the species appears to be rapidly spreading from the Coosa River to any nearby tributary. The extent of the species range in Alabama may still not be clear.

0284 Reptile Genetics & Evolution, Banquet Room J, Saturday 2 August 2014

Maria Fernanda Medina[1], Eli Greenbaum[1], Aaron Bauer[2], William Branch[3]

[1]The University of Texas at El Paso, El Paso, TX, USA, [2]Villanova University, Villanova, PA, USA, [3]Bayworld, Port Elizabeth, South Africa

Systematics of African Skinks in the *Panaspis wahlbergi* Complex

Snake-eyed skinks are relatively small lizards of the genus *Panaspis* that are mostly endemic to the savannahs of sub-Saharan Africa. Because several recent studies of widely distributed reptile species in Africa have resulted in species complexes, we assessed the widespread species *Panaspis wahlbergi*, which has never been thoroughly examined with molecular data. Mitochondrial (16S and cyt *b)* and nuclear genes (PDC and RAG1) were amplified and analyzed with maximum parsimony, maximum likelihood, and Bayesian inference optimality criteria. Two species of *Trachylepis* (Scincidae) and *Cordylus marunguensis* were used as outgroups. We recovered 15 well-supported clades of *Panaspis*, of which only two are referable to previously described species. Because several *Panaspis* species are only known from a single type specimen and molecular data is lacking, our unidentified clades might correspond to poorly known species or their corresponding synonyms. A thorough investigation is also needed to determine the status of *Afroablepharus*, formerly a subgenus of *Panaspis*, and recently elevated to full genus rank. The substantial number of cryptic clades might not support the separation of the two closely related genera, as it was based solely on morphological differences between these well-conserved species. The results of this study will prompt further taxonomic revisions on the genus and the description of potential new taxa.

0759 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Emily Meese, Christopher Lowe

California State University Long Beach, Long Beach, CA, USA

Spatial Distribution, Habitat Selection, and Effects of Temperature on Benthic Elasmobranch Species at Big Fisherman's Cove, Santa Catalina Island, CA

Animals should behave in ways that enable them to maximize fitness; this includes seeking out environmental conditions that enable them to optimize their physiological processes. Distribution of three benthic elasmobranch species found in Big Fisherman's Cove, Santa Catalina Island (*Myliobatis californica, Rhinobatos productus,* and *Urobatis halleri*) was used to determine habitat selection of resting individuals. Distribution patterns of individuals were based on field survey observations and related to detailed

georeferenced habitat maps. While the distribution areas of all three species only showed a 7% overlap; *M. californica*, the largest of the three species had a larger area use compared to the other two species. All species were found primarily associated with sand and vegetated sand substrata ($p<0.001$). Although seafloor temperatures were stratified by distance to the shoreline (range: 17- 20ºC) over the course of a 1-month period, there was a significant peak in distribution in water temperatures around 18ºC ($p<0.001$). While other abiotic and biotic variables may influence the active distribution of these benthic elasmobranchs, these results suggest that water temperature and substratum type are likely strong environmental indicators for the preferred resting habitats of these species.

0591 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Rita Mehta, Benjamin Higgins

University of California, Santa Cruz, CA, USA

Feeding Performance of the California Moray, *Gymnothorax mordax*

Moray eels (Anguilliformes: Muraenidae) comprise a large radiation of snake-like predatory fish that often occupy crevices of coral reefs. Members of this major radiation of teleost fishes, have a reduced capacity to use suction during prey capture, and apprehend their prey by biting. Once prey is in the oral jaws, rather than use hydraulic transport, morays use their pharyngeal jaws to swallow their prey. The pharyngeal jaws of moray eels are considered a functional innovation and exhibit the greatest mobility of any teleost fish documented to date. Morays have modified the general teleost feeding condition via the reduction of several important character suites associated with suction production which may have, in turn, increased functional diversity of the pharyngeal jaw apparatus. It is hypothesized that the pharyngeal jaws facilitated the ability of morays to consume large prey while hunting within the confined spaces of coral reefs. However, there is little diet data informing us of how large of prey morays can consume. We supplemented field dietary data collected on the California moray (*Gymnothorax mordax*) with feeding performance trials in a controlled laboratory environment. We find that while morays can approach ingestion ratios of mammal-consuming snakes, the material properties of the prey strongly affect the maximum size of prey morays can consume.

0164 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Jesse Meik

Tarleton State University, Stephenville, TX, USA

Climate Data Should Not be Used to Infer Ecological Divergence in Species Delimitation.

In animals, a widely accepted approach for integrating multiple datasets for species delimitation involves comparisons of phenotype, DNA, and ecological niches. Although ecological traits may be important in speciation, climate data are often used as a surrogate representing underlying physiological adaptations. I argue that this practice is epistemically unwarranted because the processes that generate variation in climate (physiographical and meteorological) are unrelated to the processes that generate variation in genotype and phenotype (evolutionary divergence). I demonstrate how this issue is relevant to delimitation by applying a test of biogeographic logic to climate data, using the speckled rattlesnake (*Crotalus mitchellii*) species complex as an empirical example.

0279 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Pietro Mello[1], Ricardo Machado[2], Cristiano Nogueira[3]

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Extinction Risk and Conservation of Endemic Squamates in the Cerrado Savanna, a Highly Threatened Biodiversity Hotspot

Endemic Squamates of the Brazilian Cerrado are noteworthy in the current worldwide scenario of biodiversity crisis. The Cerrado is a global hotspot for conservation, severely affected by constant and high rates of deforestation. Its rich and highly endemic (105 species) Squamate fauna is dominated by species tightly associated with specific habitats and microhabitats. However, we know little about threat categories and future impacts of habitat loss for the group. In this study, we assessed each group's species extinction risk using inferred population declines based on future scenarios of habitat area losses on two opposing governmental action scenarios. To define species potential distributions we used Maxent, and a watershed-based approach, and considered both time and habitat type variations among species. To help guiding conservation efforts, we mapped three types of spatial priorities: crisis (rich areas expected to be lost within ten years), refugia (rich areas not expected to be lost within 10 years) and highly irreplaceable areas. We compared these areas with Cerrado's current protected area

distribution. We observed a raise in the number of threatened species from three to at least 78. Crisis and refugia areas are in the south-central region, while irreplaceable areas are scattered through the Cerrado. Protection of herein signaled priority conservation areas is poor, and Cerrado protected areas are often coincident with rocky outcrops, regions unsuitable for agriculture. Therefore, important regions for endemic Squamates richness are not safe, and in order to avoid imminent and widespread extinctions we must strongly reduce the region's pace of deforestation.

0561 NIA, Banquet Room F, Sunday 3 August 2014

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The Rectangle of Fish Biodiversity in Central Brazil: Insights from the Genus *Characidium* (Crenuchidae: Characiformes)

The Distrito Federal, a rectangular area of 5,802 km^2, is the smallest federative unit of Brazil. It is located on the highlands of the crystalline shield of the Brazilian Central Plateau, at highs of 600 to 1,341 meters, and includes the drainage divide for the three major South-American basins: Rio Maranhão (Tocantins/Amazonas Basin - northern/northwestern border); Rio Preto (Rio São Francisco Basin - eastern/northeastern border); Rio Descoberto, Rio Alagado, Rio São Bartolomeu and Rio São Marcos (tributaries of the upper rio Corumbá, Rio Paraná Basin - central, southern and western portions). Two basin connections occur between the Rio São Bartolomeu and Rio Maranhão (Águas Emendadas) and between Rio São Marcos and Rio Preto (Arrependido). A variety of habitats are available, from small streams to medium size rivers, waterfalls, wetlands, temporary ponds, lakes and reservoirs. The total richness exceeds 220 species, many of which await formal description. 973 lots of *Characidium* were obtained from 349 stations and deposited at the IBGE/Brasília Fish Collection. The genus *Characidium* is one of the most diversified, with 16 species recognized. Within the area of study, *Characidium* cf. *zebra* is widespread in the three Basins; *C. xanthopterum* and *Characidium* sp. E occurs in the Paraná and Maranhão Basins, and *C. bahiense*, in the São Francisco and Maranhão Basins; *C. gomesi*, *Characidium* spp. A, B, C, F and W are restricted to the Paraná Basin; *C. fasciatum*, *C. lagosantense* and *Characidium* sp. D, to the São Francisco; and *Characidium* spp. 1, 2, 3, to the Maranhão Basin.

0041 Herp Development, Morphology & Histology, Banquet Room H, Sunday 3 August 2014

Joseph R. Mendelson III[1], Hamidreza Marvi[2], Chaohui Gong[3], Matt Tesch[3], Nick Gravish[2], Ross L Hatton[4], Howie Choset[3], Henry Astley[2], David L. Hu[2], Daniel I. Goldman[2]

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Sidewinder Rattlesnakes Inform Design of Robotic Devices: the Beauty of Multidisciplinary Research Teams.

Limbless organisms like snakes navigate most terrain, but their robotic counterparts do not yet possess this versatility. In particular, desert-dwelling sidewinding rattlesnakes operate effectively on granular materials like sand; these substrates often stymie limbless robots. By discovering locomotor principles used by sidewinders and measuring yield forces in inclined granular media, we enable a field-tested limbless robot to ascend sandy slopes even near the angle of maximum slope stability. As incline angle increases, the snake increases the length of body in contact with the sand to remain below the decreasing granular yield stress. Instantiating this control strategy in the robot minimizes slip, and generates performance comparable to the animal. We envision that simultaneous study of biological and robotic locomotors coupled with investigations of the physics of complex materials will enable all-terrain mobile robots.

0691 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Natália Mendes[1], Fernando Mendonça[2], Vanessa Cruz[1], Yuldi Ashikaga[1], Paulino Portela[3], Sâmia Camargo[2], George Burgess[4], Rui Coelho[5], Miguel Santos[6], Claudio Oliveira[1], Fausto Foresti[1]

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Development of Microsatellite Loci for the Sharks *Galeocerdo cuvier* and *Carcharhinus acronotus* Using Second Generation Sequencing

In the last three decades several shark species have suffered drastic population declines. Among these the tiger-shark (*Galeocerdo cuvier*) and the blacknose-shark (*Carcharhinus acronotus*), are species heavily affected by fishing and classified on the IUCN Red List as "Near Threatened". However, reviews that enable sustainability and management remain inconsistent. In this respect, the present study aimed the development of microsatellite markers using Next Generation Sequence for *G. cuvier* and *C. acronotus* species. Thus, 70.000 sequences of *G. cuvier* and 54.000 of *C. acronotus* were analyzed. After the characterization of microsatellites regions and development of primers for loci amplification, redundancy analyses were performed to avoid non-specificity of these loci. Until this moment 30 primers for each species were synthesized. Amplification of microsatellite fragments has been tested and standardized to 20 primers for each species and these will be validated in population analyzes. This study will continue with the genotyping of microsatellite fragments for identification of polymorphic loci. The development of such markers will contribute to a better understanding of the populations of these species, enabling greater efficiency in the development of conservation plans on global scale.

0441 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Savannah Michaelsen, Kyle R. Piller

Southeastern Louisiana University, Hammond, LA, USA

Spatio-temporal Variation in Genetic Structure of Red Drum *Sciaenops ocellatus* in the Northern Gulf of Mexico

Understanding population structure is important and necessary to effectively manage fisheries. Although relatively little is known about the population structure of stocks of many important marine species, especially in the Gulf of Mexico, molecular techniques allow for a more comprehensive assessment. The red drum (Sciaenidae: *Sciaenops ocellatus*) is a marine-estuarine fish that is of great recreational importance not only in Louisiana's waters but across the northern Gulf of Mexico. This study incorporated multiple microsatellite loci to examine spatio-temporal aspects of stock structure for red drum populations across the major estuaries along the Louisiana coast. Red drum have a bi-phasic life-cycle that includes both inshore and offshore stages. We gathered data from more than 300 individuals from inshore areas along the northern Gulf Coast to determine genetic structure of red drum from 2014. Using multiple population genetic analyses, we examined spatial differentiation of these populations and recovered a genetic split associated with the outflow of the Mississippi River. Little variation was recovered among populations west of the Mississippi River, suggesting ongoing gene flow among these western populations. Next, we took a temporal approach to investigate the impacts of the 2010 Deepwater Horizon Oil Spill on the population structure of inshore populations (pre- vs. post oil spill). The results indicate an impact on the genetic structure of red drum populations in the oiled areas in the eastern portion of the range in Louisiana. The implications of this will be presented in a comprehensive summary.

0598 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR PHYSIOLOGY & MORPHOLOGY

Madeline Michels-Boyce, Peter Zani

University of Wisconsin-Stevens Point, Stevens Point, Wisconsin, USA

Does Winter Temperature Tolerance of Side-Blotched Lizards Increase with Latitude?

As organisms move into higher latitudes, they may evolve mechanisms to survive in the harsher climates. The capacity of ectotherms to survive at sub-zero temperatures

without freezing is called supercooling. While insects are known to evolve lower freezing points (i.e., show greater supercooling) at higher latitudes to survive harsher winters, this has not been shown in vertebrates. We measured supercooling points in 12 populations of lizards hatched and raised in common conditions to test if vertebrates have also evolved lower freezing points. Although lizards regularly supercooled beyond -10°C, our results indicate that latitude alone does not explain supercooling capacity. Thus, it appears that populations have not evolved toward greater cold tolerance. One possible reason lizards have not evolved lower supercooling points is that they can find places to avoid extreme cold temperatures during winter.

0592 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Alejandra Mickle[1], R. Dean Grubbs[2], Jeffrey P. Chanton[1]

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Trophic Structure, Feeding Ecology and Bioaccumulation of Mercury (Hg) on Deep Sea Hagfish: An Elemental Analysis Approach

Hagfishes are common in deep waters of the Gulf of Mexico (GOM). Two out of the three species found in the GOM are endemic and yet very little is known about their life histories. To date, there is no hagfish fishery in the area, but a fishery may develop soon, as Pacific and Atlantic stocks are rapidly declining due to increased harvesting of hagfish for commercial goods. To better understand hagfish life histories, it is important to obtain data on the ecology and toxicology of the GOM populations before they are subjected to fishing pressures. The objective of this study is to investigate the trophic structure, feeding ecology and bioaccumulation of Hg on the three species found in the region (*Paramyxine springeri, Eptatretus minor, Myxine mcmillanae*). The trophic structure and feeding ecology will be examined using $\delta^{13}C$, $\delta^{15}N$ and $\delta^{34}S$ stable isotope analysis and by examining stomach contents using molecular genetic analysis. Muscle samples will be analyzed for total Hg and Methyl-mercury (MeHg) content and compared for potential variations in bioaccumulation levels caused by the changing conditions that originated after the Deepwater Horizon oil spill. The objective of this research is to create an information base on hagfishes from the GOM that could provide ecological and biological data on basic life history traits of these three species and which could be useful for the creation of a fisheries management plan.

0101 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

Joseph Milanovich[1], William Peterman[2]

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Examining the Spatial Variation of the Standing Crop of Nutrients Within a Terrestrial Salamander in a Forest Ecosystem

Animals found in high densities can have significant influence over nutrient cycles in ecosystems. For example, smaller vertebrates, such as frogs, have been known to influence nutrient cycles in tropical forest. However, research understanding the influence of lower vertebrates in nutrient cycles of North American forest is lacking. It has been found that the biomass of terrestrial salamanders (family Plethodontidae) is higher than that of birds and small mammals in a New Hampshire forest and recent studies have found prior estimates of terrestrial salamander density are likely lower than current estimates using more robust techniques and models. A re-evaluation of the impact plethodontid salamanders could have on forest nutrient cycles is justified given the updated data regarding their estimated abundance and density. We quantified the degree to which a terrestrial, lungless salamander (*Plethodon albagula*) constitutes a pool of limiting nutrients in a Missouri forest ecosystem. We utilized values of whole-body nutrient composition (C, N, P, Ca, Mg, K, and S) of *P. albagula* and spatially projected density estimates to estimate the contribution of *P. albagula* to forest nutrient cycles. We found estimates of standing crop of nutrients were spatially variable across the landscape, and were dictated by density and size distributions of *P. albagula*. These data show that a single species of terrestrial salamander could contribute to the pool of limiting nutrients within forest ecosystems.

0574 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

Jesse Miles[2], Walter Smith[1]

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Effects of Riparian Habitat Disturbance on Salamander Occupancy and Assemblage Composition

The Central Appalachian region has experienced high rates of habitat modification via mineral extraction, particularly within riparian corridors along regional streams which have historically guided railbed construction for mineral transport. However, few studies have examined how habitat changes related to mineral extraction influence riparian specialists. We performed comparative studies on modified and unmodified

bluff habitats in one such riparian corridor, the Guest River Gorge in Wise County, Virginia. We found significant turnover in amphibian assemblage composition between natural bluffs and those within the gorge. Green Salamanders (*Aneides aeneus*) were exclusively encountered in natural bluffs, whereas Seal Salamanders (*Desmognathus monticola*) were found exclusively in bluffs modified for railbed construction. These differences were correlated with changes in crevice morphology and moisture levels linked to bluff modification. Subsequent intensive studies revealed specific factors that influence occupancy of Seal Salamanders within modified bluff habitats. Refugia containing higher levels of moisture and located closer to ground level were more likely to exhibit a higher probability of salamander occupancy. The nature and magnitude of bluff affinities found in the Seal Salamander provide novel findings for this species, which is typically considered a stream specialist with only a weak affinity for vertical habitat use. More broadly, our results indicate that habitat change due to mineral transport is capable of impacting local fauna in novel ways that have not been previously considered. Ecosystem managers should consider these impacts on riparian corridors, beyond those directly caused by mineral extraction, when assessing impacts of habitat change on regional fauna.

0611 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Kyle Miller Hesed[1], William Link[2]

[1]*University of Maryland, College Park, MD, USA,* [2]*USGS Patuxent Wildlife Research Center, Laurel, MD, USA*

Growth, Maturation, and Spatial Ecology of the Red-backed Salamander (*Plethodon cinereus*)

The Red-backed Salamander (*Plethodon cinereus*) is one of the best-studied amphibians, often considered a model species for studies of amphibian behavior and ecology. Despite its commonness, abundance, and wide distribution, there have been few long-term studies of natural populations of this species; as a result, little is known about individual variation in growth, maturation, or movements. Using 2,909 records of 752 individuals collected over a four-year field study at Patuxent Wildlife Research Center in Laurel, Maryland, I report here on these poorly understood aspects of the ecology of the Red-backed Salamander. Sex-specific growth rates and ages of sexual maturity were compared using the von Bertalanffy model along with models for interval-censored and imperfect observations of maturity, with individual heterogeneity in growth modeled through Gamma processes. Although males and females reach nearly identical asymptotic size distributions, females grow more quickly, mature earlier, and show a smaller range of variation than males. A comparison of study plots with varying

population densities suggests that salamanders at low-quality sites show greater transience and less site fidelity. At higher-quality sites, juveniles occupy smaller home ranges and move greater distances between years than do adults. Males move greater distances than females, both within and between years. Together, these results provide a field-based perspective on social interactions, life history, and spatial ecology in this widespread and ecologically important species.

0027 General Ichthyology III, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Kara Million, Luciano Matzkin, Bruce Stallsmith

University of Alabama in Huntsville, Huntsville, AL, USA

Comparison of Monogenoidean Gill Parasite Infection Levels in Three Darter Species in Mill Creek

The study of parasite-host relationships has the potential to provide valuable insight into the factors that drive coevolution and cospeciation. Parasites and their hosts are locked in a perpetual "arms race" in which the parasite constantly evolves to better exploit the host, while the host evolves to combat parasite infection. Darters (*Etheostoma*), percid freshwater fishes, are hosts to a genus of monogenoidean gill parasite (*Aethycteron*). This study was performed to determine whether or not the gill parasite infection levels differed between three sympatric darter species found in Mill Creek in the Cumberland drainage of Tennessee: *Etheostoma atripinne*, *E. blennioides*, and *E. flabullare*. *E. atripinne* was of particular interest due to the fact that other species within its subgenus (*Ulocentra*, the "snubnose" darters) have been observed to have low gill parasite loads compared to other sympatric darter species outside *Ulocentra*. Individuals from each species of interest were collected from Mill Creek for one year. Prevalence, mean intensity, and mean abundance of infection were calculated for each species sample. It was found that *E. atripinne* had a significantly lower prevalence, mean abundance, and mean intensity of gill parasite infection than both *E. flabullare* and *E. blennioides*. These findings are consistent with other observations concerning darter species within *Ulocentra*. More research in this area is required to investigate the possible factors that contribute to the snubnose darters' relatively low infection levels. Phylogenetic analysis is currently being conducted to determine the extent to which these parasites have coevolved with their hosts.

0671 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Annemarie Mina, Andras Ponti, Nicole Woodcraft, Erin Johnson, Ralph Saporito

John Carroll University, University Heights, Ohio, USA

Geographic Variation in Alkaloid-based Antimicrobial Defenses of the Strawberry Poison Frog, *Oophaga pumilio*

Brightly colored dendrobatid frogs possess anti-predator defenses, which are alkaloid-based and sequestered from a diet of arthropods. The type and quantity of alkaloids in dendrobatids vary substantially with geographic location, mainly due to differences in arthropod availability. It has been suggested that frog alkaloids also function as a defense against microorganisms, and may vary in antimicrobial efficacy. We tested this hypothesis by examining the antimicrobial effectiveness of alkaloids isolated from the dendrobatid frog *Oophaga pumilio* from five geographic locations in Costa Rica and Panama. Bacterial cultures of *Escherichia coli* and *Bacillus subtilis*, and the fungus *Candida albicans* were subjected to alkaloid extracts from individual frogs. Optical density assays indicated that alkaloids significantly inhibited microbial growth, suggesting that alkaloids may defend frogs against microbes. Furthermore, there are significant differences in the degree of microbial inhibition among frog locations, suggesting that there is geographic variation in antimicrobial defenses. Frog alkaloid composition varied significantly among locations, and both the type and quantity of alkaloids are important to microbial inhibition.

0654 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

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Environmental Correlates of Fish Life-history Strategies in Spring-fed Desert Tributaries

Desert springs are a habitat type strongly affected by human activities in desert ecosystems. Understanding environmental correlates of fish life-history strategies is important in predicting future species extinction along habitat alterations in various desert spring systems. We examined the effects of habitat connectivity and size on abundance patterns of fish life-history groups in spring-fed desert tributaries of the Rio Grande in the Trans-Pecos region in Texas, USA. This region has been affected by a variety of anthropogenic activities such as reduced water quality, dewatering in the mainstem Rio Grande, and the introduction of non-native species. Our results showed

that the fish life-history groups differently responded to the local and regional factors in the desert river system. As habitat connectivity between the mainstem Rio Grande and its tributaries decreased, the abundance of opportunistic strategists decreased and the abundance of equilibrium strategists increased in the tributaries. The abundance of periodic strategists was positively related to habitat size. Our results suggest that the decrease in habitat size and connectivity may increase the dominance of certain life-history strategy groups, leading a decrease in functional diversity of the system.

0119 Physiology & Physiological Ecology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY

Shabnam Mohammadi[1], Alan Savitzky[1], Lori Neuman-Lee[1], Georg Petschenka[2]

[1]Utah State University, Logan, Utah, USA, [2]Cornell University, Ithaca, New York, USA

Molecular and Physiological Mechanisms of Bufadienolide Resistance in Toad-Eating Snakes

Toads are chemically defended by bufadienolides, a class of cardiotonic steroids lethal to most predators, including many snakes. Bufadienolides typically bind to Na^+,K^+-ATPase (NKA), inhibiting the enzyme's ability to transport ions. This inhibition leads to a series of physiological events that cause cardiac arrhythmia and increased cardiac contractility which, if prolonged, are lethal. However, a number of ophidian species are resistant to bufadienolides and consume toads with no apparent ill effects. The molecular and physiological mechanisms underlying resistance in those species have not yet been fully elucidated. Resistance to cardiotonic steroids, such as cardenolides and bufadienolides, has been studied in other animals, and their resistance has been linked to mutations in NKA that limit the binding of such toxins to the target enzyme. However, a full understanding of the complex physiology of resistance remains to be determined, even for relatively well-studied species. We present results from comparisons of molecular structures and physiological responses to bufadienolides in various North American toad-eating and nontoad-eating snakes. We have found that in addition to toad specialists, a number of natricine snakes that do not specialize on toads also exhibit resistance. We compared the coding sequences of the M1-M2 extracellular loop of NKA, a region identified as a primary binding site for cardiotonic steroids, in these species. We also compared organ-specific NKA sensitivity to bufadienolides and changes in NKA expression in response to bufadienolide dosing. Stress responses to bufadienolide dosing were determined using measures of pre- and post-dose blood corticosterone levels.

0175 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Banquet Room J, Friday 1 August 2014

Patrick D. Moldowan[1], Ronald J. Brooks[2], Jacqueline D. Litzgus[1]

[1]*Laurentian University, Sudbury, Ontario, Canada,* [2]*University of Guelph, Guelph, Ontario, Canada*

Turtles with Teeth: Tomiodont Morphology and Functional Significance in the Painted Turtle (*Chrysemys picta*)

Sexually dimorphic characters are relatively common among vertebrates, ranging from dramatic colour and body size disparities to much more subtle differences in morphology. The Painted Turtle (*Chrysemys picta*) has an upper jaw notch bordered on each side by tooth-like cusps called tomiodonts. For 180 years, these tomiodonts have been used as a descriptor in chelonian anatomy, phylogenetics, and natural history; however, no quantitative study of these traits or their function has ever been completed. Observations of *C. picta* from a long-term study in Algonquin Provincial Park (Ontario, Canada) have suggested that males have tomiodonts of more variable morphology and greater prominence than those of females. In addition, female *C. picta* in Algonquin Park have been regularly recorded with injuries on the head and neck indicative of bite wounds, possibly inflicted by the tomiodonts of males during mating. The putative sexually dimorphic nature of the tomiodonts has raised questions about their functional significance. We hypothesized that the tomiodonts confer a reproductive advantage to male *C. picta* in securing mates. Evidence for the sexual dimorphism and functional significance of the tomiodonts, including the demography of bite wounds in an Algonquin Park *C. picta* population, and experimental trials to assess courtship and pre-copulatory behavior, will be introduced. Based on our evidence, we propose that males employ a coercive mating strategy and that the sexual dimorphism and functional significance of the tomiodonts contributes to differential reproductive success among male *C. picta* in our study population.

0176 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Patrick D. Moldowan[1], Ronald J. Brooks[2], Jacqueline D. Litzgus[1]

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Courtship or Coercion? Testing for a Novel Mating Strategy in the Midland Painted Turtle (*Chrysemys picta marginata*)

The mating strategy of the Painted Turtle (*Chrysemys picta*) is well recognized as involving an elaborate male courtship display coupled with female mate choice. During breeding, male *C. picta* demonstrate a stereotyped titillation sequence including the stroking of the head and anterior carapace of a female with elongate foreclaws. Traditionally it is thought that female *C. picta* choose mates on the basis of courtship display and/or traits that demonstrate male quality. In situ field observations and experimental trials from a long-term study of *C. picta* in Algonquin Provincial Park (Ontario, Canada) suggest that males also demonstrate an alternative, coercive mating strategy. Males are equipped with prominent tomiodonts, tooth-like cusps of the upper jaw, which seemingly function in immobilizing mates and result in extensive wounding to the head and neck of females. Over 100 hours of video recordings from experimental trials during the spring and fall (2013) breeding periods will be summarized. The courtship and pre-copulatory behaviors of males, including titillation, chasing, biting, forced submergence of females, and frontal ramming, were quantified. The biological explanations for multiple reproductive strategies will be discussed. We propose that male *C. picta* exhibit sexual weapons in the form of tomiodonts used in mate coercion and challenge the notion that sexual coercion is unlikely in open-water and free-swimming freshwater turtles. As a group with a rich evolutionary history, turtles are a fascinating taxon in which to ask and address questions about mating system evolution.

0021 Ecology and Ethology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD ECOLOGY AND ETHOLOGY

Alejandro Molina-Moctezuma, J. Jaime Zuniga-Vega

Departamento de Ecologia y Recursos Naturales, Facultad de Ciencias, UNAM, Mexico City, Mexico

Food Availability and Matrotrophy: a Test of the Trexler-DeAngelis Model of Maternal Provisioning

In viviparous fishes there are two main modes of maternal provisioning of nutrients to embryos during development. One mode is known as matrotrophy (post-fertilization

provisioning), whereas the other is known as lecithotrophy (pre-fertilization provisioning). The Trexler-DeAngelis model predicts the environmental conditions under which a matrotrophic strategy should be favored over a lecithotrophic strategy. According to this model, matrotrophy should be favored when food resources for females are abundant and constant. Additionally, this model suggests that matrotrophic females should be able to reabsorb developing embryos when resource availability is low. Furthermore, a recent modification of this model suggests that the degree of lecithotrophy should increase as variation in food availability increases. In the present study we explored the relationship between food availability (calculated using a stomach fullness index) and the degree of matrotrophy (calculated using the matrotrophy index) in different populations of two species of viviparous fishes (*Poeciliopsis gracilis* and *P. infans*). We found significant differences in the degree of matrotrophy among populations of both *P. gracilis* and *P. infans*. These differences in matrotrophy were statistically associated with the amount of available nutrients in each population. Populations where nutrients were more abundant had a higher degree of matrotrophy. In addition, we found that in most populations, matrotrophy increased during the wet season. Our results are consistent with the predictions derived from the Trexler-DeAngelis model of maternal provisioning.

0674 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Chad Montgomery[1], Andrea Martinez[2], Ignacio Moore[3], Stesha Pasachnik[4]

[1]Truman State University, Kirksville, MO, USA, [2]Kanahau, Utila, Honduras, [3]Virginia Polytechnic Institute and State University, Blacksburg, VA, USA, [4]Institute for Conservation Research San Diego Zoo Global, San Diego, CA, USA

Effect of Captivity and Habitat Destruction on Stress in the Utila Spiny-tailed Iguana, *Ctenosaura bakeri*

Global biodiversity loss has increasingly led to captive breeding and head-starting programs for supplementing existing populations and/or reintroducing populations to the wild. Captive breeding and head-starting can provide a necessary benefit to a species of conservation concern. However, captive management can have negative impacts, including acclimatization to human presence. Iguanids throughout their range are threatened due to increasing levels of habitat degradation and overharvesting. The Spiny-tailed Iguanas, including *C. bakeri*, are experiencing declines and are increasingly vulnerable due to human interaction, as well as their limited geographic ranges. In an effort to conserve *C. bakeri*, The Utila Iguana Station is involved in captive breeding, captive hatching of clutches from wild females, and head-starting hatchlings. However, no data exist to document the benefits and detriments of the program. Therefore, we examined the effects of captivity on body condition and acute and chronic stress

responses in captive and wild populations of *C. bakeri* on the island of Utila. Long term captives showed reduced stress levels and greater body condition indices relative to wild iguanas. The results indicate that time in captivity can pose a threat to those animals to be released into the wild by causing acclimatization to human interaction, potentially making these animals more susceptible to poaching.

0327 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Akira Mori[1], Alan Savitzky[2]

[1]*Kyoto University, Kyoto, Japan,* [2]*Utah State University, Logan, UT, USA*

When a Mysterious Japanese Natricine Snake Met an American Natricine Expert: Unraveling the Enigmatic Nuchal Glands

Natricinae comprise a diverse colubrid group, distributed in both the Old and New Worlds. Extensive studies have been conducted on New World species, whereas comparably few studies have been made of Old World natricines, in particular Asian and African species, despite their diversity. In 1935 integumentary glands, named nuchal glands, were described in a Japanese natricine snake, *Rhabdophis tigrinus*. These organs consist of a series of paired glands embedded under the skin of the neck, containing fluids that cause aversive reactions. A subsequent study found similar organs in three Asian natricine genera, and behavioral observations of *R. tigrinus* and chemical analyses of the fluids suggested a defensive function. Nonetheless, few biologists had paid attention to these organs, and their properties had remained largely unknown. In 1994, the first author began a collaboration with Gordon M. Burghardt and soon thereafter with the second author, to elucidate the behavioral, ecological, morphological, and physiological aspects of the nuchal gland system. Our long-term collaboration has revealed that the chemical components of the glands of *R. tigrinus* are not synthesized by the snake but are sequestered from the skin toxins of toads consumed as prey; that the snake exhibits a variety of defensive displays that depend on the nuchal glands; and that the embryonic origin and ultrastructure of the glands are unique among terrestrial vertebrates. We summarize these findings and present new perspectives on the evolution of this enigmatic defensive system.

0071 Fish Behavior, Banquet Room F, Sunday 3 August 2014

Molly Morris

Ohio University, Athens, Ohio, USA

Intralocus Tactical Conflict and the Evolution of "Reversible" Alternative Reproductive Tactics

Alternative reproductive tactics (ARTs) are characterized by consistent and discrete variation in reproductive behaviors (e.g. mating, fighting, nesting) of members of the same sex. When males engaging in very different mating behaviors, such as courtship to coax females to mate as compared to sneaking to circumvent female mate preferences, the phenotypes that are optimal for using these two different behaviors are not likely to be the same. ARTs could be constrained from reaching their phenotypic optima as they share their gene pool with the other ART (either the same male, or different males within a population). If traits are not at their adaptive optimum when expressed in one or both of the ARTs, then tactical disruptive selection can produce intralocus tactical conflict (IATC). I present the concept of IATC using the ARTs in the swordtail fish *Xiphophorus multilineatus* as an example. I argue that because IATC could constrain the evolution of ARTs within a species, preventing some traits from reaching their phenotypic optimum, this could explain why reversible ARTs (behavioral plasticity in mating behaviors) are more common than irreversible ARTs. In addition, I suggest that IATC could facilitate rapid evolution once one of the ARTs is lost, potentially explaining the relationship that has been detected between ARTs and speciation.

0370 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Cy Mott, Emily Croteau

Valdosta State University, Valdosta, GA, USA

Incorporating Metapopulation Structure into Investigations of Abundant Center Distributions: What Can Presence/Absence Data Tell Us?

The abundant center distribution hypothesis predicts that population density decreases as a species' geographic range edge is approached, with the highest densities observed in the geographic range core. This hypothesis forms the basis for many inferences regarding spatial variation in ecology, evolution, conservation, and management. However, the extent to which abundant center distributions represent a biogeographical rule is unclear, as such patterns occur in less than half of all species examined and population sampling across the entirety of species' ranges is rarely feasible. For species that exhibit metapopulation structure, such as many pond-breeding amphibians, simple

presence/absence patterns might be sufficient to identify abundant center distributions while avoiding the logistical difficulties of estimating individual population densities throughout species' geographic ranges. Using breeding call survey data from the North American Amphibian Monitoring Program (NAAMP), we have identified several amphibian species that exhibit clear abundant center distributions based on population density (i.e. call count density), as well as species in which no abundant center distribution is present. Currently, we are comparing these density-based patterns with those of presence/absence (i.e. calls detected versus no calls detected) patterns within ponds across species' ranges to determine if they yield similar results. If presence/absence patterns ultimately represent a suitable surrogate for density estimates in characterizing range-wide patterns of abundance for species with metapopulation structure, the difficulties in identifying and investigating the effects of abundant center distributions would be greatly reduced.

0552 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR PHYSIOLOGY & MORPHOLOGY

Krista Mougey, Gad Perry

Texas Tech University, Lubbock, TX, USA

Thermal Ecology and Locomotor Performance of the Critically Endangered Stout Iguana (*Cyclura pinguis*)

Body temperature (T_b) is one of the most important ecophysiological factors influencing performance, behavior, and fitness of ectotherms. Consequently, there has been considerable research interest in reptilian thermal ecology and the temperature sensitivity of performance capacities. Herein we describe the results of a thermal ecophyisology study on an artificially established insurance population of stout iguanas (*Cyclura pinguis*) translocated from Anegada to Guana Island, British Virgin Islands. As a result of vegetative and topographic differences between islands, there are dissimilarities in their thermal environments. Therefore, our objectives were to determine the preferred and field active body temperatures of the Guana hatchling population and to assess the influence of body temperature on both sprint performance and endurance. Additionally, we sought to compare our results to published thermal data from the Anegada population and to evaluate the differences in thermal sensitivity and locomotor performance between head-started and wild hatchlings on the two islands. Field active T_b of Guana hatchlings ranged from 27.6 to 43.0°C with an average of 36.8 ± 0.2°C, and laboratory tests of preferred temperature showed an average of 39.5 ± 0.2°C. Both field active and preferred temperatures were similar to thermal values published for the Anegada population. Preliminary results indicate that sprint and endurance performance both show thermal sensitivity, with maximum performance

occurring between 38 and 39 °C. Head-started animals had slightly lower endurance times than wild hatchlings. These data provide valuable information on the thermal ecology and performance of two populations of a critically endangered species.

0562 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Krista Mougey[1], Douglas Bell[2], Frederic J. Burton[2]

[1]Texas Tech University, Lubbock, TX, USA, [2]Blue Iguana Recovery Program, Grand Cayman, Cayman Islands

Spatial Ecology of the Caymanian Blue Iguana (*Cyclura lewisi*): The Influence of Restored Populations on the Spatial Dynamics and Establishment of Captive Releases

The blue iguana (*Cyclura lewisi*) is a large, West Indian rock iguana endemic to the island of Grand Cayman. Just over a decade ago, it was reputed to be the most endangered lizard in the world, but extensive captive breeding and head-starting efforts have brought *C. lewisi* back from the brink of extinction. Three non-contiguous subpopulations have been established in small protected areas, but as the number of iguanas in these areas increases, and the surrounding matrix becomes increasingly developed, questions arise about carrying capacity and spatial ecology within the reserves. The blue iguanas that are now being released, as well as those born wild, are being introduced into established populations with existing territories and social hierarchies. Herein we describe a series of ongoing telemetry studies on the spatial ecology of established and newly released blue iguanas. We characterize spatial dynamics within the populations focusing on homerange size, territorial shifts, displacements, post-release dispersal, rate of establishment, and intraspecific aggression. Comparisons are made between age and sex classes, and results are contrasted to spatial establishment data from the early years of the captive release program. To determine if release efforts are still efficacious within the spatial scale of existing protected areas, understanding what is happening to both the established population and the newly released individuals is imperative.

0273 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Cynthia Moulton, Jennifer Weisenburger

Castleton State College, Castleton, Vermont, USA

Consistency of Survey Data for Plethodontid Salamander Population Assessments in Rutland County, Vermont

Plethodontid salamanders are one of the most abundant vertebrates in terms of numbers and biomass in the northeastern United States (Degraaf and Rudis 1983). They are responsible for approximately 20% of the energy flow through mammalian and avian populations (Burton and Likens 1975). We assessed both adult and larval populations at four locations in different streams that were considered "ideal" habitat in Rutland, County Vermont. In addition we were curious to see if survey results differed depending on the group searching. We set up four teams to conduct four surveys at each of three assigned sites. Between September 4, 2013 and October 15, 2013 each site was surveyed a total of twelve times. We recorded the species (except for larvae), age class, length, and microhabitat for each individual found. Adult populations were assessed with direct counts and maximums ranged from 3, 5, 14, and 11 individuals. Direct counts of the larvae ranged from maximums of 56, 151, 210, and 58 at the four sites respectively. Our average larval:adult ratios ranged from 31:1, 16:1, 16:1, and 7:1 for each site. Our results differed depending on which group surveyed the sites. Our analysis will assess differences between the survey teams, as well as differences between the survey teams and parameter means for each site. We hope to gain an understanding of how to maintain consistency between survey teams so that credible long-term data can be collected and population dynamics can be assessed over time in relation to habitat alterations and climate change.

0766 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Christopher Mull[1], Kara Yopak[2], Nick Dulvy[1]

[1]Simon Fraser University, Burnaby, BC, Canada, [2]University of Western Australia, Crawley, WA, Australia

Placentation and the Evolution of Brain Size and Structure in Sharks, Skates, and Rays

Chondrichthyans mark the evolutionary emergence of the brain archetype common across nearly all vertebrates, which is comprised of five major brain regions. Patterns of brain organization are correlated with both phylogeny and ecology, which are suggestive of neurological specialization and cognitive differences among species. In

mammals and chondrichthyans, reproductive mode significantly affects relative brain size, with increased maternal investment associated with larger relative brain size. In light of the connection between life history and brain size, the effect of reproduction on brain organization is investigated here. Variation in brain organization is correlated with both habitat and reproductive mode. The majority of variation is characterized by a trade-off between major components of the forebrain and hindbrain, specifically telencephalon and medulla, and correlates with both reproductive mode and habitat depth. Placental species have the largest telencephalons and are often found in reef habitats or are coastal/oceanic, and must navigate complex three-dimensional environments. Bathyal egg-laying or yolk-sac live-bearing species are characterized by a relatively large medulla, likely reflecting their reliance on mechanosensory and electrosensory input. While brain organization correlates with habitat, the influence of reproductive mode consistently explains more variance in brain size and structure. Life history is intimately linked to the diversity of brain sizes and structures, behaviors, sensory specializations, and ecological niches of chondrichthyans.

0089 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

SJ Mullin[1], LM Diana[1], LJ Walston[2]

[1]Eastern Illinois University, Charleston, IL, USA, [2]Argonne National Laboratory, Argonne, IL, USA

Patient Tiger, Hidden Results? A Decade-long Salamander (*Ambystoma tigrinum*) Repatriation Effort in Managed Wetlands

One strategy used to reverse population declines for some amphibian species is repatriation – moving healthy individuals from a donor population to a recipient site. Translocated individuals can either be placed immediately into suitable habitat (hard release), or placed in enclosures for an acclimation period prior to being freed in the recipient site (soft release). We report on a 10-year effort to repatriate Tiger Salamanders (*Ambystoma tigrinum*) at two breeding ponds within an 80-ha nature preserve in central Illinois. Soft-released individuals included all life-history stages (egg, larvae, and adult) released in enclosures over a five-year period, whereas hard releases involved only adults in the latter two of those years. All adults were individually marked prior to release, or at time of capture (if caught as new in subsequent years). The two ponds have since been monitored during the breeding seasons with either a drift fence-pitfall trap array or minnow traps. Following the last year of releasing new individuals, variable numbers of adults returned to the ponds and recapture rates have been low, especially between years. Within each year, whether recaptured or a new individual, more adult males were captured than females. Interannual variation in climate parameters during the transition from winter to spring necessitated variable sampling

periods among years. We cautiously view our repatriation effort as a success, and discuss our findings as they pertain to amphibian conservation efforts.

0384 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Mason Murphy[1], Steven Price[1], Michael Dorcas[2]

[1]*University of Kentucky, Lexington, KY, USA,* [2]*Davidson College, Davidson, NC, USA*

The Effects of Urbanization on Salamander Body Sizes Using a Before-after Control-impact Design

Urbanization poses a serious threat to amphibian populations, and while these effects have been noted at a population level, few studies have examined the long-term effects of urbanization on body size. We utilized a before-after control-impact (BACI) design to examine the long term effects of urbanization on larval stream salamander body size. We sampled stream salamanders from 2005-2009 in 13 first order streams that experienced urbanization after the first year, as well as 17 control streams that did not undergo development. Prior to urbanization, body sizes of larval *Eurycea cirrigera*, and *Desmognathus fuscus* were not significantly different between urban and control sites. In the year immediately following urbanization, larvae of both species exhibited a decrease in overall body size in urban streams but sizes remained similar in control streams. Following the initial decline however, impacted *Eurycea cirrigera* individuals were found to have significantly larger body sizes than individuals in the control streams. Relating these data to previously published abundance data for these sites, we suggest there may be a density dependent effect on body size. This shift from many small individuals to fewer larger individuals could have an impact on the urban stream ecosystems.

0315 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Christopher Murray[1], Mahmood Sasa[2], Craig Guyer[1]

[1]*Auburn University, Auburn, Alabama, USA,* [2]*Universidad de Costa Rica, San José, Costa Rica*

Cohort Specific Sex Ratios and Nest Thermal Regimes in the American Crocodiles of Guanacaste, Costa Rica

Previous surveys suggest the potential for a uniquely male-biased sex ratio in the Tempisque basin American crocodile (*Crocodylus acutus*) population in Guanacaste, Costa Rica. Such a bias may be responsible in part for an increase in human conflict with

crocodiles. Additionally, demographic repercussions may ensue as a result of this bias. Previous research from alternative localities suggests that regional warming may be responsible for this male bias. We independently test the hypothesis that a male-biased sex ratio exists in the Tempisque population. Further, we test the hypothesis that regional warming is biasing the sex ratio by altering thermal regimes. Our data suggests that the hatchling sex ratio is extremely male-biased and the extent of this bias decreases over older cohorts. Thermal loggers suggest that regional warming is not responsible for this unique sex ratio. Additional research is needed to determine the cause of such demographic shifts.

0257 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Erin Muths[1], Larissa Bailey[2], Mary Kay Watry[3]

[1]U.S. Geological Survey, Fort Collins, CO, USA, [2]Colorado State University, Fort Collins, CO, USA, [3]National Park Service, Rocky Mountain National Park, Estes Park, CO, USA

Quantifying Reintroduction: Interim Results and an Innovative Assessment of Survival

Quantitative evaluations of reintroductions are infrequent and assessments of milestones reached before a project is completed, or abandoned due to lack of funding, are even more rare. However, such assessments, which are promoted in adaptive management frameworks, are critical. Quantification can provide defensible estimates of biological success, such as the number of survivors from a released cohort, with associated cost per animal. It is unlikely that the global issues of endangered wildlife and population declines will abate, therefore, assurance colonies and reintroductions are likely to become more common. If such endeavors are to be successful biologically, or achieve adequate funding, implementation must be more rigorous and accountable. We use a novel application of a multistate, robust design capture-recapture model to estimate summer survival of reintroduced boreal toad tadpoles through metamorphosis (i.e., the number of individuals emerging from the pond) and thereby provide a quantitative measure of effort and success for an "in progress" reintroduction of toads. Our data also suggest that tadpoles released at later developmental stages have an increased probability of survival and that eggs laid in the wild hatched at higher rates than eggs laid by captive toads. We illustrate how an interim assessment can identify problems, highlight successes, and provide information for use in adjusting the amount of effort expended or in implementing a Decision-Theoretic adaptive management strategy.

0742 SSAR Infrared Imaging Symposium, Banquet Room J, Sunday 3 August 2014

Maria Myrback[1], Sherri Emer[2], Michael Grace[2]

[1]Eastern Florida State College, Melbourne, FL, USA, [2]Florida Institute of Technology, Melbourne, FL, USA

A Non-invasive Electrocardiography Method for Measuring Responses to Thermal Stimuli in Burmese Pythons

Burmese pythons (*Python molurus bivitattus*) detect a variety of environmental stimuli that are important for prey and predator detection and thermoregulatory behavior. For example, thermal information detected by receptors in the pit organs that is integrated with information from other sensory modalities plays in role in mediating locomotion toward or away from a thermal target. Thus far, little research has explored the effects of descending pathways at the organ level, particularly on the cardiovascular responses of this ambush predator to thermal targets (i.e., homeothermic prey). Ten wild-caught and three captive born Burmese pythons were individually isolated in dark hide box and heart rate was monitored using non-invasive electrocardiography when exposed to three randomized treatments: hide box lid movement, room-temperature target introduction, and warm target introduction. Pythons exhibited increased heart rate during warm target presentations. Cardiovascular changes in response to environmentally relevant stimuli provide insight into the relationship between stimulus detection ability, organ physiology and ultimately, behavior. Expanding our understanding of behavior of this invasive megapredator can contribute to improved population management practices in the future.

0367 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Renato C. Nali[1], Rubens A. F. Turin[2], Cynthia P. A. Prado[2]

[1]Universidade Estadual Paulista, Rio Claro, SP, Brazil, [2]Universidade Estadual Paulista, Jaboticabal, SP, Brazil

Call Differentiation Correlates with Geographical Distance in the Brazilian Hylid Frog *Bokermannohyla ibitiguara*

Bokermannohyla ibitiguara is a stream-dweller treefrog endemic to the threatened Brazilian Cerrado. Male calls are complex, composed of long and short notes. Although information on the species' natural history is available, patterns and processes of diversification are unknown. We recorded and measured males from nine different streams in southeastern Brazil, determining (1) call dominant frequency, (2) duration of the long note, (3) duration of the short notes' sequence, and (4) pulse rate of the long

note. We tested the hypotheses that (A) geographical distance among populations is positively correlated with call differentiation, and (B) geographical distance is also positively correlated with body size differentiation. We found that acoustic differentiation was correlated with geographical distance (except pulse rate), but found no correlation between body size and geographical distance. Recent studies on this species have shown that call traits 1-3 are correlated with male size, indicating that they might be under sexual selection (female choice). However, considering various populations, body size did not correlate with geographical distance, suggesting that acoustic differences are actually size-independent at a broad landscape level. Because calling parameters are crucial for anuran mate recognition, our preliminary results indicate that *B. ibitiguara* populations might be undergoing allopatric divergence, even though a combination of selective forces are certainly involved, such as local size-dependent mate choice mechanisms. Ongoing microsatellite and landscape data will be incorporated in this framework to support these results by examining possible gene flow restrictions leading to morphological and behavioral diversification in this frog species.

0546 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Kyle Newton

Florida Atlantic University, Boca Raton, FL, USA

Magnetic Field Perception, Learning and Memory in the Yellow Stingray, *Urobatis jamaicensis*

Sharks and rays are hypothesized to use geomagnetic cues to orient and navigate across the ocean, but magnetoreception is not well documented in elasmobranchs. Yellow stingrays (*Urobatis jamaicensis*) were held in a flow through seawater tank under a 12:12 hr light dark cycle and were fed daily. Rays were randomly introduced from each of the four cardinal directions into a circular arena without magnetic treatments or controls in order to determine any location preferences within the arena. Neodymium magnets and non-magnetic controls were coated in epoxy to prevent confounding galvanic currents between the metal and seawater that would stimulate the electroreceptors. Training consisted of positive reinforcement with a morsel of food when the ray stopped over the location of a magnet previously buried in the sand, whereas incorrect choices were not reinforced. The learning criterion was the minimum latency for each ray to correctly orient and stop over a buried magnet (≥75%) in four tests per day for three consecutive days. Once criterion was met the training stopped and memory retention tests began without additional reinforcement. Each test was a simple choice between a magnet and a demagnetized control buried under the sand at a random location within the arena. Memory retention was tested four times per day every seven days for 12 weeks. All rays reached criterion within two weeks and retained the memory for over 60 days. Future

experiments will increase the sample size of the current procedure and determine the mechanism of magnetoreception in elasmobranchs.

0410 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Kirsten Nicholson[1], David Laurencio[2], Craig Guyer[2]

[1]*Central Michigan University, Mt. Pleasant, MI, USA,* [2]*Auburn University, Auburn, AL, USA*

One or Two? Investigating the Status of *Norops lionotus* and *N. oxylophus* in Central America

Recent work on *Norops* species has found considerable cryptic diversity in what were formerly considered to be wide spread species. In light of this, a careful reconsideration of the specific status of populations of *N. lionotus* and *N. oxylophus* is warranted. Originally described by Cope as two species—*Norops lionotus* (Cope 1861) and *Norops oxylophus* (Cope 1875)—these two putative species have been treated as one (*N. lionotus*) for much of the time since they were described. Barbour (1934) placed *N. oxylophus* in synonymy with *N. lionotus*, where it remained until Williams (1984) reestablished *N. oxylophus* as a valid species based on the difference in dorsal scale size (first noted by Campbell, 1983). Recent works conflict on the status of these species: Köhler (2003, 2008) appears to recognize only the single *N. lionotus* species, whereas Guyer and Donnelly (2004), Leenders (2001) and Savage (2002) still recognize *N. oxylophus* in Costa Rica. To resolve this conundrum we tested the hypothesis that two species exist using molecular data from samples collected throughout the ranges of both purported species. We present the results of our data collection and analysis, and discuss the current status of these species in Central America. In addition, we present preliminary data regarding the phylogeography of this/these species, and discuss patterns of distribution as they relate to other *Norops* species.

0184 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Max Nickerson[1], Kirsten Hecht-Kardasz[2], Joseph Mitchell[1]

[1]*University of Florida, Florida Museum of Natural History, Gainesville, Florida, USA,* [2]*University of Florida, School of Natural History and the Environment, Gainesville, Florida, USA*

Are Fish Responsible for the Decline of Hellbender Salamander (*Cryptobranchus alleganiensis*) Populations?

Abstract: Hellbender salamander *Cryptobranchus alleganiensis* population decline has been partially attributed to predation by fish. Most published scientific support for this hypothesis is from behavioral laboratory studies interpreting the movement or lack of movement of hellbenders following a potential stimulus, and these studies cite some incorrect information regarding field studies or known diets of the accused fish species. Most of the research was conducted on Missouri populations where both described forms of hellbenders *Cryptobranchus alleganiensis alleganiensis* and *C. a. bishopi* are found. Four of the fish species accused of "excessive hellbender predation", especially of *Cryptobranchus* larvae, are two native species; the Ozark Sculpin *Cottus hypselurus* and the Banded Sculpin *C. carolinae* and two introduced species; Rainbow Trout *Oncorhynchus mykiss* and Brown Trout *Salmo trutta*. We reviewed our labs data from fish diet studies and field data from four *C. a. bishopi* and four Missouri *C. a. alleganiensis* streams (1968- 2007) as well as our surveys from seven non- Missouri hellbender streams (1970 -2013). We also surveyed the literature concerning the diets of these four fish species. No evidence supporting these fish as predators of hellbenders was found. Even if they are an occasional predator there is no support for them being a significant factor in hellbender population decline.

0387 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Philip Nicodemo, Nathan J. Kley

Stony Brook University, Stony Brook, NY, USA

Variation in the Segmental Lengths of Epaxial Muscles in the Pre-cloacal Region of Snakes

Among vertebrates, snakes are unusual for having complex and often elongate axial muscles in which individual muscle segments span numerous vertebrae. Consequently, the length of individual muscle segments are constrained as their sites of skeletal attachment approach either the cranial or caudal extremities of the trunk. Despite a strong expectation for variation to occur along the entire length of the body in snakes, most of the previously reported longitudinal variation in muscle length is based on

dissections within the anterior half of the trunk, with remarkably less being known from more posterior regions. Thus, the purpose of this study was to investigate the morphology of, and quantify longitudinal differences in, *M. spinalis* (SP) muscle length in the posterior half of the trunk, with emphasis on segments close to the cloacal region. SP muscle segments were dissected in 10 diverse species of snakes representing six families. Near mid-body, segments of the SP spanned from 9–36 vertebrae, whereas segments inserting near the cloaca spanned 8–32 vertebrae. Thus, most had longer SP muscles at mid-body compared to those near the cloaca, which were generally invariant in length. The posterior reductions in total span of SP segments resulted primarily from reduced length of the anterior tendon, rather than changes in the length of contractile tissue. Three distinct anatomical modifications resulted in changes in total SP muscle span, some of which varied among taxa and were distinct from length-altering modifications that have been reported to occur within the anterior trunk.

0172 AES Behavior, Banquet Room E, Thursday 31 July 2014

Andrew Nosal, Philip Hastings

Scripps Institution of Oceanography, La Jolla, CA, USA

Shoreward Homing in Experimentally Displaced Leopard Sharks (*Triakis semifasciata*)

This study investigated shoreward homing in leopard sharks (*Triakis semifasciata*), displaced from a coastal aggregation site in La Jolla, California, USA to locations 9 km (*n*=8) and 18 km (*n*=9) offshore (depth=500-700 m). Sharks were tagged with continuous acoustic transmitters with depth and temperature sensors, released at the surface, and manually tracked for four (9-km displacement) or seven hours (18-km displacement). Given the inhospitable environment for this nearshore benthic species, the coastline was hypothesized to be the "goal" upon release. Swimming speed averaged 0.63±0.07 m/s (0.43±0.05 BL/s) and swimming depth averaged 21.4±5.1 m (maximum: 97.8 m). Seven of eight sharks displaced to 9 km advanced 5.4-8.4 km toward shore along fairly straight paths (linearity index, LI: 0.709-0.871). The one apparently disoriented shark swam 2.1 km offshore along a tortuous route (LI: 0.557). In contrast, five of nine sharks displaced to 18 km advanced 10.9-16.0 km toward shore along fairly straight paths (LI: 0.812-0.921), whereas four appeared disoriented, swimming 15.2% slower and advancing only 1.1-3.1 km toward shore along tortuous paths (LI: 0.201-0.320). Consistent with improved shoreward homing by sharks released at the closer displacement site and "U-turns" made by oriented sharks that initially swam offshore, is the presence of some detectable, likely chemical, cross-shore gradient. One additional shark displaced to 9 km and released with its nostrils plugged appeared disoriented, swimming 1.2 km offshore along a tortuous route (LI: 0.203). Upcoming work will further investigate the

importance of olfaction and other sensory cues, including magnetic and solar, to elasmobranch orientation and navigation.

0526 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Tanya O'Brien

Northern Illinois University, DeKalb, IL, USA

The Importance of Pre- and Postnatal Thermal Conditions in Determining Growth Trajectories in Three Viviparous Grassland Snakes

In many reptile species, the onset of reproductive maturity is determined by size rather than age. Rapid growth during the first year may therefore promote rapid population growth by shortening generation time and increasing the probability of survival to reproduction. Patterns of neonatal growth were observed over five years in three sympatric grassland snakes at Potawatomi Woods in Northern Illinois. Dekay's Brownsnakes (*Storeria dekayi*), Redbellied Snakes (*S. occipitomaculata*) and Common Gartersnakes (*Thamnophis sirtalis*) varied similarly among years such that neonates achieved 20-44% greater SVL in warmer years (mean Apr-1 thru Sept-30 temperature) than in cooler years ($F_{1,10} = 44.919$, $P < 0.001$). Variation in expected SVL on Oct-1 was better explained by mean Apr-May temperatures (partial $h^2 = 0.79$) than by Jun-Jul or Aug-Sept temperatures (partial $h^2 = 0.48$ for each), possibly reflecting the importance of temperature on timing of ovulation. In contrast, an enclosure experiment in 2013 suggests that when basking opportunities are limited, temperature during gestation could have a greater effect. Individual enclosures were used to house 25 wild-caught gravid *S. dekayi* females divided among two temperature treatments. Females in the warmer (Sun) treatment gave birth significantly earlier than females in the cooler (Shade) treatment ($t = -9.814$, $P < 0.001$). Together, the field and experimental data suggest that females may be able to behaviorally compensate for lower temperatures during gestation, whereas lower temperatures in spring (Apr-May) may delay ovulation, resulting in smaller neonates by Oct-1 and potentially reducing population growth rates.

0193 AES Conservation & Physiology, Banquet Room E, Sunday 3 August 2014

Jason O'Bryhim[1], Douglas Adams[3], Julia Spaet[4], Gary Mills[2], Stacey Lance[2]

[1]George Mason University, Fairfax, VA, USA, [2]Savannah River Ecology Laboratory, Aiken, SC, USA, [3]Florida Fish & Wildlife Conservation Commission, Fish & Wildlife Research Institute, Melbourne, FL, USA, [4]King Abdullah University of Science and Technology, Red Sea Research Center, Thuwal, Saudi Arabia

Relationships of Mercury Concentrations Across 23 Tissue Types for Three Shark Species

Mercury has been shown to cause reduced fertility, slower growth and developmental rates, abnormal behavior, and mortality in a variety of fish species, and also poses a human health risk. The ability of sharks to bioaccumulate high concentrations of mercury is well established. However, little is known regarding the distribution of mercury among different tissue types (e.g. muscle, fin, liver, kidney) within an individual. We evaluated total mercury concentrations from eight muscle regions, four fin types (2 regions per fin), and five organs from three different shark species (*Carcharhinus falciformis*, *C. leucas*, *Sphyrna tiburo*) to determine the relationships of mercury among tissue types and among species. Our goals included determining whether mercury concentrations of various tissue types could be predicted from a single fin-clip or muscle biopsy. Across species, total mercury concentrations were highest in the eight muscle regions (1.14 ± 0.31 to 3.1 ± 2.12 ppm dry wt) with significant correlations existing between each muscle region. Total mercury concentrations were lowest in samples taken from the center of the first dorsal, pectoral, and caudal (lower lobe) fins of all species (0.017 ± 0.008 to 0.055 ± 0.083 ppm dry wt). Mercury concentrations for these locations were highly correlated between each other and across species, as were samples taken from the trailing edge of the dorsal, pectoral, and caudal fins (upper and lower lobe). Our initial results suggest the potential for using non-lethal sampling to gain valuable information about the health of the animal and its ecosystem.

0064 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Friday 1 August 2014

David O'Connor, David M. Green

McGill University, Montreal, Quebec, Canada

Latitudinal Variation in the Sexual Dimorphism of the American toad (*Anaxyrus americanus*)

Sexual dimorphism can arise from sexual selection, or from different selective pressures on either sex. Variation in dimorphism across the range of a species may indicate changing selective pressures. Observations from across the range, including the previously under sampled northern half, of the American toad suggest a latitudinal gradient in dimorphism. We assessed: 1) morphological variation and sexual dimorphism within and between populations of American toads; 2) how this dimorphism changes with latitude across the entire range. Over 400 preserved museum specimens were assessed. Specimens had been collected from locations ranging from 30°-50° latitude. 28 traits were measured with dial calipers, while 24 photograph landmarks were used to examine cranial morphology and morphologies were analyzed in R. Differences in snout-to-vent length were examined across the entire range of the American toad and no significant dimorphism was found ($p=0.4656$). When the range was divided, some areas had counter-intuitive inversions in the dimorphism with males being significantly larger than females. There was no relationship between cranial and morphological variation and latitude in female toads. However, males at higher latitudes were larger, had narrower heads ($p=0.038$) and longer rear legs ($p<0.001$) than their southern counterparts. We concluded that varying selective pressure across large geographic ranges may result in drastically different morphological variation and a single population should not be considered as exemplary of the entire species.

0456 SSAR SEIBERT CONSERVATION AWARD, Banquet Room J, Friday 1 August 2014

Jason O'Connor, Tracy Rittenhouse

University of Connecticut, Storrs, CT, USA

Importance of Late Fall Movement and Snow Cover to Overwinter Survival of Wood Frogs

Regional climate models predict increased winter rainfall and decreased snowfall for much of New England. Reduced snow cover will result in more variable soil temperature and moisture conditions and could be detrimental to organisms that overwinter near the soil surface. Our goal was to characterize Wood Frog (*Lithobates*

sylvaticus) overwintering habitat in CT and experimentally test the effect of snow depth on overwinter survival. We tracked 34 frogs to their overwintering locations. Frogs were enclosed as transmitter batteries failed. Since many frogs made considerable late fall movements (up to 314m), we enclosed an additional frog at the location prior to the last movement greater than 30m for each of the tracked frogs to determine the importance of these movements. We randomly assigned half of the enclosures to a snow removal treatment. Unexpectedly, we observed above litter activity in as many as 13% of frogs in early January. Soil moisture was highly variable among frog overwintering locations (range: 16.4% - 53.1% VMC). Logistic regression indicated that tracked frogs were 5.67 times more likely to survive than paired frogs (Wald X2 = 8.18, df = 1, p = 0.004) and frogs where snow was removed were 7.33 times less likely to survive than frogs that received natural snow cover (Wald X2 = 10.74, df = 1, p = 0.001). Future changes in winter precipitation will likely reduce overwinter survival in Wood Frogs and potentially other terrestrially overwintering amphibians, thus more research is warranted on this important, but rarely observed life stage.

0459 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Katherine O'Donnell[1], Frank Thompson[2], Raymond Semlitsch[1]

[1]*University of Missouri, Columbia, MO, USA,* [2]*USDA Forest Service Northern Research Station, Columbia, MO, USA*

Evaluating Effects of Prescribed Fire and Timber Harvest on *Plethodon serratus* in Southeast Missouri

Prescribed fire is increasingly being used in natural areas across the country to reintroduce fire as an ecosystem process after decades of fire suppression. Timber harvest is another anthropogenic disturbance that markedly affects forest ecosystems. Effects of timber harvest on wildlife are relatively well-documented, but effects of prescribed fire on wildlife – especially amphibians – are inadequately understood. Terrestrial salamanders are integral components of ecosystems, but have physiological characteristics that cause unique responses to fire. Salamanders also have notoriously low detection probabilities; changes to the landscape may unpredictably alter their detectability. We are investigating how timber harvest and prescribed fire affect *Plethodon serratus* populations and microhabitat use at the Sinkin Experimental Forest (Mark Twain NF) in southeast Missouri. We surveyed 40 experimental sites from spring 2010 to spring 2014 via area-constrained searches; sites were either shelterwood-harvested, prescription burned, or left untreated as a control. We accounted for potential changes in detection probability by using hierarchical binomial mixture models to estimate salamander abundance before and after disturbances. This approach requires

spatially and temporally replicated counts, and allows us to simultaneously estimate abundance and detectability without marking individuals. We found that salamander microhabitat use changed substantially following timber harvest and prescribed fire; relative capture frequencies of leaf litter decreased and cover object captures increased. Salamander surface activity also decreased following disturbances, but varied strongly with recent rainfall. Cover object abundance best predicted conditional capture probability, while aspect best predicted salamander abundance.

0454 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Katherine O'Donnell[1], Frank Thompson[2], Raymond Semlitsch[1]

[1]*University of Missouri, Columbia, MO, USA,* [2]*USDA Forest Service Northern Research Station, Columbia, MO, USA*

Using Binomial Mixture Models to Partition Detectability Components in Terrestrial Salamander Populations

Detectability of individual animals is highly variable and nearly always <1; imperfect detection must be accounted for to reliably estimate population sizes and trends. Hierarchical models can simultaneously estimate abundance and effective detection probability, but there are several different mechanisms that may cause variation in detectability. Neglecting temporary emigration can lead to biased population estimates because availability and conditional detection probability are confounded. We developed a binomial mixture model that partitions detectability into these two distinct components. Our state process describes ecological mechanisms that generate spatial and temporal patterns in abundance, while the observation model accounts for the imperfect nature of counting individuals due to temporary emigration and false absences. We illustrate our model's potential advantages – including the allowance of temporary emigration between sampling periods – with a study of southern red-backed salamanders *Plethodon serratus*. We fit our model and a standard binomial mixture model to counts of salamanders surveyed at 40 sites during 3-5 surveys each spring and fall 2010-2012. Our models that partition detectability generated similar parameter estimates to standard binomial mixture models that estimate effective detection probability. Models with season-specific abundance intercepts yielded lower abundance estimates than models with site-by-season abundance intercepts. Aspect was the best predictor of salamander abundance in our case study; abundance increased as aspect became more northeasterly. Increased time-since-rainfall strongly decreased salamander surface activity (i.e. availability for sampling), while higher amounts of woody cover

objects and rocks increased conditional detection probability (i.e. probability of capture, given an animal is exposed to sampling).

0038 AES Behavior, Banquet Room E, Thursday 31 July 2014

Owen O'Shea[1], John Mandleman[2], Brendan Talwar[3], Edward Brooks[1]

[1]Cape Eleuthera Institute, Eleuthera, Bahamas, [2]John H. Prescott Marine Laboratory, New England Aquarium, Boston, MA, USA, [3]Florida State University Coastal and Marine Laboratory, Teresa, FL, USA

Hierarchical Predation Behaviour in Four Species of Marine Apex Predator: Does Size Matter?

Assessing dominance between and among individuals is a fundamental prerequisite in establishing the boundaries of social structures and hierarchies within populations. While the concept of dominance is valuable when describing hierarchical relationships in natural systems, few data are available on heterospecific interactions, particularly in elasmobranchs. Here we provide empirical data from an opportunistic observation made from four sharks (*Caracharhinus leucas*, *Galeocerdo cuvier*, *Sphyrna mokarran* and *Carcharhinus perezi*) competing for foraging opportunities on a fifth shark (*C. perezi*). Video data were analysed at one-second resolution and behaviours were coded into eight categories and durations were assessed. Behaviours during multiple species interactions were also assessed. Feeding opportunity within interactions among all sharks was dominated by *G. cuvier* (44% of time spent feeding, 15% spent guarding the resource) and to a lesser extent, *C. leucas* (11% of time spent feeding). Estimated sizes and length-mass conversions suggest *G. cuvier* to be the third largest individual, yet dominated interactions. Both *G. cuvier* and *C. leucas* defended the prey resource from the other two species, despite *Sphyrna mokarran* being the largest individual present. Interactions between the two competing species may have been mutually beneficial, with a greater cost on defending the resource rather than competing for it. While theoretical studies are effective tools when investigating dominance driven hierarchical interactions, empirical data are always more valuable. These observations are among the few to describe competitive interactions among heterospecific marine apex predators.

0178 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Lacy Obenschain[1], Yong Wang[1], Callie Schweitzer[2]

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The Effects of Forest Disturbance on the Oviposition Site Preference of Amphibians on the Southern Cumberland Plateau

Amphibian response to silviculture practices has merited a significant amount of interest because of their sensitivity to habitat disturbance; the effects of these practices on adult egg deposition have yet to be fully explored. The purpose of this study is to evaluate the impacts of forest disturbance, distance from forest edge, and the effect of light intensity on the breeding pool preference of anurans. The study area is located on the mid-Cumberland Plateau, in Grundy County, Tennessee. One of three silviculture treatments (control with gaps, shelterwood, and oak shelterwood) was applied to each stand, with five replications. Within each stand 3 pool arrays were randomly placed at distances of 10, 50, and 100 m from the edge, with each pool arrays consisting of 3 artificial mesocosms with each mesocosm being assigned a different screen to manipulate light intensity. Artificial pools will be monitored over two breeding seasons from April to September. Opportunistic encounters, visual encounter surveys, coverboards, aquatic funnel traps, and dip-net surveys will be conducted 3-4 times weekly, and physiological data will be recorded on all collected individuals. The results of this study will improve our understanding of forest disturbance on the community ecology of amphibians, and will provide forest managers and private landowners the knowledge to help reduce the negative impacts of forest management techniques on amphibian populations while managing for oak species regeneration on the Cumberland Plateau.

0767 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Charles W. Olaya-Nieto, Jesika Cortés-Salcedo, Fanny Anaya-Sánchez

Laboratorio de Investigación Biológico Pesquera-LIBP, Departamento de Ciencias Acuícolas. Universidad de Córdoba, Lorica, Cordoba, Colombia

Trophic Ecology of Dorada *Brycon sinuensis* in the Sinu River Basin, Colombia

The trophic ecology of Dorada *Brycon sinuensis* in the Sinu River Basin, Colombia, was studied. We analyzed 260 stomachs of individuals collected between January and December, with sizes between 17.0-67.0 cm TL and total weight (WT) between 60.0-6448.0 g. The stomach content was analyzed using the Proportion of empty stomachs, Grade of digestion, Frequency of occurrence, numerical Frequency and Gravimetry. Only 25% of the stomachs were empty and most of the foods were half digested (67.2%).

Three preys were identified: Fishes, Vegetable rests and Others. Vegetable rests were the most common group (88.2%) and the most abundant group (52.8%), although Fishes is the main prey in the composition by weight (50.7%); being the first report for the species in Colombia and for the Brycon in South America. The results achieved suggest that Dorada is an omnivorous fish that tend to consume fishes.

0723 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Charles W. Olaya-Nieto, José D. Pérez-González, Aracely Ojeda-Julio

Laboratorio de Investigación Biológico Pesquera-LIBP, Departamento de Ciencias Acuícolas. Universidad de Córdoba, Lorica, Cordoba, Colombia

Trophic Ecology of Chipe *Hoplosternum magdalenae* in the Cienaga Grande de Lorica, Colombia

To study the trophic ecology of Chipe in the cienaga Grande de Lorica, Colombia, were analyzed 199 stomachs of individuals collected with sizes between 9.2 and 13.5 cm total length (TL) and total weight (WT) between 16.0 and 44.0 g. The stomach content was analyzed using the Proportion of empty stomachs, Grade of digestion, Frequency of occurrence, numerical Frequency and Gravimetry. The Proportion of empty stomachs was high and most of the foods were half digested, identifying five food groups: Vegetable rests, Insects, Scales, Detritus and Others. Vegetable rests was the most common group (58.3%), the most abundant group (39.3%), the greatest group composition in weight (50.8%) and the main food in the Chipe´s diet. The results indicate that Chipe is an omnivorous fish that tend to consume Vegetable rests, whose food preferences are kept as they grow.

0345 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Christian Oldham, Leo Fleckenstein, Steven Price

University of Kentucky, Lexington, KY, USA

Novel Application of Passive Integrated Transponder (PIT) Telemetry in Natricine Snakes

Passive Integrated Transponder (PIT) technology has proved to be a valuable tool for monitoring wildlife. Recent developments in this technology now allow for novel applications through PIT telemetry utilizing portable antennas. During the summer of 2013, we conducted PIT telemetry surveys and hand-capture surveys of Queen Snakes

and Northern Water Snakes in Jessamine County, Kentucky. We found that efficacy of detecting marked snakes was significantly enhanced when employing a portable antenna rather than traditional search methods. We also noted similar detection rates or marked individuals between morning, afternoon, and night PIT telemetry surveys. We were able to track movements of individuals using the portable antenna to determine distances moved between detections. Our results demonstrate the utility of PIT telemetry using portable antennas in a previously untested system and underscore the value and applicability of this technology in future behavioral and ecological studies.

0313 Herp Behavior, Banquet Room I, Saturday 2 August 2014

Mark Oliva

California State University, Northridge, Northridge, CA, USA

Mate Recognition and Attraction in the Executioner Treefrog: Producing a Killer Attractive Call

Frogs predominantly communicate acoustically, using advertisement calls to mediate both inter- and intrasexual interactions. In many frogs, these signals comprise a single component; however, in others they are composed of distinct multiple components. Male executioner treefrogs, *Dendropsophus carnifex*, exhibit a multicomponent advertisement call composed of an introductory screech note followed by two or more secondary click notes. The purpose of my study was to determine the effect of the multicomponent advertisement call on female call recognition and preference in this species. I conducted three 3-choice phonotaxis experiments: I tested (1) female phonotaxis to each call component and to a complete call, (2) female preference for differences in the number of click notes, and (3) female preference for differences in call rate. I found that both notes, presented separately or together as a complete call, evoked similar female phonotactic responses, suggesting that either note was sufficient to elicit a mate-recognition response. Additionally, I found that females preferred calls with greater numbers of added click notes and faster call rates. Because females preferred stimuli with greater call output, males calling with more click notes or at faster rates should experience a greater mating advantage. As calling is energetically expensive and possibly indicates male quality, selecting mates based on these call parameters may provide females with indirect benefits, such as good genes. Determining female phonotaxis towards multicomponent calls and the direction of call preferences is important in understanding the evolution of signal complexity in light of sexual selection.

0123 Herp Systematics, Banquet Room H, Sunday 3 August 2014

Lauren Oliver, Elizabeth Scott-Prendini, Christopher Raxworthy

American Museum of Natural History, New York, New York, USA

Dispersal and Diversification of *Hylarana* Across Multiple Biogeographic Regions

Hylarana (Anura: Ranidae) has a unique distribution amongst frogs as it occurs in Africa, Asia, and Melanesia, crossing many recorded biogeographic barriers, such as Wallace's Line. With 86 currently described species, the taxonomy of *Hylarana* is in a state of flux as subgeneric classifications are shown by molecular studies with moderate sampling to be paraphyletic. Previous studies have been limited with uneven taxonomic sampling, problems of tissue identifications from museum collections, and "widespread" taxa that are probably not conspecific across their entire range. Combined with the lack of a complete identification key to the genus, a large number of species, and taxonomic uncertainty, a large-scale genetic approach is required to adequately resolve clades within *Hylarana.* Here, we present (1) the results of our molecular phylogenetic analysis of *Hylarana* with the most inclusive taxon sampling of the genus to date, (2) historical dispersal in and out of Africa, Asia, and Melanesia, and (3) taxonomic implications of the research.

0102 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Claudia Olivera-Tlahuel[1], Maricela Villagran-Santa Cruz[1], Norma Angelica Moreno-Mendoza[2], Jose Jaime Zuniga-Vega[1]

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Relationship Between Superfetation and Placentation in Viviparous Fishes of the Family Poeciliidae

Different levels of superfetation (embryos of different developmental stages within the female reproductive tract) can be observed among members of the family Poeciliidae. Few studies have examined the morphological correlates of superfetation in the female ovary. In this study we tested the hypothesis that superfetation should be associated with a greater complexity in the placentas. The placenta is the close apposition of maternal and fetal tissues. Specifically, we focused on follicular cells as well as on blood vessels because these traits are directly related to the transfer of nutrients from the mother to the embryos. Our main prediction was that follicular cells should be larger and with more blood vessels in species with superfetation compared to species without

superfetation. We examined the female ovary of eight species of poeciliid fishes (*Alfaro cultratus*, *Gambusia regani*, *Heterandria bimaculata*, *Poecilia butleri*, *Poeciliopsis gracilis*, *P. infans*, *P. viriosa* and *Xiphophorus helleri*) using the hematoxylin-eosin histological technique. Our results indicate interesting differences between species with superfetation (*Heterandria bimaculata*, *Poeciliopsis gracilis*, *P. infans* and *P. viriosa*) and species without superfetation (*Alfaro cultratus*, *Gambusia regani*, *Poecilia butleri* and *Xiphophorus helleri*). Overall, the observed differences agreed with our predictions. Our results provide insight on the morphological mechanisms that facilitate superfetation in poeciliid fishes.

0744 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Robert E. Ortega, Steven Salinas, Justin Saiz, Jesus Rivas

New Mexico Highlands University, Las Vegas, New Mexico, USA

The Impact of Invasive Bullfrogs on the Demographics of Northern Leopard Frogs in Northern New Mexico

Invasive species alter the dynamics of the trophic levels of an ecosystem and have no natural controls. They displace native species in the food web, and prey on species with no adaptive defenses. The Rio Mora National Wildlife Refuge has both invasive Bullfrogs and native Northern Leopard Frogs. The purpose of this study is to investigate the effects of the presence of the invasive Bullfrog on the demographics of the native Northern Leopard Frog in northern New Mexico. The Mora River was divided into two 2400-meter long sections, a control site containing Bullfrogs and an experimental site, where Bullfrogs were eradicated. Call, visual, and radio telemetry surveys were utilized to sample the population. Fifty-one Leopard Frogs were captured, pit tagged, and processed for demographic data. Six frogs were fitted with radio transmitters. Control and experimental regions did not differ in the relative abundance of Leopard Frogs. We did not find a significant difference in the mass of frogs from the two regions. However, preliminary data does show lower average mass and greater abundance in the experimental region suggesting an increase in recruitment of metamorphosis frog into the population. Telemetry data for four frogs in the control region produced a mean home range size of 531.7 square meters. The Telemetry data shows a large range of sizes in their home range area. Further study of the home range will be conducted to determine if there is a difference in home range between the control and experimental areas.

0745 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Guillermo Orti[1], Ricardo Betancur-R[2], Ed Wiley[3], Masaki Miya[4], Guillaume Lecointre[5], Nicolas Bailly[6]

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Revised Classification of Bony Fishes Based on Molecular Data (Version 3)

This classification (version 3), builds on Wiley and Johnson (2010) and Betancur-R. et al. (2013a), and intends to preserve names and taxonomic composition of groups to facilitate communication. It is based on new analyses of a molecular data set with 1591 taxa that adds 165 new taxa and ca. 25 families not examined in version 1. The new data set combines evidence published by Betancur-R. et al. (2013a) and Near et al. (2013). Adjustments have been made to version 2 to recognize well-supported molecular clades, obtained by new molecular studies, and to correct deficiencies of the previous versions. International collaboration and building consensus to endorse a sound classification based on explicit phylogenetic analyses is critical to provide the ichthyological community with a most necessary resource.

0571 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Brittany Ousterhout, Raymond Semlitsch

University of Missouri, Columbia, Missouri, USA

Natal Pond Conditions and Juvenile Habitat Affect Distance Moved by Ringed Salamanders (*Ambystoma annulatum*)

Dispersal is the movement of individuals from their natal population to a different breeding population. Although the ultimate consequences of long distance dispersal are increasingly well understood, there are many unanswered questions about proximate mechanisms. It has been estimated that 9% of juveniles disperse, however it is unknown what factors contribute to those individuals dispersing while others remain residents. In this study, we tested whether natal habitat conditions affected the propensity of an individual to move farther, and if natal conditions interact with juvenile habitat to affect movement distance. We reared juvenile ringed salamanders (*Ambystoma annulatum*) from larvae in experimental mesocosms at different intraspecific densities. Following

metamorphosis, we marked individuals with passive integrated transponder (PIT) tags and released them in enclosures located in forest or grassland habitat. We tracked juveniles daily for 7 days, after which we attempted to recapture all animals to confirm survival. We released 454 animals, and detected 363 individuals at least once (mean 6.5 ± 3.8 [1 SD] detections over one week). Distance moved increased as natal habitat quality decreased. Although the movement distance of animals reared in medium and low density natal habitats did not vary with juvenile habitat, small animals which were reared in high density experimental ponds moved farther in the forest habitat than the field. Our study indicates that the traits of natal ponds, including conspecifics density and surrounding habitat conditions, may affect the number of amphibian dispersers produced.

0769 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Banquet Room J, Friday 1 August 2014

Dustin Owen[1], Evin Carter[2], Matthew Holding[3], Ignacio Moore[4], Kamal Islam[5]

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You Cruise, You Lose: Roads Facilitate a Blunted Stress Response in Copperheads (*Agkistrodon contortrix*)

Roads represent a highly influential form of human disturbance at the local and landscape scales. However, the physiological impacts, especially concerning stress physiology, of roads remain relatively unstudied. We investigated the plasma corticosterone (CORT) levels (baseline, change in concentration, and stressed) in free-ranging copperhead (*Agkistrodon contortrix*) individuals captured while crossing roads or in forests. Copperheads responded to capture, handling, and confinement stress by increasing levels of CORT. There was no difference in baseline CORT levels or body condition between road and forest snakes. However, road snakes showed a reduction in the magnitude of the CORT response and in stressed levels of CORT as a result of the 30 minute capture and confinement. Additionally, increased amounts of traffic also resulted in decreased baseline, CORT response, and stressed CORT levels in road snakes. Our results suggest that adjacency to roads facilitates a blunted stress response in copperheads. Reduced stress responses are an indicator of either acclimation to environmental stressors or chronic stress brought on by constant influence of roads. Both explanations would result in decreased survival potential for snakes living in close proximity to roads, which could eventually result in population fragmentation.

0771 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR PHYSIOLOGY & MORPHOLOGY

Dustin Owen[1], Matthew Holding[2], Emily Taylor[3], Chris Gienger[1]

[1]Austin Peay State University, Clarksville, TN, USA, [2]The Ohio State University, Columbus, OH, USA, [3]California Polytechnic State University, San Luis Obispo, CA, USA

A Comparison of Commonly Applied Body Condition Indices in Snakes

Body condition indices (BCI) are commonly used surrogate measures for estimating relative amounts of stored energy reserves, especially fat, in vertebrate taxa. These measures are assumed to provide ecologists and management biologists with a useful, non-lethal metric for assessing the "health" of free-ranging organisms. However, most BCIs lack empirical validation, and their usefulness is thought to vary among taxa. While comparative evaluations for BCIs have been conducted in many taxa (i.e. birds, mammals, and amphibians); reptiles have received considerably less attention with regards to evaluating current BCI methodologies. We evaluated the performance of seven of the most commonly applied BCIs to data on known fat pad masses from two rattlesnake species, *Crotalus oreganus* and *C. atrox*. Our results provide a critical evaluation for the usefulness of BCIs in snakes. These results will aid in future conservation and ecological research employing BCIs as metrics for assessing organismal health.

0137 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Jacob Owen, Jesse Meik, T. Wayne Schwertner

Tarleton State University, Stephenville, Texas, USA

Effects of Agriculture on Snake Diversity and Abundance in Northeastern Swaziland

The conversion of natural habitat to agricultural use likely has detrimental effects on biodiversity; however, information for many groups, including snakes, remains limited. Using highways as a sampling transect, we compared diversity and relative abundance of snake assemblages between protected areas and plantations in northeastern Swaziland, a small African nation where much of the subtropical Lowveld habitat has been converted to sugarcane monoculture. We encountered 20 of the 31 species of

snakes reported from the country. Although species richness was similar between the two habitats, snakes were encountered nearly 3 times more frequently in protected areas than in sugarcane plantations. The threatened Southern African python, *Python natalensis*, was the most frequently encountered species along the transect, and was found exclusively in Lowveld habitat. At the family level, only elapids were more abundant in sugarcane, although sample size was small. Our data suggest that overall snake communities in northeastern Swaziland are adversely affected by intensive agriculture, but that medically relevant species may benefit from human-modified habitats.

0042 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Hannah Owens

University of Kansas, Lawrence, KS, USA

Investigating Modes of Speciation in Trans-Isthmian Haemulid Grunts

Traditionally, geminate taxon pairs are thought to arise through allopatry when a geographic barrier emerges, bisecting a taxon's geographic range and preventing gene flow between the now-separated populations. However, incipient parapatric speciation prior to final barrier emergence is also possible. In the case of the former scenario, one may expect the ecological niche tolerances of geminate species to be conserved, whereas in the latter, niche tolerance divergence is expected to be correlated with genetic divergence. Grunts in the family Haemulidae present a possible example of pre-isolation speciation; evidence from previous studies have suggested possible non-simultaneous divergence in four marine geminate pairs separated by the formation of the Isthmus of Panama. To investigate this idea, I pursued two lines of inquiry. First, I developed ecological niche models for each of the eight taxa by integrating locality data from several observational and specimen databases with ecological data from the World Ocean Atlas. The resulting models were then projected into their sister taxon's geographic range, and the power to accurately predict observations of the sister taxon was assessed. Second, I measured similarity between modeled ecological niche tolerances of geminate taxa and calculated the degree to which niche divergence and genetic divergence were correlated. Generally, niche models of one taxon did not accurately predict its geminate, and niche and genetic divergence were correlated. While equivocal, my results suggest that speciation in haemulid geminate pairs may have begun parapatrically prior to final isolation by the completion of the Isthmus of Panama.

0470 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Mayra Oyervides, Frederic Zaidan III

University of Texas-Pan American, Edinburg, TX, USA

Heterospecific Aggregational Shelter Use by *Rhinella marina* and *Incilius nebulifer* in Deep South Texas

Animal aggregations occur in nature and are often perceived as beneficial interactions between animals. However, in places where shelters are limited, animals may seek refuge with conspecifics or heterospecifics in order to survive. In these cases co-inhabiting may be crucial to survival, but can potentially be detrimental by facilitating the transmission of pathogens and disease not only within a species but among species. The purpose of this study is to investigate under what conditions heterospecific toads share refuge. Two toad species, *Rhinella marina* and *Incilius nebulifer*, of varying sizes were used for this experiment. An insulated chamber (61x61x91 cm) was constructed and maintained at 37.8°C using two heat lamps (60 watt bulbs). Two equal sized burrows were placed within the chamber; however, one burrow was maintained at 21.1°C using a TEC cooling system, while the other was maintained cooler than ambient temperature (32.2°C). Our results show that conspecifics of both species often co-inhabit. However, it was observed that among heterospecifics *I. nebulifer* chose less favorable shelter sites than to co-inhabit with *R. marina* when two shelters were offered. Upon removing one shelter site, *R. marina* conspecifics always co-inhabited. When heterospecifics were offered only one shelter, it was only used by *R. marina*. Heterospecific aggregations were observed less than 5% of the time under all the different conditions. Our results may help improve our understanding of toad ecology in order to preserve their populations by means of habitat alteration, and to help assess the risk of pathogen transmission among terrestrial amphibians.

0261 Turtle Ecology, Banquet Room H, Sunday 3 August 2014

Vivian P. Páez, Beatriz Rendón Valencia, Paula Espinal, Brian C. Bock

Instituto de Biología, Universidad de Antioquia, Medellín, Antioquia, Colombia

Assessment of the Population Demographics of *Podocnemis lewyana* in the Middle Magdalena Drainage, Colombia

Podocnemis lewyana (Chelonia: Podocnemididae) is endemic to northern Colombia and is endangered due to over-exploitation and habitat contamination and destruction within its entire distributional range. *P. lewyana* is considered one of the top 25 more threatened freshwater or tortoise species in the world. During the past four years we have conducted a mark-recapture study of this species in four channels connecting wetlands

to the main course of the Magdalena River in order to estimate population vital parameters and construct a projection matrix as an essential step towards achieving scientifically rigorous management. We also characterized different aspects of habitat quality in these four channels in order to associate them with the demographic results and obtain an average of the demographic parameters. To date, we have marked more than 500 individuals of all size classes, with a recapture rate of 10%. We have documented significant differences among our sites in terms of recapture probabilities, size distributions and sex ratios. With the combined use of an ultrasound scanner, analyses of tracks left by females when nesting, and comparing growth rates of different size classes, we have estimated a minimum size at reproduction for the species. We also documented from 80 to 100% nest loss due to human harvest and nest trampling by cattle on the main nesting areas close to our study sites. This analysis provides information on the life history of this species, which, even under different spatial and temporal conditions, will help direct management plans intended to recover these over-exploited populations.

0506 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Daniel Paluh[1], Scott Simpson[2], Christopher Sheil[1]

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Estimating Growth Rates of *Chelydra serpentina* (Chelydridae) Across Latitudes

Bergmann's rule is described as a within-species tendency for increasing body size with increasing latitude or decreasing environmental temperature. This ecogeographic pattern has been identified in multiple amniote lineages, including mammals, birds, and turtles. *Chelydra serpentina* is a turtle that exhibits indeterminate growth and has been shown to follow Bergmann's Rule; however, it remains unknown whether northern-latitude turtles are large because of faster growth rates, or because they survive longer. We conducted a study of skeletochronology on *C. serpentina* to estimate ages and growth rates, and to assess body size variation as it relates to latitude. If populations present similar growth rates, this may suggest that northern populations contain larger individuals as a result of longer survival. If growth trajectories differ, there may be an underlying physiological mechanism, such as the ability to conserve heat, driving latitudinal differences. Data were collected from 64 specimens, ranging from northern Ohio to southern Florida. Lines of arrested growth (LAGs) were recorded from sections of the femur, and a correction factor was applied to account for missing LAGs in the

remodeled zone of the medulla. Corrected ages were used to estimate growth rates, which were correlated with body size for several populations across North America.

0306 Herp Reproduction, Banquet Room I, Sunday 3 August 2014

M. Rockwell Parker

Monell Chemical Senses Center, Philadelphia, PA, USA, Washington and Lee University, Lexington, VA, USA

How to Smell Sexy: Hormonal Architecture Underlying Pheromone Expression in Garter Snakes

Animals communicate using a variety of sexual signals to attract and choose between potential mates, and many of these signals are overt (e.g., badges, behavioral displays) while others are cryptic (e.g., pheromones). Primary sex steroid hormones (testosterone, estradiol) activate and sculpt the expression of sexually dimorphic signals such that inhibition of or supplementation with these hormones can dramatically alter signal strength and composition. The only type of sexual signal used by snakes, as supported by experimental evidence, is a female sex pheromone. Further, pheromone isolation, identification and testing has been pursued in only one genera of snakes, *Thamnophis*. Garter snakes use sex pheromones to make exquisitely specific mate choice decisions, and in the red-sided garter snake, *Thamnophis sirtalis parietalis*, the female sex pheromone shows significant plasticity. My research has elucidated the role of sex steroids in activation and, surprisingly, suppression of sex pheromone expression. Estradiol (E2) can activate pheromone expression in male snakes, and the effect is reversible. Testosterone (T), however, actively inhibits pheromone expression in males: castration alone induces female pheromone expression. Further, supplementation of intact males with T activates a unique pheromone profile that may be "super-male." Lastly, E2 is a dominant signal over T since intact males with E2 implants produce an attractive, female-typical pheromone profile. Many reptiles use overt, hormonally-dependent sexual signals, and I postulate that many (all?) of these species use chemical signals as well that would be carried in hormonal tandem with known signals and subject to the same physiological modulation.

0672 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Wesley Parsons, Logan Fehrenbach, Richard D. Durtsche

Northern Kentucky University, Highland Heights, KY, USA

Diurnal Activities and Metabolism of *Podarcis muralis* as an Introduced Species to the Greater Cincinnati Region

The European wall lizard (*Podarcis muralis*) is an introduced species that was originally brought to Cincinnati from Italy in 1952. Over the past 60 years, what started as a small founder population of ten individuals has since grown exponentially to a large isolated population that can be found throughout the Greater Cincinnati area. This explosion of "wall" lizards is due to their ability to thrive in urbanized saxicolous microhabitats, such as sidewalks, concrete cracks, and rock walls. This research was conducted as the initial analysis of the niche occupied by these introduced lizards to determine if they 1) occupy a vacant urban niche, and 2) potentially impact other species in the ecosystem. Our objectives were to study the food ecology of these lizards, as well as to determine their allocation of time and energy on daily activities. Lizards were observed for 10-minute focal samples, recording: location, sex, age (juvenile or adult), time spent in behavioral activities, microhabitats occupied, foraging success/ failure, and the climate exposure selected. Stomach contents were then obtained through stomach flushing for comparative analysis of diet to that of native lizard species. Food competition was evaluated using a Y-box between *P. muralis* and local lizard species (*Sceloporus undulatus, Plestiodon fasciatus*). An ontogenetic size-classed series of *P. muralis* individuals were also tested for metabolic differences using a flow-through respirometry system. Metabolic rates of local lizard species (*Sceloporus undulatus, Plestiodon fasciatus*) were also determined for interspecific comparisons.

0138 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Corinne Paterson

California State University, Northridge, Northridge, CA, USA

The Genetic Diversity and Population Structure of Barred Sand Bass (*Paralabrax nebulifer*)

Barred sand bass (commonly, sand bass), *Paralabrax nebulifer*, is part of the largest recreational fishery in Southern California as well as a large artisanal fishery in Mexico. This species ranges from Santa Cruz, California to the southern tip of Baja California, Mexico, but is common only south of Pt. Conception. Sand bass form large spawning

aggregation in the summer months of June-August which makes them highly susceptible to overfishing. In the last decade, populations of sand bass in southern California have experienced a severe decline in numbers and subsequently the recreational fishery has been seriously impacted. Large population declines, such as a fishery decline, can lead to a decrease in genetic diversity and potentially a genetic bottleneck. This is a concern for barred sand bass populations, however the population structure and genetic diversity of barred sand bass populations was previously unknown. This study looks at both aspects using the d-loop region of the mitochondrial DNA and microsatellite markers for populations throughout California and Mexico. Both markers show a high degree of genetic diversity and suggest two populations of barred sand bass however there is a high degree of connectivity between those populations. The San Quintin upwelling zone in Baja, California is likely an oceanographic barrier to larval transport; however it is an incomplete barrier as evidenced by the high degree of gene flow between the two populations.

0328 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Austin Patton[1], Kristin Bakkegard[2]

[1]*Warren-Wilson College, Asheville, NC, USA,* [2]*Samford University, Birmingham, AL, USA*

Slimy Salamanders in Central Alabama Infected with Chiggers

Chiggers are the larval form of trombiculid and leeuwenhoekiid mites which parasitize terrestrial vertebrates. In salamanders, chiggers burrow under the skin and can be seen by the naked eye as a moving red or orange dot, swollen nodules, skin lesions, or pustules. Alabama has only one previous report of a salamander (*Eurycea bislineata*) infected with chiggers. We visually examined 45 Northern Slimy Salamanders (*Plethodon glutinosus*) from 5 localities in Jefferson and Shelby Counties and counted the number of chiggers. The infection rate was 66.7% and the number of chiggers per salamander ranged from 0 to 52. Feet and limbs were most heavily infested (28.5% on fore limbs/feet and 35.0% on hind limbs/feet). By body region, 2.6% were found in/on the head and throat, 4.2% were present in/on the cloaca, 13.8% in/on the tail, and 15.9% were in/on the body. Infected salamanders were found at all localities except one, Red Mountain Park (Jefferson Co.) but at the Trussville locality (Jefferson Co.), only 1 of 9 salamanders was infected and that was with just two chiggers. Salamanders (N=6) from the Moss Rock Preserve (Jefferson Co.) were all infected. This locality had the salamander with 52 chiggers. Of the 25 salamanders collected at four locations within Oak Mountain State Park (Shelby Co.), all but two had chiggers. The mite has not yet been identified, but *Hannemania dunni* is most likely candidate. However, other possibilities include

Eutrombicula alfreddugesi and other species of *Hannemania* also known to infect amphibians.

0651 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

Thomas Pauley[1], William Sutton[2]

[1]*Marshall University, Huntington, WV, USA,* [2]*Tennessee State University, Nashville, TN, USA*

Cheat Mountain Salamander (*Plethodon nettingi*): What We Know after 37 Years of Observation

Long-term datasets represent a wealth of information and can often be used to detect changes in species populations. We present 37 years of data on the distribution and natural history of the Cheat Mountain Salamander (*Plethodon nettingi*), as well as other sympatric salamander species. *Plethodon nettingi* is federally protected (threatened) and only occurs above 670 m elevation in the eastern Allegheny Mountains of West Virginia. We began our inventories in 1976 and continued through 2013. Over this 37-year period, we conducted diurnal inventories for salamanders from May to mid-October by searching under rocks, logs, and litter for approximately one-person hour at each site. We searched over 1,300 sites and have determined *P. nettingi's* total range, approximate number of populations, reproductive behavior, interactions with sympatric species, and conservation issues. We will present these data and discuss the long-term conservation implications and challenges facing this species and its associated habitats. While 37 years is a snapshot of time relative to the eons that salamanders have been on earth, this long-term data set can provide biologists with population trends and potential causes of salamander declines and extirpations.

0173 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Phillip Pearson, Daniel Warner

University of Alabama at Birmingham, Birmingham, Alabama, USA

Natural Thermal Environments Experienced by Eggs Affect Morphology and Performance of Hatchling Lizards (*Anolis sagrei*)

Reptile embryos are heavily dependent upon their environment for regulating physiological processes, which makes them excellent models for studies of developmental plasticity. Extensive work demonstrates that egg incubation

environments affect offspring phenotypes, but very few studies have explored the effects of natural incubation conditions. In this laboratory study, we incubated eggs of the lizard *Anolis sagrei* under thermal conditions that mimic diel fluctuations found in the field to determine if natural thermal variation affects offspring morphology and performance. Eggs were exposed to thermal conditions that were measured in two microhabitats (open and shade) at two different times of the incubation season (April and July) in a 2 x 2 factorial design. After eggs hatched, all offspring were measured and their locomotor performance was quantified. Incubation duration was influenced by temperatures that mimicked different microhabitats and the two times of the season; incubation duration was shortened under relatively warm conditions. Variation in offspring morphology was also influenced by variation in natural thermal regimes. Locomotor performance was influenced only by temporal factors, with late July temperatures producing hatchlings that ran faster than those produced under early April temperatures; this effect could compensate for any negative effects of hatching late in the season. These findings highlight the importance of natural incubation temperatures in shaping fitness-related phenotypes of offspring.

0347 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Guillem Pérez i de Lanuza[1], Enrique Font[2]

[1]*CIBIO/UP, Vairao, Portugal,* [2]*University of Valencia, Valencia, Spain*

Now You See Me, Now You Don't: Iridescence (Angle-dependent Reflectance) Increases the Efficacy of Lizard Chromatic Signals

The selective forces imposed by primary signal receivers and unintended eavesdroppers often act in opposite directions, constraining the development of conspicuous animal coloration. Because iridescent colours change their chromatic properties with viewer angle, iridescence offers a potential mechanism to relax this trade-off when the relevant observers involved in the evolution of chromatic signal design adopt different viewer geometries. We used reflectance spectrophotometry and visual modelling to test if the striking blue head coloration of males of the lizard *Lacerta schreibeiri* (which presumably acts as a social signal informing on male dominance during reproductive periods) 1) changes its chromatic appearance with viewer geometry, and 2) is more conspicuous when viewed from the perspective of conspecifics than from that of the main predators of adult *L. schreibeiri* (i.e. raptors). Our results demonstrate that the blue heads of *L. schreiberi* show angle-dependent changes in their chromatic properties. This variation allows the blue heads to be relatively conspicuous to conspecific viewers located in the same plane of the sender, while simultaneously being relatively cryptic to birds that see it from above. This study is the first to suggest the use of angle-dependent chromatic signals in lizards and provides the first evidence of the adaptive function of an angle-

dependent coloration based on the efficacy design of colour signals and their detectability by different observers.

0401 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

William Peterman[1], John Crawford[2], Andrew Kuhns[1], Christopher Phillips[1]

[1]University of Illinois, Champaign, Il, USA, [2]Lindenwood University, St. Charles, MO, USA

Landscape Effects on Amphibian Species Richness and Wetland Conservation Coefficients

Wetlands are among the most imperiled habitats, frequently being altered, polluted, or drained. Amphibians, many of which are dependent on wetlands for reproduction, are also increasingly threatened with extinction, in many cases due to wetland habitat loss or degradation. Because of their biphasic life cycle and semipermeable skin, amphibians can serve as indicators of wetland quality. Despite the importance of assessing the health and function of wetlands, standardized metrics of wetland quality for amphibians are lacking. In this study, we compare two metrics at a series of wetlands: species richness and wetland conservation coefficients. The wetland conservation coefficient is a weighted measure based on the amphibian species documented at a wetland that incorporates a species' sensitivity to disturbance, rarity, and distribution. We assessed each metric in relation to within-wetland features as well as broader landscape features. Using amphibian assemblage data collected from 40 wetlands in eastern Illinois, we found that species richness was an insensitive metric when assessing within-pond and landscape effects. Only the most isolated wetlands embedded within a landscape of minimal forest coverage had significantly lower estimates of species richness compared to wetland conservation coefficients. In contrast, we found that the wetland conservation coefficient more effectively differentiated wetlands and highlighted the importance of semipermanent hydroperiods and contiguous forested habitat surrounding wetlands. These findings reflect the importance of incorporating species' sensitivity to habitat alteration into the assessment of wetland quality, and underscores the importance of developing more integrated metrics when assessing the function of wetlands.

0703 AES Morphology & Reproduction, Banquet Room E, Sunday 3 August 2014

Ashley Peterson[2], Misty Paig-Tran[1], Adam Summers[2]

[1]CSU Fullerton, Fullerton, CA, USA, [2]U Washington, Friday Harbor, WA, USA

Mega Filtration: Using Biomimetic Models to Understand Manta Ray Feeding

Mobulid fishes (mantas and devil rays) filter prey smaller than the pore size of their filter pads. The branchial filter is formed from the five branchial arches; each arch presents both an anterior face directed at the incoming flow and a posterior face that is shielded from the incoming free stream. The flow through these filter elements is complex and varies with the angle and anatomy of the filter. We used enlarged 3D biomimetic models to examine fluid flow over a variation of filter morphologies and at different attack angles. Models were based on gross dissections of *Manta birostris* filter lobes and created with a 3D rapid prototyper. Fluid movement was visualized with a dye stream aimed to show flow in specific areas of the filter. In anterior and posterior orientations the fluid makes contact with the filter lobe and then makes a 90 degree turn into the filter pore. The vorticity of the system is complex and we distinguished three different processes that depend on orientation and fine scale morphology: 1) vorticity parallel to the plane of the filter that moves downstream, 2) vortices parallel to the free stream and perpendicular to the filter plane maintained in the pore opening, and 3) vorticity seen in anterior facing filter lobes with projections consisting of vortices shed downstream above the filter plane. This complicated vorticity indicates that some form of cyclonic filtration is playing an important role in the filter-feeding of Mobulids.

0316 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Cheston Peterson[1], Dean Grubbs[2]

[1]Florida State University, Tallahassee, FL, USA, [2]FSU Coastal and Marine Laboratory, St. Teresa, FL, USA

Community Structure and Stable Isotope Ecology of Sharks and Large Teleost Fishes in the Florida Big Bend

Community structure and trophic ecology of sharks and large teleost fishes in seagrass beds of the Florida Big Bend were investigated using fishery-independent longline and gillnet surveys and stable isotope analyses. Community structure was analyzed using a combination of cluster analysis, indicator species analysis, and non-metric multidimensional scaling (NMDS). Carbon and nitrogen stable isotope analyses were used to infer relative trophic structure of these taxa and the potential for regional variation in trophic patterns. We found community structure to be correlated with water

clarity, salinity, and depth. Stable isotope analyses suggest this system is trophically diverse, with considerable isotopic overlap across many taxa. The results of our study suggest an ecological gradient in the Big Bend, culminating in a relatively distinct southern faunal zone; and we hypothesize patterns of community composition and trophic structure are related to varying levels of river influence across the habitat.

0586 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Christopher Peterson[1], Matthew Chatfield[2]

[1]University of Tennessee, Knoxville, TN, USA, [2]Tulane University, New Orleans, LA, USA

Comparison of Trap Baiting Methods for Sampling Aquatic and Semi-Aquatic Herpetofauna

Poor detectability and low capture rate are frequent concerns for studies of herpetological ecology, particularly for aquatic or semi-aquatic species. Funnel traps are a commonly used passive sampling method in these studies. Prior work has demonstrated that both food and light can serve as baits to increase trap effectiveness, but the relative quality of these two methods has not been assessed. The objective of this study was to compare the effectiveness of glow stick and food baited aquatic funnel traps for capturing reptiles and amphibians. We sampled three locations in southern Mississippi for four field seasons using traps baited with glow sticks, cat food, or nothing. The catch was counted and organized at broad taxonomic levels (salamanders, turtles, etc.) and analyzed with PERMANOVA using bait type and site as main effects. Preliminary analyses suggest that bait type had little effect on capture diversity, although cat food appears somewhat less effective at attracting tadpoles than glow sticks or empty cages.

0445 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Mariah O. Pfleger[1], R. Dean Grubbs[2], Toby S. Daly-Engel[1]

[1]University of West Florida, Pensacola, FL, USA, [2]Florida State University, Tallahassee, FL, USA

DNA Barcoding in the Genus *Squalus* Reveals a Novel Dogfish Species from the Gulf of Mexico

Sharks of the genus *Squalus* are slow-growing, long-lived, and have long gestation periods, as is typical of most deep-water sharks. In addition, low genetic diversity is

frequently observed, making this group slow to rebound from depletion due to overfishing. The shortspine spurdog shark (*Squalus mitsukurii*) is a putative circumglobal deep-water shark that was originally described from Japanese waters. This species is easily misidentified due to the high degree of similarity with their congeners, and recent taxonomic research from the Pacific has indicated that *S. mitsukurii* may in actuality comprise a species complex, a group of separate but closely related species. We analyzed 596 bp of the mitochondrial cytochrome oxidase 1 (CO1) gene (barcoding region) of *Squalus* cf. *mitsukurii* from the Gulf of Mexico and compared it to sharks from the type locality in Japan to test the hypothesis that Gulf *S. mitsukurii* comprise a distinct species. Our results show high bootstrap support for a 1.5-2.0% sequence divergence between Gulf of Mexico and Japanese *S. mitsukurii*, with 0.3-0.7% separation between *Squalus* cf. *mitsukurii* and *S. cubensis*, also from the Gulf of Mexico. Within-species divergence ranged from 0.0-0.5%. These results confirm that *Squalus* species in the Gulf of Mexico are more closely related to one another than they are to congener species in the Pacific regardless of nomenclature, and that *Squalus* cf *mitsukurii* from the Gulf of Mexico merits recognition as a novel dogfish species.

0070 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Taylor Phillips, Matthew White

Ohio University, Athens, Ohio, USA

Seasonal Movements of the Sandstone Falls Population of Lower New River Walleye

An ultrasonic telemetry and habitat use study of 20 walleye was conducted on the lower New River in West Virginia to determine seasonal movement, spawning locations, and habitat use. There are two distinct genetic stocks of walleye within this section of river, from Sandstone falls to Hawks Nest. Representatives from each stock were tracked with the majority consisting of the Eastern Highlands stock. 63% of tagged walleye returned to the initial tagging location/spawning grounds while other 37% were not located except after the initial tagging. Both walleye stocks used the same spawning grounds, traveled considerable distances downstream post-spawn, and showed no significant differences in their overall movement. Although there were differences among fish, no significant difference between males and females or between the two genetic stocks was observed. Both walleye stocks preferred habitat with cobble/boulder substrate during spawning periods and post-spawn. There was no difference in habitat choice between males and females.

0149 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Josh Pierce[1], Craig Rudolph[1], Steve Reichling[2], Emlyn Smith[3], Michael Sealy[4], Daniel Saenz[1]

[1]USDA Forest Service, Nacogdoches, TX, USA, [2]Memphis Zoo, Memphis, TN, USA, [3]USDA Forest Service, Bentley, LA, USA, [4]US Fish and Wildlife Service, Lafayette, LA, USA

Returning the Louisiana Pine Snake (*Pituophis ruthveni*) to Restored Habitat

Ongoing surveys suggest that the Louisiana Pine Snake (*Pituophis ruthveni*) is rapidly declining; and currently occupied habitat is limited to a few small blocks of degraded and highly fragmented habitat. Research suggests that the species requires frequently burned sites with a well developed herbaceous understory capable of supporting populations of its primary prey, Baird's Pocket Gopher (*Geomys breviceps*). Recent changes in management practices on U. S. Forest Service lands, primarily to enhance Red-cockaded Woodpecker populations, have resulted in restoration of substantial blocks of suitable habitat, which are now available for reintroduction. A captive population consisting of ~60 individuals has been established from wild-caught snakes from Bienville Parish, LA. The reintroduction site is located on the Catahoula District of the Kisatchie National Forest. Forty-five individuals have been released to date. The current protocol is to continue to breed captive snakes and release 50% of available animals as neonates immediately following post-natal shed, while the remaining snakes will be head-started and released the following April. Currently, automated pit tag readers (APTR) and trapping are the primary monitoring techniques, however canine detection and radiotelemetry, may be used in the future. To date, four snakes have been detected two years post-release. Production of neonates and release of young will be repeated annually until a viable population is established or it is concluded that further releases are not likely to result in establishment of a population.

0196 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Todd Pierson[1], Thomas Floyd[2], Paul Moler[3], Anna McKee[4], Stephen Spear[5], Misty Penton[3], Troy Kieran[1], Carlos Camp[6], John Maerz[7], Travis Glenn[1]

[1]Environmental Health Science, University of Georgia, Athens, Georgia, USA, [2]Georgia Department of Natural Resources, Forsyth, Georgia, USA, [3]Florida Fish & Wildlife Conservation Commission, Gainesville, Florida, USA, [4]U.S. Geological Survey, Norcross, Georgia, USA, [5]The Orianne Society, Clayton, Georgia, USA, [6]Piedmont College, Demorest, Georgia, USA, [7]Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia, USA

Detection of Plethodontid Salamanders Using Environmental DNA

The recovery of DNA from environmental samples (eDNA) has been demonstrated to be a cost-effective and efficient way to detect rare or secretive species that is being widely incorporated into inventory and monitoring programs for a variety of taxa, including amphibians. Two general techniques are used: 1) species-specific primers and probes are used to amplify DNA from a target species, and presence is inferred from quantitative PCR (qPCR) amplification, or 2) more general primers are used to amplify a short barcoding region of DNA, samples are uniquely tagged and sequenced in parallel on a next-generation sequencing platform, and resulting reads are matched against a reference library to characterize an entire community (often called 'metabarcoding'). Here, we present results of a pair of qPCR assays developed and used to detect two enigmatic plethodontids in the Southeast: the patch-nosed salamander (*Urspelerpes brucei*) and the Georgia blind salamander (*Eurycea* [*Haideotriton*] *wallacei*). Additionally, we present preliminary results from an attempt to use metabarcoding to characterize diverse communities of semi-aquatic plethodontids from the Southern Appalachians. Our studies represent the first efforts to use eDNA to survey for plethodontid salamanders and demonstrate the great potential for its future use in detecting rare and secretive species.

0012 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Theodore W. Pietsch[1], James Wilder Orr[2]

[1]University of Washington, Seattle, Washington, USA, [2]Alaska Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington, USA

Fishes of the Salish Sea: Puget Sound and the Straits of Georgia and Juan De Fuca

A synthesis of information about the fishes that inhabit the Salish Sea is in preparation to be published by the University of Washington Press. Illustrated in color by the famous Joseph R. Tomelleri, the book will constitute the first comprehensive overview of the diversity, natural history, ecology, and distribution of the fishes found in the inland marine and brackish waters of Washington State and British Columbia. In addition to an introduction and historical perspective, chapters will include a summary of the geology, oceanography, and biogeography of the Pacific Northwest; anatomical considerations, keys to families and genera, and taxonomic accounts of 253 species in 78 families and 31 orders. The final result will be a comprehensive, fully illustrated guide that can be used effectively by all, whether student, professional scientist, sport fisher, or curious amateur. The book will also serve as an introduction to the semi-popular and scientific literature of the ichthyofauna of the region, and thus provide a place to start for further inquiry into the biology of Salish Sea fishes, all of whose ranges extend beyond our regional waters into the Eastern North Pacific Ocean.

0341 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

David Pike

James Cook University, Townsville, Australia

Why Sea Turtles are Great Survivors of Climate Change

Ectotherms living in tropical regions may be at increased risk from climate change because current temperatures at these locations already approach critical physiological thresholds. Relatively small temperature increases could cause animals to exceed these thresholds more often, resulting in substantial fitness costs or even death. Oviparous species could be especially vulnerable because the maximum thermal tolerances of incubating embryos is often lower than adult counterparts, and in many species mothers abandon the eggs after oviposition, rendering them immobile and thus unable to avoid extreme temperatures. As a consequence, the effects of climate change might become evident earlier and be more devastating for egg production in the tropics. Loggerhead sea turtles (*Caretta caretta*) have the widest nesting range of any living reptile, spanning temperate to tropical latitudes in both hemispheres. Currently, loggerhead sea turtle

populations in the tropics produce nearly 30% fewer hatchlings per nest than temperate populations. Strong correlations between empirical hatching success and habitat quality allowed global predictions of the spatiotemporal impacts of climate change on this fitness trait. Under climate change, many sea turtle populations nesting in tropical environments are predicted to experience severe reductions in hatchling production, whereas hatching success in many temperate populations could remain unchanged or even increase with rising temperatures. Some populations could show very complex responses to climate change, with higher relative hatchling production as temperatures begin to increase, followed by declines as critical physiological thresholds are exceeded more frequently.

0465 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Kyle Piller[1], Emily Moriarty Lemmon[2], Alan Lemmon[2]

[1]*Southeastern Louisiana University, Hammond, LA, USA,* [2]*Florida State University, Tallahassee, FL, USA*

A Phylogenetic Investigation of the Cyprinodontiformes Using Anchored Phylogenomics

The Cyprinodontiformes are a morphologically and ecologically diverse group of fishes that are globally distributed in tropical and temperate, freshwater and estuarine habitats. The order includes ten families (Aplocheilidae, Rivulidae, Profundulidae, Fundulidae, Nothobranchiidae, Valenciidae, Anablepidae, Poeciliidae, Cyprinodontidae, and Goodeidae) and more than 800 species, including important laboratory study species, such as the Mummichog (*Fundulus heteroclitus*) and popular aquarium fishes including swordtails (*Xiphophorus* spp.) and guppies/mollies (*Poecilia* spp.). Several studies have investigated the evolutionary relationships among the families in the order with each recovering a slightly different topology. The objective of this study was to use an alternative data set, genomic data, to test previous hypotheses of cyprinodontiform relationships and the phylogenetic position of Goodeidae. We used the recently developed anchored hybrid enrichment approach with a modified set of probes to generate data from hundreds of loci from seven families in the order with heavy sampling within Goodeidae. Preliminary phylogenetic analyses indicate support for many of the previously recovered relationships. An understanding of the phylogenetic position of Goodeidae within the order is needed to provide a historical framework for the placement of fossils for temporally based comparative analyses and to test these previous phylogenetic hypotheses.

0405 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

John Placyk

University of Texas at Tyler, Tyler, Texas, USA

The Details of a Conservation Genetics Lab Founded on Burghardtian Principles

The influence of Gordon Burghardt on the herpetological community is well-established, but Gordon's influence stretches well beyond the land of reptiles and amphibians. While working on his Ph.D. in the Burghardt lab in the 2000's, Dr. John Placyk was given the opportunity to work on a side project with the Butler's gartersnake, *Thamnophis butleri*, that would shape his career more than any project he had ever worked on before. From snakes and turtles to freshwater mussels and plants, Dr. Placyk shares his trip from a humble behavioral biologist that worked on plethodontid salamanders and gartersnakes to a conservation geneticist working with a wide variety of species of conservation concern. Along the way, Dr. Placyk has produced seven academic grandchildren for Gordon and provided invaluable data to conservation managers struggling against political red tape and a lack of information in their race to save threatened and endangered species. The result is a legacy for Gordon Burghardt that stretches well beyond snake biology.

0557 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Renata Platenberg

University of the Virgin Islands, St Thomas, U.S. Virgin Islands

***Bd* in a Hot Climate: Detection of Amphibian Chytrid Fungus in the US Virgin Islands**

St Thomas, US Virgin Islands is a low elevation (to 474m) island at 18N latitude in the Eastern Caribbean. Characterized by a subtropical climate, the average daily high temperatures hover around 29°C (85°F). The island's terrain consists of primarily dry forest on steep rocky hillsides with low permeability, and natural freshwater sources limited to a very few spring-fed pools in stormwater drainage channels. The island supports four species of native frogs, three of which are direct developers, plus three non-native species primarily associated with human-altered areas with collected water. With high ambient temperatures and few freshwater resources, the island seems an unlikely location in which to detect the amphibian chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*), a lower-temperature active fungus with a strong association with

freshwater habitats. Chytridiomycosis has had a significant impact on global amphibian populations and documenting the distribution of the pathogen is a critical part of amphibian conservation efforts. I conducted *Bd* testing using PCR on six species of frogs during the summer and winter rainy seasons in 2011. I initially pooled samples by species and site and subsequently tested individuals, for a total of 52 samples of 132 frogs from five sites on St Thomas. None of the frogs showed symptoms of chytrid infection, but three of the pooled samples tested positive, although weakly, confirming the presence of *Bd* among *Eleutherodactylus* frogs in the Virgin Islands. Extensive sampling effort is now required to determine the prevalence and distribution of the pathogen on this subtropical Caribbean island.

0518 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Helen Plylar, Clifford Fontenot Jr.

Southeastern Louisiana University, Hammond, LA, USA

Visual Accommodation in Semi-aquatic Colubrid Snakes: A Photorefractive Study of Defocus and Refractive State

The vertebrate eye is similar to a camera, where the cornea and lens refract light onto the retina. How light is refracted, and the power of each lens, influences the image produced. Because the vision system is subject to natural selection, it presumably reflects species' evolution and ecology. Differences in refractive indices between air and cornea facilitate this refraction in terrestrial vertebrates and are necessary to produce a clear image. Semi-aquatic vertebrates face a unique challenge when transitioning from terrestrial to aquatic environments: the refractive index of the cornea is similar to that of water, and so the refractive power of the cornea is lost. This loss of refractive power results in defocus of the eye, though there is evidence that some species can overcome this refractive error. To compare refractive state in air vs water between four sympatric colubrid snake species (*Nerodia cyclopion*, *N. erythrogaster*, *N. fasciata*, and *Pantherophis obsoletus*), representing three ecotypes (aquatic specialist, aquatic generalist, and terrestrial generalist). I used photoretinoscopy (defocus assessment) and photokeratoscopy (to determine corneal power). Results of these techniques will be presented and interpreted in terms of air vs underwater visual acuity, and how these relate to ecotype.

0620 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

John Pojman Sr[2], John Pojman Jr[2], Clifford Fontenot Jr[1]

[1]Southeastern Louisiana University, Hammond, LA, USA, [2]Louisiana State University, Baton Rouge, LA, USA

Clove Oil as a General Anesthetic for *Amphiuma tridactylum* and Recovery Time as a Function of Body Mass

Amphiuma tridactylum is a large (up to 1 m and 1.5 kg), slimy, aquatic salamander that can deliver a powerful bite, and is difficult and potentially dangerous to handle. A variety of chemical anesthetics have been used on amphibians, but they are expensive, difficult to obtain, or difficult to apply in the field. Clove oil is effective and can be applied by immersion, so potentially suitable for field application, but the effect of body size is unknown. To assess the utility of clove oil anesthetic for *A. tridactylum*, and the effect of body size on recovery time, we anaesthetized individuals of various body sizes via submergence in a clove oil solution. Each of 17 specimens was placed separately in a solution containing 4 L of water with 2 mL of clove oil for five minutes, then moved to another container without water for twenty minutes for residual absorption. Each was then placed in 10 L of tap water in a cooler, and tested every 15 minutes for righting response to indicate recovery. At five minutes of exposure, each was sufficiently anesthetized for easy handling, and some had already lost the righting response. After the twenty minute waiting period, each had no righting response and was completely limp, suitable for tasks like taking measurements PIT tag insertion. There were significant relationships between recovery time and body mass that were positive for individuals 19-365 g, and negative for individuals 540-3,185 g, which may represent a physiological absorption threshold.

0017 Herp Systematics, Banquet Room H, Sunday 3 August 2014

Frank Portillo[1], Eli Greenbaum[1], Maximilian Dehling[2], Michele Menegon[3], Chifundera Kusamba[4]

[1]University of Texas at El Paso, El Paso, TX, USA, [2]Universität Koblenz-Landau, Koblenz, Germany, [3]Museo Tridentino di Scienze Naturali, Trento, Italy, [4]Centre de Recherche en Sciences Naturelles, Lwiro, Congo

Phylogeography and Species Boundaries of Glode Eyed Treefrogs from the Albertine Rift

The genus *Leptopelis* occurs in multiple habitats throughout sub-Saharan Africa, and it includes several species that have highly variable color patterns, which makes

taxonomic studies challenging. In this study, we examined multiple populations of *Leptopelis* from the Albertine Rift (AR), a region known for its high levels of endemism and biodiversity. Currently, five species are recognized from the AR: *Leptopelis fiziensis*, *L. karissimbensis*, *L. kivuensis*, and two new species (being described by FP and EG in spring 2014) from the region in and around the Itombwe Plateau in Democratic Republic of the Congo. We employed both traditional gene-tree and coalescent species-tree approaches for estimating phylogenies, with a multi-locus data set consisting of two mitochondrial genes (16S and cyt b) and one nuclear gene (RAG1). Both analyses supported the recognition of several cryptic lineages within the genus, suggesting a revision of AR *Leptopelis* taxonomy is needed. Further investigations of acoustics and morphological data will clarify species delimitations.

0655 AES Genetics, Genomics, & Systematics, Banquet Room E, Saturday 2 August 2014

David Portnoy, Chris Hollenbeck, John Gold

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

Historical Genetic Demography and Stock Structure of the Blacknose Shark, *Carcharhinus acronotus*, in the western North Atlantic

Population structure and historical genetic demography of blacknose sharks, *Carcharhinus acronotus*, were assessed via variation in sequences of mitochondrial (mt)DNA and nuclear-encoded microsatellites. Samples came from the Gulf of Mexico (Gulf), the Florida Keys, the southeastern U.S. Atlantic (U.S. Atlantic), the Bahamas, and the Bay of Campeche (Mexico). Significant heterogeneity and/or inferred barriers to gene flow in microsatellites and/or mtDNA delineated three regional groups in U.S. waters: the U.S Atlantic, the eastern Gulf, and the western Gulf. The relationship of blacknose sharks from the Florida Keys to the Gulf and Atlantic was equivocal. Blacknose sharks from Mexico and the western Gulf are similar genetically, suggesting historical and/or current gene flow. On the other hand, blacknose sharks from the Bahamas appear relatively divergent and consequently isolated from all other sharks sampled. A minimum spanning network of mtDNA haplotypes and nested-clade analysis indicated population expansion in the Gulf and U.S. Atlantic, occurring less than 60 thousand years ago. The presence of shared haplotypes, common in the Bahamas but rare along the Florida Coast, suggests historical contact between these regions, while levels of genetic variation and estimates of long-term effective sizes indicate that the southern Gulf may have served as a refugium during the last glacial period.

0011 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Tomas Praet[1], Dominique Adriaens[2], Céline Neutens[2], Anabela Maia[3], Matthieu De Beule[1], Benedict Verhegghe[1]

[1]Ghent University, IBiTech – bioMMeda, department of Civil Engineering, Gent, Belgium, [2]Ghent University, Evolutionary Morphology of Vertebrates, Gent, Belgium, [3]Eastern Illinois University, Dept. of Biological Sciences, Charleston, IL, USA

Understanding the Mechanics of Tail Grasping in Seahorses using a Parametrized Computer Model

Seahorses are intriguing fishes for several reasons, one being their prehensile tail. Syngnathid fishes, to which seahorses, pipefish, seadragons and pipehorses belong, are characterised by a body armour of bony plates. They form a serially articulated system that encloses the vertebral column and its musculature. In the ancestral condition, as in pipefish, the tail is straight with limited flexibility, and mainly used for steering (pectorals and dorsal used for swimming). During evolution, the tail became modified into a grasping apparatus multiple times independently within the syngnathid family. Less known than the seahorse prehensile capabilities, pipehorses also show different morphologies related to grasping performance. To better understand the structural basis of tail grasping mechanics, a parameterized model of the seahorse tail was developed. By combining multibody dynamics analysis with finite element analysis, we analysed the implication of partial contribution of epaxial and hypaxial muscles, versus ventral median muscle, as well as that of the bony plate geometry. Natural bending postures, as observed in living seahorses, can be obtained up to some degree. The analyses showed particular relations between morphology and bending kinematics. Using this seahorse model, functional implications of evolutionary changes in in syngnathid tails can be further analysed, as well as to develop biomimetic designs of serially articulated systems that meet particular application demands.

0393 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Heather L Prestridge[1], Luci Cook-Hildreth[2]

[1]Biodiversity Research and Teaching Collections, Texas A&M University, College Station, TX, USA, [2]Inland Fisheries, Texas Parks and Wildlife Department, Austin, TX, USA

Come and Take It: Invasion of the Armored Catfishes in Texas

Members of the South American armored catfish family Loricariidae are popular aquarium fishes and have been frequently introduced outside of their native range, with established non-native populations reported from Mexico, Japan, the Philippines, Singapore, Taiwan, Thailand, and the United States. As a group, the loricariids possess a suite of characteristics that may have facilitated their successful invasion, including: relatively quick maturity and high fecundity; male parental care; ability to respire aerially via modifications of the gut; and body covered in a suite of well-developed dermal armor. Despite the potential to disrupt natural ecosystems, established non-native populations of loricariids have received little attention from natural resource management agencies. In the United States, vouchered records of loricariids exist from California, Florida, Hawaii, Nevada, South Carolina and Texas. In Texas, the first vouchered collection of a loricariid dates back to 1977. Since that time, more than 5 species have been recorded from 7 drainages including the Guadalupe, Nueces-Rio Grande Coastal, Rio Grande, San Jacinto, San Antonio, San Jacinto-Brazos, and San Antonio-Nueces. In Texas, the invasion appears to be centered on areas of thermal insulation, including spring fed waters, concrete improved bayou systems, and areas downstream of water treatment plants. We present species profiles for taxa currently invading Texas waters, distributional maps based on vouchered collections, and next steps in predicting and preventing the spread of loricariids in Texas.

0386 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Kimberly Price[1], Jason O'Bryhim[2], Bruce Saul[1], Stacey Lance[3]

[1]Georgia Regents University, Augusta, GA, USA, [2]George Mason University, Fairfax, VA, USA, [3]Savannah River Ecology Laboratory, Aiken, SC, USA

Diet Analysis of the Bonnethead Shark, *Sphyrna tiburo*, Around St. Catherine's Island, Georgia

The trophic structure in the estuarine waters off the coast of Georgia is being altered due to reductions in larger predatory sharks and the resulting increase in populations of the mesoconsumer, *Sphryna tiburo*. This alteration may have important implications for the health of this ecosystem. However, in order to predict the effects of an increase in *S.*

tiburo populations, it is important to identify its primary prey within this area of its range. We examined the stomach contents of 39 *S. tiburo* caught off the coast of St. Catherine's Island, GA. Overall the diet of *S. tiburo* along the Georgia coast consisted primarily of crabs regardless of time of year, shark age, or shark gender. We did find some diet differences among sharks including that males consumed a higher amount of vertebrates than females, juvenile males consumed a greater amount of shrimp than adult males, and adult males were found to consume a greater amount of vertebrates than juvenile males. While crabs remained the primary prey item of *S. tiburo* throughout the year, a temporal analysis revealed a shift towards an increased consumption of other prey types (i.e shrimp, squid) during summer and fall months. This analysis will be instrumental in determining the ecological and economic effects of increasing populations of *S. tiburo* on lower trophic level species, as well as the overall estuarine habitat.

0125 AES GRUBER AWARD, Banquet Room E, Friday 1 August 2014

Bianca Prohaska[1], Paul Tsang[2], William Driggers III[3], Eric Hoffmayer[3], Carolyn Wheeler[4], James Sulikowski[4]

[1]*Florida State University, Tallahassee, FL, USA,* [2]*University of New Hampshire, Durham, NH, USA,* [3]*National Marine Fisheries Service, Pascagoula, MS, USA,* [4]*University of New England, Biddeford, ME, USA*

Effects of Delayed Phlebotomy on Plasma Steroid Hormone Concentrations in Elasmobranchs

Circulating concentrations of steroid hormones can be utilized as a method for determining reproductive maturity and reproductive cycling in elasmobranchs. It is unknown how long steroid hormones remain stable in elasmobranch blood following capture, and thus how quickly these samples should be collected for the results of subsequent steroid hormone analyses to be accurate. The objectives of this study were to determine if the sex steroid hormones progesterone, testosterone and estradiol would remain at stable concentrations in the blood of sharks that were captured and left out of water un-refrigerated for 24 hours. Blood samples were serially drawn from five initially live sharks over a period of 24 hours. This analysis was conducted in two species of elasmobranchs, *Squalus acanthias* and *Rhizoprionodon terraenovae*. Results suggest that plasma concentrations of testosterone and estradiol are relatively stable in *R. terraenovae* blood over 24-hours, while progesterone and testosterone are relatively stable over a 24-hour period in *S. acanthias* blood. Additionally, no significant changes in hematocrit were detected in either species over the 24-hour period. This research represents an extreme situation in which sharks were un-refrigerated, and suggests that even when

subjected to these conditions steroid hormone concentrations and hematocrit remain relatively unchanged in the blood following capture for up to 24 hours.

0594 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Jake Pruett[1], Stephanie Campos[2], Helena Soini[2], Milos Novotny[2], Cuauhcihuatl Vital[3], Jaime Zúñiga -Vega[4], Emilia Martins[2], Diana Hews[1]

[1]Indiana State University, Terre Haute, Indiana, USA, [2]Indiana University, Bloomington, Indiana, USA, [3]Universidad Autonoma de Ciudad Juarez, Juarez, Chihuahua, Mexico, [4]Universidad Nacional Autonoma de Mexico, Mexico City, Mexico

Variation in Volatile Compound Composition of Femoral Gland Secretions from Four Species of *Sceloporus*: A Preliminary Analysis

Lizards are excellent models for studying multimodal communication because many species mediate social interactions through visual and chemical signals. Male *Sceloporus* lizards differ in signaling traits such as ventral color (blue vs. white belly) and visual display patterns. During the breeding season, males exude waxy secretions from femoral glands (FGs) that contain volatile organic compounds (VOCs), lipids and proteins. Previous studies found a negative association between visual signaling and chemosensory behavior, but a thorough understanding of how evolutionary changes in visual signaling traits influence the evolution of chemical signals is lacking. We predicted that absence of the blue visual signal would be associated with increases in the relative proportion of some components of FG secretions. We collected *Sceloporus* FG secretions from four species (2 blue, 2 white) and analyzed VOC components with gas chromatography-mass spectrometry. We tentatively identified 25 compounds including linear carboxylic acids and methyl ketones. The abundance of carboxylic acids varied among species but showed no distinct pattern associated with phylogeny or color signaling traits. The abundance of methyl ketones was higher for one white species relative to the more closely related blue species, however, the opposite pattern was observed in the other species pair. Our results show species specificity in the VOC composition of *Sceloporus* FG secretions, and a potential association between visual signaling traits and VOC abundance for one class of compounds in at least one lineage.

0711 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Jake Pruett[1], Cuauhcihuatl Vital[2], Jaime Zúñiga-Vega[3], Emilia Martins[4], Diana Hews[1]

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Behavioral Responses to Conspecific Chemical Cues Among Four Species of *Sceloporus*

Male *Sceloporus* lizards differ in signaling traits such as ventral color (blue vs. white belly) and visual display patterns. Previous work showed exposing males to conspecific chemicals elicits higher rates of social display in a white species, but did not alter display rates over controls in a blue species. Here, we further investigate associations of visual signaling traits and behavioral responses to conspecific chemical cues in four species (two blue-white pairs) of *Sceloporus*. We predicted that responses to chemical cues would be stronger in *S. siniferus* and *S. cozumelae* (white bellies) than in *S. merriami* and *S. parvus* (blue bellies). We presented swabs of cloacae and femoral glands or clean swabs (control) to free-ranging males in the breeding season and recorded social displays, chemosensory behaviors, and movement. For each species pair (*parvus-cozumelae*, and *merriami-siniferus*), a PCA extracted two components explaining 79% and 80% of the total variance respectively. Analysis of factor loadings for the *parvus-cozumelae* pair, shows *S. cozumelae* exhibited higher rates of social displays than *S. parvus* following exposure to chemical cue relative to control swabs. For the *merriami-siniferus* pair, *S. siniferus* exhibited higher rates of social display than *S. merriami* overall. Rates of movement and chemosensory behaviors were similar for each species, but *S. cozumelae* exhibited higher rates of chemosensory behavior following exposure to swabs with male chemical cues relative to control swabs.

0121 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Fabio Pupo[1], Vitor Abrahão[2], Hernán Ortega[3]

[1]Museu Nacional/UFRJ, Rio de Janeiro/RJ, Brazil, [2]Museu de Zoologia da Universidade de São Paulo - MZUSP, São Paulo/SP, Brazil, [3]Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru

Brain and Olfactory Organs from Some Species of the Family Astroblepidae (Teleostei: Ostariophysi: Siluriformes)

Astroblepidae is a monophyletic clade of loricarioid catfishes endemic to the Andes, which forms the living sister group to the species-rich Loricariidae. Astroblepidae is moderately diverse, with 61 species currently described, and many more species recognized in museum collections. About 90% of astroblepid species were described before 1950, and there is currently no accepted phylogenetic framework for the group. Despite the vast amount of osteological information available for catfishes and other teleost fishes, knowledge of the central nervous system and the phylogenetic implications of such data remain sparse. This study provides morphological descriptions of gross morphology of the brain from 20 astroblepid species, including several undescribed species. We introduce nine new characters to help elucidate higher-level phylogenetic relationships: shape of nasal organ; number of lamellae in nasal organ; position of olfactory bulbs in relation to telencephalic lobes; thickness of olfactory nerves in relation to olfactory tracts; shape of telencephalic lobes; shape of posterior margin of cerebellar corpus; position, shape and size of facial lobes. The thickness of the olfactory and facial nerves, and the enlarged facial lobes, suggest high accuity of the chemical senses in astroblepids. The relatively small retinae and thin optic tracts of astroblepids suggests reduced visual accuity. These character states were present in all specimens dissected and indicate that the brain has important morphological features to enhance phylogenetic studies. The results of this study provide increased resolution to current hypotheses of phylogenetic reconstruction, especially at the family and genus level of interrelationships.

0450 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Fabio Pupo, Marcelo Britto

Museu Nacional/UFRJ, Rio de Janeiro/ RJ, Brazil

Brain and Olfatory Organs from Some Species of the Family Trichomycteridae (Teleostei: Ostariophysi: Siluriformes)

Trichomycteridae is the second most diverse family among the Loricarioidea with 278 species. The family has one of the largest feeding modes spectra among fishes, including omnivorous, mucus and scale eaters and bloodsuckers. Its monophyly is supported by several synapomorphies and is organized into eight subfamilies. Due to the possible relationship with Nematogenyidae on composition of a monophyletic clade with basal position in Loricarioidea and consequently in Siluriformes, the elucidation of their phylogeny is fundamental to the understanding the order evolution. Despite the large amount of information contained in many osteological studies on Teleostei, the knowledge about brain gross morphology and their phylogenetic implications is scarce, thus an untapped source of characters to be discovered and analyzed. This study consists of the anatomical description of the brain, serving as a basis for survey of new characters that may elucidate phylogenetic issues for the group. We dissected specimens from 41 species of the eight subfamilies. Characters include: arrangement of the lamellae of nasal organ; size and shape of lamellae of nasal organ; positioning and shape of the olfactory bulb; format of the cerebellar corpus; size and shape of facial lobes. The enlargement and shape of facial lobes suggests a synapomorphy for the currently paraphyletic subfamily Trichomicterinae. Those features when optimized on current topologies corroborate studies based on morphological characters and suggest that the brain has features relevant to increment past studies arrays, bringing more resolution to current phylogenetic reconstruction hypotheses.

0234 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Brad Pusey[1], Sue Jackson[1], Michael Douglas[2], Mark Kennard[1], Jabal Huddlestone[3], Bill Harney[4], Lenny Liddy[3], Mona Liddy[3], Robert Liddy[3], Lizzie Sullivan[3], Brenda Huddleston[3], Melissa Banderson[3], Andrew McMah[3], Quentin Allsop[5]

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"We Like to Listen to Stories about Fish": Integrating Indigenous Ecological and Scientific Knowledge to Inform Environmental Flow Assessments

Studies that apply indigenous ecological knowledge to contemporary resource management problems are increasing globally; however, few of these studies have contributed to environmental water management. We interviewed three indigenous landowning groups in a tropical Australian catchment subject to increasing water resource development pressure and trialled tools to integrate indigenous and scientific knowledge of the biology and ecology of freshwater fish to assess their water requirements. The differences, similarities, and complementarities between the knowledge of fish held by indigenous people and scientists are discussed in the context of the changing socioeconomic circumstances experienced by indigenous communities of north Australia. In addition to eliciting indigenous knowledge that confirmed field fish survey results, the approach generated knowledge that was new to both science and indigenous participants, respectively. Indigenous knowledge influenced (1) the conceptual models developed by scientists to understand the flow ecology and (2) the structure of risk assessment tools designed to understand the vulnerability of particular fish to low-flow scenarios.

0098 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Milica Radanovic, Joseph R. Milanovich

Loyola University Chicago, Chicago, IL, USA

Ecological Role of Larval Anurans in Facilitating Decomposition Rates of Leaf Litter in Mesocosms

Wetlands are a basin for nutrients and energy that become available to higher trophic levels via the process of decomposition. Amphibians are abundant and diverse in wetlands and it is known that they utilize nutrients and energy within wetlands from decomposed plant material; however, it is unknown what their role is in the process of decomposition. The purpose of this project was to examine if two species of larval anurans (*Lithobates sylvatica* [Wood Frog] and *Pseudacris crucifer* [Spring Peeper]) affected the rate of decomposition in mesocosms, and to examine what characteristics of larval anurans facilitated, decomposition rates (i.e. nutrient excretion). I utilized pre and post-weight of leaf litter in mesocosm and natural wetlands to determine if the rate of decomposition across tadpole treatments (mesocosms) differed. The data from this project should be able to demonstrate in detail the role that tadpoles play in the decomposition rates of wetlands.

0532 Ecology & Ethology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Matthew Ramirez[1], Larisa Avens[2], Lisa Goshe[2], Jeffrey Seminoff[3], Selina Heppell[1]

[1]Oregon State University, Corvallis, OR, USA, [2]NOAA Fisheries, Southeast Fisheries Science Center, Beaufort Laboratory, Beaufort, NC, USA, [3]NOAA-National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA, USA

Loggerhead Sea Turtle (*Caretta caretta*) Ontogeny and Growth: Evidence of Facultative Ontogenetic Shifts Using Skeletochronology and Stable Isotope Analysis

Juvenile loggerhead sea turtles (*Caretta caretta*) experience pronounced ontogenetic shifts during their life cycle, transitioning between diets (epipelagic/benthic) and foraging habitats (offshore/inshore) at critical sizes. Theory predicts this transition to occur in a discrete step; however, recent evidence suggests this transition may be facultative. As the factors that affect growth rates vary by location, differential habitat use associated with ontogenetic shifts may affect individual growth trajectories. Our research seeks to identify patterns and durations of foraging habitat associations related to ontogenetic shifts and to couple them with individual growth rates to characterize the relationship

between juvenile growth and foraging ecology in loggerhead sea turtles. Skeletochronology and stable isotope analyses (SIA; $\delta^{15}N$, $\delta^{13}C$) of sequential humerus growth layers were used to reconstruct diet, habitat use, and growth histories. SIA indicate that as turtles increase in size they increasingly feed at higher trophic levels and in nearshore food webs, supporting known life history patterns. Reconstructed diet and habitat use histories provide evidence for facultative ontogenetic shifts in juvenile loggerhead sea turtles that may last up to four years, potentially altering our understanding of loggerhead life history and population dynamics. A quadratic relationship exists between juvenile annual growth rates and foraging ecology; growth declines when foraging at lower trophic levels (i.e. pre-ontogenetic shift) and increases when foraging at higher trophic levels (i.e. post-ontogenetic shift). This suggests there may be a minimum growth rate, or series of low or declining annual growth rates, that may signal a turtle to undergo an ontogenetic shift.

0197 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Waleeja Rashid[1], Maria Medina[1], Edward Stanley[2], Eli Greenbaum[1], Michele Menegon[3], Marie Nguyen[1], William Branch[4]

[1]University of Texas at El Paso, El Paso, TX, USA, [2]California Academy of Sciences, San Francisco, CA, USA, [3]Museo delle Scienze, Trento, Italy, [4]Bayworld, Humewood, South Africa

Systematics of African Limbless Skinks (Squamata: Scincidae) of the Genus *Melanoseps*

The genus *Melanoseps* (Squamata: Scincidae) consists of eight recognized species of legless skinks found in forested regions of central and eastern Africa, ranging from Cameroon to Mozambique. Fossorial habits of this genus make specimens difficult to obtain for molecular and morphological analyses. In 2011, a specimen classified as *M.* cf. *occidentalis* was collected from Bizombo forest, eastern Democratic Republic of Congo (DRC). Distance between the type locality (Cameroon) of *M. occidentalis* and Bizombo is approximately 2000 kilometers, raising the possibility that the two populations are not conspecific. Moreover, the lowland forests of Cameroon and DRC were separated during the Miocene era, making the hypothesized speciation of *M.* cf. *occidentalis* a possible result of vicariance. We explored systematics of the genus by sequencing the 16S mitochondrial rDNA gene from available specimens of *Melanoseps*, and our phylogeny was constructed with maximum-likelihood criteria with the program RAxML. We also generated high-resolution x-ray computer tomography (CT) images from *M. ater* (*Melanoseps* type species), topotypic *M. occidentalis*, the Bizombo *M.* cf. *occidentalis*, *M. poensis*, and a specimen of *Feylinia currori* (sister group to *Melanoseps)*. Although DNA samples from topotypic *M. occidentalis* are unavailable, the Bizombo *M.*

cf. *occidentalis* and *M. poensis* samples showed substantial genetic divergences from other *Melanoseps* species and from each other. Preliminary morphological comparisons between CT scans of *M.* cf. *occidentalis* and *M. poensis* show several differences from the type species *M. ater.* Our results suggest that *M.* cf. *occidentalis* and *M. poensis* might represent a different genus from *Melanoseps sensu stricto*.

0687 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Keith Ray, Jonathan Armbruster

Auburn University, Auburn, AL, USA

Phylogeography of Longnose Dace, *Rhinichthys cataractae* (Cypriniformes: Cyprinidae), in the Southern Appalachian Mountains

The widespread Longnose Dace, *Rhinichthys cataractae*, is restricted to the Southern Blue Ridge geologic province in the Southern Appalachian Mountains, south of Roanoke Gap. This area is geologically ancient and very stable, leading to the isolation and evolution of many endemic species. Many authors have noted the unique distribution of *R. cataractae*, yet few have proposed hypothesis to explain it. We investigated the hypothesis that suggests the distribution of *R. cataractae* in the Southern Appalachians occurred due to stream capture from the New River with headwater transfers into the adjacent basins further south, into the Tennessee and Savannah River basins. This was hypothesized to have occurred during the last major glacial cycle. We use two mitochondrial markers, cytb and nd2, and two nuclear markers, RAG1 and S7, to investigate phylogeographic patterns of *R. cataractae* in the region.

0549 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Robert N. Reed[1], Brian Todd[2], Oliver Miano[2], Mark Canfield[3], Louanne McMartin[4], Robert N. Fisher[3]

[1]U.S. Geological Survey, Fort Collins, CO, USA, [2]U.C. Davis, Davis, CA, USA, [3]U.S. Geological Survey, San Diego, CA, USA, [4]U.S. Fish and Wildlife Service, Stockton, CA, USA

Biology and Control of Exotic Banded Watersnakes (*Nerodia fasciata*) in an Urban Lake in Los Angeles, California

Native to the southeastern United States, the banded watersnake (*Nerodia fasciata*) is a generalist predator, primarily on aquatic vertebrates. At least two populations of *N.*

fasciata are established in California, probably as a result of the pet trade. We sampled the watersnake population in an urban lake in Los Angeles using aquatic traps (>15,000 trap-nights) and nocturnal visual surveys with the goal of assessing population structure and the potential for eradication. We captured 308 watersnakes (187 female, 119 male), averaging 456 mm SVL and 130 g. Females attained larger body sizes than did males, and the largest female was >2x the mass of the largest male, but it is likely that observed size distributions are partly a product of size-dependent variation in capture probability. Neonates appeared in late summer and the smallest six individuals averaged 170 mm and 4.1 g. We did not observe any native species among prey removed from watersnakes, but high-density exotic prey species (e.g., *Gambusia*) may promote high watersnake densities. No native aquatic or semi-aquatic snake species were detected by any means. Trap success decayed over time at our various trap-lines, but rates of decay may not reflect reduction of the population via trapping and overall we estimate that only a small proportion of the population was removed. We will discuss these findings in relation to the apparent invasiveness of these watersnakes and implications for the success of a major restoration initiative at this site.

0136 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

Koy Regis, Jesse Meik

Tarleton State University, Stephenville, TX, USA

Body Size and Sexual Size Dimorphism in Turtles: A Comparison of Mass and Length Data

What is body size? Although this question seems obvious, different research groups often equate body size to disparate measurements, such as length in non-avian reptiles and body mass in mammals. Although mass scales as the cube of length, differences in shape mean that these measures are not directly comparable. We examined body size distributions and sexual size dimorphism in chelonians using both body mass and carapace length datasets, and asked whether biological inferences would differ based on properties of these different measures of body size. Our results have important implications for comparative and macroecological studies of body size across diverse taxonomic groups.

0680 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Binod Regmi

University of Arkansas, Arkansas, USA

Effects of Salt Water Intrusion and Habitat Separation on Gene Flow in a Costal Ecosystem: Mosquitofish in Louisiana

Effects of increased salinity on dispersal of fresh- and saline water adapted organisms are still poorly understood. We examined freshwater (FW) and brackish water (BW) as potential barriers to gene flow in Mosquitofish (*Gambusia affinis*) along coastal areas in Louisiana. We hypothesized that FW represents a barrier for populations from BW, but not from FW sites and vice versa. We genotyped 602 individuals across seven microsatellite loci collected from 15 sites. Seven sites were situated in coastal marshes (BW) and eight in nearby freshwater (FW), with Sabin and Calcasieu reservoirs (BW) separating western localities and Atchafalaya and Mississippi rivers (FW) bisecting eastern localities. Overall FST (0.028 ± 0.002) indicated moderate gene flow among sites. Reduced gene flow among FW sites (FST 0.019, $p<0.001$) was associated with BW barriers, but these had little effect on BW sites (FST 0.0036, $p<0.001$). The Atchafalaya River contributes large amounts of freshwater to coastal marshes, reducing the barrier effect of FW (FST 0.0074, $p<0.001$). In contrast, flood control on the Mississippi River (dams and levees) have greatly reduced freshwater input into coastal areas, increasing salinity levels, and FW sites separated by the Mississippi River are more divergent (FST = 0.023, $p<0.001$). Adaptive divergence for salinity tolerance in Mosquitofish is known from coastal marshes in Louisiana. Our results suggest habitat heterogeneity in coastal ecosystems may restrict gene flow resulting in adaptive divergence for salinity tolerance despite gene flow.

0667 Herp Ecology II, Banquet Room E, Sunday 3 August 2014

Lisa Regula Meyer

Kent State University Trumbull, Warren, Ohio, USA

Experimental Venue and Effects on Experimental Results in a Study of Amphibian Ecology

Whether a study is conducted in a natural setting, a lab setting, or a mesocosm can have large implications for how the study is done, the methodology used, the data analysis, and the conclusions that are drawn from the findings of that study. While a natural setting may have the most biological relevance in ecological studies, and may allow for large scales to be used, it is also fraught with confounding variables and may include

logistical challenges such as travel and weather-related complications. At the opposite end of the spectrum, laboratory studies tend to have better control over variables in the study and are fewer unexpected challenges, but may be less biologically relevant and may be more expensive in dollars and person-hours. Balancing these two systems and trying to find a suitable methodology which minimizes the problems of both extremes has lead to the increased adoption and refinement of mesocosm studies. This option presents better control over variables than natural settings, but also tends to have greater complexity (and thus biological relevance) than lab settings. However, this is not to say that all mesocosm studies are created equal. On the contrary, this study found striking differences based on the design and scale of the mesocosms used in various years and experiments, and varying ability to replicate findings of studies conducted in natural settings. Mesocosms that were smaller but more closely resembled natural settings more closely replicated natural settings, while larger systems had very different dynamics.

0069 Ecology & Ethology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Brendan Reid, Zachariah Peery

University of Wisconsin-Madison, Madison, WI, USA

Using Genetic and Demographic Methods to Characterize Nesting Philopatry in a Long-lived Turtle

Philopatry, or the tendency to return to a "home" site to breed, has been observed in a broad array of animal taxa. Female turtles often exhibit behaviors suggestive of fidelity to a particular nest site (possibly the natal site); however, long-term philopatry is difficult to track in many turtle species due to their long maturation times and longevity. In this study, we characterized nesting philopatry in a central Wisconsin population of Blanding's turtles (*Emydoidea blandingii*). To investigate patterns of lifetime and intergenerational philopatry in this extremely long-lived species, we used 14 microsatellite loci to identify closely related dyads of nesting females. We then conducted individual-based, spatially explicit population simulations to generate expected patterns of relatedness given different levels of breeding and nesting philopatry and compared these patterns to the observed distribution of close relatives. The genetic data indicate that closely related females usually nest in the same areas, and our simulations revealed that the observed patterns of relatedness are consistent only with high levels of philopatry (>99% yearly breeding philopatry and >90% natal philopatry). Mark-recapture and genetic autocorrelation analyses indicating nest site fidelity at a relatively small scale (<500m) corroborate these results. Given the long-distance nesting migrations often undertaken by Blanding's turtles (often >1000m) and their observed capacity for terrestrial dispersal, our results demonstrate an unexpectedly

strong tendency for female philopatry in this species. A better understanding of philopatry in Blanding's turtle will help to guide restoration of nesting habitat and other conservation efforts for this endangered species.

0400 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Patrick Reilly[2], Jordan Chaney[1], Debra Miller[1], Rebecca Wilkes[2], Rachel Hill[1], Matthew Gray[1]

[1]*University of Tennessee Center for Wildlife Health, Knoxville, Tennessee, USA,*
[2]*University of Tennessee College of Veterinary Medicine, Knoxville, Tennessee, USA*

Assessing the Risk of Pathogen Pollution: A Preliminary Test of Co-Evolution Between Ranavirus and Wood Frogs

Hosts that co-evolve with pathogens presumably have a greater immune response to endemic strains. Ranaviruses are an emerging pathogen and have been associated with die-offs in wood frog (*Lithobates sylvaticus*) populations from Georgia, USA, to Northwest Territories, Canada. We hypothesized that pathogenicity of ranavirus would increase as distance between isolate and host population locations increased. We are testing pathogenicity of two FV3-like ranaviruses isolated from die-offs in Minnesota and Tennessee, USA, among four populations of wood frog tadpoles collected from Tennessee, Michigan, Minnesota USA, and Manitoba Canada. Inasmuch as temperature affects amphibian immune response and viral replication, we are performing our experiments in environmental chambers at 15 and 25 C. If our predictions hold true, pathogenicity of the Tennessee isolate should decrease in the following order: Manitoba, Minnesota, Michigan and Tennessee populations. Similarly, pathogenicity of the Minnesota isolate should decrease in the following order: Manitoba, Tennessee, Michigan, and Minnesota populations. With the Tennessee population completed, initial data show that tadpoles exposed to the MN isolate experienced 100% mortality in a 2-day period compared to 5 days for the TN isolate, with the median day to mortality being a half-day faster with the MN isolate. Mortality also was much later in the 15 C chamber as compared to the 25 C chamber. Our results have potential implications in host-pathogen evolutionary theory and conservation relevance regarding the threat of pathogen pollution. Additionally, our temperature results may provide insight into possible effects of global climate change on ranavirus emergence.

0477 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Banquet Room J, Friday 1 August 2014

Sean Reilly, Jimmy McGuire

Museum of Vertebrate Zoology, University of California, Berkeley, CA, USA

Evolutionary History of Flying Lizards (Genus: *Draco*) from the Lesser Sunda Islands, Indonesia

Flying lizards of the genus *Draco* are known to have originated and diversified in Southeast Asia. Populations occupying islands within the biogeographic region of Wallacea, which lies to the east of the Sunda shelf, have colonized these islands by overwater dispersal. The Lesser Sunda Islands make up the southern portion of Wallacea, are poorly studied, and are home to two described species of Flying Lizards (*Draco boschmai* and *D. timoriensis*). We obtained tissues from over 300 flying lizards from the Lesser Sunda Islands of Bali, Lombok, Sumbawa, Flores, Lembata, Pantar, Alor, Wetar, Sumba, Rote, and Timor. These samples were sequenced for the *ND2* gene to provide an initial glimpse into the biogeographic history of this monophyletic group. We then used a next-generation sequencing approach to create a phylogeny and estimate population genetic parameters. We infer that flying lizard biodiversity within the Lesser Sunda Islands is substantially underestimated, and that there has been an unexpectedly complex pattern of colonization that is related to the tectonic history of the archipelago. Conservation of the biodiversity within the Lesser Sunda Islands is dependent on an accurate understanding of species diversity and its spatial organization. We believe that genomic studies of this and other widely distributed species in the archipelago will reveal that they in fact represent species complexes, which will prove crucial for conservation planning in the region.

0179 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

Rick Relyea[1], John Hammond[2], Patrick Stephens[3], Lisa Barrow[12], Andrew Blaustein[4], Paul Bradley[4], Julia Buck[4], Ann Chang[7], James Collins[9], Brian Crother[6], Julia Earl[8], John Fauth[10], Stephanie Gervasi[4], Jason Hoverman[5], Oliver Hyman[9], Tom Luhring[8], Moses Michelsohn[12], Emily Moriarty Lemmon[12], Chris Murray[6], Steve Price[11], Raymond Semlitsch[8], Andrew Sih[7], Aaron Stoler[1], Nick VanderBroek[6], Alexa Warwick[12], Greta Wengert[7]

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Phylogenetic Patterns of Plasticity: Insights from Amphibian Embryos and Tadpoles

Phenotypic plasticity is ubiquitous in nature and researchers have provided numerous insights regarding the ecology and evolution of plasticity across a wide range of taxa. While phylogenetic signals for traits and trait plasticities can potentially constrain evolution, we know little about how plastic responses have evolved within a phylogenetic context. In a large collaborative effort, we addressed these questions by conducting predator-induction experiments on amphibian embryos and predator- and competitor-induction experiments on tadpoles. Using 20 species, we quantified life history, morphology, and behavior. The embryo experiments documented large difference in life history traits among species such as time to hatching, mass at hatching, and developmental stage at hatching. After constructing a phylogeny, we detected significant phylogenetic signal in these traits. Several species also exhibited predator-induced plasticity in their embryonic traits, but these plasticities did not exhibit any phylogenetic signal. The tadpole experiments also documented large differences among species in relative morphology and activity level and these traits exhibited significant phylogenetic signal. Plastic responses were widespread in tadpoles including predator-induced increases in relative tail depth and decreases in activity. Once again, the plasticity of the morphological traits did not exhibit phylogenetic signal. However, the plasticity of tadpole activity did exhibit phylogenetic signal. This suggests that the plasticity of morphological traits is not constrained from evolving different magnitudes of plasticity whereas activity may be constrained. Collectively, these results suggest that whereas species traits can be phylogenetically constrained, the plasticity of these traits may be quite easily modified over evolutionary time.

0081 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Qiu Ren

Saint Louis University, Saint Louis, MO, USA

Comparative Phylogenetics of the Asian Genus "*Puntius*" and Relatives (Cypriniformes; Cyprinidae): Explorations into the Potential Impacts of Taxon and Character Sampling

The southeast Asian genus *Puntius* was historically thought to be monophyletic and consisting of 120 valid species. Findings from a recent small study (Pethiyagoda et al. 2012) identified *Puntius* as a paraphyletic group as currently recognized, consisting of five lineages. This study used partial sequences of cytb and 16S and several morphological characters in a phylogenetic analysis that lead to the resurrection of genera formerly in *Puntius* or *Systomus* or descriptions of new genera. Given the use of partial sequences and the few taxa in Pethiyagoda et al. and the taxanomic complexities of these fishes, this study provided an initial phase of phylogeny/classification of this complex. Previous hypotheses of this diverse group offer an excellent opportunity to examine the potential impacts of taxon and character sampling on the resolution, stability, and support for relationships. Partial sequence data from Pethiyagoda et al. are re-analyzed; this data set is augmented with partial sequences of an additional 40 species to compare with the previous findings. Results of Pethiyagoda et al. are compared with analyses of complete sequences and additional taxa. Finally, both cytb and 16S are used in combination to compare relationships with those based on partial sequences and notably fewer species.

0740 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Paulette C. Reneau

Florida A&M University, Tallahassee, Florida, USA

Impact of Pulp Mill Effluent on *Gambusia holbrooki*

Endocrine disrupting chemicals (EDCs) interfere with hormonal balance and can impact reproduction and development. Several species of aquatic animals that live downstream of paper mills have abnormal characteristics that indicate exposure to endocrine disruptors. When exposed to EDCs, fish show various toxic responses including androgenic/estrogenic related effects in the liver and reproductive organs which are the main target tissues for EDCs. In the state of Florida, one species of freshwater fish -

Gambusia holbrooki - has been observed with abnormal secondary sexual characteristics at paper mill impacted sites. In order to determine the transcriptional activity of three key genes - vitellogenins (Vtg), heat shock protein 90 (hsp 90), and cytochrome P450 (cP450) - involved in the metabolic and reproductive pathways, fish were collected from impacted and non-impacted sites and their livers and gonads used for direct quatitation of expression levels. Findings show a significant difference in the gene expression levels in impacted site as compared to non-impacted site. The molecular and biochemical mechanism utilized during exposure to paper mill effluent provide insight into the synergistic effect of EDCs.

0601 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Bradley Reynolds, Thomas Wilson

University of Tennessee at Chattanooga, Chattanooga, TN, USA

A Walk in the Woods: Battling Herpetophobia among Non-Science Majors

Some individuals, including non-science majors in general education, conservation-based courses, possess an irrational fear of reptiles and amphibians. In an effort to combat " herpetophobia" and develop an appreciation for reptiles and amphibians among non-science majors, we integrated field work and hands-on herpetology into our instruction of a non-laboratory lecture course entitled Conservation of Biodiversity. Specifically, we used paired t-tests to evaluate the students' ability to feel empathy for a variety of organisms before and after the course. Data suggest that for the lecture-only group, empathy scores were not statistically different when compared to their scores prior to the experience. The empathy scores for the lecture-field group were also not statistically different when compared to their initial scores, except for salamanders. The lecture-field group reported a significant increase in empathy for salamanders, the only amphibian listed on the survey and the one organism the students were routinely exposed to and focused on "in the field." Further, analysis of the reflective journals and the results from structured interviews indicated that several lecture-field participants were able to overcome their irrational fears and even learned to admire and appreciate salamanders, frogs, and snakes. This study suggests that hands-on, experiential learning involving direct encounters with traditionally unpopular organisms is a powerful tool that educators may be able to use to alter negative student attitudes toward reptiles and amphibians.

0606 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Bradley Reynolds, Thomas Wilson

University of Tennessee at Chattanooga, Chattanooga, TN, USA

Transformational Leadership, Hands-on Herpetology, and Reflective Journaling: Impacting Student Conservation Ethic

Technology has made our lives faster, better, and increasingly multidimensional. When we immerse ourselves in technology, however, we risk losing our connection to nature and a proper perspective on our place in the natural world. In an effort to combat "nature deficit disorder," we integrated field work and hands-on-herpetology into our instruction of a non-laboratory lecture course. Specifically, we evaluated the impact of transformational leadership, experiential learning, and reflective journaling on the conservation ethic of non-science majors in an introductory survey course. We used paired t-tests to compare the students' conservation ethic before and after the course. Data suggest that for the lecture-only group, their ethic scores were not statistically different when compared to their scores prior to the experience. The ethic scores for the field group were statistically different when compared to their initial scores. Our field group also displayed an increase in empathy for salamanders while the lecture-only group did not. Further, analysis of the reflective journals indicated several recurring themes, including confronting fear, recognition of life's interconnectedness, the importance of small changes and of educating others, and evidence of true empathy. Structured interviews revealed transformational leadership and experiential learning did positively impact students, while reflective journaling had a lesser impact. Most notably, the student participants were impacted in that they were empowered and became conservationists in their own right. This study suggests that transformational leadership, experiential learning, and reflective journaling are powerful tools that educators may be able to use to positively influence student conservation ethic.

0131 Reptile Genetics & Evolution, Banquet Room J, Saturday 2 August 2014

R. Graham Reynolds[1], Matthew Niemiller[3], Liam Revell[2]

[1]Harvard University, Cambridge, MA, USA, [2]University of Massachusetts Boston, Boston, MA, USA, [3]Yale University, New Haven, CT, USA

The Boa and Python Tree of Life

Snakes in the superfamilies Booidea and Pythonoidea constitute some of the most spectacular reptiles and comprise an enormous diversity of morphology, behavior, and ecology. While many species of boas and pythons are familiar, taxonomy and

evolutionary relationships within these families remain contentious and fluid. A major effort in evolutionary and conservation biology is to assemble a comprehensive Tree-of-Life, or a macro-scale phylogenetic hypothesis, for all known life on Earth. Using both novel and previously published sequence data, we have produced a species-level phylogeny for 84.5% of boid species and 855% of pythonid species, contextualized within a larger phylogeny of henophidian snakes. We obtained new sequence data for three boid, one pythonid, and two tropidophiid taxa which have never previously been included in a molecular study, in addition to generating novel sequences for seven genes across an additional 12 taxa. We compiled an 11-gene dataset for 127 taxa, consisting of the mitochondrial and nuclear genes totaling up to 7561 base pairs per taxon. We suggest a revised taxonomy for the boas (13 genera, 58 species) and pythons (8 genera, 41 species), and discuss evolutionary and biogeographic implications of our phylogeny.

0252 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Rachel Rhymer, Jeanne Robertson, Gilberto Flores, Robert Espinoza

California State University Northridge, Northridge, CA, USA

Why do Parents Care? Testing the Roles of Maternal Care in an Argentinean Lizard

Mammals, birds, and crocodylians exhibit parental care, but this behavior is considered rare in squamate reptiles. *Phymaturus extrilidus* is a recently described herbivorous and viviparous lizard that inhabits rock outcrops in the high-elevation desert (Puna) of San Juan Province, Argentina. Females and neonates have been observed interacting in the days and weeks after birth. Our study goals are to (1) confirm whether the females associating with neonates are their mothers, and (2) identify the likely evolutionary pressures selecting for maternal behaviors in this species of *Phymaturus*. Such pressures likely include reducing predation risk and/or the need to socialize to transfer vital microbial endosymbionts from one generation to the next. First, we will confirm relatedness among individuals via kinship analyses of microsatellite data. Predation pressure was assessed in the field by conducting predator-approach experiments with models of two confirmed predators (fox and hawk) of *P. extrilidus*. Microbial communities necessary for digesting plant material will be compared between associated females and neonates to address the possible transfer of microbes from one generation to the next. We will use barcoded 16S pyrosequencing and standard bioinformatics pipelines and analytical tools for this comparison. Although grouping rate was not as high as expected, it was most commonly observed in neonates and adult females, suggesting that these associations are linked to fitness. Because other

Phymaturus appear to exhibit maternal care as well, our study will be the first to elucidate the pressures selecting for the evolution of this behavior in this lineage.

0391 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Bradley Richardson, Michael Flinn

Murray State University, Murray, KY, USA

A Dietary Comparison of Four Sympatric Gar Species: Alligator Gar, Longnose Gar, Shortnose Gar, and Spotted Gar

During the past decade, increased efforts to reintroduce alligator gar (*Atractosteus spatula*) to the Lower Mississippi River basin have resulted in the early success of populations at low densities. To ensure sustainable populations of alligator gar, continued monitoring is crucial. The reintroduction of alligator gar to western Kentucky, places the species into a system from which it was absent for more than 50 years. Currently, the system is occupied by three other native gar species: Longnose Gar (*Lepisosteus osseus*), Shortnose Gar (*L. platostomus*), and Spotted Gar (*L. oculatus*). This project aims to compare diets of these four species within Clarks River, Kentucky. Scales and bones were collected from stomachs and used to identify prey items. Shad (Family: Clupeidae) was the most common prey fish found in the Clarks River and in the diet for three of the four gar species, occurring in 29% (alligator gar, n=12) to 59% (longnose gar, n=19) of stomachs containing prey. However, 40% of freshwater drum (Family: Sciaenidae) prey were found in alligator gar stomachs versus 21% across all gar species. This difference in composition suggests that alligator gar prefer a more benthic location in the water column. Sunfishes (Family: Centrarchidae) were also found in significantly different rates of occurrence between gar species, being most common in alligator gar stomachs (55.5% of all centrarchids). Collected data suggests that this pattern is correlated to water turbidity. Centrarchids were most common in alligator gar stomachs on days of high turbidity.

0060 General Ichthyology II, Banquet Room G, Friday 1 August 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Shelby Richins, Chris Walser

The College of Idaho, Caldwell, ID, USA

Genetics and Summer Movement and Habitat Use of Columbia River Redband Trout, *Oncorhynchus mykiss gairdneri*, in Dry Creek, Idaho (Boise River Drainage)

The Columbia River redband trout (*Oncorhynchus mykiss gairdneri*) is Idaho's least studied salmonid. In this investigation, we documented the genetics, movement, and habitat use of redband trout in Dry Creek, a 3rd order, seasonally intermittent tributary of the Boise River, Idaho. During the summer of 2013, we surveyed 48 stream reaches throughout the Dry Creek watershed for redband trout. We collected fin clips and analyzed the genetic integrity of 136 individual fish. A total of 407 redband trout (47—250 mm TL) were collected via electrofishing and PIT tagged during the survey. Redband trout movement was monitored May 30, 2013—September 30, 2013 via two 10' BIO Lite in-stream PIT Tag Antenna Systems. Finally, we gathered habitat characteristics (*e.g.*, temperature, channel width, depth, elevation) of 20 isolated pools with and without redband trout to evaluate critical summer trout habitat. Genetic analyses confirmed a single population (F_{ST}=0.015) of non-introgressed Columbia River redband trout with relatively low genetic diversity (He=0.24). Movement detected by the PIT arrays was 91% (52/57) upstream (median 92-m) and 9% downstream (median 53-m). 56.1% (32/57) of movement occurred in June, prior to drying of mid-elevation reaches in mid-July, 2013. Fish persisted longest (>3 weeks) in large isolated pools (>495-cm channel width) at mid-elevation (1042—1051-m). Average daily maximum pool temperature (19.3 ˚C) was within the known temperature tolerance for redband trout. Redband trout were observed in pools with dissolved oxygen levels of 1.8 mg/L, indicating redband trout may have evolved physiological adaptations to hypoxia in intermittent desert streams.

0541 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Banquet Room J, Friday 1 August 2014

Eric Rittmeyer, Christopher Austin

Louisiana State University, Baton Rouge, LA, USA

Species Boundaries and Niche Evolution in the New Guinean *Carlia bicarinata* group (Squamata: Scincidae)

New Guinea is among the most biodiverse and geologically complex regions globally, yet mechanisms responsible for evolution of the region's herpetofauna remain poorly

understood. This is particularly true regarding the xeric eucalypt savanna regions that, while historically widespread, are currently restricted to two isolated patches in south-central and southeastern New Guinea. Among the diversity of these habitats is the *Carlia bicarinata* group, a small group largely restricted to the savannas of New Guinea, Cape York, Australia, and the nearby Aru Islands. To examine the phylogeny and evolution of this xeric-restricted group, we sequenced one mitochondrial and eight nuclear loci from samples spanning all major populations of *C. bicarinata* group skinks. Phylogenetic analyses reveal that *C. schmeltzii* is likely comprised of at least two distinct species, and forms an unresolved trichotomy with the rest of the *C. bicarinata* group and the *C. fusca* group. Species delimitation analyses further reveal extensive cryptic diversity within the group, including at least four currently undescribed species. We also examined the role of environmental niche evolution on diversification using ecological niche modeling and multivariate analyses of niche similarity. These analyses reveal that while some allopatric species (e.g. New Guinean *C. "storri"* and *C. bicarinata*) occur in regions more environmentally similar than expected given the availability of habitats, other species (e.g. *C. bicarinata* and *C. sp. "Amau"*) occur in habitats more environmentally divergent than expected. These results suggest that niche evolution and niche conservatism both play a role in driving diversification within the *C. bicarinata* group.

0704 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Jesús Rivas

New Mexico Highlands University, Las Vegas, New Mexico, USA

Population Dynamics of Green Iguana (*Iguana iguana*): Does it Pay for Little Boys to Save Their Sisters?

Altruism via kin selection has been broadly documented in several vertebrates. Among reptiles parental care has been documented in a variety of taxa. However, kin selection directed to siblings, which is common among social insects, has not been reported in reptiles. This is likely because most diploid siblings are better off maximizing their direct fitness. Previous studies have documented neonate male Green Iguanas exhibiting risky behaviors in the face of a predator which increase their odds of being preyed upon. These behaviors have the potential to increase the survival of their sisters by attracting the predator towards them. However, since the studies were done in artificial trails, the consequence of the altruistic behavior on the survival in the wild could only be inferred. In this contribution I present data from a five year long mark and recapture study of iguana population dynamics analyzing the data on light of the risky behavior exhibited by males. Neonate green iguanas suffer mortality in excess of 2.2 times higher than that of neonate females until they reach adulthood. Mortality evens out when females start

reproductive maturity, and later becomes stronger again among males; likely a consequence of injuries during mating combats. Because of the high mortality in early ages and long time to reproduction, it is likely that very few males reach the size in which they have a good chance of breeding, thus males helping sisters survive could very well be the best way to maximize inclusive fitness.

0528 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Travis Robbins, Tracy Langkilde

Pennsylvania State University, University Park, PA, USA

Exposure to an Invasive Species During Juvenile Development Results in Adaptive Behavior Mediated by the Stress Hormone Corticosterone

The effects of early life stress on adult behavior are generally regarded as negative but may adapt an organism to a given stressful environment. We examined the effects of early exposure to an invasive stressor (fire ants) on anti-predator behavior of a native lizard. Fire ants invaded some eastern fence lizard populations over 70 years ago. Fence lizards have adapted to the threats posed by these novel invaders as both predators and venomous prey, with observable changes in antipredator and feeding behavior of adults following fire ant invasion. Lizards from invaded populations likely experience frequent encounters with fire ants throughout their development. These encounters induce a stress response, increasing plasma corticosterone (CORT). Here, we test whether exposure to fire ants during juvenile development is the driving factor behind known behavioral differences in adult fence lizard populations and, specifically, if CORT is a physiological mediator underlying these responses. We exposed lizards weekly, from hatching to adulthood, to sublethal encounters with fire ants, exogenous CORT, or a sham control. We found that exposure to fire ants during development explains much, but not all, of the variation in adult behavior. CORT mediated some changes in adult behavior, but evolutionary history of exposure to fire ants (invaded vs. uninvaded populations) altered the nature of these effects. Our results highlight the importance of early life stress on adult behavior, which could work as a buffer, allowing populations to persist long enough for evolutionary changes in hormone induced behavior.

0482 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Spencer Roberts[1], Ricardo Hernández[2], James Spotila[1], Frank Paladino[3], Pilar Santidrián Tomillo[4]

[1]Drexel University, Philadelphia, PA, USA, [2]Universidad Nacional, Heredia, Costa Rica, [3]Indiana-Purdue University, Fort Wayne, IN, USA, [4]Institut Mediterrani d' Estudis Avançats, Mallorca, Spain

Nesting Ecology of East Pacific Green Turtles at Playa Cabuyal, Costa Rica

Knowledge of reproductive history and ecology is needed to better conserve and restore threatened and endangered wild populations. We studied the nesting ecology of the East Pacific green turtle (*Chelonia mydas*) at Playa Cabuyal, North Pacific Costa Rica form January 2010 to April 2013. We found the clutch size (mean ± SD: 76.9 ± 18.2 eggs per clutch) to be lower than previously reported, while seasonal reproductive output (409 ± 135 eggs per female) and Estimated Clutch Frequency (ECF) (4.3 ± 2.3 clutches) fell within the limits reported for the species. Females laid 75% of clutches in the upper vegetated area of the beach, especially under trees (79%). In this zone, shaded nests exhibited higher hatching success (0.89 ± 0.17) than nests exposed to the sun (0.75 ± 0.33). Nesting success (54% of nesting attempts) and false crawl frequency (49% of nesting activities) were consistent with other populations. Compared to other populations, the Observed Internesting Period between consecutive oviposition events as well as the mean duration of nesting was longer for the Eastern Pacific turtles, by 2 days and 45 minutes respectively. Our results will aid in improving beach monitoring plans and population estimates for this green turtle population. Along with our conservation efforts to address and limit local egg poaching, predation and tourism disturbances, official protection is needed to ensure the future preservation of the East Pacific green turtle.

0026 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

D Ross Robertson, Katie Cramer

Smithsonian Tropical Research Institute, Balboa, Panama

Defining and Dividing the Greater Caribbean: A Shorefish Biogeographical Perspective

The Greater Caribbean (GC) biogeographic region represents the high-diversity heart of the tropical west Atlantic, one of four global centers of tropical marine biodiversity. The traditional view of the GC is that it is limited to the Caribbean, West Indies, southwest

Gulf of Mexico and tip of Florida, and that, due to its faunal homogeneity, it lacks major provincial subdivisions. In this scenario the northern 2/3 of the Gulf of Mexico and southeastern USA represent a separate temperate, "Carolinian" biogeographic region. We assessed the biogeographic similarities of the local faunas of 45 sections of the shelf waters of the GC and adjacent areas by comparing the distributions of 1,559 shorefishes. This analysis shows that the GC occupies a much larger area than usually thought, extending south to at least Guyana, and north to encompass the entire Carolinian area. Rather than being homogenous, the GC is divided into three major provinces, each with a distinctive, primarily tropical fauna: (i) a central, tropical province comprising the West Indies, Bermuda and Central America; (ii) a southern, semi-tropical province spanning the entire continental shelf of northern South America; and (iii) a northern, subtropical province that includes all the Gulf of Mexico, Florida and southeastern USA. This three-province pattern holds for both reef and soft-bottom fishes, indicating a general response by demersal fishes to major differences in provincial shelf environments. Those environmental differences include latitudinal variation in sea temperature, the abundances of different major habitats, and nutrient additions from upwelling areas and large rivers.

0099 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Luiz Rocha[2], Sarah Friedman[1]

[1]*University of Washington, Seattle, WA, USA,* [2]*California Academy of Sciences, San Francisco, CA, USA*

Molecular Evidence for Biogeographic Speciation of the Yellowtail Damselfish, *Microspathodon chrysurus*

Globally, there are numerous biogeographic barriers that physically restrict the dispersal and distributions of marine ichthyofauna. These barriers range from obtrusive land masses, such as the Isthmus of Panama to large spatial separations like the Eastern Pacific Barrier. Regardless of the method of separation, these biogeographic obstacles are known to correlate with speciation events. One of the more geologically recent barriers is the massive outflow of freshwater from the Amazon and Orinoco Rivers off the coast of Brazil. In this project, we conduct molecular analysis of two fish: the yellowtail damselfish, *Microspathodon chrysurus*, which ranges from the Caribbean to Brazil and a sister species, *Microspathodon frontatus*, which is endemic to the western coast of Africa. While *M. chrysurus* and *M. frontatus* are known to be genetically isolated by the vast expanse of the Atlantic Ocean, we hypothesize that the Amazonian outflow has caused a disruption in the gene flow between the Caribbean and Brazilian populations of *M. chrysurus*, inducing a speciation event. To analyze the separate populations, two mitochondrial genes (cytochrome oxidase 1 and cytochrome b) were sequenced from

specimens collected in each locality. Coalescent and population genetic analyses of the sequenced genes were conducted to elucidate discrepancies between the two populations. It was estimated from the coalescent analysis that the populations were joined 123,000 years ago, correlating with a rise in sea level which is associated with Amazon Barrier permeability. Further evidence must be gathered before these two populations can be unequivocally established as two separate species.

0480 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Anthony Rodger[1], Corey Krabbenhoft[2], Kirk Winemiller[1]

[1]Texas A&M University, College Station, TX, USA, [2]Wayne State University, Detroit, MI, USA

Intra-annual Flow Variation and its Impact on Larval Fish Abundance in Two Texas Gulf Coast Rivers

Given increasing human demands for freshwater, the conservation of biodiversity in rivers and streams requires estimation of environmental flows that maintain the habitats and ecosystem dynamics that facilitate persistence of local populations of native species. A challenging aspect of identifying environmental flow regimes is determining requirements for seasonal high flow pulses that trigger fish spawning, larval transport, and/or early life stage survival. Our study investigates the dynamics of hydrology and fish reproduction, larval abundance, and survival rates in the lower Brazos River and middle Trinity River, Texas. From March 2013 to March 2014, abiotic environmental data, including river discharge, was collected as well as data concerning reproductive ecology, abundance, recruitment, and growth of larval fish. Larval fish were collected bimonthly at night using three arrays of stationary driftnets. Total abundance of protolarvae in both the Brazos and Trinity rivers exhibited a strongly bi-modal temporal distribution with peaks occurring in early May and August. The spring pulse of larvae was dominated by clupeids, and the summer pulse was dominated by cyprinids. In each case, peak protolarvae abundance coincided with flow pulses that followed periods of relatively low flows. Findings from this ongoing research will expand our limited knowledge of the life history of minnows classified as fluvial specialists, such as *Macrhybopsis hyostoma*, *Notropis shumardi* and *Notoropis buchanani*, and cyprinids that sustain reproductive effort from spring through fall. Study results will contribute to current and future initiatives aimed at conserving aquatic biodiversity in Texas and the northwest Gulf coastal plains.

0314 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

E. Alexander Rohtla[1,2], Aaron M. Bauer[1]

[1]*Villanova University, Department of Biology, Villanova, PA, USA,* [2]*Academy of the New Church Secondary Schools, Science Department, Bryn Athyn, PA, USA*

Advertisement Calls of the Thick-toed Geckos (Reptilia: Gekkonidae: *Pachydactylus*)

The gekkonid genus *Pachydactylus* comprises more than 50 species of highly vocal, small bodied lizards endemic to southern Africa. Although *Pachydactylus* spp. are known to possess complex vocal repertoires quantitative and comparative analysis of these calls are lacking. Advertisement calls were recorded from one captive male of each of six species, representing the two most species-rich groups in the genus, the serval/weberi clade (*P. montanus*, *P. visseri*, and *P. weberi*) and the northwestern clade (*P. scutatus*, *P*. cf. *oreophilus*, and *P*. cf. *parascutatus*). Calls have not been previously characterized in any of these taxa. Call duration, units per call, unit duration, unit rate, pulses per unit, pulse rate, inter-unit duration, mean unit frequency, maximum and minimum unit frequency, frequency bandwidth, and maximum sound intensity were analyzed using Raven Pro 1.4 sound analysis software. There is no significant correlation between body size and call properties, nor are calls more similar within clades than between them. Calls of *Pachydactylus* spp. were similar in overall structure but differed greatly from calls of non-congeners. Significant variation was detected between species. The call of *Pachydactylus* cf. *oreophilus* consisted of a single chirp. All other species produced multiple chirp calls lasting on average 2-8 s and comprising 6-17 units with each unit consisting of 1-22 discrete or fused pulses. It is evident that the call structure of *Pachydactylus* spp. is conserved across at least part of the genus though calls appear to be species specific.

0448 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Aaron Ross, Rebecca Blanton Johansen

Austin Peay State University, Clarksville, TN, USA

Conservation in the Dark: Comparison of Night Versus Day Sampling of an Imperiled Nocturnal Species, *Noturus fasciatus*

Madtoms (*Noturus* spp.) are a highly imperiled group of fishes in the southeastern US. Despite their nocturnal behavior, studies that describe population parameters and conservation status of madtoms have largely relied on daytime collection methods. Due to its small range, *Noturus fasciatus* is listed as state threatened and the US Fish and

Wildlife Service was recently petitioned to consider for federal listing. This species is restricted to 33 historical localities in the Duck and Tennessee River systems, TN. The most recent status survey (1996) found individuals at 12 historical localities and noted an average of 2.1 individuals/collection versus historical records averaging 9.3 individuals/collection. We evaluated the current status of *N. fasciatus* and specifically compared presence, abundance, and density observed during day versus night collections. Of the twenty-four historical localities surveyed for population parameters, a subset was recollected at night using the same methods. *Noturus fasciatus* was present at 20 localities and was most frequently associated with shallow, moderately flowing glides and riffles in both day and night samples. The average number of individuals/collection across all localities was 5.0 and the average number of individuals collected at night (26.9) was significantly greater ($p = 0.04$) than the number collected during the day (15.8). Although preliminary, populations of *N. fasciatus* appear stable. Results also demonstrate that daytime only collections of nocturnal species, especially rare species, may underestimate population variables and lead to erroneous conclusions regarding conservation status.

0181 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

David Rostal[1], Wade Carruth[1], Luke Wyrwich[2], Brad Lock[2]

[1]*Georgia Southern University, Statesboro, Georgia, USA,* [2]*Zoo Atlanta, Atlanta, Georgia, USA*

Reproductive Patterns in Three Genera of Asian Turtles: *Manouria*, *Heosemys* and *Coura*

Most species of turtle in SE Asia are under heavy exploitation pressure by human beings. The development of captive breeding programs at Zoos and Aquaria have provided the opportunity to study their reproductive biology. We present reproductive data on three different genera of threatened Asiatic turtles and compare their reproductive traits: Impressed tortoise (*Manouria impressa*), Arakan forest turtle (*Heosemys depressa*), and McCord's box turtle (*Coura mccordi*). Reproductive cycles were monitored using ultrasonography. Circulating testosterone levels were measured using ELISA. All three species were seasonal and reproduced at different times of the year. *Coura mccordi* hibernated during the winter and produced multiple clutches of 1 to 2 eggs during the spring and summer. Vitellogenesis and follicular development were primarily observed in fall prior to hibernation. Both *M. impressa* and *H. depressa* produced one clutch of eggs from June to January. *Manouria impressa* underwent vitellogenesis and follicular growth from January to July and ovulated eggs from July to January. They displayed nest mound building characteristics like *Manouria emys. Heosemys depressa* underwent vitellogenesis and follicular growth in the summer and

ovulated eggs from September to January. While *C. mccordi* is found in southern China above 20° latitude and exposed to more seasonal temperature extremes, it still lays multiple clutches of several large eggs across the season similar to Kinosternon turtles in North America. Both *M. impressa* and *H. depressa* are from more tropical equatorial Asia and display slightly different timing of reproduction, most likely driven by seasonal rain patterns influenced by ocean currents.

0399 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Erica Rottmann, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Revealing What Lies Beneath: Utilizing Environmental DNA (eDNA) to Detect Rare Fishes in Louisiana

The relatively new environmental DNA (eDNA) technique has proven to be a valuable monitoring tool for the detection of invasive and imperiled aquatic organisms, but it has yet to be comprehensively utilized in the southern United States where the usefulness of this approach may be impacted by more rapid DNA degradation due to higher water temperatures. Southeastern Louisiana has a large number of imperiled aquatic species in the Lake Pontchartrain Basin that are in need of study from a conservation perspective, and a cost-effective, non-invasive monitoring approach is needed to assess the conservation status of many aquatic species in the basin. The eDNA approach coupled with traditional field sampling surveys allows for a comprehensive assessment of the usefulness of the technique and provides information on the occurrence of rare fishes. This project used both eDNA and traditional techniques in a seasonal sampling to assess the conservation status of two rare taxa of the Lake Pontchartrain Basin, the Gulf Logperch, *Percina suttkusi* (Percidae), and the Flagfin Shiner, *Pteronotropis signipinnis* (Cyprinidae). Both species are known to occur historically in a limited number of localities in the basin making them ideal candidates for field-testing the eDNA method. Multiple sites within the basin drainage were sampled using traditional and eDNA sampling approaches. Positive eDNA hits and specimens recovered during the first collection period (spring/summer) will be presented. This project will shed light on the efficacy of the eDNA method for resource managers in the south.

0200 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

John Rowe[1], Brittany Miller[1], Mark Stuart[1], Cassandra Snyder[1], John Tucker[2], David Clark[1], Lawrence Wittle[1], James Lamer[3]

[1]Alma College, Alma, MI, USA, [2]Illinois Natural History Survey, Champgaign, IL, USA, [3]Kibbe Field Station, Macomb, IL, USA

Substrate Color-induced Melanization in Eight Turtle Species from Four Chelonian Groups

Background color convergence of prey can reduce predation rates by visual predators, occurring through local adaptation or phenotypically plastic responses. We assessed the capacity for substrate color-induced melanization in eight turtle species within the groups: Chelydridae, Emydidae, Kinosternidae, and Trionychidae by rearing individuals on black or white substrates for 160 days. In all aquatic turtle species, integuments of the head and carapace in the individuals that were reared on a black substrate were darker than on those reared on a white substrate. In the terrestrial *Terrapene carolina carolina*, however, no significant differences in dorsal head skin or carapace color were observed between treatments. Histological examination of tail tips in three aquatic species (*Chelydra serpentina serpentina*, *Graptemys geographica*, and *Trachemys scripta*) indicated that substrate color-induced melanization is morphological involving the transfer of melanosomes from basal epidermal melanocytes to adjacent keratinocytes. Interestingly, substrate color-induced melanization in a Pleurodiric species apparently involves physiological color change suggesting possible differences between Cryptodiric and Pleurodiric lineages. However, we could not rule out physiological color change in the turtles of our study.

0032 SSAR SEIBERT CONSERVATION AWARD, Banquet Room J, Friday 1 August 2014

Patrick J. Ruhl, Rob N. Chapman, John B. Dunning

Purdue University, West Lafayette, IN, USA

The Effect of Biomass Harvests on Eastern Red-backed Salamanders (*Plethodon cinereus*)

Forest biomass harvests for bioenergy production involve the removal and utilization of otherwise unprofitable wood such as tree-tops, limbs, small-diameter trees, and pre-existing deadwood. This material, if removed, can no longer perform ecosystem services such as nutrient cycling, nor can it provide essential habitat for forest wildlife. Lungless salamanders from the family Plethodontidae have strict microhabitat and soil moisture requirements that make them especially sensitive to timber harvest practices.

Due to their high densities, wide distribution, and high site fidelity, plethodontid salamanders have been suggested as ideal indicator species for forest ecosystem management. In this study, we monitored the abundance of salamanders in response to a gradient of retained coarse woody debris (CWD) following a forest biomass harvest. This project is the first to assess the impacts of intensive biomass harvest for bioenergy on plethodontid salamanders. In addition to abundance, we also considered key aspects of salamander health such as standard metabolic rate (SMR) and body condition. Preliminary analyses suggest that body condition metrics respond more to the presence or absence of canopy cover than to the proportion of retained CWD on our gradient. However, our N-mixture models show that the percent of CWD retained has a statistically important positive effect on eastern red-backed salamander abundance. If we are able to identify a threshold of resilience for plethodontids based on a gradient of retained CWD, this study could have implications for future biomass harvest regulations allowing for better protection of the integrity and biodiversity of forest ecosystems.

0375 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Samantha Rumschlag, Michelle Boone

Miami University, Oxford, Ohio, USA

The Effects of Size at Metamorphosis and Overwintering on Susceptibility to *Batrachochytrium dendrobatidis* in Northern Leopard Frogs

Mounting an immune response is an energetically costly process for hosts that may require tradeoffs with other energetic demands such as growth and survival. Energetic tradeoffs between immune responses and growth/survival may be more costly for hosts that are smaller in size as a result of exposure to suboptimal environmental conditions. In addition, these tradeoffs might be compounded by exposure to pathogens when immune function may be naturally suppressed, such as during overwintering. In this study, we exposed northern leopard frogs (*Lithobates pipiens*) to varying environmental conditions in the larval phase that would influence size at metamorphosis and to a fungal pathogen, *Batrachochytrium dendrobatidis* (Bd) after metamorphosis and/or before overwintering. We predicted that smaller size at metamorphosis resulting from exposure to suboptimal larval conditions would increase the effects of Bd exposure on growth and survival. In addition, we predicted that exposure to Bd before overwintering would result in greater negative effects on growth and survival compared to exposure after metamorphosis. Our work indicates that larval conditions did not influence the impact of Bd on subsequent growth and development prior to overwintering. However, Bd exposure at metamorphosis or prior to overwintering

increased mortality during overwintering. Our study suggests that exposure to Bd at or after metamorphosis may reduce overwinter survival in northern leopard frogs and could impact population dynamics in areas outside of regions of decline.

0229 Herp Biogeography & Phylogeography, Banquet Room J, Sunday 3 August 2014

Wade Ryberg, Johanna Harvey, Anna Blick, Toby Hibbitts, Gary Voelker

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

Interspecies Genetic Determination of the Massasauga Distribution in Texas

Recent genetic research suggests the Massasauga should be split into an Eastern (*S. catenatus*) and Western Massasauga (*S. tergeminus*) species, which should be further split into two subspecies, the Desert Massasauga (*S. t. edwardsii*) and Prairie Massasauga (*S. t. tergeminus*). While the *S. catenatus-S. tergeminus* split is well-supported, the geographic relationships among *S. t. edwardsii* and *S. t. tergeminus* populations remains unresolved due to poor sampling throughout the species range. Unresolved geographic relationships between these subspecies pose a difficult challenge for conservation of this species in Texas where both subspecies exist, because *S. t. tergeminus* has no special state or federal status and *S. t. edwardsii* has been petitioned for listing under the US Endangered Species Act. To address this challenge, we used nuclear and mitochondrial DNA variation to define the geographic relationships between *S. t. tergeminus* and *S. t. edwardsii* in Texas. We found strong evidence that *S. t. tergeminus* and *S. t. edwardsii* are genetically indistinguishable for the nuclear and mitochondrial genes investigated. Within the *S. t. tergeminus-edwardsi*i group, we found evidence of population structure, which included populations of Massasaugas from 1) Arizona and New Mexico, 2) Colorado and Kansas, 3) Missouri, 4) Oklahoma, and 5) south Texas. These 5 distinct population segments could be considered for listing, but with no clear evidence suggesting relationships among these disjunct populations, we recommend that more research using other molecular markers be conducted to provide a measure of genetic connectivity capable of revealing more detailed population structure for identifying conservation units.

0511 Fish Systematics & Taxonomy III, Banquet Room G, Sunday 3 August 2014

Mark Sabaj Pérez

Academy of Natural Sciences, Philadelphia, PA, USA

On the Identity of Catesby's Fish in Armour, "Cataphractus Americanus" (Siluriformes: Doradidae); a Handmaiden's Tale

In the Appendix to his classic two-volume work, "The Natural History of Carolina, Florida and the Bahama Islands…", Mark Catesby (1747:19, Pl. 19) described and illustrated the doradid catfish "Cataphractus Americanus". Linnaeus (1758) subsequently cited Catesby's "Cataphractus Americanus" in his description of *Silurus cataphractus*, a species currently valid in *Acanthodoras* Bleeker 1862. The names "Cataphractus" and "Cataphractus Americanus" are not available from pre- and post-Linnaean editions of Catesby's work (i.e., Catesby, 1747; 1754; 1771) including Edwards' (1771b) Catalogue appended to the third edition. Based on this study of Catesby's original description and illustration, his "Cataphractus Americanus" is newly assigned to *Platydoras* Bleeker 1862, rendering polytypic the type series of *Silurus cataphractus* Linneaus 1758. Consequently, BMNH 1853.11.12.193 [ex. Museo Gronovii] is here designated the lectotype of *Silurus cataphractus* Linneaus 1758, and its objective synonyms *Cataphractus americanus* Bloch & Schneider 1801, and *Cataphractus americanus* Lacépède 1803. Nomenclatural housekeeping such as this is greatly facilitated by traditional resources like brick-and-mortar natural history libraries as well as outstanding on-line resources like Eschmeyer et al.'s Catalog of Fishes and the Biodiversity Heritage Library.

0114 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Allison Sacerdote-Velat

Lincoln Park Zoo, Chicago, Illinois, USA

An Occupancy-based Conservation Assessment of Smooth Greensnakes (*Opheodrys vernalis*) in Northern Illinois

Smooth Greensnakes (*Opheodrys vernalis*) are grassland specialists that are state endangered in Indiana and Iowa, and a Species of Greatest Conservation Need in Illinois. Building on a conservation assessment for *O. vernalis* in Lake County, surveys expanded into neighboring DuPage and McHenry counties in northern Illinois. Using an occupancy approach, 31 grassland preserves were sampled using coverboard transects and area-constrained surveys. Sites were surrounded by varying intensities of urbanization and agriculture, and many have undergone restoration. 7200 individual

coverboard checks occurred from May - October, 2013, grouped into 80 transects, and pooled by month into 224 sampling occasions across sites. 115 area-constrained surveys occurred across sites. Program PRESENCE (Hines 2006) was used to estimate detection probability and proportion of area occupied (PAO) within sites and at landscape scale. Transects were buffered at 25, 50, 100, 250, 500, and 1000 meters to examine the influence of percent open canopy habitat, agriculture, and development on occupancy. *Opheodrys vernalis* were detected in five of 31 sites during sampling. Regional occupancy was estimated at 0.18. Site-specific estimates of PAO did not exceed 0.5. Detection probability varied in time between 0.07-0.44, being lowest in August and September and greatest in June. Detection increased slightly with shorter burn intervals. Percent open canopy had a positive influence, and percent development had a negative influence on occupancy at all scales. Within larger buffers, percent agriculture negatively influenced occupancy. We recorded detection histories for other snake species encountered during sampling. Occupancy patterns for additional species are being assessed.

0210 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Daniel Saenz[1], Toby Hibbitts[2], Cory Adams[1]

[1]*Southern Research Station, Nacogdoches, Texas, USA,* [2]*Texas A&M University, College Station, Texas, USA*

The Calling Ecology of Crawfish Frogs (*Lithobates areolatus*) from the Gulf Coastal Prairie of 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. Crawfish frogs are secretive and spend most of their time in or near crawfish burrows, making it difficult to detect them 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 part of their range. Our study is an attempt to learn about crawfish frog calling phenology, diel calling activity, and the exogenous factors that influence calling on the coastal prairie of Texas. We found that crawfish frog calling activity occurred in January, April, May, October, and November suggesting a more prolonged breeding season than expected, based on previous studies. Unlike northern crawfish frogs that show a decline in calling activity during the night, our data showed that calling commenced shortly after sunset and did not decline until sunrise in the Texas population. Finally, we found that an accumulation of rain was the only variable that was useful for predicting crawfish frog calling activity in our study, while other studies have concluded that temperature is important. Currently, we only have data for one year, making our results preliminary, however there are strong

indications that crawfish frogs on the Coastal Prairie of Texas are behaving differently than northern conspecifics.

0529 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Christina Saidak[1], Mark Cantrell[2], Carlos Echevarria[3], Kathlina Alford[4], Jason Henegar[5], Bernard Kuhajda[4]

[1]University of Tennessee, Knoxville, Tennessee, USA, [2]U.S. Fish and Wildlife Service, Asheville, North Carolina, USA, [3]U.S. Fish and Wildlife Service, Warm Springs, Georgia, USA, [4]Tennessee Aquarium Conservation Institute, Chattanooga, Tennessee, USA, [5]Tennessee Wildlife Resources Agency, Nashville, Tennessee, USA

Movement Patterns of Lake Sturgeon (*Acipenser fulvescens*) in the Upper Tennessee River

The Tennessee River Lake Sturgeon reintroduction program is an interagency cooperative project initiated in 2000. This program has released over 140,000 juveniles and fingerlings into the Tennessee River from wild Wisconsin broodstock. In August 2013 we established an array of 22 acoustic receivers in the upper Tennessee River to detect movement patterns, potential spawning habitat, and fish passage barriers in this system. These receivers were deployed, mapped, and range tested at select locations around known concentrations of Lake Sturgeon, at locks/dams, and at the mouth of large tributaries from Chattanooga, Tennessee upstream to above Knoxville, Tennessee. A receiver has also been mounted on a towboat that travels the Tennessee River weekly between these two cities. In November 2013 we surgically implanted resident Lake Sturgeon of hatchery origin (n=42) with coded acoustic tags programmed with a variable delay and an expected battery life of 3-5 years. Tagged Sturgeon ranged from 63-116 cm, 0.95-8.57 kg, year classes 2000-2012, and included 9 males, 30 females and 3 of unknown gender. Receivers have been checked and data offloaded regularly in order to map the overall movement patterns of Lake Sturgeon. Through March 2014, 35 of 42 tagged fish have been detected and one fish has traveled at least 18.5 miles, however most Sturgeon are still near their tagging sites in Fort Loudon and Watts Bar Reservoirs. Movements of sturgeon appear to be correlated with environmental variables, including water temperature.

0718 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Norma Salcedo[1], Haley O'Brien[2]

[1]*College of Charleston, Charleston, SC, USA,* [2]*Ohio University, Athens, OH, USA*

Morphology of the Hyoid Arch and Branchiostegal Rays of *Lipopterichthys carrioni* (Siluriformes: Loricariidae) Based on Computed Tomography Scan Data

The enigmatic species *Lipopterichthys carrioni* is poorly represented in museum collections in the United States, hindering the possibility of using destructive techniques to study its morphology. Based on computed tomography (microCT) scan data from two specimens of *Lipopterichthys carrioni*, the morphology of its hyoid arch and branchiostegal rays is visible for the first time. The shape of the anterohyal is noticeably wide distally, with a notch on its anterior border. The posterohyal is triangular and V-shaped in cross section. Three branchiostegal rays are present, of which the two most lateral (first and second) articulate with the posterohyal. The third branchiostegal ray is narrow, with a long distal projection. To notice is the absence of the fourth branchiostegal ray, observed only in two species within the *Chaetostoma*-group: *Chaetostoma marmorescens* and *C. taczanowskii*. In particular, relationships among elements of systems such as the hyoid arch and associated branchiostegal rays might have been overlooked and need further study.

0395 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Jessica Sanchez, Joel Trexler

Florida International University, Miami, FL, USA

Studying the Evolution of Herbivory Using the Sailfin Molly, *Poecilia latipinna*

Herbivory is thought to be an inefficient feeding strategy because animal tissues are protein-rich, but basal resources are rich in carbon. In addition, many basal resources have chemical defenses that deter herbivores. These characteristics suggest that herbivorous diets are of low quality, which may affect the way energy is allocated to different life processes. The diets of herbivores contain less protein, which limits growth and reproduction. Moreover, herbivores consuming defended plants must allocate energy to resisting toxic effects. The negative effects of plant-based diets calls to question why herbivory is common in nature. In the Everglades, periphyton mats are the primary basal resource and are thought to be a poor quality resource for consumers. The sailfin

molly is native to the Everglades and consumes periphyton. In this study, we investigate diet selectivity, the effects of a poor-quality diet on growth, and a detoxification pathway that may be involved in detoxification of cyanotoxins in sailfin mollies. Gut contents of field-caught fish show that diet is dominated by low quality items, whereas laboratory studies show that fish selectively feed on higher quality components when available. In addition, newborn fish raised on Everglades periphyton grew slower and reached a smaller size than those raised on commercial diets. When fed toxin-producing cyanobacteria in the laboratory, sailfin mollies showed evidence of detoxification. These experiments begin to reveal the effects of a poor quality herbivorous diet on life history. We plan to expand these studies and shed light on the evolution of this arduous diet strategy.

0585 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Enrique Santoyo-Brito, Matthew Anderson, Stanley Fox

Oklahoma State University, Stillwater, Ok, USA

Sex Ratio According to Incubation Temperature in the Collared Lizard, *Crotaphytus collaris*

Two modes of sex determination occur in squamates: genotypic sex determination (GSD) and environmental sex determination (ESD). An example of ESD is temperature-dependent sex determination (TSD). Temperature-dependent sex determination is well known in many reptiles and has evolved multiple times. Collared lizards, *Crotaphytus collaris*, are oviparous diurnal crotaphytids distributed in the southwestern United States and northern Mexico. It is not known with certainty if this species has GSD or TSD. Although no sex chromosomes have been identified, the species is regarded as having GSD. In a previous preliminary study in which sex was determined after incubation of eggs at different temperatures in the laboratory, the authors considered their results inconclusive. Thus, the exact sex determination mechanism in *C. collaris* is unknown. The objective of this study was to measure the effect of incubation temperature on sex proportion of *Crotaphytus collaris* hatchlings. We incubated eggs at seven constant temperatures: 21°, 27°, 28°, 30°, 32°, 33.5 and 35°C. We determined the sex, by secondary sexual characters (presence/absence of enlarged pre-cloacal scales), of 79 hatchlings from 19 females from a population located at the Glass Mountains (Major Co.), Oklahoma. To increase sample size, we included the results, reported in Viets et al. (1994), of 18 hatchlings for the same species incubated at 27°, 28°, 30°, and 32°C. Data analyses suggested a clear difference in sex ratio dependent on incubation temperature.

0595 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Neha Savant, Kristine Kaiser

Pomona College, Claremont, CA, USA

Chronic Anthropogenic Noise Decreases Testicular Testosterone in White's Treefrog, *Litoria caerulea*

Studies investigating causes of global amphibian declines often focus on the ecology of declines, but a complete understanding of declines requires an integrative perspective, incorporating an animal's physiological response as well as ecological and behavioral. Indeed, many of the leading causes that declines have been attributed to are likely to be perceived by animals as stressors, leading to secretion of corticosterone (CORT), a stress-responsive hormone. Chronic elevations of plasma CORT levels are associated with pathology. Previously, we have shown that exposure to anthropogenic noise, a generalized environmental stressor, increased levels of corticosterone, and decreased sperm count and sperm viability in male frogs exposed to chronic noise. The mechanism by which this occurs likely involves interactions between the hormone axes that govern stress responses and reproduction as successful spermatogenesis requires secretion of testosterone (T) in the testes. In order to elucidate the factors that mediate reproductive suppression in response to chronic stress in amphibians, we subjected male White's treefrogs (*Litoria caerulea*) to anthropogenic noise and chorus noise for eight nights and compared the relative abundance of testicular T to that of frogs presented with only chorus noise. We fixed, sectioned, and stained testes using immunohistochemical techniques and quantified fluorescence using Fiji. We observed increased T in the testes of frogs exposed to noise, suggesting that an imbalance in testicular T may contribute to the decrease in sperm health and production. The portion of the endocrine pathway responsible for this pathology, however, remains unknown.

0144 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Jake Schaefer, Nkrumah Frazier, Jonathan Barr

University of Southern Mississippi, Hattiesburg, MS, USA

Mississippi Coastal Fish Assemblage Structure and Dynamics Before and After the Deepwater Horizon Oil-spill

Anthropogenic disturbances have been shown to have a variety of effects on ecosystem processes and function. As a result of the April 2010 Deepwater Horizon (DWH) incident, oil and oil dispersants were introduced into northern Gulf of Mexico ecosystems. Rigorous empirical data are required to assess the potential impact of the DWH to coastal ecosystems. To assess potential impacts to fish assemblages, we utilized

a previously published dataset (1992-1994) and our own collections (2011-2013) to assess patterns of current and pre-DWH fish assemblage structure and dynamics. Sampling included a total of 254 pre-DWH and 180 post-DWH trawl samples covering estuary and subestuary habitat across the Mississippi coast. The final dataset contains over 40,000 individuals representing over 100 species.

0397 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Christopher Schalk[1], Daniel Saenz[2]

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Abiotic Drivers of Anuran Calling Activity in a Seasonal Neotropical Environment

Abiotic factors have been shown to play an important role in the organization of amphibian communities. In particular, abiotic factors have been shown to be strongly tied to amphibian calling activity. Our study was conducted in the semiarid thorn forests of the Gran Chaco ecoregion of Southeastern Bolivia, a season environment with distinct wet and dry seasons. We used automated recording devices to collect audio recordings of nocturnally vocalizing amphibians at seven sites from 20 January 2011 and continuously until 31 October 2011. We also collected abiotic factors (temperature, rainfall, and daylength) nightly. We detected 14 species of anurans at our seven survey sites. The majority of calling activity was concentrated between the months of January and the first week of April, which coincided with the rainy season. We did observe some variation in calling activity amongst species within the rainy season. Two species, *Leptodactylus bufonius* and *Phyllomedusa sauvagii*, appeared to not respond to any abiotic factor and called nearly continuously during the rainy season. Species such as *Physalaemus albonotatus*, *P. biligonigerus*, *Rhinella major*, and *Scinax nasicus* called during the entire rainy season, but calling activity was strongly associated with rainfall, whereas other species (*Ceratophrys cranwelli*, *Dermatonotus muelleri*, and *Scinax fuscovarius*) were only detected at the beginning of the sampling period. Our study demonstrates that the interspecific variability of calling activity of Chacoan anurans is strongly linked with abiotic factors, which in turn can have important consequences for the structure and subsequent interspecific interactions between tadpoles within the breeding ponds.

0398 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Christopher Schalk[1], Carmen Montaña[2], Nicole Smolensky[1]

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Intercontinental Convergence of Arid-Adapted Amphibians: Evidence from Morphology

Similar phenotypes and ecomorphological patterns across a community of distantly related species provide strong evidence for evolutionary convergence and have been detected in multiple taxa, including freshwater fish, birds, and lizards. Amphibian communities inhabiting arid environments may subject to environmental filtering and possess specific ecomorphological attributes associated with limited rainfall. We explored whether amphibian communities of the deserts in North America and the semi-arid thorn forests and savannahs of the Gran Chaco in South America exhibit patterns of morphological convergence across the entire community and between individual species among the communities. We measured 13 morphological traits associated with feeding and habitat use in 39 species of Chacoan anurans and 17 species of North American desert anurans. We conducted PCA and phylogenetic generalized least squares to test for associations between morphology, habitat and phylogeny. At the community-scale, we found that the Chacoan amphibian community exhibited greater morphological diversity as compared to North America; which was primarily driven by the higher diversity of hylids and leptodactylids present in the Chaco. At the species-scale, we found evidence suggesting one-to-one convergence, most notably between the Ceratophryidae of South America and the Scaphiopodidae of North America. These convergent patterns between the Ceratophryidae and Scaphiopodidae are indicative of environmental filtering associated with limited rainfall. However evolutionary conservatism among the bufonids in both communities also influenced the observed pattern. Future studies could examine whether these species are convergent in other aspects, including trophic ecology as well as their tadpole stage.

0658 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Ray Schmidt

Tulane University, New Orleans, LA, USA

Historical Biogeography of Fishes of the Fouta Djallon Highlands and Surrounding Areas

The Fouta Djallon highlands and Guinean Range are reported to serve as the boundary between two ichthyo-regions in West Africa. The Upper-Guinean region, to the west, comprises rivers that originate in remnant rainforests on the western slope of the range and flow southwest, directly to the Atlantic Ocean. On the eastern slope of the range, rivers of the Nilo-Sudan region flow north and east through the Sahel before eventually reaching the Atlantic Ocean. This study investigates the historical biogeography of the Guinean highlands and surrounding areas by comparing the phylogeographies of co-distributed clades of mountain catfishes (Amphiliidae: *Amphilius*), suckermouth catfishes (Mochokidae: *Chiloglanis*), and the African barbs (Cyprinidae: *'Barbus'*) from the region. Phylogenies inferred from both mitochondrial (Cytochrome b) and nuclear markers (Growth Hormone introns) reveal numerous divergent lineages within each clade that require formal taxonomic description. Most of the newly discovered taxa are endemic to individual river basins. The largest number of endemic species is associated with the Konkouré River basin, a large watershed in the Upper-Guinean region. The results point to a complex biogeographic history for the region, characterized by a mix of vicariance and biotic dispersal (headwater capture) events. A hypothesis for the historical biogeography of the area is presented and the potential for other discoveries from the area is discussed.

0235 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Julia Schmidt-Petersen[1], James W. Orr[2], Christopher D. Marshall[3], Dominique Adriaens[1]

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Functional Morphology of the Jaw Protrusion in Seamoths (*Eurypegasus draconis*) (Pisces, Pegasidae)

Eurypegasus draconis are small fish that, despite their rigid body and generally slow movements, perform an astonishing fast downwards jaw protrusion for feeding on

small benthic invertebrates. To better understand the process of this movement, the 3D anatomy of the musculoskeletal components of the feeding apparatus, reconstructed in AMIRA, was studied, using μCT data of a phosphomolybdic acid stained specimen of *E. draconis*. To get insight into the kinematics, high speed video recordings of feeding movements were qualitatively analyzed. The video recording revealed an extremely fast suction motion (10ms from closed mouth to full jaw protrusion), where the protrusion of the upper jaw follows a lower jaw depression. From a lateral view, no buccal movement other than protrusion could be observed. The upper jaw consists of movable, paired maxilla and premaxilla, to which no muscles seem to attach, and large cartilage structures. Another eleven movable bony structures with six attached paired muscles could be identified to be directly or indirectly connected to the fused articular/dentary bones that form the lower jaw. If the mouth is retracted, one of these muscles, the protractor hyoidei, lies in a position where it closes the mouth. However, during depression of the lower jaw, the relative position of the muscle shifts, so that it changes to being a mouth opener. In theory, this mechanism could be used to build up elastic energy, which would then be abruptly released by the depression of the lower jaw, and would explain the rapidness of the movement.

0428 Ecology and Ethology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD ECOLOGY AND ETHOLOGY

Michael Schram, Mark Steele

California State University, Northridge, Northridge, California, USA

Effects of Simulated Size-Selective Harvesting on a Protogynous Temperate Reef Fish, *Rhinogobiops nicholsii*

The exploitation of marine fishes has increased as technology has improved, ultimately reducing stocks of fishes worldwide. Understanding the impacts humans have on particular species and the overall effect that has on community composition, habitat structuring, and ecosystem stability is vital for the maintenance of sustainable stocks for a continually growing world population. To maintain the sustainability and accessibility of fish stocks, fishery managers often set size limits that result in the disproportionate removal of specific size ranges, a practice known as size-selective harvesting. Observational studies examining the effects of size-selective harvesting on protogynous fishes across large temporal and spatial scales have noted reductions in size at maturity and size at sex-change; however controlled, manipulative studies demonstrating the causal links have not been conducted. The purpose of this study was to investigate those direct effects using a model study species, the blackeye goby (*Rhinogobiops nicholsii*), occupying twenty 2.25 m^2 artificial reefs subjected to size-selective removals. Five reefs each received one of three size-selective removals (large, medium, and small) with the

five remaining reefs as controls. Reproductive output was measured on artificial nesting plates photographed weekly for 5 weeks, to quantify clutch size and egg density, and individual fish growth was recorded. All three size-selective removals reduced population densities by roughly 25% but did not significantly affect reproductive output or growth rates. Results suggest there is adequate social flexibility to buffer relatively low intensity short-term or single generation effects of size-selective harvest.

0437 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Aaron Schrey[1], Kyle Adams[1], Joyce Bongang[1], Emily Brunner[1], Jacob Lee[1], Kyle Ashton[2], Earl McCoy[3], Henry Mushinsky[3]

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The Effect of Fire-based Habitat Disturbances on the Genetic Characteristics of Florida Scrub Herpetofauna

Fire-based habitat disturbances are inherently variable and can alter genetic characteristics of local populations. Because of the variability and potentially large effect on local areas caused by fire, species that occur on fire maintained habitats must adapt mechanisms to persist through the disturbance. The Florida scrub habitat offers a unique opportunity to study the effect of fire on populations of herpetofauna. Florida scrub is a fire maintained habitat, and Florida scrub is highly threatened and exists as fragmented patches. The Florida Sand Skink (*Plestiodon reynoldsi*), the Florida Scrub Lizard (*Sceloporus woodi*), Blue-tailed Mole Skink (*Plestiodon egregius lividus*), and the Six-lined Racerunner (*Aspidoscelis sexlineata*) occur in the threatened and fire-maintained Florida scrub habitat. Each has different habitat preferences and likely has different responses to local fire-based habitat disturbances. We compare patterns of change at multiple microsatellite loci among these species to identify the fire history characteristics that predict changes in genetic diversity and differentiation. We find that time-since-last fire coupled with dispersal capabilities of these species is a good predictor of genetic characteristics of local populations. Also, number of fires and fire interval are important factors that affect genetic diversity. Together, these species show preferences for different fire histories, but all appear to maintain genetic diversity when faced with a fire history similar to that naturally required to maintain the Florida scrub habitat.

0442 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Aaron Schrey[1], Travis Robbins[2], Duong Vo[1], Tammy Nguyen[1], Jacob Lee[1], Kyle Ashton[3], Earl McCoy[4], Henry Mushinsky[4]

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Ecological Epigenetics of Herpetofauna in the Fire Maintained Florida Scrub Habitat

Epigenetics is the study of changes in gene expression not caused by changes in DNA sequence, and ecological epigenetics studies how epigenetic variation affects ecologically relevant characteristics. DNA methylation is the most well-studied epigenetic mechanism, and is known to affect gene expression and can alter phenotype. DNA methylation may underlie an organism's response to stress, and may be important for fine-tuning phenotype to local conditions. We used metAFLP to screen epigenetic variation among three Florida scrub reptiles; the Florida Sand Skink (*Plestiodon reynoldsi*), the Florida Scrub Lizard (*Sceloporus woodi*), and the Six-lined Racerunner (*Aspidoscelis sexlineata*). Each of these species is known to have incompatible genetic responses to fire-based habitat disturbances. We screened individuals that had previously been characterized at genetic markers, from multiple locations with known fire histories to determine if DNA methylation variation was associated with ecological characteristics or fire history for these species. We hypothesize that DNA methylation will vary with fire history, but the pattern of change will differ for each of the three species based on their habitat preferences and dispersal capabilities.

0515 General Ichthyology II, Banquet Room G, Friday 1 August 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Hayley Schroeder, Kevin Tang

University of Michigan - Flint, MI, USA

Phylogeny of Rabbitfishes (Teleostei: Perciformes: Sigandae)

Rabbitfishes (family Siganidae) are comprised of 28 species in genus *Siganus*. The family is a well-known member of the perciform fishes. Most commonly found in Indo-Pacific waters, these fishes have since migrated and become established in the Eastern Mediterranean. Rabbitfishes (also called spinefeet or foxfaces) are so named for their small, rabbit-like mouths, and are also equipped with unique features such as spiny pelvic and anal fins with venomous spines. The focus of this study is to reconstruct a phylogenetic tree of this family of fishes. Relatives of the rabbitfishes from numerous

percomorph families will be used for comparison in order to determine the relationships within Siganidae and their relationships to other families. Nuclear and mitochondrial genes will be amplified and then analyzed to construct a phylogeny of these species, determining which groups are monophyletic. With this newly generated data, this study has the capacity to revise the current classification of Siganidae and provide some insight into these fishes concerning their higher-level relationships and evolutionary patterns.

0554 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Kristina Schultz, Kayla Parham, Martina Contreras, Jennifer Dombrowsky, David Strong, Todd Huspeni

University of Wisconsin-Stevens Point, Stevens Point, Wisconsin, USA

Characterization of Malaria Infections in Side-Blotched Lizard Populations

While human malaria-causing *Plasmodium* species are relatively well characterized, the other hosts for *Plasmodium* parasites have been less studied. For example, there are several species of *Plasmodium* that infect birds and non-avian reptiles. *Plasmodium mexicanum* has been reported from a variety of lizards (e.g., *Sceloporus* spp.) in the western US and reported from *Uta* lizards in a number of western states. Studies have previously shown that infections of lizards by *Plasmodium* spp. do not generally result in death of the host, but pathology is manifested in decreased reproduction (e.g., reduced egg clutch size) and stamina of tested hosts. The purpose of our study was to characterize malaria infections in Side-Blotched Lizards (*Uta stansburiana stansburiana)* with respect to prevalence (percent infected), geographic distribution, and the relationship of infections to sex and age of lizard. We hypothesized that malaria infections would be negatively associated with increasing latitude. We also hypothesized there would be no significant infection differences between males and females but also that infection prevalence would be higher in older individuals. Blood smears were obtained from field-fresh lizards at 14 sites in northern Nevada and eastern Oregon. Smears were preserved, stained and assessed by microscopic examination for *Plasmodium* infection. We found no significant difference in infection between males and females, nor was there a significant latitudinal gradient of infections among the populations sampled. No significant infection prevalence differences were observed between age classes. We continue to analyze the effect of malaria infection on female reproductive success.

0579 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Eric Schuppe, Devaleena Pradhan, Kevin Thonkulpitak, Matthew Grober

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Sexually Dimorphic Co-localization of Steroidogenic Enzyme and Androgen Receptor in Spinal Cord and Supracarinalis Muscle in *Lythrypnus dalli*

In vertebrates, androgen biosynthesis and signaling through receptor binding are critical for regulation of physiological and morphological processes for the expression of male-typical reproductive behavior. Muscles essential for courtship behavior and copulation are highly sensitive to androgens, and differences in the distribution and number of the androgen receptor (AR) may be important for maintaining dimorphic musculature. In *Lythrypnus dalli*, a protogynous teleost fish, reproductive behavior is sexually dimorphic. One such difference is male specific courtship behavior, characterized by rapid jerky movements towards a female or around the nest. These rapid turns are based on fin movements that might be controlled by the supracarinalis muscle. To further investigate the role of androgens in dimorphic reproductive behavior, we examined differences in local production of 11β-hydroxysteroid dehydrogenases type 2 (11β-HSD), the enzyme that synthesizes the potent fish androgen, 11-ketotestosterone (KT) and AR (the receptor for this androgens) in the supracarinalis muscle and spinal cord. We demonstrate that spinal motor neurons expressing AR and 11β-HSD are high in males and low or absent in females. In addition, both AR and 11β-HSD are co-localized in a subset of supracarinalis muscle fibers in males, but not females. Sex differences in the distribution and number of cells expressing AR and 11β-HSD in spinal motor neurons and supracarinalis muscle may underlie expression of dimorphic behaviors in *L. dalli*, and may be an indicator of sexual selection acting on this tissue.

0412 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Michael Schwemm[1], Anthony Echelle[2], Ronald Van Den Bussche[2], Jason Schooley[3]

[1]University of New Mexico, Albuquerque, NM, USA, [2]Oklahoma State University, Stillwater, OK, USA, [3]Oklahoma Department of Wildlife Conservation, Miami, OK, USA

Comparison of Genetic Structure Across Age-Groups of Paddlefish in Grand Lake, Oklahoma

At present, 80% of the paddlefish in Grand Lake, Oklahoma were spawned in 1999. We assessed the level of genetic diversity for microsatellite loci, and estimated genetic effective size over nine cohorts, including the 1999 year-class. Results from 13 loci

suggest only moderate diversity relative to other fishes. The mean number of alleles across all cohorts is 4.04 (SE = 0.16) and mean expected heterozygosity is 0.57 (SE = 0.02). The relatively low variation in Grand Lake potentially reflects a historic population bottleneck for this reservoir, possibly associated with construction of the Neosho River lakes (Grand, Hudson, and Ft. Gibson). Allele frequencies across cohorts were consistent from 1996 – 2004 (χ^2 = 24.1, P = 0.34), and there is no evidence of heterozygote deficiency in the pooled sample. These results indicate that cohorts are products of random mating. Point estimates of both inbreeding and variance effective number of breeders per cohort fluctuated from <50 to ∞, however, estimates of generational effective size are large (> 500), and suggests their long life-span and iteroparous reproduction buffer annual changes in genetic variation.

0213 Herp Ecology III, Banquet Room H, Sunday 3 August 2014

Roy Scudder-Davis, Christina Benedict, Alyssa Hubbard, Rebecca Jeong, Leif Van Laar, Michon Martin

Berea College, Berea, KY, USA

Diversity and Abundance of Salamanders in Relation to Human Development in Six Selected Stream Habitats in Central Kentucky

The diversity and abundance of salamanders in six streams in Central Kentucky were monitored during the summer of 2013. The habitat surrounding four of the streams showed various amounts of human development, while two were relatively undisturbed habitats. In two of the disturbed habitat streams, human development took the form of the north and south bound lanes of Interstate 75 which passed on both sides of the streams forming "habitat islands." In the other two disturbed habitat streams, human development took the form of nearby roads, bridges, culverts and dwellings. Two, ten-meter long transects were established within each stream, and each stream was sampled five times during the study. The number of objects turned and the time spent sampling were recorded for each sampling session. Salamander diversity was higher in the two undisturbed habitat streams than in the disturbed habitat streams. While it was postulated that the isolation of the I-75 streams would decrease diversity more than in the non-isolated disturbed habitat streams, both kinds of habitat streams were dominated by a single species, the southern two-lined salamander, *Eurycea cirrigera*. Abundance of salamanders showed no consistent pattern among the types of stream habitats. One each of the undisturbed, disturbed isolated, and disturbed non-isolated stream habitats had relatively high abundance of salamanders and one each had relatively low salamander abundance.

0226 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Ryan Seddon, Diana Hews

Indiana State University, Terre Haute, IN, USA

Do Melaninization and Testosterone Play a Role in Aggression for the Western Fence Lizard, *Sceloporus occidentalis*?

A growing area of behavioral ecology examines how mechanisms underlying production of pigments can affect traits other than body coloration. Melanin, and molecules that regulate melanin, can directly and indirectly affect other phenotypic traits, such as aggression or physiology. These associations have been studied mainly in birds and mammals, but less so in reptiles. As a first step in examining an elevational gradient of melanization, we studied adult males in a high- and low-elevation population of the western fence lizard, *Sceloporus occidentalis* during the breeding season (June 2013) along the Merced River and in Yosemite National Park. This genetically-characterized elevational gradient exhibits increasingly darker-bodied and larger adults at higher elevations. We measured degree of melanization in the two populations to quantify differences in coloration. By calculating melanization in multiple ways, we confirmed that the higher elevation population was significantly darker than the lower elevation population. Then, we assessed agonistic behavior of males in response to standardized staged territorial intrusions (STIs). Principle-components analysis of behavioral responses to the STIs revealed that darker (higher-elevation) males had higher mean aggressive. Melanization and aggression were correlated between the two populations, but not within. We also tested whether there was a testosterone difference associated with elevation and found no significant difference between the two populations in baseline plasma testosterone levels. Similarly, baseline corticosterone did not differ between populations.

0737 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Fredys F. Segura-Guevara, Irina J. Arroyo-Segura, Charles W. Olaya-Nieto

Laboratorio de Investigación Biológico Pesquera-LIBP, Departamento de Ciencias Acuícolas. Universidad de Córdoba, Lorica, Cordoba, Colombia

Length-Weight Relationship of Perico *Trachelyopterus badeli* f.c. in the Sinu River, Colombia

The length-weight relationship of individuals of Perico (*Trachelyopterus badeli* f.c. Dahl, 1955) collected in the Sinu River, Colombia, between January and December 2003 were estimated. The length-weight relationship and condition factor were estimated with the equation $TW = a\ TL^b$ and $Cf = TW/TL^b$, respectively. The sizes ranged between 11.4 and

23.1 (15.7 ± 2.0) cm TL, the total weight between 16.0 and 192.0 (58.6 ± 28.0) g, and the mean length in the catch was 15.9 cm TL. Length-weight relationship estimated was WT = 0.007 (± 0.19) LT $^{3.25\ (\pm 0.16)}$, r = 0.92, n = 289, were the monthly growth coefficient ranged between 2.25 and 3.75, with statistically significant differences, and the condition factor ranged from 0,002 and 0.083, without statistically significant differences. Correlation between condition factor, the river levels, and gonadosomatic index were found in several months of the study, especially in rising waters.

0023 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

David Sever

Southeastern Louisiana University, Hammond, LA, USA

Anatomy of Female Sperm Storage in Lizards

Female sperm storage tubules (Ssts) in lizards were first reported in three species of chameleons (*Chameleo*) by Saint Girons (1962) and in the Green Anole (*Anolis carolinensis*) by Fox (1963). Most research on anatomy of sperm storage in female lizards has been limited to light microscopy, and at least 27 species representing eight families have been studied in that manner. Phylogenetic analyses of sperm storage characters in female squamates present different hypotheses for evolution of these characters when they are mapped on morphological and molecular phylogenies. Missing data from some families, however, hinders such analyses. Several characters are relatively conserved across the sampled squamates (including presence of sperm storage and Ssts, embedding of sperm in Sst epithelium, and sperm storage with eggs *in utero*). Alternatively, location of Ssts, secretions within the Ssts, and length of sperm storage are highly variable traits. This talk reviews studies dealing with the ultrastructure of the Ssts of *Anolis sagrei*, *Scincella lateralis*, and *Hemidactylus turcicus* as these species show striking variation in location and cytology of Ssts.

0075 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

David Sever, Christopher Beachy

Southeastern Louisiana University, Hammond, LA, USA

Phylogeny of Mental Glands, Revisited

Houck and Sever (1994) hypothesized that presence of a mental gland was ancestral in plethodontids and proposed a secondary loss for those taxa that lack a mental gland.

Subsequently, Beachy (1997) hypothesized that "head-sliding" as found in basal taxa like *Pseudotriton* and *Gyrinophilus* that lack mental glands, preceded the evolution of mental glands, and the absence of a mental gland in plethodontids was the ancestral condition. We mapped mental gland characters used by Houck and Sever (1994) and the occurrence of head-sliding on a phylogeny of plethodontids from Vieites et al. (2011). The ancestral condition for plethodontids is resolved as lack of a mental gland and also lack of head-sliding. Lack of a mental gland occurs in each major clade, and it is likely that absence of a mental gland is ancestral in some clades (like *Pseudotriton* and *Gyrinophilus*), and secondary in others (like paedomorphic *Eurycea*). If taxa that lack a mental gland are excluded, the ancestral shape of the mental gland of all plethodontids is equivocal, but for the eastern and southern clade, a small pad is ancestral. Desmognathines have the most unique mental glands, occurring in an anterior protrusion or bifurcated (only *Desmognathus wright*). Fan-shaped mental glands evolved independently in *Eurycea* and *Oedpina.* Large pads arose independently in (1) tropical bolitoglossines and (2) *Hydromantes, Aneides* and some *Plethodon*. The ancestral condition for pheromone delivery is a combination of pheromones and sexually dimorphic teeth that allow for delivery by pulling and snapping.

0500 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Brian Shamblin[1], Mark Dodd[2], DuBose Griffin[3], Michelle Pate[3], Matthew Godfrey[4], Michael Coyne[5], Ruth Boettcher[6], Campbell Nairn[1]

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Genetic Capture-recapture to Assess Reproductive Parameters for Loggerhead Turtles Nesting in the Southeastern United States

Reproductive parameter estimates for marine turtles have traditionally been generated through flipper-tagging projects. Intercepting all nesting females on each nesting attempt is logistically infeasible, and many females appear transient at the scale of a single tagging beach. To generate more robust reproductive parameter estimates, we have initiated a genetic capture-recapture project spanning most of the nesting range of Northern Recovery Unit loggerhead turtles. The study site spans all monitored beaches from the Georgia-Florida border through the northern extent of loggerhead turtle nesting in Maryland. Maternal genomic DNA is extracted from a single egg from each recorded clutch and genotyped at eighteen microsatellite markers to generate a unique genetic tag for each individual female. To date, approximately 30,000 clutches have been

assigned to 7,000 individual females nesting between 2006 and 2013. Observed clutch frequencies range from one to seven nests per season. In contrast to previous studies that suggested bimodal nest site fidelity behavior, females exhibited a range of behaviors along a broad continuum. Females with the highest nest site specificity nested on less than five kilometers across multiple nesting seasons. In contrast, the least site-specific females deposited clutches over 500 kilometers apart within a single nesting season. In addition to nesting female population size and clutch frequency estimates, longterm goals of this genetic tagging include characterization of remigration intervals, annual survival, and spatial recruitment patterns. This research would not be possible without the enthusiastic support of an expansive volunteer network.

0088 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Utpala Sharma, Dayal P. Gupta

Dayalbagh Educational Institute, Agra, Utter Pradesh, India

Phylogenetic Analysis Among Cyprinidae Family Using 16SrRNA

In the present study the cyprinid fishes (*Labeo rohita*, *Catla catla*, *Cirrihinus mrigala*) of Agra region were selected for resolving their phylogeny. Sequencing of fishes were done using mitochondrial 16S rRNA gene and it was compared with other cyprind fishes on the basis of similarity. 17 sequences of cyprinid fishes were downloaded from NCBI along with one out group of family Balitoridae as a root of tree. They were examined to construct the phylogenetic tree within the most diverse family Cyprinidae. Present study reveals the high rate of mutation in the fishes. The overall transition/ transversion bias R shows the high deviation from the neutral evolution where R= 0.5. In the phylogenetic tree the neutrality test are conducted which rejected the neutral variation. The negative values of Tajima's D test shows the bottle neck effect where as values of Li and Fu'S D* and Li and Fu's F* test show excess of external mutation. The maximum parsimony analysis method shows the relation of *Catla catla* with subfamily Labeoninae and these are indicated through the bootstrap values. The family Cyprinidae was resolved as a paraphyletic group which shows the divergence may occur but they share the same common ancestor and the value of consistency index and retention index supports that they have shared the common ancestor.

0267 Herp Systematics, Banquet Room H, Sunday 3 August 2014

Donald Shepard[1], Rebecca Chong[2], Cheng Sun[2], Rachel Mueller[2], Kenneth Kozak[3]

[1]University of Central Arkansas, Conway, AR, USA, [2]Colorado State University, Fort Collins, CO, USA, [3]University of Minnesota, St. Paul, MN, USA

Nuclear Markers for Shallow-scale Phylogenetics in Taxa with Giant Genomes: Resolving Relationships within the Plethodontid Salamander Genus *Desmognathus*

The availability of genomic resources often constrains marker development in non-model taxa. At present, genomic resources for amphibians are limited and existing protein-coding nuclear loci are too conserved to resolve phylogenetic relationships at shallow timescales. The giant genomes of plethodontid salamanders further complicate marker development because they are composed substantially of repetitive elements. To mitigate these challenges, we devised a method to develop anonymous nuclear DNA sequence markers from modest amounts of 454 whole genome shotgun sequence. Using our method, we identified 26,714 – 194,530 potentially amplifiable nuclear loci (PANL) for five plethodontid species, and generated primer pairs for 2000 PANL per species. We then validated our method by using a subset of markers to infer phylogenetic relationships of species in the genus *Desmognathus*. Of the 38 PANL we screened, six amplified and were variable across most species. When we combined data for these six markers with four established nuclear markers, we were able to infer a fully resolved species-level phylogeny of *Desmognathus* with high support for most nodes. Such phylogenetic resolution has not been achieved previously in this group due in large part to a recent period of rapid speciation. Per base pair, our six nuclear markers were more phylogenetically informative within the rapid speciation interval than the four established nuclear markers, and this was attributed to the higher substitution rates of our markers. These results demonstrate that our method for developing nuclear markers is effective and yields markers that outperform existing ones at shallow timescales.

0014 AES Conservation & Physiology, Banquet Room E, Sunday 3 August 2014

David Shiffman, Neil Hammerschlag

University of Miami, Miami, FL, USA

Conservation and Management Policy Preferences of Elasmobranch Researchers

A growing body of research suggests that many species of elasmobranchs are threatened with extinction from overfishing, habitat loss, and other threats. There is increasing

public interest in their conservation, and many conservation and management policy solutions have been suggested and debated. For this study, a survey was distributed to the members of the American Elasmobranch Society, the Oceania Chondrichthyan Society, and the European Elasmobranch Association. While many conservation organizations support total bans on shark fishing and the sale of shark products ("shark sanctuaries" and "shark fin bans,") the overwhelming majority of survey respondents believe that policies designed to promote sustainable fisheries are preferable over banning fishing entirely. Shark sanctuaries and fin bans had the lowest support of any suggested conservation and management policy among elasmobranch researchers. Additionally, many elasmobranch researchers expressed concerns over misinformation shared by conservation organizations and the focus of these organizations on what researchers believe to be the wrong issues and the wrong solutions. This study is the first to quantify the conservation and management policy preferences of the world's leading experts on elasmobranchs, and results show a conflict between the policies that the research community recommends and the policies that many conservation organizations are promoting.

0587 NIA, Banquet Room F, Sunday 3 August 2014

Brian Sidlauskas[1], Michael Alfaro[2], Michael Burns[1], Casey Dillman[4], Brant Faircloth[2], Ben Frable[1], Kendra Hoekzema[1], Bruno Melo[3], Claudio Oliveira[3], Richard Vari[4]

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New Molecular Insights into the Exceptional Morphological Radiation of Neotropical Headstanding Fishes (Characiformes: Anostomoidea)

The approximately 300 species of headstanding fishes (and their close relatives) in superfamily Anostomoidea represent one of the most ecomorphologically diverse and economically important components of the Neotropical fauna, but no one has yet proposed a comprehensive molecular phylogeny for them. Using traditional and next-generation genetic methods in combination and in contrast with a morphological database approaching 500 characters, we are reconstructing their evolutionary history and investigating why some anostomoid clades have diversified greatly in oral jaw shape and coloration, while others seem to have diversified internally. We will present a detailed molecular phylogeny assembled from Sanger-sequenced data, discuss its extensive congruence with a prior morphological hypothesis, highlight the macroevolutionary implications of a few critical topological conflicts, and preview our

next steps in ultraconserved elements sequencing and comparative phylogenetic analysis of morphometric and lineage diversification.

0037 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

Dustin Siegel

Southeast Missouri Sate University, Cape Girardeau, MO, USA

Cloacal Anatomy of Female Lepidosaurs

Morphological aspects of the female snake cloaca were reviewed as recently as 2011. In this presentation morphological aspects of lizards and *Sphenodon* will be discussed and synthesized. All squamates possess a proctodaeum that communicates the external environment with the urodaeum. The urodaeum is the main cavity for the deposition of urinary, fecal, and reproductive material; i.e., the ureters (through ampullae ureters), intestine (through a urodaeal sphincter), and oviducts (through oviducal papillae) communicate directly with the urodaeum. In lizards and *Sphenodon*, two morphologies exist for the communication of the urodaeal sphincter with the urodaeum: 1) the urodaeal sphincter branches ventrally from the urodaeum ("branched" condition); 2) the urodaeal sphincter is continuous cranially with the urodaeum ("continuous" condition). Snakes only possess the "branched" condition. In all lizards examined and in *Sphenodon*, oviducal papillae are prominent (except *Podarcis muralis*) unlike snakes, where numerous members of the Colubroides have lost oviducal papillae and instead have a seamless transition from the urodaeum to the oviducts. Furthermore, some lizards possess a bipartite-like uterus with the cranial paired uteri joining before emptying into the urodaeum through a common uterine opening. This has never been observed in snakes. Unlike most snakes (*Nerodia* being an exception) that typically possess only one dorsal cloacal gland mass and paired anal glands emptying into the proctodaeum, non-serpent squamates possess extravagant extracloacal proctodaeal gland complexes (especially in legless lizards), extracloacal urodaeal gland complexes, and prominent mucosal glands of the proctodaeum and urodaeum.

0009 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Dustin Siegel[1], Stanley Trauth[2], Brian Rabe[1], Brenton Ruopp[1], Justin Rheubert[3]

[1]Southeast Missouri State University, Cape Girardeau, MO, USA, [2]Arkansas State University, Jonesboro, AR, USA, [3]Saint Louis University, St. Louis, MO, USA

Novel Cloacal Glands in Snakes: The Phylogenetic Distribution of Ventral Urodaeal Glands in Thamnophiine

Novel ventrally positioned extra-cloacal glands were discovered through examination of cloacal histology of Thamnophiine snakes. The glands discovered are paired and empty into the caudal extremity of the urodaeum, lateral to the opening of the urodaeal sphincter through primary ducts that resemble folds of the urodaeal wall. In concordance with historical literature, these glands are the first cloacal glands described in snakes that definitively empty into the urodaeum from a ventral position. Ventral urodaeal glands are complex with multiple branching ducts that empty alveolar terminal secretory units. The epithelial linings of the branching duct networks are stratified (primary and secondary ducts), pseudostratified (tertiary ducts) or simple (quaternary ducts and terminal alveoli). The terminal alveoli possess epithelia that stain weakly with hematoxylin, and an eosinophilic secretory material is common in the lumina of alveoli. The secretion produced in the alveoli stains positive with the periodic acid-Schiff's procedure, negative with brilliant blue, and positive with fast green, indicating that the majority of the secretion is composed of a neutral carbohydrate moiety with a minor protein component. Ventral urodaeal glands were observed in all taxa of *Nerodia* examined except *N. cyclopion*, and were not observed in any other taxa of Thamnophiine. Through optimization to Thamnophiine topologies, ventral urodaeal glands either evolved once on the branch leading to *Nerodia* and were subsequently lost on the branch leading to *N. cylcopion*, or evolved independently on the branches leading to *N. floridana* and all other species of *Nerodia*.

0220 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Cameron Siler[1], Rafe Brown[2]

[1]Sam Noble Museum & University of Oklahoma, Norman, OK, USA, [2]University of Kansas, Lawrence, KS, USA

From Ancient Dispersals to Conservation Genetic Insights—The State of Philippine Geckos

Although a modest 57 species of geckos currently are recognized to occur in the Philippines, 47 of these species are endemic (more than 82%) to this archipelago in Southeast Asia. Incredibly, with the continued discovery and description of new

species, we predict that within the next five years the Philippines will possess a gecko fauna that is more than 90% endemic. Not only have studies of this unique group of lizards provided insights into the complex nature of vertebrate diversification in this country of more than 7,100 islands, but also, opportunities to address issues related to species delimitation, conservation challenges, and biodiversity studies. As we have developed a more comprehensive understanding of this group of Philippine reptiles, it has become clear that much remains to be understood about species-level diversity in the Philippines, particularly among amphibians and reptiles. We review the state of our current understanding of Philippine geckos, from evidence of ancient origins for certain taxa to recent diversification resulting in complexes of morphologically similar but genetically distinct species. We highlight the continued discovery of new species, both cryptic and rare, the datasets that have been employed in studies of these lizards, and the conservation implications of a highly endemic fauna in a country plagued by habitat destruction. More importantly, with the large amount of published data and increasingly fine-scale understanding of phylogeographic patterns, we highlight the unique opportunities Philippine geckos provide for a wide range of future studies in the Philippines, a Megadiverse nation and Biodiversity Hotspot.

0566 Herp Ecology II, Banquet Room E, Sunday 3 August 2014

Joseph Simpson, Thomas Wilson, Team Salamander

University of Tennessee at Chattanooga, Chattanooga, TN, USA

An Assessment of a Herpetofaunal Community in Southeastern Tennessee: Ecology, Biodiversity, Threats, and Conservation Status

Long-term investigations are needed to adequately assess herpetofaunal community structure and dynamics, and habitat alteration remains the most critical threat to these communities. Herein, we report on a 32-month study investigating species richness, abundance, sex ratios, and body sizes of amphibians and reptiles in a Hamilton County, Tennessee, wetland. Utilizing drift fencing in conjunction with pitfall arrays, a total of 14 reptile species and 16 amphibian species was recorded. Evenness was low among all study years due to large sample sizes of ambystomatid salamanders relative to all other species. Body sizes of *Ambystoma* were larger in females, and sex ratios of all *Ambystoma* were significantly male-biased in all study years except one female-biased sample of *Ambystoma opacum* (2009). This study is the first wetland community assessment for the southeastern Tennessee region and provides baseline data for future comparisons regarding changes in community structure and dynamics.

0374 General Ichthyology, Banquet Room G, Sunday 3 August 2014

Randy Singer, Phillip Harris

University of Alabama, Tuscaloosa, AL, USA

Back to the Future: Carrying the University of Alabama Ichthyology Collection into the Modern Age

Formed in 1947 by the late Dr. Ralph L. Chermok, The University of Alabama Ichthyology Collection or UAIC continues to this day to document and preserve specimens of fishes from around the globe. Following a period with no collection manager, the 1.5 million specimen collection is currently being brought into the 21st century. The implementation of a brand new database, internet web portal, and new large specimen housing has given the collection necessary organization and space to remain among the largest and most utilized collections in the south. The UAIC has much to offer the scientific community in terms of specimens, ecological data, and collection data for both the Southeastern United States and abroad. The UAIC is positioned to continue to grow and remain one of the most diverse and specimen rich collections in the United States.

0429 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jennifer M. Singleton, Theodore Garland, Jr., Mingna Vicky Zhuang

University of California at Riverside, Riverside, CA, USA

Social Badges in *Dipsosaurus dosalis* and the Importance of Museum Specimens as Preliminary Data

Social interactions in many animal species can be mediated by external color signals. A signal which displays the sex, age or reproductive status of an individual is called a "badge." A badge depicting juvenile status may protect an individual from attack in a territorial society or could be used by females to deter harassment from males. Some Desert Iguanas (*Dipsosaurus dorsalis*) live in populations of high density and considerable home range overlap; mediation of social interactions via status-dependent badges could conserve energy and reduce aggressive encounters. We measured supra-axillary spot number for male, female, and juvenile Desert Iguanas collected from Riverside County, CA and preserved at the Los Angeles Natural History Museum. The majority of juveniles (<60 mm S-V) and sexually immature females (61-109 mm) possessed spots, as did 41% of adult females (>109 mm). No spots were visible on adult males (>114 mm). The data suggest that the spots may serve as a badge of juvenile status, and might also allow mature females to avoid male attention. Conducting this type of preliminary survey is a simple step before the complexity of behavior trials and

attempts to assess Darwinian fitness in the wild. Furthermore, a cursory look at photographs of Desert Iguana from different areas suggests that populations may vary in the prevalence and distribution of this signal. Further research, in the form of behavioral trials and museum surveys, will elucidate the potential relationship between supra-axillary spots and the behavioral ecology/life history of Desert Iguanas.

0559 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Banquet Room J, Friday 1 August 2014

Rachel Skinner, Todd Jackman, Aaron Bauer

Villanova University, Villanova, PA, USA

Phylogenetic Relationships of South African Geckos in *Pachydactylus geitje* Species Complex (Squamata: Gekkonidae)

Pachydactylus is a widespread and speciose genus of southern African gekkonid lizards. Although patterns of relationship within many monophyletic subunits of *Pachydactylus* have been resolved, and numerous new species identified and described, a detailed analysis of the *P. geitje* species complex has not been performed. The *Pachydactylus geitje* complex, comprising *P. geitje*, *P. maculatus*, and *P. oculatus*, is the only primarily temperate, mesic-adapted lineage within this chiefly arid zone genus. We used a molecular phylogenetic approach to investigate the relationships between and within species of the *P. geitje* complex using the mitochondrial gene ND2 and the nuclear genes RAG1 and MXRA5 in maximum parsimony, maximum likelihood, and Bayesian frameworks. Our data have confirmed the monophyly of the *P. geitje* group and supported its sister relationship to the *P. rugosus* group. Of the more easterly-distributed taxa, *Pachydactylus maculatus* and *P. oculatus* are sister species. All three species exhibit significant genetic substructuring across their ranges. There is support for the recognition of cryptic taxa within the species group, but putatively distinct lineages do not correspond to existing names in the synonymy of the recognized species. Body size, scale texture, and coloration vary considerably within each species even on a small spatial scale.

0488 AES Behavior, Banquet Room E, Thursday 31 July 2014

Gregory Skomal, John Chisholm

Massachusetts Division of Marine Fisheries, New Bedford, MA, USA

Movements of White Sharks in the Western North Atlantic

Despite its well-established presence in the North Atlantic, the white shark, *Carcharodon carcharias*, is not considered an abundant species and efforts to study its life history and ecology have been hampered by the inability of researchers to predictably encounter these sharks. However, with the protection of marine mammals over the last 40 years, the western North Atlantic gray seal population has rebounded and white sharks are expanding their foraging strategies to include active predation on these animals in the nearshore waters of Cape Cod, MA. From 2009-2013, we tagged 39 white sharks in this region to examine fine- and broad-scale movements, habitat use, site fidelity, residency, and feeding behavior. The sharks, which ranged from 2.4-5.5m total length (mean = 4.0 m), were tagged with pop-up satellite tags, smart positioning satellite tags, passive acoustic transmitters, and/or conventional tags. To date, we have found that some white sharks exhibit seasonal site-fidelity to the coastal waters of Cape Cod, returning over multiple years. Broad-scale movements have varied from a relatively restricted coastal seasonal migratory pattern to deep diving behavior and expansive use of offshore regions from the Sargasso Sea to the Mid-Atlantic Ridge. As demonstrated elsewhere, white sharks in the North Atlantic appear to have a complex migratory pattern likely linked to reproductive biology.

0363 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Gerald Smith

University of Michigan, Ann Arbor, MI, USA

Conservation of Fishes and Amphibians in the Era of Hydraulic Fracturing for Gas and Oil

There are now more than one million oil and gas wells in the U.S. Hydraulic fracturing is the use of pressurized injected fluids containing benzene, toluene, xylene, and many other chemicals and solids into wells to increase rock porosity and production of gas and oil. Between 70 and 140 billion gallons of water are used to fracture 35,000 U.S. wells each year, according to the US EPA in 2011. The process is in its sixth decade and public attention is now making potential water contamination a concern for human health. But economic pressures guarantee that local hydrocarbon exploration and production will be central to our energy policies long into the future, so research on the environmental

consequences of fracking is urgently needed. NGOs are making the threat of contaminated groundwater a primary human issue, but the need to protect aquatic habitats and organisms has received almost no research attention. The effects of water withdrawal and return are of greatest importance to fish and amphibian conservation. ASIH members need to step up and promote field research to document low in-stream flow and contaminated return water in order to protect the ecological integrity of our diverse North American ground- and surface-water resources and aquatic faunas. We cannot expect industry to do it for us because corporations are legally obligated to maximize profits—and they've "got the juice." This talk will discuss aquatic ecological problems related to fracking along with potential sources of funding and crucial directions for field research.

0471 Herp Ecology I, Banquet Room H, Friday 1 August 2014

Kevin Smith, Walter Bien

Drexel University, Philadelphia, PA, USA

The Neonatal Spatial Ecology of the Northern Pinesnake (*Pituophis melanoleucus*) in the New Jersey Pine Barrens

Due to the cryptic and fossorial nature of northern pine snakes (*Pituophis melanoleucus*), there is a lack of data on their early life behavior and dispersal. An understanding of first season life history traits from hatching to ingress is particularly difficult to monitor. We used a combination of chemosensory assays and radio telemetry to investigate neonate dispersal and habitat use. Snakes use their chemosensory system to aid in prey determination and conspecific communication. Many pine snake females may nest in the same area, so neonates may gather chemical cues from siblings and non-siblings. Neonates (n=15) were selected to run a y-maze test with the options of following a scent trail from a sibling and from a non-sibling conspecific neonate. Neonates followed sibling trails more often, though not significantly (p=0.059). The relatedness of a scent trail may be a factor in dispersal. We surgically implanted 18 *P. melanoleucus* neonates with transmitters and radio-tracked them from nest egress until hibernaculum ingress. All neonates utilized habitat for foraging and thermoregulation within maximum distances of 34m to 450m from their nest. First year hibernacula were in close proximity to nest sites, and consistent distances between both years of study (2012: 33m to 255m, 2013: 30m to 225m). A compositional analysis is underway to elucidate habitat preference of neonates for northern pine snakes. We observed ten implanted neonates with boluses, and seven neonates with signs of ecdysis. Investigating optimal sites for these procedures will be beneficial for habitat conservation of this state threatened species.

0719 Fish Systematics & Taxonomy IV, Banquet Room G, Sunday 3 August 2014

Leo Smith

University of Kansas, Lawrence, KS, USA

Evolution of the Scorpionfishes and Allies

During the last 30 years ichthyologists have made tremendous improvements in our understanding of the relationships among scorpionfishes and their allies using the explict phylogenetic analysis of either morphological or molecular data. These studies have often resulted in the polyphyly of many traditionally recognized groups, and are often at odds with each other in various results. Using a combination of morphological and molecular data, a revised phylogenetic hypothesis for scorpionfishes and their allies will be discussed in terms of the group's taxonomy and evolution. Further, an expanded molecular dataset will be used to explore the diversification and macroevolution of this large and ecologically and anatomically diverse group in light of the revised combined, molecular, and/or morphological phylogenies.

0439 Herp Conservation I, Banquet Room F, Friday 1 August 2014

Marcia Snyder[1], W. Matthew Henderson[2], Donna Glinski[1], S. Thomas Purucker[2]

[1]Oak Ridge Institute for Science and Education, Athens, GA, USA, [2]Environmental Protection Agency, Athens, GA, USA

Biomarker Analysis of Leopard Frog (*Rana pipiens*) Tadpoles Following Exposure to Atrazine

Atrazine, is one of the most commonly detected herbicides in surface waters throughout the United States. It has been found at concentrations from 0.23-250 μg/L and therefore presents a probable exposure scenario for non-target species such as amphibians. Studies have examined the effect of Atrazine on the metamorphic parameters of amphibians; however, these data are often contradictory. The objective of this study was to use a biomaker approach to investigate the influence of atrazine exposure on *Rana pipiens* (Leopard frog) tadpoles. To this end, Gosner stage 28 tadpoles were exposed to 25 μg/L, 100 μg/L , 200 μg/L, and 400 μg/L of atrazine for 48 hours. Endogenous metabolites were extracted and analyzed using gas chromatography coupled with mass spectrometry analysis. Statistical analyses of the acquired spectra demonstrated changes in biomarkers between exposed and control tadpoles. Biochemical fluxes observed in the

exposed group included perturbations in a number of classes of biological macromolecules including fatty acids, amino acids, sugar derivatives, and AXPs. Understanding the influence of these classes of compounds on the endocrine pathways of tadpoles following exposure to atrazine will aid in developing predictive biomarkers of pesticide exposure in non-target species.

0635 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Brenton Spies, Mark Steele

California State University, Northridge, Northridge, CA, USA

Effects of Temperature and Latitude on Larvae Traits of Two Estuarine Fishes in Differing Estuary Types

Variations in abiotic conditions across large latitudinal gradients have been found to strongly influence the early life history of marine organisms. This study investigates the effects of temperature and latitude on the larval traits of two native estuarine fish species. The arrow goby (*Clevelandia ios*) and the endangered tidewater goby (*Eucyclogobius newberryi*) were studied in 18 estuaries along the California coast. The arrow goby prefers fully tidal bays and mudflats, whereas the tidewater goby prefers estuaries and lagoons that experience some degree of seasonal closure, or isolation, from the sea. Recently settled individuals were collected from July-October 2011 and temperatures within each estuary were recorded hourly in order to determine how temperature variations affect larval duration, settlement, and growth rates. Temperatures were more variable among sites for estuaries inhabited by the tidewater goby (10^{o} C range) than for those inhabited by the arrow goby (5^{o} C range). Larval traits of both species varied significantly among sites, but among site variation was greater for the tidewater goby, a difference that was tied to the greater differences in temperatures among sites in the seasonally closed estuaries it inhabited. On average, for both species, fish that experienced warmer temperatures had a shorter larval duration, faster growth rates, and were smaller at settlement. Since the length of the larval period has been related to dispersal distance for some species, and survival in others, future variations in temperature could have a direct and predictable influence on population connectivity and community interactions of estuarine associated species.

0293 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Bruce Stallsmith, Joshua Mann

University of Alabama in Huntsville, Huntsville, Alabama, USA

Reproductive Characteristics of Four Cyprinid Species in One River

The Osteichthyes class in general is known for a high level of resource allocation towards gamete production and spawning. The reasons behind certain fish spawning at particular times are often associated with different characteristics of their environment. A better insight into these environmental triggers may be obtained once the timing of reproduction is revealed. This study is being conducted to observe when several species of cyprinid are spawning throughout the year and what level of fecundity each species employs in their relative spawning events. The different species (*Notropis photogenis, Erimystax insignis, Lythrurus fasciolaris,* and *Cyprinella galactura*) were collected from the same river in Northern Alabama using cast and seine nets. Monthly Gonadal somatic indexes (GSI) are calculated to determine when the species spawn. Maturation stages and numbers of eggs throughout the year are also recorded. Each species appears to be utilizing a determinate single-spawning method. *N. photogenis* is the first species of the four to spawn in the year with a female GSI sharply peaking in March over 25%. *E. insignis* shows a female GSI with a much broader peak starting in March and continuing into May. The female GSI for *E. insignis* peaks at 16%. *L. fasciolarsis* had an elevated GSI in April with a relatively shallow peak of ~11% in May. *C. galactura* is the latest of the four to spawn with a female GSI peak in July. *C. galactura* also has the lowest GSI peak of 10%. The fecundity research is still ongoing.

0022 General Ichthyology, Banquet Room G, Sunday 3 August 2014

Bruce Stallsmith[1], Gisela Reina[2], Rigoberto Gonzalez[2], Luciano Matzkin[1], Kara Million[1]

[1]University of Alabama in Huntsville, Huntsville, Alabama, USA, [2]Smithsonian Tropical Research Institute, Panama City, Panama

Monogenoidean Gill Parasites of the Poeciliid Fish *Brachyrhaphis episcopi* in Panama

Parasites are known to be important regulators of energy flow through ecosystems. Monogeneoidean trematodes such as the genera *Dactylogyrus* and *Gyrodactylus* that live in hosts' gills or on the skin have been shown to be harmful to a variety of fishes under laboratory, aquaculture and natural conditions. The freshwater Poeciliid genus *Brachyrhaphis* has several recognized species common in Panama, with different species

found variously in highland or lowland streams. *Brachyrhaphis episcopi* is endemic to Panama, found in streams in the region of the Panama Canal in central Panama as well as to the west in parts of Coclé Province such as El Valle de Anton. One goal of this project is to identify any monogenoidean gill parasites found in *B. episcopi*. Another goal is to examine any patterns of parasite infection both within and between host populations, including any relationship between host size and parasite load. Host fish were collected at six sites, four of them tributary to the Panama Canal and two of them in El Valle de Anton. The monogenoidean infection prevalence ranged from 0% in the high altitude Río Mata Ahogado site in El Valle de Anton to 75% in the lowland Panama Canal tributary Río Mendoza. Stepwise regression showed a positive relationship between host standard length and intensity of infection among 104 fish examined with an R2 of 0.20 and $p < 0.001$.

0146 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Jay Stauffer[1], Timothy King[2]

[1]Penn State University, University Park, PA, USA, [2]U.S. Geological Survey, Leetown Science Center, Kearneysville, WV, USA

Designation of a Neotype for Brook Trout, *Salvelinus fontinalis*

The taxonomic status of *Salvelinus fontinalis* (Mitchill) is problematic. Difficulties in comparison of populations are exacerbated by the lack of type material from the original description. Here we designate a neotype from Connetquot River, Long Island, NY and provide genetic and morphological data for the neotype, conspecifics, and other populations (Swan Creek, Nissequoque Creek) from Long Island, New York. We demonstrate, using molecular markers, that the population from Connetquot River most likely has not been influenced by the major broodstock strains utilized in the Northeast for supplemental and restorative stocking programs. We distinguish the above populations morphologically from lower interior basin populations represented by fishes from the Pigeon-French Broad drainage. Finally, we position populations from Long Island, NY within six distinct lineages of *S. fontinalis*.

0614 NIA STUDENT COMPETITION, Banquet Room G, Friday 1 August 2014

Sarah Steele[1], Hernán López-Fernández[2]

[1]University of Toronto, Toronto, Canada, [2]Department of Natural History - Royal Ontario Museum, Toronto, Canada

Consequences of Extreme Body Size Evolution in Neotropical Cichlid Fishes

Species diversification through adaptive radiation results in highly diverse morphologies that complement extraordinary species numbers within radiating clades. Macroevolution of particular phenotypes or key innovations is examined to determine underlying mechanisms for such diversity. Morphological traits are often linked with tangible biological or ecological processes (e.g. jaw morphology and prey capture, limb length and habitat) as a result of evident associations with an adaptive landscape. These traits and relationships seemingly tend to be taxon-dependent, and though interesting, are problematic when addressing broader macroevolutionary questions. Body size is an important trait that is linked to most physiological, ecological, and life history traits in vertebrates, yet the understanding of how body size influences species and morphological diversification is relatively poor. The processes underlying body size evolution and the consequences of occupying particular regions of body size space is particularly obscured in fishes, where large-scale molecular phylogenies and ecological datasets have previously been lacking. We explored body size in Neotropical cichlid fishes to examine the role of body size evolution in the process of adaptive radiation in teleost fishes. We explore ecological and morphological diversification associated with body size evolution, particularly evolution towards extreme body size. Overall lineage, morphological, and ecological diversification appears to be highly constrained at both extremely small and large body size. In addition, variation in diversity is clade-specific but not necessarily positively correlated. Decoupling of diversity in species richness, morphology, and ecology may be associated with strong stabilizing selection towards an adaptive peak within uniquely occupied body size regions.

0080 Herp Ecology & Phylogeography, Banquet Room E, Sunday 3 August 2014

David Steen, Jim Godwin

Alabama Natural Heritage Program, Auburn, Alabama, USA

Recent Investigations of Snake Community Ecology with Potential Implications for Ongoing Indigo Snake Reintroductions in Alabama

We often have little idea why a species of snake may occupy one area but not another. On the contrary, nearly all of our information about snake habitat preferences is based

on either qualitative habitat descriptions where snakes were observed or by quantifying habitat selection by individual animals. To examine species-level occupancy we used a database of snake captures from across the southeastern United States and used these data to evaluate hypotheses related to large-scale habitat preferences for thirteen terrestrial species. Once we generated this information, we evaluated multiple hypotheses to determine if there was evidence for competitive exclusion between closely related and ecologically similar species. We found that Timber Rattlesnakes were less likely to occur in evergreen forests when Eastern Diamondback Rattlesnakes were present. To better understand how Black Racers and Coachwhips co-occur without competitively excluding each other, we evaluated the hypothesis that Black Racers were smaller in areas where Coachwhips were present. We found evidence that this was indeed the case. Finally, we examined whether there was a relationship between the abundance of the mysteriously declining Kingsnake and the abundance of a common prey item, the Copperhead. There was. Overall, my collaborators and I identified large scale habitat preferences of upland snakes in the southeastern United States and revealed how interspecific interactions like competition and predation may influence their populations. I will discuss how these trends have informed current and ongoing research regarding the ecological effects of the Indigo Snake reintroduction in Alabama.

0082 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

David Steen[1], Brittney Hopkins[2], James Van Dyke[3], William Hopkins[2]

[1]Alabama Natural Heritage Program, Auburn, Alabama, USA, [2]Virginia Tech, Blacksburg, VA, USA, [3]University of Sydney, NSW, Australia

Prevalence of Ingested Fish Hooks in Freshwater Turtles from Five Rivers in the Southeastern United States

Freshwater turtles may ingest baited fish hooks because many are opportunistic scavengers. Although the ingestion of fish hooks is known to be a source of mortality in multiple vertebrate groups, the prevalence of hook ingestion by freshwater turtles has not been well studied. We trapped turtles from five rivers in the southeastern United States and used radiographs to examine over 600 individuals of four species. Depending on the species, sex, and age class, 0-33% of turtles contained ingested fish hooks. For some species, larger turtles were more likely to contain a fish hook than smaller individuals. Freshwater turtle demography suggests that even small increases in adult mortality may lead to population declines. If our study areas are representative of other aquatic systems that receive fishing pressure, this work likely identifies a potential conflict between a widespread, common recreational activity (i.e., fishing) and an imperiled taxonomic group.

0326 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Carol Stepien, Carson Prichard

University of Toledo, Toledo, OH, USA

Population Genetics of the Invasion by Bighead and Silver Carps: An Analysis of Fronts versus Established Populations

Of top ecological concern is the impending invasion of bighead and silver (collectively "Asian") carps that are rapidly spreading from Mississippi River watershed towards the Great Lakes, however, almost nothing is known of their fundamental population genetic variability. We are characterizing comparative population genetics across their North American invasive ranges, including longer established populations and two fronts: (1) the Illinois River north of Peoria, IL (approaching southern Lake Michigan), and (2) the Wabash River, Lafayette, IN (approaching the Maumee River/Western Lake Erie system). We examine the comparative population genetic structure using two mtDNA genes (COI (barcode) and cyt-b) and 10 nuclear DNA microsatellite loci. Initial analyses reveal three COI and four cyt-b haplotypes in North American populations, of which three of the latter are newly discovered. Results show high microsatellite genetic diversity for both species, with greater allelic richness in silver carp and private alleles in all sampling sites. Future research will increase the sample sizes and the number of microsatellite loci to 50 and 20, respectively Results are being used to ground-truth concurrent research to develop and implement a new next-generation sequencing environmental DNA assay, and will provide managers with important genetic baseline tools towards understanding the invasion.

0323 Herp & Ich Genomics, Banquet Room J, Sunday 3 August 2014

Carol Stepien, Carson Prichard, Thomas Blomquist

University of Toledo, Toledo, OH, USA

Species Identities and Relative Abundances of Entire Fish Communities Using Environmental DNA and Next-Generation Sequencing: Case Studies from the Great Lakes

Biological community assessments depend on accurate species identification, their relative abundances, and population genetic/genomic variation and adaptations. However, sampling rare and/or endangered species may harm them and their habitats, elusive species often avoid collection gear, and new invasive species may be overlooked at low abundances, especially during early life history. Environmental (e)DNA coupled

with next-generation sequencing (NGS) and population genetics and bioinformatic tools, can be used to assess the species identities, relative numbers, and genetic composition of entire communities. We have developed a new eDNA/NGS assay to collect these data simultaneously for all fish species from water samples, targeted for all Great Lakes and Mississippi River fish species, as well as all high-risk potential invasive fish species. Our assay amplifies and sequences targeted diagnostic regions of various lengths from the cytochrome b and COI mitochondrial DNA genes, and we are adding a nuclear gene, yielding a redundant and accurate system. Experiments employing varying concentrations of DNA from known fish communities yielded results highly correlated to expected relative species abundances, confirming our assay's performance. We have ground-truthed our results from water samples with aquarium experiments of captive fish communities, as well as wild fish communities in field sampling (netting and electroshocking).

0147 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

James R. Stewart, Tom W. Ecay

East Tennessee State University, Johnson City, TN, USA

Reproductive Biology of Lizards: Influence of Mode of Parity on Embryonic Calcium Nutrition

Reptile yolk and eggshell are provisioned with maternal calcium. Embryos of oviparous lizards mobilize calcium from both sources. Viviparous lizard embryos lack a calcareous eggshell and supplement yolk with calcium from placental transport. The chorioallantoic membrane facilitates calcium uptake from eggshell and placenta in late embryonic stages. The pattern of expression of marker proteins in the chorioallantoic membrane for epithelial calcium transport activity is identical within and between modes of parity. Timing and mechanisms for embryonic calcium uptake are similar, but the timing of uterine calcium secretion is shifted to later stages of development in viviparous females. Lizard species with geographic variation in mode of parity (*Saiphos equalis*, *Zootoca vivipara*) provide evidence of the transition in pattern of calcium delivery to embryos. For example, embryos of some populations of *S. equalis* acquire calcium from yolk, from placental secretion during prolonged intrauterine egg retention, and from the eggshell following oviposition. Placental calcium transport compensates for lower calcium deposition in eggshell. None the less, viviparous neonates of *S. equalis* and *Z. vivipara* contain less calcium than oviparous hatchlings. In contrast, neonates of a placentotrophic species, *Pseudemoia pagenstecheri*, with a specialized chorioallantoic placenta contain higher concentrations of calcium than hatchlings of a closely related oviparous species. These comparisons suggest: 1) embryonic mechanisms of calcium

transport by the chorioallantoic membrane are conserved in the evolution of viviparity, 2) placental calcium transport precedes the evolution of viviparity, 3) evolution of viviparity entails a cost in embryonic calcium nutrition and, 4) placental specializations enhance embryonic calcium nutrition.

0222 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Samantha Stewart, Thornton Larson, Eli Greenbaum

University of Texas at El Paso, El Paso, TX, USA

Systematics of the Genus *Lygodactylus* from Democratic Republic of the Congo

The dwarf gecko genus *Lygodactylus* currently consists of 62 diurnal species, which are endemic to sub-Saharan Africa, Madagascar and South America. Because the *Lygodactylus* species from Central Africa are poorly known (only one specimen was included in the most comprehensive phylogenetic analysis of the genus), we analyzed 12 samples from Democratic Republic of the Congo (DRC) to understand how they are related to other populations in sub-Saharan Africa. We sequenced the commonly used 16S mitochondrial gene from our samples and combined them with 68 GenBank samples with maximum-likelihood and Bayesian inference optimality criteria in the programs RAxML and MrBayes, respectively. Our results confirmed the monophyly of *Lygodactylus*, and can be used to clarify the relationships between species within the genus. The phylogeny indicated that some samples collected are congruent with recognized species such as *L. angularis heeneni*, *L. capensis* and *L. gutturalis*, whereas some samples from Kinshasa and Katanga may possibly represent undescribed species that warrant further investigation with morphological comparisons to type material. Analyses resulted in 40 clades, three of which represent unknown species. With 37 species recognized in sub-Saharan Africa and only six species known from DRC, there is a strong possibility that *Lygodactylus* diversity is underestimated in Central Africa.

0128 General Ichthyology III, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Carla Stout[1], Milton Tan[1], Alan Lemmon[2], Emily Moriarty Lemmon[2], Jonathan Armbruster[1]

[1]Auburn University, Auburn, AL, USA, [2]Florida State University, Tallahassee, FL, USA

Preliminary Phylogeny of Cypriniformes Based on Anchored Hybrid Enrichment with a Focus on Leuciscinae

Many studies using varied molecular and morphological data have been conducted to try to resolve relationships among Cypriniformes, the largest clade of freshwater fishes, and just as many conflicting trees across different taxonomic levels have been proposed with varying levels of node support. Thus, major cypriniform relationships are still in question. Our approach to providing a robust, well-supported hypothesis of relationships is to use a newly developed anchored hybrid enrichment method that takes advantage of next generation sequencing techniques. Our preliminary data result in a strongly supported tree describing both deep and shallow relationships among 175 taxa using 99 single-copy nuclear loci. Major results for Cypriniformes relationships include non-monophyly of Cobitoidea, a novel placement of *Paedocypris* as sister to remaining Cyprinidae, and support for Sundadanioninae as a distinct subfamily. Leuciscinae are recovered as sister to Tanichthyinae, and within Leuciscinae, relationships among established clades (leuciscins, Eurasian phoxinins, Western North American, Creek Chup-Plagopteran, and Open Posterior Myodome) are as follows: (leuciscins + (Eurasian phoxinins + (OPM + (CC-P + WNA)))).

0736 General Herpetology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD GENERAL HERPETOLOGY

James Stroud, Ken Feeley

Florida International University, FL, USA

Using Biological Invasions to Model the Fundamental Niche: A Case Study Using the Cuban Brown Anole (*Anolis sagrei*)

Biological invasions give the unique opportunity to investigate many questions in ecology and evolution which may otherwise be more difficult to answer. There is uncertainty in projections of potential species distributions as a large assumption of Species Distribution Modelling (SDM) is that the realized niche matches the fundamental niche. Occurrence data of a species' current distribution is assumed to represent the realized niche, and therefore used a proxy of the fundamental niche in

SDM. The Cuban brown anole (*Anolis sagrei*) has recently experienced a rapid global range expansion following multiple independent introductions. Using GBIF occurrence data I tested whether climatic niche shifts of *A. sagrei* had occurred between its native and introduced range. SDM's revealed a large difference between areas of climatic and environmental suitability for *A. sagrei* when using conditions experienced in native range versus total range (i.e. accounting for non-native invasions). Additionally, temporal analysis of introduction patterns of *A. sagrei* was conducted to assess whether the range of suitable environmental conditions has continued to increase over time or begun to asymptote. Results will be presented. This study has major implications in forecasting future species distributions, and could be an important caveat for predicting species responses to global climate change.

0517 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Emily Stulik, Bruce Kingsbury

Indiana University Purdue University Fort Wayne, Fort Wayne, Indiana, USA

Modeling Anuran Occupancy and Habitat Use in a System of Restored Wetlands

Amphibians have been of great conservation concern due to alarming declines in populations worldwide. These vulnerable ectotherms are threatened by habitat loss and degradation, especially in the Midwestern United States. Efforts to restore wetland habitat can mitigate some aspects of habitat loss, but effective sampling techniques and suitable analytical approaches are needed to accurately measure the quality and functionality of the restored habitat. Recently, occupancy modeling in program PRESENCE has shown promise as an innovative and advanced approach to measuring presence, absence, and habitat use of various species. This type of analysis was applied to anurans to measure occupancy rates, habitat use, and reproductive success in a 716 acre restored wetland system in Northeast Indiana. Two types of survey methods, call surveys and tadpole surveys, were used to measure anuran presence and absence. A preliminary model with constant occupancy and detection probability, denoted $\Psi(\bullet)p(\bullet)$, revealed that all species heard and caught were suitable for occupancy modeling, with the exception of American Bullfrog tadpoles, *Lithobates catesbeianus*. This model $\Psi(\bullet)p(\bullet)$ showed high occupancy rates in the Eastern Gray Tree Frog, *Hyla versicolor*, and The Northern Leopard Frog, *Lithobates pipiens*, for both surveys. Covariate effects on occupancy and detection probability, such as wetland size, degree of restoration, temperature, and humidity will be modeled in PRESENCE to rank occupancy models and predict habitat use. Multiple species, multiple season models will

also be used to generate inferences on metapopulation dynamics and conservation statuses of these vulnerable species.

0425 AES Behavior, Banquet Room E, Thursday 31 July 2014

James Sulikowski[1], Amy Carlson[1], Lance Jordan[2]

[1]*University of New England, Biddeford, ME, USA,* [2]*Microwave Telemetry Inc, Columbia, MD, USA*

The Little Shark that Could: The Amazing Travels of a Young of the Year Porbeagle Shark

The porbeagle (*Lamna nasus*) is a predatory, endothermic shark that typically inhabits the upper pelagic zone from the surface to 200 m deep. Conventional and satellite tagging data suggest this species is highly migratory, however; these studies also indicate that this shark predominantly inhabits coastal and shelf-break regions, where they can remain localized for prolonged periods of time. Furthermore, the available information regarding the spatial ecology of this species has focused on adults with little to no information available on young of the year (YOY) or juveniles. The only information to date, suggests mature females tagged off the Canadian coast migrate to give birth in deep water in the Sargasso Sea, where the pups are reported to then follow the Gulf Stream as they return north. In order to test the hypothesis that the returning YOY sharks were using the Gulf of Maine (GOM) as a nursery ground, a satellite tag was attached to a 88 cm TL female on October 8th, 2012. Geolocation data indicated this shark was not using the GOM as a nursery ground, but instead embarked on a 10,000 km round trip that took it up to Nova Scotia Canada, down to South America, past Panama, Cuba, into the Gulf of Mexico and back up the Atlantic coast into the Gulf of Maine where the tagged released 5km from where it was attached 365 days earlier. This incredible little shark also made consistent dives from the surface to 300m with the deepest dives reaching nearly 700m.

0555 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

William Sutton[1], Kyle Barrett[1], Allison Moody[2], Cynthia Loftin[3], Phillip DeMaynadier[4], Priya Nanjappa[5]

[1]Clemson University, Clemson, South Carolina, USA, [2]University of Maine, Orono, Maine, USA, [3]United States Geological Survey, Orono, Maine, USA, [4]Maine Department of Inland Fisheries and Wildlife, Bangor, Maine, USA, [5]Association of Fish and Wildlife Agencies, Washington, D.C., USA

Determining Vulnerability of Priority Amphibian and Reptile Conservation Areas to Climate Change in the Northeastern United States

Climate change represents one of the most complex and globally important ecological stressors. As virtually all ecosystems are projected to face impacts from climate change, it is essential to develop appropriate strategies that include pro-active conservation planning measures. The effort to establish Priority Amphibian and Reptile Conservation Areas (PARCAs) was enacted to identify valuable habitat for priority herpetofauna throughout the United States using a system informed by scientific criteria and expert review. Implicit in the identification of these habitats includes understanding long-term persistence to ecological stressors. We will present a framework for assessing the long-term vulnerability of proposed PARCAs in the North Atlantic Landscape Conservation Cooperative region to climate change. Our framework determines vulnerability by incorporating exposure (i.e., extent of climate change experienced by a species or locale), sensitivity (i.e., degree to which survival, persistence, or fitness may be impacted), and adaptive capacity (i.e., capacity of a species or locale to cope with climate change) of proposed PARCAs. We use a variety of spatially-explicit metrics that include projected temperature change, projected landuse change, priority amphibian and reptile species sensitivity, geographic context, patch size, and topographic relief in a GIS-based framework to assess climate change vulnerability of selected PARCAs. Our efforts provide a science-based structure to assess the long-term vulnerability of these habitats to climate change, which will aid in the allocation of conservation efforts to priority landscapes based on projected climate resiliency.

0290 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Meredith Swartwout, Jenifer Walke, Matthew Becker, Myra Hughey, Lisa Belden

Virginia Polytechnic Institute & State University, Blacksburg, VA, USA

Structure and Function of Bacterial Communities on Spring Peeper Skin (*Pseudacris crucifer*) in Virginia

The spring peeper (*Pseudacris crucifer*) is a widely distributed North American treefrog that may serve as a good model organism for studying interactions between skin bacteria and the chytrid fungus (*Batrachochytrium dendrobatidis*; Bd). At least one species of amphibian skin bacteria, *Janthinobacterium lividum*, has been shown to inhibit Bd on North American amphibian species *in vivo*. Diversity of skin bacteria has also been hypothesized to play a role in disease resistance. To examine bacterial communities, glycerol swabs were taken from 12 spring peepers at one site (Heritage Park) in Montgomery Co., VA. Cultured skin bacteria were isolated and assayed against Bd to determine inhibitory ability. Isolates were identified using Sanger sequencing of the 16S rRNA gene and these sequences were compared to a culture-independent characterization of the microbiota using Illumina sequencing. At Heritage Park, where only one spring peeper was infected with Bd, Proteobacteria was the dominant phylum, making up 40% of the cultured community and 64% of the total DNA extracted for Illumina. Eight out of twelve spring peepers sampled at Heritage Park had at least one isolate with strong (>95%) inhibition against Bd. Community structure revealed by Sanger sequencing was similar to that from Illumina, indicating that our culture methods may sufficiently represent the original skin bacteria community. By examining the diversity and protective properties of spring peeper skin bacteria, we hope to eventually be able to develop probiotics that can be used to protect other amphibians from Bd infection.

0715 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

MaryKate Swenarton, Eric Johnson, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Lionfish (*Pterois* spp.) Population Structure and Size at Maturity in Eastern Florida Waters

The Indo-Pacific lionfish (*Pterois volitans/miles*) is a predatory marine invasive species, currently distributed throughout most of the western Atlantic, Gulf of Mexico, and Caribbean Sea. Scientific investigations of the impacts of lionfish have been focused

predominantly in tropical ecosystems (i.e., the Caribbean and south Florida) with little recent research focused in the South Atlantic Bight. Since fish life history parameters vary with a suite of environmental, biological and ecological factors, understanding differences in the life history of local lionfish populations is important to guiding management. To establish baseline population data on lionfish in a new biogeographical region, throughout 2013 and 2014, approximately 2,000 specimens have been collected from the coast of northeast Florida, and another 500 fish have been collected from Key Largo, FL, as a comparative population. Length frequency analysis and statistical length-based modelling have revealed a unique, distinct bimodal distribution in the lionfish population in northeast Florida. These findings are inconsistent with the population structure of lionfish in more tropical regions. Morphological reproductive staging, corroborated with histology, has been used to determine size at maturity for fish in two different regions of Florida. Stages will be compared statistically to determine if significant differences between populations exist and their potential contribution to the discrepancy in population structure. These findings will help managers better understand the life history of this troublesome invasive species region-wide, and help in the development of more effective mitigation strategies for this species.

0698 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

George Szarka, Thomas Wilson

UT of Chattanooga, Chattanooga, TN, USA

Sampling Amphibians and Reptiles in Southeastern Tennessee: Lessons Learned with Implications for Conservation and Management

Amphibians and reptiles are imperiled throughout much of the southeastern United States; and, in an effort to combat these declines, rapid assessments (RA) have been used to develop adaptive conservation and management strategies. However, researchers are urged to standardize capture techniques and have a working knowledge of the target species life-history and ecology before conducting an RA. Practitioners cannot elucidate action plans that are forward-thinking without first addressing these points. Furthermore, without this level of understanding, we cannot effectively sample populations of rare or cryptic species or assess landscapes that have been under sampled. To this end, we collected data from two sampling periods fall (9/12/11 to 11/3/11) and spring (3/11/12 to 5/3/12) totaling 107 days at a wetland in Hamilton County, Tennessee. Data were analyzed to show the efficacy of various capture methods (e.g., drift-fences, pitfalls, funnel traps, and incidental captures). We developed a decision tree that incorporates life-history data, literature, methodology, and associated costs. Using this decision tree and aforementioned methods, 15 amphibian species and 12 reptile species were captured, totaling 2,982 individuals. Funnel traps

captured statistically more individuals than incidental captures with a t-test probability of .039 and a p-value <.05. Species captured by trap type are 15 for pitfall traps, 19 for funnels traps, and 20 for incidentals. Our study suggests that a combination of techniques that target specific species, habitats and timeframes can be as successful as studies of a longer duration.

0404 NIA, Banquet Room F, Sunday 3 August 2014

Victor Tagliacollo[1], Scott Duke-Sylvester[1], Fabio Roxo[2], Claudio Oliveira[2], James Albert[1]

[1]University of Louisiana at Lafayette, LA, USA, [2]Universidade Estadual Paulista, SP, Brazil

Uncovering Large-scale River Capture Events in Amazonian Lowlands

River capture is a geomorphological process of reshaping watershed drainages that affects macroevolutionary and biogeographic patterns in obligate freshwater organisms. River capture results in the formation of vicariant barriers to dispersal and, almost simultaneously, the erosion of geophysical barriers, allowing species range expansions. Here we develop a new parametric-biogeographic method for evaluating the diversification of taxa under the influence of river capture. The method evaluates the fit between observed phylogenetic and geographic patterns with the expectations of alternative Landscape Evolution Models (LEMs), using a Dispersal-Extinction-Cladogenesis (DEC) model of species-range evolution in a formal Maximum-Likelihood (ML) framework. We implemented this method using a species-dense, time-calibrated phylogeny of pimelodid catfishes with taxa that diversified in the Sub-Andean Foreland over the Cenozoic. We conduced ML ancestral-area reconstructions in BioGeoBEARS. We infer Pimelodidae originated in the Upper Cretaceous c. 70 (± 20) Ma, in southern tributaries of the Sub-Andean system, in what is now the La Plata basin. The best-fit LEM to the pimelodid data is a history includes three chronologically independent large-scale river-capture events between the Western Amazon and La Plata drainages, with river capture events at the Michicola Arch at 43-32 Ma, Chapare Butress at 32-23 Ma, and Altiplano at 23-15 Ma. This LEM has two important implications for diversification in the Sub-Andean Foreland: 1, river capture reversal initiated with expansion of the southern (La Plata) basin contributed to the accumulation of species richness in the northern (Amazon) basin; 2, river capture reversal results in basal lineages accumulating in the periphery.

0103 General Ichthyology III, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Milton Tan[1], Carla Stout[1], Alan Lemmon[2], Emily Lemmon[2], Jonathan Armbruster[1]

[1]Auburn University, AL, USA, [2]Florida State University, FL, USA

Phylogenomics and the Evolution of Paedomorphism in the Cyprinidae

The phylogenetic relationships of paedomorphic members of the Cyprinidae (species in the genera *Paedocypris*, *Danionella*, *Sundadanio*) have been challenging to infer. Morphological studies suggest that these paedomorphic taxa form a single clade. Molecular phylogenetic studies that included mitochondrial sequences unite *Paedocypris* and *Sundadanio* as sister genera, while a study that included only nuclear loci place these three genera in disparate parts of the phylogeny. To address this difficult phylogenetic problem, we utilized sequence capture to enrich 393 loci in these fishes for a phylogenomic-scale study. Preliminary analysis of 99 single-copy loci revealed that *Paedocypris*, *Danionella*, and *Sundadanio* do not form a clade, and thus are convergent in their paedomorphism; however, the recovered relationships present a novel hypothesis for the placement of *Paedocypris*.

0457 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Rebecca Tarvin[1], Juan Santos[2], Lauren O'Connell[3], Harold Zakon[1], David Cannatella[1]

[1]University of Texas at Austin, Austin, TX, USA, [2]University of British Colombia, Vancouver, BC, Canada, [3]Harvard University, Cambridge, MA, USA

Genetic Basis of Alkaloid Resistance in *Atelopus* and Dendrobatidae

Chemical defense using alkaloids has evolved multiple times in amphibians, including newts (*Cynops*, *Taricha*), toads (*Atelopus, Melanophryniscus*), and poison frogs (*Mantella*, Dendrobatidae). Tetrodotoxin (TTX, in *Taricha, Cynops,* and *Atelopus*) and diverse lipophilic alkaloids (e.g. pumiliotoxin, PTX, in many dendrobatids and mantellids) bind to and disrupt the function of voltage-gated sodium channels, a family of genes that encode proteins responsible for muscle and nerve function. Explaining alkaloid resistance is important because some predators evolve resistance to prey alkaloids, and prey organisms must be resistant to their own alkaloids. Alkaloid resistance can be traced directly to amino acid (AA) substitutions in sodium channels at sites where the alkaloids bind. AA substitutions that contribute different levels of TTX resistance have been identified in garter snakes (exposed to TTX when consuming *Taricha* newts) and in pufferfish (exposed to their own TTX defenses). Using Next Generation Sequencing, we

found AA substitutions at homologous sites in two sodium channels of *Atelopus*, as well as at a novel site unknown in other TTX-defended organisms. Convergence in the mechanism of alkaloid resistance suggests that the binding sites of alkaloids such as PTX can be identified by phylogenetic analysis of AA substitutions in alkaloid-defended and non-defended clades. We are analyzing sequences of several species of poison frogs to locate the binding site of PTX (currently unknown) as well as AA substitutions that may contribute to PTX resistance.

0142 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Emily Taylor[1], Matt Holding[2], Kory Heiken[1], Ignacio Moore[3]

[1]California Polytechnic State University, San Luis Obispo, CA, USA, [2]The Ohio State University, Columbus, OH, USA, [3]Virginia Tech, Blacksburg, VA, USA

Is Translocation Stressful to Rattlesnakes?

Land development has led to increasing frequency of interactions between humans and "nuisance" venomous rattlesnakes. Translocation, or movement of an animal away from its site of capture, is a commonly used tool for management of nuisance rattlesnakes. Translocated rattlesnakes often show high movement rates and mortality, although this varies from study to study. However, whether translocation causes sub-lethal stress has not previously been investigated. We conducted two studies to test the hypothesis that translocation is stressful to rattlesnakes, one using both short-distance translocation, in which snakes were moved within their home ranges, and the other using long-distance translocation, where male rattlesnakes were moved outside their home ranges. Although translocation increased the activity range size, neither form of translocation affected the snakes' behaviors, body condition, or thermoregulatory effectiveness. Corticosterone ("stress hormone") levels at baseline and after exposure to a one-hour acute stressor were not affected by translocation. Interestingly, long distance translocation resulted in a dramatic, acute increase in testosterone levels, suggesting that navigation in a novel environment may stimulate secretion of androgens. In mammals, stress typically causes a reduction in hippocampal volume and cell count. However, translocation did not cause a reduction in size of cortical brain regions homologous to the mammalian hippocampus. Instead, medial cortex volumes increased dramatically, likely reflecting increased navigational demands. These results indicate that rattlesnakes are behaviorally and physiologically resilient to translocation.

0668 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Leonardo Tedeschi[1], Jéssica Fenker[2], Cristiano Nogueira[4], Lilian Gimenes Giugliano[3]

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Molecular Phylogeny and Biogeography of *Psomophis*, and History of Diagonal Neotropical Open Areas

The South American arid diagonal is formed by three tropical open vegetation regions in the center of the continent: Caatinga, Cerrado and Chaco. The genus of snakes *Psomophis* comprises three species and is widely distributed in this region. However, their relationships and distribution are still poorly understood. The present work aims to study the evolutionary relationships and biogeography of *Psomophis* to bring new data about the biogeography of the South American open diagonal. The species of *Psomophis* showed low intraspecific diversity and high interspecific differences. The divergence date of the genus was estimated in the Oligocene and the differences between species were dated from the middle to late Miocene. We obtained significant niche identity differences between each species and indications that there are barriers between species distributions. The divergence date of the genus was estimated in the Oligocene (~ 30Ma) and the differences between species were dated from the middle to late Miocene (~ 13-7Ma). The probable ancestral area of this group is between southern portions of the Chaco and northern part of the Pampas. The second divergence event in the group probably occurred between Cerrado and Chaco, after the subsidence of the Upper Paraguay depression, in the Pantanal lowlands. This supports the hypothesis that Pampas and Monte regions should be included as a biogeographical unit of arid diagonal. Finally, we presented here a comprehensive compilation of molecular and distribution data, and therefore this is the most significant study about *Psomophis* since its description.

0171 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

William Ternes (co-presenter), Celeste Wheeler (co-presenter), Vincent Farallo

Ohio University, Athens, Ohio, USA

Microhabitat Use of the Big Levels Salamander: A Microendemic Plethodontid

The Big Levels Salamander, *Plethodon sherando*, has a narrow geographic distribution of 100 km^2 found primarily within Augusta County, Virginia. Generally, it occurs in rocky and forested habitats. The species is typically active on the surface during rainy nights and can also be found under rocks, logs, bark, mossy substrate, and other cover objects similar to many other plethodontid salamanders. *Plethodon sherando* is morphologically similar to *Plethodon cinereus* and both occur in striped and unstriped morphs. There is a narrow band of sympatry between the two species at lower elevations of *P. sherando*'s range, however *P. sherando* is the only small bodied *Plethodon* species throughout most of its small range. In order to better understand the ecology of *P. sherando* we studied microhabitat use which will be a first step in determining how this microendemic persists despite being surrounded by the wide ranging and closely related *P. cinereus*. We collected data starting in 2013 and will continue through 2014. We recorded soil moisture content, leaf litter depth, humidity, and air, soil, and ground temperature to characterize the microhabitat of *P. sherando*. We will be presenting our findings on *P. sherando* microhabitat use and also making comparisons to nearby *P. cinereus*.

0545 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Christopher Thawley[1], Travis Robbins[1], Nicole Freidenfelds[2], Tracy Langkilde[1]

[1]Penn State University, University Park, PA, USA, [2]University of Connecticut, Storrs, CT, USA

The Costs and Benefits of Adaptation: A Case Study Using Native Fence Lizards and Invasive Fire Ants

As global change accelerates, species often must adapt quickly or face extirpation or extinction. However, adaptation to novel selective pressures may maladapt a species to original conditions, such as predators, that remain present in its environment. Invasive fire ants (*Solenopsis invicta*) are novel venomous predators of Eastern Fence Lizards (*Sceloporus undulatus*). Lizards from fire ant-invaded sites flee and twitch at higher frequencies to escape attacking ants. We found that lizards exhibiting this behavior have higher survival in the presence of fire ants; however, these adaptive changes in behavior may incur costs via native threats. For example, a shift from crypsis to fleeing in response to avian predators or an increased behavioral responsiveness to native ants,

could attract visual predators and reduce probability of survival when attacked. We simulated predatory encounters between lizards and a taxidermied American Kestrel and found that differences in lizards' responses to fire ants did not carry-over to affect responses to a perceived avian predator. We did, however, find that lizards that behaviorally responded to fire ants responded similarly to native ants. We also found evidence of a potential cost of this behavioral change; fire ant-adapted lizards had relatively lower survival in the absence of fire ants. This suggests a generalized anti-ant behavior may improve survival in the presence of fire ants but reduce fitness in the absence of this invader, potentially due to increased predation by native visual predators. These results help inform our understanding of both the consequences and limitations of rapid adaptation.

0432 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Cheryl Theile, Terry Grande

Loyola University Chicago, Chicago, IL, USA

Comparison of Jaw Mechanics Among North American Esocids

Functional morphology, such as jaw mechanics, can serve as an important tool to study both the feeding behavior and evolution of fishes. However, few studies have investigated variation at the family level or below. Within the commercially and ecologically important family Esocidae, little to no work has been done to study jaw mechanics outside of the species *Esox lucius*. Not only are these fish prized by anglers, but they are important members of the food webs in their ecosystems. As ambush predators, these species rely on a fast feeding strike to quickly grab their prey, so a low in-lever to out-lever ratio, or mechanical advantage (MA), would be advantageous for this group. In order to explore variation within the North American esocids, the theoretical mechanical advantage (MA) for jaw opening and closing was calculated, using cleared and stained young of the year specimens ranging in SL from 4.1 cm to 14.4 cm. Preliminary data suggests that *Esox masquinongy* has the lowest MA, and therefore the fastest theoretical speed, for both jaw opening and closing. The highest MA, and therefore slowest and strongest, for jaw opening was calculated for *E. lucius*, while the highest MA for jaw closing was calculated for *E. niger*. Future considerations are to track any changes in theoretical jaw mechanics across development, as the diets of these fish shift from small invertebrates to other fish and a faster bite would become more beneficial after this shift.

0266 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Benjamin Thesing, Donald Shepard, Richard Noyes

University of Central Arkansas, Conway, AR, USA

Phylogeography of the Southern Redback Salamander (*Plethodon serratus*)

The southeastern United States has experienced dynamic environmental changes over the past several million years that have impacted species distributions. In many cases, contiguous ranges were fragmented and a lack of gene flow between allopatric populations for extended periods led to genetic divergence and speciation. The Southern Redback Salamander, *Plethodon serratus*, is a small woodland salamander that inhabits four widely disjunct regions of the southeastern U.S.: the southern Appalachian Mountains, the Ozark Plateau, the Ouachita Mountains, and the Southern Tertiary Uplands of central Louisiana. We sequenced portions of the ND4 and cytochrome b mitochondrial genes (1399 bp total) for 43 *P. serratus* from across the species distribution to infer phylogeographic relationships and estimate the extent and timing of lineage divergence. In our Bayesian phylogeny, Appalachian, Ozark, and Louisiana populations each formed well-supported clades. In contrast, Ouachita Mountain populations sorted into two geographically distinct clades; one Ouachita clade was sister to the Louisiana clade whereas the other was sister to the (Ozark + Appalachian) clade. Divergence times estimated using a relaxed clock model in BEAST indicated that *P. serratus* diverged from its sister taxon, *P. sherando*, ~5.6 mya and the most recent common ancestor of all *P. serratus* was ~2.4 mya. Our results suggest that climate-induced environmental changes during the Pleistocene played a significant role in driving isolation and divergence of disjunct populations of *P. serratus*. Future work with expanded sampling and multiple independent loci is needed to determine if allopatric populations warrant recognition as distinct species.

0334 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Meagan Thomas, Stephen Mullin

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Quantifying Dietary Overlap in a Community of Invertebrate Eating Snakes

Competition for resources exerts significant influence on the structure of biological communities, particularly when multiple species of a community utilize similar resources. Despite their widespread abundance across North America, there is a paucity of information about niche partitioning among snakes that are invertebrate specialists, possibly because of the relatively rapid rates at which they digest their prey. Stable

isotope analysis can reveal information about snake foraging ecology because it offers insights into species' diets without requiring individuals to have fed recently. Using this technique, we quantified the overlap in the dietary niches of five different species of invertebrate eating snakes *Coluber*, *Diadophis*, *Opheodrys*, and *Storeria* [2 spp.]). We collected blood and scale tissue from wild-caught snakes, as well as a range of whole prey specimens to assess niche partitioning between species across a broad temporal scale. A 2-way ANOVA revealed that the nitrogen signatures among the five snake species were similar, but that they differed in their carbon signatures. This indicates that all species occupy similar positions in the trophic web, but that the components of each species' diets are different. A Bayesian mixing model in the program MixSIR was used to determine whether or not food-resource partitioning was present in this community. We discuss our findings as they pertain to the co-existence of these snakes in a single habitat, especially between consecutive years.

0524 General Ichthyology I, Banquet Room G, Thursday 31 July 2014, ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Andrea T. Thomaz[1], Vinicius A. Bertaco[3], Luiz R. Malabarba[2], L. Lacey Knowles[1]

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Species Delimitation Integrating Morphological and Genetic Data Within a Bayesian Framework Using iBPP: Application in the Southeastern Brazilian Species Complex *Hollandichthys* (Teleostei: Characiformes)

With the expanding use of genetic data in species delimitation, the utility of morphological is being overlooked. Traditional systematic practices established morphology as an important source for species delimitation, especially when divergence is limited to selected characters, and for species recognition (in contrast to species delimited using genetic criteria alone). However, lack of model-based frameworks for integrating morphological data with genetic data has contributed to an over-emphasis of solely genetic-based methods; numerous approaches are available for evaluating whether hypothesized taxa are supported by patterns of genetic variation, as informed from coalescent theory. Yet, the power for species delimitation is reduced when a single data source is used. For example, in the genus *Hollandichthys* a species complex that inhabits the coastal rivers in Southeastern Brazil, two described species (*H. multifasciatus* and *H. taramandahy*) are made up of eight morphospecies based on osteological and external morphology, whereas analysis of mtDNA using Generalized Mixed Yule Coalescent method supports ten main lineages. Although some species boundaries are concordant across morphological and mtDNA analyses, others are not. Here we use the

newly developed Bayesian program iBPP to evaluate alternative hypotheses about species boundaries based on joint analysis of morphological and genetic datasets in one common model-based framework. As such, this approach can capture information that relates to biological processes during the speciation (i.e., the approach accommodates selectively driven morphological differences), and inferences are more robust to delimiting taxa when divergence occurs with gene flow (in contrast to methods that rely on genetic data alone).

0112 Fish Systematics & Taxonomy IV, Banquet Room G, Sunday 3 August 2014

Kenneth Thompson

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

Karyotype of *Centropristis striata*, the Black Sea Bass with a Discussion of Chromosome Evolution in the Serranidae

There are 475 species in 64 genera in the family Serranidae (sea basses). Karyotypes of only 35 species (7.4%) are known. All 35 species have diploid numbers (2N) of 48. Twenty four species have arm numbers (NF) of 48 and 11 species have NF values greater than 48. Chromosome formulae (2N/NF) of 48/48 (68.6%), 48/50 (20.0%), 48/54 (5.7%), 48/62 (2.8%) and 48/96 (2.8%) have been reported. *Centropristis striata*, the black sea bass is a protogynous hermaphrodite common in fish collections at The Chincoteague Bay Field Station at Wallops Island, Virginia. No karyotypic data exist for this species. Eleven juvenile specimens from Chesapeake Bay and near shore areas off Chincoteague and Assateague Islands were examined. Air dried, C-metaphase chromosome preparations were produced from gill epithelium. One hundred thirty seven metaphase spreads were evaluated from these specimens. Diploid counts of 48 were indicated for 120 (87.6%) of these. Metaphase spreads with 2N = 48 were considered to be complete diploid sets and these were measured and classified by type (metacentric, submetacentric or subtelocentric). There were 26 metacentrics (arm ratio ≤ 1.50), 14 submetacentrics (1.50 < ratio ≤ 3.00) and 4 subtelocentrics (ratio >3.00) indicating an arm number of 92. This provides for a chromosome formula of 48/92. The chromosomes were arranged by type and size to produce karyotypes.

0165 Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

Michelle E. Thompson, A. Justin Nowakowski, Maureen A. Donnelly

Florida International University, Miami, Fl, USA

Amphibians and Reptiles in Changing Landscapes

Habitat loss and degradation are considered primary threats to amphibians and reptiles but the extent to which anthropogenic habitat alteration affects amphibian and reptiles and the mechanisms that underlie the response at an individualistic and community level remain to be clearly determined. Here we present a review on the effects of four prevalent types of habitat alteration (urbanization, agriculture, pasture, and silviculture) on amphibians and reptiles. For each type of habitat alteration, we (1) summarized the effects on species richness and abundance, (2) determined the effect size of the matrix on total species richness and group-specific species richness based on habitat preference (matrix specialists, generalists, natural habitat specialists, or rare species), and (3) evaluated associations between habitat preference and species traits. There were overall mixed conclusions from studies, some showing negative, neutral, and positive effects of matrix habitat on species richness and total abundance; however, there was strong support for species-specific effects of individual species abundance. In our analysis of effect size, we found an overall trend of a negative effect of matrix on total species richness and illustrate that analyzing specific groups, based on habitat preference, can alter the magnitude and direction of the effect of matrix habitat. Our study highlights the importance of defining target groups in conservation studies and examining the influence of disturbance associated species on whole assemblage analyses and provides a useful platform from which to initiate future directions in the study of amphibians and reptiles in changing landscapes.

0140 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Avery Thomson, Leo Demski

Pritzker Marine Biology Research Center, New College of Florida, Sarasota, FL, USA

A Comparative Study of Chromatophore Systems for Vertical Banding in Bluegills and Selected Cichlids

Vertical banding (VB), a rapid occurrence of multiple dark vertical bars separated by light interspaces, is a sympathetically mediated response to threatening situations in the bluegill sunfish (*Lepomis macrochirus*), many cichlids and other percomorphs. Morphologically unique chromatophore systems (previously defined based on dermal depth and position within a scale/specific color pattern) effecting VB have been studied

in cichlids, while the CNS pathways for electrically evoked VB have only been mapped in sunfish. This study proposes the existence of a common neural effector system for sunfish and cichlid VB. To test this hypothesis, the chromatophore systems mediating VB of bluegills were compared to those of two cichlids (the African jewelfish, *Hemichromis bimaculatus*, and the blue tilapia, *Oreochromis aureus*) that show a similar VB response. Possible combinations of the four defined chromatophore systems were identified in all three species based on photomicrograph analysis. One of the four systems was most strongly linked to VB in blue tilapia and bluegills compared to the other three systems. This relatively deep melanoiridophore-dense system extends over most of the scale outline, and is aggregated in the light interspaces and dispersed in the dark bands. A second more superficial system on the anterior part of the scale pattern was likely involved in bluegill VB. Since the former of these two chromatophore systems is likely a common neural effector for VB in cichlids and sunfish, the central pathway for this fear-induced behavior may be at least partly homologous within the two families.

0720 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Ryan Thoni

Saint Louis University, Saint Louis, MO, USA

Morphological Variation and Diversity Within the *Catostomus plebeius* Complex (Cypriniformes, Catostomidae) in Mexico

The Rio Grande Sucker, *Catostomus plebeius*, is known to occur from the Upper Rio Grande drainage in Colorado and New Mexico, south to Durango and Zacatecas, Mexico, through Atlantic, endorheic, and Pacific Slope drainages. This species has received some attention for morphological and molecular variation from various researchers in previous years, however, few investigations have examined patterns of variation across populations in Mexico. This has historically been due to limited voucher materials as a result of the dangers associated with conducting fieldwork in the Sierra Madre Occidental. Over the course of many years, several voucher specimens have now been amassed, offering better insight into diversity in this complex. In this study, patterns of morphological variation in *C. plebeius* are examined from all known drainages in Mexico, including Atlantic, endorheic, and Pacific drainages. Different diagnosable entities are identified within the *C. plebeius* species complex.

0489 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Ryan Thoni, Ninon Martinez, Richard Mayden

Saint Louis University, Saint Louis, Missouri, USA

Diversification of *Gila* (Cypriniformes: Cyprinidae) in Western Mexico, with the Description of a New Species

The genus *Gila* has been one of the more taxonomically challenging groups of cyprinid fishes in North America. Until recently, no robust phylogenetic studies have been conducted on these taxa. Species and populations of *Gila* from Mexico have received even less attention. The rios Mezquital and Nazas are hypothesized to have had an historical connection, as indicated by similar aquatic assemblages. Many fishes present in one of the drainages can either be found in or have sibling representatives in the other. Some of these species present evidence of anagenesis in the drainages following isolation. However, understanding of the species diversity has been confounded due to limited collecting efforts, voucher materials, and details of live coloration. Recent collections from the region has allowed for more complete analyses of *Gila* from these and other nearby drainages. *Gila* sp. nov. is endemic to the upper Rio Mezquital and resolves as genetically distinct from other species of *Gila* (Schonhuth et al., 2014). This species is also morphologically diagnosable from its nearest congeners, *G. conspersa* and *G. pulchra*. It is hypothesized that lineage isolation and divergence of the new species is linked with the headwater transfer of the Rio Tunal across the Sierra Madre Occidental to the Rio Mezquital, resulting in the separation of these two bodies of water, a pattern also observed in other co-distributed species.

0219 General Herpetology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD GENERAL HERPETOLOGY

Pascal Title, Dan Rabosky

University of Michigan, Ann Arbor, MI, USA

Niche Evolution Dynamics and Their Role in Australian Reptile Diversification

Phylogenetic niche conservatism (PNC), the tendency of closely-related species to retain aspects of their fundamental niche over time, has been proposed as an important factor in allopatric speciation. If species are restricted to particular environmental conditions, then they are more constrained in their dispersal ability. Above the species level, clades might exhibit PNC if the species within these clades exhibit low niche lability. A prediction of the PNC hypothesis is that clades with low rates of niche evolution will

have higher rates of speciation because niche conservatism will promote isolation that could lead to allopatric speciation. Alternatively, greater rates of niche evolution might enable clades to move into new niche space and diversify. Lizards and snakes of Australia provide an excellent study system to examine diversification across climatic regions, as there have been multiple radiations of species that are unevenly distributed across these climatic zones. To test how niche evolution might affect diversification, I quantified rates of speciation and rates of niche evolution using a novel method called BAMM, which identifies clades that are operating under distinct macroevolutionary dynamics. An examination of the correlation between these rates across such a speciose group can help us understand what factors play an important role in diversification.

0458 Herp Conservation IV, Banquet Room J, Saturday 2 August 2014

Brian Todd[1], J. Mark Peaden[1], Melia Nafus[1], Kurt Buhlmann[2], Tracey Tuberville[2]

[1]UC Davis, Davis, CA, USA, [2]University of Georgia, Savannah River Ecology Lab, Aiken, SC, USA

Quantifying Road Effect Zones for Desert Tortoises (*Gopherus agassizii*) to Estimate Benefits of Mitigation and Habitat Protection

Roads can have significant negative impacts on wildlife populations. This is especially true for species with large home ranges and "slow" life histories. Desert tortoises are one such example, with at least two studies finding that the abundance of tortoise sign is reduced along roads. To quantify the distance at which roads negatively affect tortoise abundance (i.e., the "road effect zone"), we conducted line transect surveys along seven interstate plots and ten county road plots in the eastern Mojave Desert of San Bernardino County, California in 2012. We recorded all signs of desert tortoises along 1.6 km transects parallel to roads at distances of 0, 200, 400, 800, and 1600 m from the road's edge. Abundance of tortoise sign was significantly reduced closer to roads and increased with distance from roads. The effect of road type was also significant; tortoise abundance was reduced up to 229.6 ± 34.0 m from the edge of a county road and up to 305.7 ± 60.7 m from the edge of an interstate. Based on these estimates, for each 1.6 km of fencing installed along one side of the road, 36.8 hectares of habitat would be reclaimed along that side of a county road and 49.0 hectares would be reclaimed along that side of an interstate by reducing tortoise mortality. Lastly, we provide one way to prioritize roads for the installation of road-side fencing for mitigation purposes and we discuss the limitations of road-side fencing in preserving desert tortoise populations.

0768 Fish Conservation & Management, Banquet Room F, Sunday 3 August 2014

Glenys Tordecilla-Petro[2], Fredys F. Segura-Guevara[1], Charles W. Olaya-Nieto[1]

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Length-Weight Relationship of Dorada *Brycon sinuensis* in the Sinu River Basin, Colombia

The length-weight relationship of individuals of Dorada *Brycon sinuensis* collected in the Sinu river basin, Colombia, between January 2000 and December 2004 was estimated. The length-weight relationship and condition factor were estimated with the equation TW = a TLb and Cf =TW/TLb, respectively. The sizes ranged between 18.5 and 79.5 (41.6 ±12.7) cm TL, the total weight between 68.0 and 8966.0 (1462.5 ±1316.2) g, and the mean length in the catch was 41.7 cm TL. Length-weight relationship estimated was WT = 0.004 (± 0.06) LT 3.37 (± 0.04), r = 0.99, n = 545, were the monthly growth coefficient ranged between 3.08 (year 2000), 3.34 (year 2001), 3.49 (year 2002), 3.41 (year 2003) y 3.31 (year 2004). All coefficients were positive allometric, except the coefficient of 2000 year, which was isometric. The condition factor ranged from 0.012 (year 2000), 0.004 (year 2001), 0.002 (year 2002), 0.003 (year 2003) and 0.004 (year 2004), with statistically significant differences, showing inverse relationship with growth coefficient and correlated with the spawning season of Dorada and Sinu river levels.

0588 Ecology & Ethology, Banquet Room J, Thursday 31 July 2014; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Brian Tornabene[1], Robert Bramblett[1], Stephen Leathe[2], Alexander Zale[3]

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Nesting Ecology of the Turtle *Apalone spinifera* in a Large River-Floodplain Ecosystem

The nesting ecology of spiny softshell turtles in Montana, where they are at the northern extent of their range and a state Species of Concern, is poorly known. We used visual surveys and remote cameras to document nesting and emergence timing, behavior, and habitat in a 101-kilometer reach of the Missouri River. A large flood event occurred during 2011 that peaked three times higher than average and produced substantial riparian scour. We located fewer nests in 2011 than in 2012. Nesting followed annual peak river stage and occurred in the afternoon when no humans were present. Nesting

and emergence occurred later in 2011 than 2012, but incubation periods were similar. Most nests were in mixed-gravel substrates and vegetative cover at nest sites was sparse. Nest elevation and distance from shore in 2011 were generally greater than in 2012. More nests were found on islands than mainland in 2012 compared to 2011. Predation occurred on 46 nests and was higher on mainland nests. Fewer nests were successful in 2011 than in 2012. Substrate temperatures in simulated nests were higher in mixed-gravel than pure sand substrates. Potential freezing episodes occurred at all nest depths and varied among depths and between substrates. Flooding in 2011 probably decreased nesting effort and success by reducing habitat availability, delaying the onset of nesting, and prematurely ending incubation. However, flood events maintain and create nesting habitats. The northern range of this species is probably limited by habitat availability and successful incubation and emergence before winter each year.

0534 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Joshua P. Traub[1], Sloan Hill-Lindsay[2], Ralph A. Saporito[1]

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Maintenance of Aposematic Color in the Strawberry Poison Frog from Northeastern Costa Rica

The strawberry poison frog *Oophaga pumilio* is well known for its variable aposematic dorsal coloration, especially in Bocas del Toro, Panama. Although individuals within a population are variable in color, the greatest differences are among populations. The mechanism by which populations maintain dorsal coloration has not been well studied. One hypothesis is that stabilizing selection via predation pressure maintains color within a population. To test this hypothesis, we conducted a field study at the La Selva Biological Station in northeastern Costa Rica, to measure differences in predation on red, orange, yellow and brown clay model frogs. Frogs at this location are red in coloration, and we expected that the local red morph would be attacked less than an orange morph and yellow morph. Additionally, we quantified the variation in color (hue) of this population with a spectrophotometer. We found no difference in attacks between red, orange, or yellow frog models, although each color was attacked significantly less than the brown control models. Our findings appear to suggest that stabilizing selection is not maintaining color in this population; however, following our experiment, it was determined that the red clay used in our experiment was outside of the average coloration for the population studied. This finding makes it difficult to interpret our data, but when our results are compared to previous studies at the same location, we provide some evidence that stabilizing selection by way of predation pressure may act to maintain color within this population of *O. pumilio*.

0040 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

Stan Trauth

Arkansas State University, Jonesboro, AR, USA

Anatomy of the Distal Urogenital Duct System and Cloaca in Lizards

I performed a histological and ultrastructural analysis of the distal urogenital structures (i.e., ductus deferens, ampulla ductus deferentis, ampulla urogenital papilla, ureter, anterior dorsal recess of the urodaeum, and urogenital papilla) of members of six lizard families (Anguidae, Crotaphytidae, Phrynosomatidae, Polychridae, Scincidae, and Teiidae) using light microscopy, and scanning and transmission electron microscopy. Morphology of the epithelium of the ductus deferens revealed two predominant cell types in *Plestiodon fasciatus*: light and dark cells. In *Scincella lateralis*, each ductus deferens becomes highly fluctuated with irregular folds, taking on the appearance of an ampulla ductus deferentis. Moreover, the urogenital papillae (UPG) in this species contain the orifices of the ampullae ductus deferentis medially and are surrounded by slits opening from collecting ducts (*sensu stricto*, the ureters). Urinary and genital ducts, however, never merge in *S. lateralis. Plestiodon fasciatus* lacks an ampulla ductus deferentis. An ampulla ductus deferentis was present, but less well developed in phrynosomatid species (*Cophosaurus texanus*, *Holbrookia propinqua*, *Phrynosoma cornutum*, and *Sceloporus consobrinus*). In *P. fasciatus*, an anterior dorsal recess of the urodaeum appears to exhibit sperm crypts. All members of the Teiidae possess paired ampullae urogenital papillae; these pouch-like sacs, found for the first time in lizards and only in teiids. The UPG in lizards is either a single, medial structure or they are paired, bilateral papillae. Individual UGP can be described as simple mounds (e.g., in *Sceloporus consobrinus*), conical towers (in *Crotaphytus collaris, Anolis carolinensis,* and *Scincella lateralis*), and elongated oval folds (in *Ophisaurus attenuatus* and *Plestiodon laticeps*).

0010 Herp Development, Morphology & Histology, Banquet Room H, Sunday 3 August 2014

Stan Trauth[1], Kevin Gribbins[2], David Sever[3], Dustin Siegel[4], Justin Rheubert[5]

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Unusual Spermatogenic, Spermiogenic, and Spermatozoal Features in the Western Lesser Siren, *Siren intermedia nettingi*

One of the most notable characters of sirenoids is the possession of a biflagellated spermatozoon—an easily-recognized, diagnostic feature and one that distinguishes them from all other salamanders. Moreover, recent investigations into the spermatogenic cell morphology and the process of spermiogenesis in the western lesser siren, *Siren intermedia nettingi,* indicate additional evidence to support the uniqueness of this group. For example, Sertoli cells are unusual by being binucleated cells. Large (ca. 35-65 μm in diameter) spermiogenic cells are released individually into the lumina of spermatic cysts. The following briefly describes sperm cell elongation using scanning electron microscopy. Initially, each spermatid cell body (SCB) undergoes an abrupt elongation that begins with the protrusion of a blunt cytoplasmic bud that immediately attenuates. As development proceeds, this cytoplasmic bud progressively lengthens and acquires at least eight thin, filamentous, flagellar membranes as it projects itself posteriorly, spiraling away from the SCB in a twisted, corkscrew-shaped configuration. At the same time, anterior segments of these flagellar membranes encroach onto the external surface of the SCB, and two of these membranes eventually lie laterally and extend in an anterior direction well beyond the SCB as attenuated, arrow-shaped projections. Two axonemes eventually arise within the lateral edges of two of the flagellar membranes. Eventually, two undulating membranes support the axonemes, and this developmental morphology is configured initially in the posterior region of the tail and then proceeds anteriorly. The resulting spermatozoa vary from 250 to 300 μm in length and ca. 5 μm in width.

0653 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Alfonso Trujillo, Jesus Rivas

New Mexico Highlands University, Las Vegas, NM, USA

The Impact of the Invasive American Bullfrog (*Lithobates catesbeianus*) on Woodhouse Toad (*Anaxyrus woodhousii*) Demographics in the Rio Mora Wildlife Refuge in Northeastern NM

The introduction of bullfrogs (*Lithobates catesbeianus*) has a negative impact on native species by out competing them for food and habitat. Woodhouse toads (*Anaxyrus woodhousii*) are among the native species to the Rio Mora National Wildlife Refuge (RMNWR) that co-exists with Bullfrogs. Early on bullfrogs were eradicated from a 2,600 meter section of the Mora River to evaluate the impact of their eradication on the local fauna while a control site of the river was left untouched where bullfrog density did not change. A parallel study on the diet of the euthanized bullfrogs found the presence of Woodhouse toads in their diet. The goal of this project is to investigate the impact of bullfrogs on Woodhouse toads by using three methods to determine differences between the control and experimental sites: (1) Determine abundance via two methods: A) a mark-recapture study demographic parameters (rate of increase, survival, capture rate). Distance sampling using random or systematic transects in the study area; (2) comparison of demographic structure using the animals caught in both sites; and (3) radio telemetry to explore habitat use and mobility of the Woodhouse toad as well as how it is affected by the presence of Bullfrogs.

0492 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Ben Tumolo, Michael Flinn

Murray State University, Murray, KY, USA

Diet Analysis of Silver Carp (*Hypophthalmichthys molitrix*) in Two Large Embayments of Kentucky Lake, A Reflection of Availability or Selectivity?

The Silver Carp (*Hypophthalmichthys molitrix*) has established populations throughout the United States. Recently, two large reservoirs in western Kentucky (Kentucky Lake and Lake Barkley) were invaded by significant populations of Silver Carp. The objective of this project is to understand potential impacts of Silver Carp on reservoir primary productivity. Silver Carp show considerable diet plasticity and quantifying the impacts of their invasion may be related to reductions of the lowest trophic levels. Silver Carp (n=9) were caught from two embayments of Kentucky Lake with mono-and-multifilament gill nets. The foregut from each fish was removed and extruded. Contents were then identified to the taxonomic level of genus when possible and enumerated

based on cell count. Reference phytoplankton samples were identified with the same methodology. Diet analysis comparing the two embayments showed no significant difference between diets at the taxonomic level of Class except for Euglenophyceae ($P<0.05$). At the generic level significant differences in diet composition were noted between sampling locations. Though most genera were similar, Ledbetter Bay diets had higher numbers of *Coelosphaerium* and Blood River diets showed higher counts of *Anabaena*, *Microcystis* and *Volvox*. The results of Chesson's electivity index showed that fish from Blood River embayment selected against Diatoms and positive electivity for *Microcystis*. Within the taxonomic level of class, Blood River showed negative selection for Bacillariophyceae, while fish from Ledbetter illustrated random electivity towards Chlorophyceae and positive electivity of Trebouxiophyceae. These results show that Silver Carp feed with little selectivity on the lowest trophic levels of southeastern reservoirs.

0746 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

John Tupy[1], James Lee[2], Joseph Pechmann[1]

[1]*Western Carolina University, Cullowhee, NC, USA,* [2]*The Nature Conservancy, Camp Shelby, MS, USA*

Dusky Gopher Frog (*Rana sevosa*) Colonization and Translocation at an Improved Pond in Southern Mississippi

The dusky gopher frog (*Rana sevosa*) was once abundant in longleaf pine forests along the Gulf Coastal Plain from southeastern Louisiana to southwestern Alabama. Declared endangered in 2001 by the U.S. Fish and Wildlife Service, only two natural populations remain, including Glen's Pond. Pony Ranch Pond, located approximately 1.4 km southeast of Glen's Pond, was improved in 2008 by construction of a water retention berm, clearing of the pond basin and prescribed burning of the uplands as well as the basin in preparation for *R. sevosa* translocation. In late February 2014, months before translocation was to begin, *R. sevosa* males were heard calling at Pony Ranch Pond. Through the use of a drift fence two female and five male *R. sevosa* were captured leaving the pond. The females bore marks (VIA tags) which indicated they originated from Glen's Pond. Surveys in the pond discovered three *R. sevosa* egg masses. Translocation of *R. sevosa* from Glen's Pond to Pony Ranch Pond began April 2013. *R. sevosa* were translocated in 3 different stages: tadpoles headstarted in cattle tanks for 1 month, tadpoles headstarted for 2 months, and newly-metamorphosed juveniles reared in tanks. Total numbers of *R. sevosa* released into Pony Ranch Pond were: 1,134 one-month tadpoles, 489 two-month tadpoles and 105 juveniles. Total numbers of *R. sevosa* metamorphs captured leaving Pony Ranch Pond were: 18 translocated at one month, 13

translocated at two months and 18 unmarked (presumed natural reproduction). Survival was 1.6% for 1 month and 2.7% for 2 month tadpoles.

0321 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Alec J. Turner[1], Peter J. Etnoyer[2], Steve W. Ross[3]

[1]College of Charleston, Charleston, SC, USA, [2]NOAA Center for Coastal Environmental Health and Biomolecular Research, Charleston, SC, USA, [3]University of North Carolina at Wilmington, Wilmington, NC, USA

Oviposition Substrate Preference in Scyliorhinid Shark Species

Understanding habitat usage is key to managing long-lived, late maturing organisms such as chondrichthyans. Roughly 13% of all chondrichthyans belong to the family Scyliorhinidae, colloquially called catsharks. Despite their abundance and diversity, life history characteristics for many catsharks remain poorly understood. Initial observations suggest oviparous scyliorhinid sharks may have microhabitat substrate preference for oviposition on deep-sea corals. Video from remotely operated vehicle surveys in southern California and the Gulf of Mexico were used to quantify egg case abundance *in situ* on deep-sea substrates (coral, sponge, rock, or fishing gear). Mean water temperature at sites of egg case observations was 7.7 ± 2.4 ^{o}C in the Gulf of Mexico and 7.9 ± 0.7 ^{o}C in southern California, while mean depth was 586 ± 145 m and 298 ± 68 m respectively. There was a significant difference in egg case abundance on each substrate type ($X^2 = 46.91$, d.f. = 3, $p < 0.001$) and the position on the substrate (top, middle, or bottom) ($X^2 = 56.28$, d.f. = 2, $p < 0.001$), with both coral and the top of substrates preferred. This information, along with planned behavioral microcosms and molecular identification of collected egg cases, will provide insight into whether oviposition preference exists in oviparous elasmobranchs and may help determine the extent to which microhabitats contribute to the reproductive success of scyliorhinid sharks.

0351 Fish Genetics, Banquet Room G, Saturday 2 August 2014

Thomas Turner, Megan Osborne, Tyler Pilger, David Propst

Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico, USA

Origin and Diversification of Rio Grande Sucker (*Pantosteus plebeius*) in the Gila River Basin

Field collections in the 1940s and 1950s revealed that Rio Grande Sucker, a native of the Rio Grande and Guzman Basins, was present west of the Continental Divide in the Upper Gila River Basin. Ichthyologists working at the time suspected that Rio Grande Sucker had been introduced by humans after European settlement, probably in the 20th century. However, it is also possible that the species is native to the basin. We tested alternative hypotheses of recent introduction versus earlier (e.g., Pleistocene) colonization. Populations in Sapillo Creek, and San Francisco, Mimbres and Jemez Rivers in New Mexico were genotyped at 10 DNA microsatellite loci and two mitochondrial DNA loci (ND4 and cyt-b). Analyses of gene frequencies and gene genealogies indicated that Rio Grande Sucker colonized Sapillo Creek from the Mimbres River via headwater stream capture in the late Pleistocene, and subsequently colonized the San Francisco River via dispersal. Rio Grande Sucker populations in the Gila Basin exhibited low levels of introgression with Desert Sucker (*P. clarkii*). Overall, our analysis indicates that the species should be considered native to the Gila River Basin, and managed accordingly.

0721 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR PHYSIOLOGY & MORPHOLOGY

Ashleigh Tynes, Jerrod Tynes, Lani Lyman-Henley

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A Morphological Comparison of Old World (*Coelognathus*), New World (*Pantherophis & Scotophis*), and Hybrid (*Pantherophis + Scotophis, Pituophis + Scotophis*) Colubrid Snakes

Morphology has long since been a major component of species distinction and recognition. Anatomical features are genetically inherited and can be used to understand genetics and species relationships. While there is a copious amount of morphological data on many snake species, there is little information on hybrid and intergrade morphology. In this study, we evaluated the iris color and tongue color of corn snake/rat snake hybrids (*Pantherophis + Scotophis*), pine snake/rat snake hybrids (*Pituophis + Scotophis*), rat snake intergrades (*Scotophis spp.*) and compare it to other pure

colubrids in order to understand the phenotypic expression of these features among hybrids and intergrades. Analysis of the phenotypic expression can then allow us to better understand how some morphological features are passed on across the species and genus borders of certain taxa.

0751 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Jerrod Tynes, Lani Lyman-Henley

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A Comparison of the Arboreal Behavior of Old World (*Coelognathus*), New World (*Pantherophis & Scotophis*), and Hybrid (*Pantherophis + Scotophis, Pituophis + Scotophis*) Colubrid Snakes

A total of 24 colubrid snakes were observed for their arboreal behavior and hide box selection. These snakes had been allocated into six different testing groups, group 1 consisting of four yearling corn snake/rat snake hybrids (*Pantherophis + Scotophis*), group 2 consisting of four pine snake/rat snake hybrids (*Pituophis + Scotophis*), group 3 consisting of four second generation intergrade rat snakes (50% *Scotophis obsolete*, 37.5% *S. alleghaniensis*, 12.5% *S. spiloides*), group 4 consisting of four yearling Okeetee corn snakes (*Pantherophis guttatus*), group 5 consisting of four Texas rat snakes (*Scotophis obsoleta*), and group 6 consisting of 4 trinket snakes (*Coelognathus helena helena).* The arboreal behaviors and hide box selections were documented and differences between groups and sexes were analyzed. Chi-square results show arboreal preference for groups 1,2,3,6, a terrestrial preference for group 4 and no distinct preference for group 5 [X^2 (df = 1, n = 4) = 0.640, $p \leq 0.05$]. One way ANOVA and Tukey HSD tests indicate that group 1 and group 2 had a significantly higher selection of the arboreal locations than group 4 at the 0.05 level of significance. Females of groups 1, 2, 3, and 4 were more arboreal than the males within their respective groups, while males in groups 5 and 6 were more arboreal than their female counterparts.

0296 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Shem Unger[2], Carl Bergmann[1], Olin Rhodes[2], Gerardo Gutierrez-Sanchez[1]

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Proteomic/glycomic Profiling of Medaka (*Oryzias latipes*) for Elucidation of Physiological Response to Chronic, Low Level Ionizing Radiation in the Environment

Manmade disasters such as Fukushima are becoming increasingly identified as sources of radio-nucleotide contamination, which can have long lasting detrimental effects on the environment. However, there is little understanding of the specific mechanisms through which such contamination including ionizing radiation (IR), influences individual aquatic organisms. Much of what we comprehend regarding the interaction of radiological contamination and fish physiology has been derived from the study of radiation as an environmental stressor and its detrimental effects at the cellular level, including DNA damage, genomic instability, and patterns of protein expression and modification. Thus, the majority of experimental studies involving radiological contamination on fish have focused on acute, high dose rates. Consequently, very little is known regarding the underlying biological responses of fish to chronic, low doses of IR, which can be difficult to quantify using traditional methods. In this research we utilize state-of-the-art glycomic and proteomic approaches which pair mass spectrometry and current bioinformatic tools with a unique outdoor experimental mesocosm facility which provides chronic, low doses to Medaka fish (*Oryzias latipes*), a model species, at varying levels (2, 20, & 200mGy/day). We have identified over 123 candidate proteins (false discovery rate <1%, mean spectral abundance = 282.9) in Medaka as potential biomarkers for radiological contamination and other cellular processes. This research will further our understanding of protein and glycan profiles involved in environmentally relevant radiological exposure.

0609 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Peter Unmack[1], Justin Bagley[2], Aaron Davis[5], Michael Hammer[3], Mark Adams[4], Jerald Johnson[2]

[1]University of Canberra, ACT, Australia, [2]Brigham Young University, Provo UT, USA, [3]Museum & Art Gallery of the Northern Territory, Darwin NT, Australia, [4]South Australian Museum, Adelaide SA, Australia, [5]James Cook University, Townsville QLD, Australia

Phylogeny, Biogeography and Evolution of the Temperate Perches (Percichthyidae)

The family Percichthyidae is of great significance in temperate Australian freshwater environments in terms of their ecological influence and their importance to humans. The evolution of the group has resulted in massive morphological and ecological diversification from the small pygmy perches (up to ~10 cm), enigmatic blackfishes and larger perches and cods (up to ~1.8 m). On the whole, members of this family are the largest fish species historically present in most habitats and an unusual biogeographic quirk is they have the highest number of sympatric genera and species of any freshwater fish family in Australia. After a poorly understood taxonomic history, the relationships within and between other families has been clarified. Relationships to other families are not yet fully resolved, but there is a tantalising potentially monophyletic relationship with freshwater perches from North America (Centrarchidae) and Asia (Sinipercidae), along with the marine families Cirrhitidae, Cheilodactylidae, Oplegnathidae, Aplodactylidae, Chironemidae and Enoplosidae. Within the family, South American species (*Percichthys*, Percilia) are nested within the Australian percichthyids. One major change to the taxonomy of Percichthyidae is the placement of Bass and Estuary Perch back into the genus *Percalates* and their removal from the family. *Percalates* appears to be unrelated to any currently recognised family. In this presentation we will explore percichthyid phylogenetic relationships, provide a time scale of their evolution using a biogeographically calibrated molecular clock and provide insights into the evolution of body size and other traits within the family.

0610 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Peter Unmack, Bernd Gruber, Arthur Georges

University of Canberra, Canberra, ACT, Australia

Comparative Phylogeography of Four Aquatic Species from the Murray-Darling Basin

The Murray-Darling Basin (MDB) has a complex biogeographic history as it is surrounded by more independent river basins than any other Australian basin. As a result portions of the aquatic fauna have a mix of relationships to all surrounding regions, as well as an endemic component. Our project has three principal goals. 1) Is there an historical signature on biodiversity in the MDB and adjacent drainages that remains evident in the genetic structure of widespread species? 2) Are there concordant patterns of genetic structure across disparate aquatic and water-dependent organisms? 3) What are the impacts of dams on dispersal and degree of erosion of local genetic diversity of aquatic organisms? We chose four unrelated aquatic species that were widespread across the MDB, but that lacked known complications due to introgression or presence of cryptic species: the fish Australian Smelt (*Retropinna semoni*), river turtle (*Emydura macquarii*), yabby (*Cherax destructor*) and shrimp (*Macrobrachium australiense*). We are exploring patterns of genetic diversity using SNP variation from thousands of loci to address these three questions.

0530 Reptile Genetics & Evolution, Banquet Room J, Saturday 2 August 2014

Nicole Valenzuela[1], Itay Mayrose[2], Niv Sabath[2], Shai Meiri[2]

[1]Iowa State University, Ames, IA, USA, [2]Tel Aviv University, Tel Aviv, Israel

Sex Determination and the Birth and Death of Turtle and Squamate Species

What promotes speciation and extinction? This question remains an unsolved evolutionary mystery. Sex determination is expected to influence species diversification because it influences sex ratio, population growth, post-zygotic isolation, and consequently, the origination and demise of species. Yet, the impact of the evolution of sex determination on diversification in clades such as reptiles remains obscure. Using phylogenetic likelihood methods of trait evolution we find evidence that sex determination (whether genotypic - GSD, or temperature-dependent - TSD) affects diversification patterns by modifying speciation rates, but it does so in opposite directions in turtles and squamates. Geo-climatic niche evolution appears to mediate the observed differences. We propose that the contrasting longevity between turtles and squamates might explain the reverse patterns between groups. Our approach includes a

novel test of the effect that including taxa with unknown states has on the uncertainty of the analyses.

0782 SSAR Infrared Imaging Symposium, Banquet Room J, Sunday 3 August 2014

James Van Dyke

University of Sydney, Sydney, NSW, Australia

Convergent Evolution of Pit Organs in Snakes: Costs and Benefits of a Novel Sensory System

Infrared-detecting pit organs are novel sensory structures that allow pythons, pit vipers, and some boas to detect thermal contrast in the environment. Thermal information is mapped by the optic tectum simultaneously with visual information, allowing these snakes to view the environment in both infrared and visible spectra. Pit organ systems evolved independently in boid and crotaline snakes, and their biochemical mechanisms and neural organizations are remarkably convergent. The pit organ system thus represents an ideal model for investigating the evolution of complex novel traits in vertebrates. However, the evolutionary history of this novel sensory system remains unclear. New phylogenetic analyses indicate that the pit organ system was lost in one lineage of pythons (*Aspidites*) and has either been lost or independently evolved multiple times in boas. These trends suggest that the pit organ system may be costly to develop or maintain in species that inhabit ecosystems where it is not adaptive, but may also provide strong adaptive benefits in certain circumstances. Behavioral experiments show that the pit organ system plays key roles in foraging, thermoregulation, and detection of potential predators, yet whether sympatric snake species that lack pits but utilize similar ecological niches are impaired in these tasks remains unknown. Thus, the selective benefits are poorly understood. Here, we review the current state of knowledge of the evolution of pit organ systems, and suggest new research avenues that not only further understanding of the evolution of this system, but more generally illustrate how complex novel traits evolve in vertebrates.

0078 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

James Van Dyke

University of Sydney, Sydney, NSW, Australia

To Breed or Not to Breed: Transcriptomic Approaches for Determining how Reptiles Decide to Reproduce

To maximize fitness, animals should initiate reproduction based on information from suites of cues that communicate at least three variables critical to reproductive success: 1) environmental conduciveness for reproduction; 2) sufficient resource abundance to permit both parental survival and offspring developmental success; and 3) likelihood of successful mating. After these cues are detected, they are likely communicated to the hypothalamo-pituitary-gonadal axis (HPGA), which directly regulates reproductive physiology and behavior. However, evidence for these cues is largely phenomenological: environmental conditions, body condition, food abundance, and mating have all been linked to the decision to reproduce, but we have only a partial mechanistic understanding of the neuroendocrine cascades that underlie these phenomena. Fundamental limitations on these studies include that we do not know the structures of the peptide hormones involved in the HPGA in squamates (e.g., gonadotropin, gonadotropin releasing hormone, etc.), we do not have a full understanding of which organs exhibit receptors to these hormones, and we do not fully understand the neuroendocrine mechanisms that communicate cue detection to the HPGA. Transcriptome sequencing may hold the keys to these answers, because it allows us to identify how gene expression changes in response to stimulation, which can then be used to develop hypotheses to test using traditional molecular methods. Here, I will present preliminary data from a sequencing study that identifies hormone production and receptor sites in several tissues potentially critical in the decision to reproduce in female lizards: fat bodies, muscle, brain, hypothalamus, pituitary, ovaries, and liver.

0158 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; AES CARRIER AWARD

Kelley van Hees, David Ebert

Moss Landing Marine Laboratories, Moss Landing, CA, USA

Maternal Offloading of Mercury in Two Coastal Elasmobranchs in Elkhorn Slough, CA

Maternal offloading in elasmobranchs is one pathway through which juveniles may accumulate mercury, a harmful contaminant. Although elasmobranchs accumulate and may transfer high levels of mercury, this pathway has not been well investigated. This study examines maternal offloading of mercury in two common coastal elasmobranch species: leopard sharks (*Triakis semifasciata*) and thornback rays (*Platyrhinoidis triseriata*). Elasmobranchs were collected in Elkhorn Slough, California, an important elasmobranch nursery area. Muscle tissue and liver samples were collected from adult males and females. Embryos, including yolk, and ova were collected from gravid females during early and late development. Leopard sharks are also being aged to determine whether age correlates better with mercury concentration than length, and how female age affects offloading. Samples are currently being analyzed with a Direct Mercury Analyzer (DMA) 80 for total mercury concentration. Leopard shark muscle tissue mercury concentrations increased linearly with length, ranging from 0.47 mg/g (ww) to 1.80 mg/g, with an average of 0.97 mg/g. Thornback rays had lower muscle tissue concentrations with an average of 0.32 mg/g. Comparing female and offspring tissues at two development phases may help determine the route and degree of transfer of mercury to offspring. Comparing male and female liver concentrations may help determine the extent females are able to reduce their mercury loads. This study may elucidate further the mechanisms of maternal offloading in coastal sharks and rays.

0206 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jessica Vannatta, Matthew Klukowski

Middle Tennessee State University, Murfreesboro, TN, USA

Demographic Characteristics, Seasonal Corticosterone, and Prevalence of *Ranavirus* Infection in the Eastern Box Turtle, *Terrapene carolina carolina*

The Eastern Box Turtle is a species of concern in Tennessee because its population is in decline. The decline is due mainly to anthropogenic causes including, but not limited to, road mortality, disease, habitat fragmentation, and global climate change. The purpose of this study is to assess the general health of Eastern Box Turtles by measuring demographic characteristics, physiological characteristics, and infection status of turtles

in a wetlands habitat in middle Tennessee. Demographic characteristics recorded include population density, sex ratio, age, and several body size measurements (e.g., carapace length and carapace height). A small blood sample (≤0.2 ml) was drawn to measure corticosterone levels, triglycerides, uric acid, innate immunity, and to determine *Ranavirus* infection status via PCR. I predict that turtle density will be high relative to other studies. I hypothesize that in a healthy population the sex ratio should be approximately 1:1 and most turtles will fall into the adult age range (>10 years). I also predict an absence of *Ranavirus* infection and baseline corticosterone levels to be higher during the summer season due to energetic demands of mating and reproduction. To our knowledge, this is the first report of baseline corticosterone values in free-ranging Eastern Box Turtles. The results obtained will aid in the conservation and protection of this species of concern.

0487 Fish Systematics & Taxonomy IV, Banquet Room G, Sunday 3 August 2014

Rebecca Varney[1], Toby Daly-Engel[1], Dean Grubbs[2]

[1]*University of West Florida, Pensacola, Florida, USA,* [2]*Florida State University, Tallahassee, Florida, USA*

Preliminary Analysis of Genetic Variation in Three Species of Gulf of Mexico Hagfishes

Hagfishes (Myxiniformes, Myxinidae) are bathy pelagic jawless fishes with primitive physiology about which little is known. Though they are frequently bycatch in deep-sea fisheries and directly fished for commercial use as eelskin, knowledge of stock structure and population sizes is limited, and currently there is little regulation on the fishing of hagfish. Current species delineations are based almost entirely on morphology, and to date there was been only one investigation of hagfish phylogenetics, in 2003. This project aims to determine the phylogenetics and phylogeography of the three hagfish species in the Gulf of Mexico, *Eptatretus springeri*, *Myxine mcmillanae*, and *Eptatretus minor*. 612 hagfishes captured on pelagic long-lines in the Gulf of Mexico were subsampled and DNA extracted. Though preliminary data from the cytochrome oxidase I (COI) and NADH dehydrogenase II (NDII) genes is reported here, sequencing will eventually include three mitochondrial loci and the development of species-specific microsatellite loci. Genetic investigation of hagfishes, correlated with morphology, will greatly improve our understanding of species and population dynamics in primitive vertebrates, and inform our knowledge of the dispersal and speciation of deep sea fishes.

0738 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Friday 1 August 2014

Mariana Vasconcellos[1], Guarino Colli[2], David Cannatella[1]

[1]*The University of Texas at Austin, Austin, TX, USA,* [2]*Universidade de Brasília, Brasília, Brazil*

Recent Diversification of Treefrogs Into and Out of the South American Cerrado Savanna

Although the Neotropical region encompasses a large fraction of global biodiversity, knowledge about the origin and diversification of its biota is still insufficient, particularly in dry forest and savanna regions. The Cerrado savanna in Central Brazil, one of the 25 global hotspots of biodiversity, is remarkable for the high endemicity level of frogs and lizards, among other organisms. Yet, the evolutionary processes responsible for this great diversity are poorly known. We studied the diversification pattern and biogeographic history of a lineage of 33 treefrog species in the *Hypsiboas pulchellus* group with several endemics of the Cerrado savanna and other South American hotspots such as the Andes and the Atlantic Forest. This treefrog lineage shows a pattern of multiple recent origins of the endemic Cerrado, Andean and Atlantic Forest clades rather than long-term *in situ* diversification in those areas. Our biogeographic analysis also indicates an interesting pattern of recurrent dispersal events among distinct ecoregions in South America (including open and forest vegetation). This highlights the dynamic historical interchange between the Cerrado savanna and other ecoregions in South America.

0304 Fish Systematics & Taxonomy II, Banquet Room G, Sunday 3 August 2014

Diego Vaz, Marcelo Carvalho

Universidade de São Paulo, São Paulo, Brazil

Morphological and Taxonomic Revision of the Genus *Centroscymnus* with Comments on the Generic Arrangement Within the Family Somniosidae (Chondrichthyes: Squaliformes)

The morphology and taxonomy of *Centroscymnus coelolepis* and *C. owstonii* are described in detail, including an investigation of the ontogenetic variation in dermal denticles. Even though both species are highly similar, the present study verified significant differences in dermal denticle morphology, shape and size of dorsal fins, and in the neurocranium that support the validity of *Centroscymnus coelolepis* and *C. owstonii*. Previously proposed morphometric characters (e.g. comparative measurements of snout and mouth) proved not to be diagnostic. Additionally, the somniosid species

Centroselachus crepidater and *Proscymnodon plunketi*, that have been allocated in *Centroscymnus*, present shared features with *Scymnodon ringens*, *Scymnodalatias albicauda*, *Zameus ichiharai* and *Zameus squamulosus*. These similarities are interpreted as evidence of a close relationship between these species and give additional support that *Centroselachus crepidater* and *Proscymnodon plunketi* should not be placed in *Centroscymnus*.

0485 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Matthew Venesky[1], Alexandra Hess[1], Joe DeMarchi[1], Alejandro Weil[1], Cari Hickerson[2], Carl Anthony[2]

[1]Allegheny College, Meadville, PA, USA, [2]John Carroll University, University Heights, OH, USA

Red-striped and Lead Phase Eastern Redbacked Salamanders (*Plethodon cinereus*) Differ in their Resistance to *Batrachochytrium dendrobatidis*

Polymorphic species provide an excellent system to study population divergence because different phenotypes often face diverse selection pressures within their shared environment. Previous studies have demonstrated that different color morphs of *Plethodon cinereus* (i.e., red-striped and lead phase) vary temporally in their seasonal activity, tend to mate assortatively with respect to color, and differ in metrics associated with stress physiology. It is unknown, however, whether or how morph-specific differences in stress physiology affect salamander health. We performed a laboratory experiment in which we exposed juvenile and adult *P. cinereus* to the pathogenic chytrid fungus (*Batrachochytrium dendrobatidis*; hereafter "*Bd*") and tested the hypothesis that the different color morphs differ in their response to *Bd*. If lead-phase individuals of *P. cinereus* have higher circulating glucocorticoids, we predicted that individuals of this color morph would experience a higher cost of exposure to *Bd* and would be less resistant to *Bd* compared to red-striped individuals. Our findings support our prediction that lead phase color morphs differ in their response to *Bd* and further suggest that these color morphs are physiologically, and perhaps ecologically, separated. Future studies that directly manipulate glucocorticoid levels and/or temperature are needed to better understand the differences in *Bd* resistance in this species.

0109 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Natalin Vicente[1], Monique Halloy[2]

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Form and Structure of Male Headbob Displays in a Neotropical Lizard, *Liolaemus pacha*

One of the most common forms of visual signaling in lizards are headbob displays, consisting of stereotyped up and down movements of the head and/or torso. Our objectives were to describe and analyze the form and structure of these headbob displays in the neotropical lizard, *Liolaemus pacha*, and to compare between two social contexts in natural conditions: male without an apparent audience (MA) and male in the presence of another male (MM). Headbob displays in *L. pacha* included one to several sets of headbob bouts, separated by intervals or pauses of less than two seconds. We calculated duration and maximum amplitude of each headbob bout, duration of the intervals between headbob bouts, number of headbob bouts per headbob display, and presence or absence of modifiers. We performed linear mixed-effects models (LMMs) to compare duration, maximum amplitude of headbob bouts and intervals between contexts, and a Mann-Whitney test to compare the number of headbob bouts between contexts. The form of male headbob displays in *L. pacha* was characterized by triple headbob bouts of two types, A and B. We found that duration and maximum amplitude were significantly greater in the MM than in the MA context. We did not observe static modifiers in the latter context, in contrast to the MM context in which there was at least one modifier present. We conclude that the two headbob displays are each associated to a different social context, corresponding to what has been reported as the challenge and broadcast headbob displays.

0633 SSAR SEIBERT ECOLOGY AWARD, Banquet Room J, Friday 1 August 2014

Ryan Vincent, Jarrett Johnson

Western Kentucky University, Bowling Green, KY, USA

Investigating Population Structure and Connectivity of California Tiger Salamanders (*Ambystoma californiense*) in the Los Vaqueros Watershed

Genetic diversity is an essential component for maintaining healthy biological systems. The evolutionary process of gene flow acts to increase genetic diversity by introducing new alleles into a population's gene pool and limiting the deleterious effects of inbreeding. The occurrence of gene flow is typically responsible for a characteristic

change in allele frequencies. Landscape genetics has proved to be a powerful approach for assessing the ways that landscape features can affect gene flow, and in turn, influence these dynamic allele frequencies. This study examines the landscape-level population genetic structure of the California tiger salamander, *Ambystoma californiense*, living within the Los Vaqueros Watershed of Contra Costa County, California. 285 larvae were collected from 16 ponds and genotyped at 12 microsatellite loci. A number of open-access population genetics software packages (e.g., MicroChecker, GenAlEx, STRUCTURE) were utilized for an examination of potential correlation between genetic structure and landscape morphology. Our analysis indicates that gene flow is occurring among the sampled populations and that pairwise interpond distance is negatively correlated with gene flow. Two main breeding clusters were identified, indicating a north-to-south stratification of connectivity across the landscape. The results from this investigation will help address the conservation requirements for *A. californiense*, as well as contributing to the body of knowledge needed for the effective conservation of other species.

0342 Genetics, Development, & Morphology, Banquet Room G, Friday 1 August 2014; ASIH STOYE AWARD GENETICS, DEVELOPMENT, AND MORPHOLOGY

Kirill Vinnikov

University of Hawaii at Manoa, Honolulu, HI, USA

Phylogeny and Adaptive Evolution of Righteye Flounders (Pleuronectiformes: Pleuronectidae)

Clinal variation in quantitative morphological traits associated with temperature gradient or geographic latitude is well known among fishes. It shows that some species tend to have higher average number of vertebrae and fin rays in northern cold-water regions than their southern conspecifics. Therefore, it is reasonable to assume that sister species evolved by parapatric speciation along latitude-temperature gradient will have similar direction of change in quantitative characters as the clinal variation in their ancestral species. However, several sister species within family Pleuronectidae (righteye flounders) exhibit the opposite direction of change, having lower character values in the north and higher in the south, which may indicate some adaptive response in quantitative trait variation between species. In the present study, I propose the most complete phylogeny of Pleuronectidae including 58 species out of 62. Bayesian and maximum likelihood phylogenetic trees were reconstructed using RAG1, RAG2, cytb and COI partial gene sequences (~4200 bp in total). By using this phylogeny, I test several adaptive hypotheses to explain morphological differences between species by shape and by meristic characters. Interspecific character variation was analyzed first

with principal components and ANOVA. Then first and second principal components, representing meristics and shape respectively, were tested for the different selective regimes by comparative phylogenetic approach. Adaptive response to oceanic depth regimes was the best-supported model for meristic characters, and shape variation was explained by geographic factor. These results provide new insights on character variation in flatfish species and on their responsivity to different selection pressures.

0319 SSAR SEIBERT ECOLOGY AWARD, Banquet Room I, Thursday 31 July 2014

Philip N. Vogrinc[1], John D. Willson[1], Andrew M. Durso[2]

[1]University of Arkansas, Fayetteville, Arkansas, USA, [2]Utah State University, Logan, Utah, USA

Landscape-scale Responses of Semi-aquatic Snakes to Drought

Climate change is predicted to result in increased average temperatures and alteration in the frequency and intensity of precipitation events, placing stress on aquatic ecosystems and their associated wildlife. Semi-aquatic snakes serve important roles as predators and prey within aquatic ecosystems and several species are threatened. Yet, little is known about the effects of drought on semi-aquatic snakes due to their secretive behavior. Long-term studies at an isolated wetland in South Carolina found that drought caused populations of Banded Watersnakes (*Nerodia fasciata*) and Florida Green Watersnakes (*Nerodia floridana*) to crash. Alternatively, Black Swamp Snakes (*Seminatrix pygaea*) fared well, exhibiting a resistance strategy by aestivating within the wetland. However, the generality of these interspecific differences in drought susceptibility remains unknown. Following a supra-seasonal drought in 2013, we collected presence/absence data using repeated systematic trapping of snakes within 31 isolated wetlands in South Carolina. We then compared our results with similar data collected in 2007, prior to the drought. We also collected wetland and landscape covariates that may influence species occupancy, detectability, and drought susceptibility. We used occupancy modeling to determine drought-induced shifts in occupancy, detection, and covariate relationships for five semi-aquatic snake species. Site occupancy decreased dramatically for *N. fasciata* (0.96 to 0.62) and *N. floridana* (0.36 to 0.05) but was relatively unchanged for *S. pygaea* (0.48 to 0.42), *Farancia abacura* (0.65 to 0.50) and *Regina rigida* (0.13 to 0.16). Our results confirm that supra-seasonal drought can have negative effects on some, but not all, semi-aquatic snake species.

0717 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Richard Vogt[1], Virginia Bernardes[1], Camila Ferrara[2]

[1]INPA, Manaus, Amazonas, Brazil, [2]WCS, Manaus, Amazonas, Brazil

Tracking Migrating Hatchling Giant Amazon River Turtles *Podocnemis expansa* in the Rio Trombetas, Brazil with Sonic Transmitters

Studying habitat use and migrations of hatchling river turtles is now possible using 0.6g sonic transmitters. On 16 December 2013 we released 38 hatchlings with sonic transmitters in front of the nesting beach on the Rio Trombetas the night after hatching, along with 5000 without transmitters. We tracked the turtles with their mothers for 96 days using mobile and fixed receivers. Hatchlings were migrating with adult females in the deep water in the river channel, 13 migrated that night and were located 8 hours later in 6m of water 6 km downstream. Another 7 hatchlings were followed as they migrated downstream for 23 days, 71km downstream in 10-17 days after their release. One hatchling detected on 29 December was later recorded 65km downstream on 3 January, 65 km in 5 days. Six hatchlings migrated over 2 km upstream past our fixed recorder. The remainder of the hatchlings remained in an area within 4 km of the release site until 24 February, only two of the hatchlings were found entering lakes. Hatchlings do not remain in shallow water along the shorelines of the river but migrate out in the river channel with the adults, often at depths up to 25 m. Hatchlings did not behave in the same way, most went downstream, some went upstream, some stayed within the vicinity of the nesting beach, but only 2 went into the nearby lake, where the Reserve personnel have been releasing the hatchlings for 20 years along the shoreline in shallow water.

0547 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Joseph Waddell, William Crampton

University of Central Florida, Orlando, FL, USA

Electric Signaling Energetics and Life History in a Sympatric Assemblage of *Brachyhypopomus* (Ostariophysi Gymnotiformes, Hypopomidae) from the Peruvian Amazon

Sexual signaling energetics and other aspects of reproductive energy allocation are predicted to be linked to life history strategy - including age at first reproduction, reproductive lifespan, and the number of eggs. For a sympatric assemblage of nine species of *Brachyhypopomus* (Gymnotiformes, Hypopomidae) in the Peruvian Amazon, I explored EOD (electric organ discharge) waveform diversity and reproductive ecology through a complete annual hydrological cycle. EOD waveforms are species-specific,

sometimes sexually dimorphic, pulsed electrical discharges utilized in electrolocation and communication. EOD waveforms and amplitudes were recorded in the field during peak hours of nocturnal activity and within moments of capture (i.e. characterizing natural EOD variation in unstressed individuals). For each recorded individual, age (assessed by otolith analysis), sex, reproductive condition (e.g. gonad maturity, gonadosomatic and hepatosomatic indices), and scores of damage and regeneration were quantified. General aspects of life history such as annual- versus multi-stage life expectancy, and the timing and frequency of breeding season were integrated from data collected across multiple species and seasons. The analyses summarized in my poster demonstrate that life history strategy plays a significant role in shaping EOD waveform modulations in breeding males.

0111 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Whitney Walkowski

Southeastern Louisiana University, Hammond, Louisiana, USA

Endogenous and Exogenous Factors that Affect the Reproductive Ecology of *Lithobates grylio*

The reproductive ecology of anurans is affected by a variety of biotic and abiotic factors. This study seeks to define which factors influence reproductive behavior in male *Lithobates grylio*. The study will last over one "calling season" in Louisiana. Abiotic measurements will be analyzed with the rate of calling to determine correlation. These abiotic readings may indicate a threshold response that initiates calling activity. In similar species of ranids, male frogs have shown levels of territoriality during the calling season. Territorial, calling males have shown high levels of corticosterone and low levels of testosterone in *Lithobates catesbeianus*, the American Bullfrog. Circulating hormone concentration as well as field behavioral observations will be analyzed to make inferences about the potential territorial nature of *L. grylio*. The results of this study will focus on correlations between the reproductive ecology of male *L. grylio* and the physiology that affects reproductive behavior.

0505 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Danielle Walkup, Lee Fitzgerald

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

Landscape Fragmentation Disrupts Population Dynamics in Dune Dwelling Lizards

Fragmentation alters biotic and abiotic characteristics of landscapes, variously affecting the size and distributions of species' populations and potentially disrupting the phenology and demography of a population. For example, if individuals encounter barriers to movements or difficulties finding mates or nesting sites we may expect differences in population dynamics and population structure, depending on a species' life history. Habitat specialists, especially, are predicted to be negatively impacted by fragmentation because of their specific habitat requirements that may be disrupted by fragmentation. During five breeding seasons (2009-2013), we trapped lizards on 27 trapping grids located in unfragmented and fragmented dunelands in the Mescalero Sands ecosystem in southeastern New Mexico. Six lizard species were commonly captured. One species, *Sceloporus arenicolus* (dunes sagebrush lizard), is a habitat specialist endemic to this ecosystem, the other species are generalists found across the western United States. Using a two-way ANOVA, we examined the effects of landscape condition and year on capture rates of each species. Capture rates of *S. arenicolus* decreased in fragmented sites; the other five species responded variably. To test for effects of fragmentation on demography among species, we applied goodness-of-fit tests with expected frequencies computed from the average demographic structure observed on unfragmented grids. *Sceloporus arenicolus* and two other species showed disparate demographic structure on fragmented grids with juveniles, males and females being over or under represented. The pattern indicates that population reduction due to fragmentation causes severe alterations of population dynamics of habitat specialists in this system.

0701 NIA, Banquet Room F, Sunday 3 August 2014

Brandon Waltz

University of Louisiana at Lafayette, Lafayette, LA, USA

Morphological Variation in the *Eigenmannia virescens* Species Group (Gymnotiformes: Sternopygidae)

Neotropical fishes constitute the most species-rich continental ichthyofauna on Earth, and as in all biotas, reliable measures of species richness depend on an accurate alpha taxonomy. Because all species concepts ultimately come down to the presence of

phenotypic gaps, it is necessary to understand the nature of variation as the basis for a valid alpha taxonomy. Here I examine variation in head shape and mouth position in 104 specimens of the *Eigenmannia virescens* species group from the Amazon, Orinoco, and La Plata basins, using geometric morphometrics of landmarks from the external surface of the head. Substantial variation was found in mouth shape and position, with specimens in all three basins and both sexes displaying mouth positions ranging from terminal to subterminal. However, no discrete (i.e. diagnostic) differences in mouth position were found among river basins, or between sexes. Urogenetal pore position and anal-fin origin load most heavily on PC1, and urogenetal pore position is found to be associated with reproductive maturity, not basin or sex. PC1 also represents differences in adult mouth position. Relative elongation of the head, especially in the post-orbital/opercular region, relative flattening of the head depth, and axial position of pectoral-fin base, all load heavily on PC2. Body depth is greater in specimens with a terminal mouth position, but neither trait is directly correlated with body size. One population in the La Plata basin (Lago Ypoa, Rio Paraguay) grows to a larger body size and has a distinct phenotype in the morphospace from other *Eigenmannia* cf. *virescens*.

0177 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR PHYSIOLOGY & MORPHOLOGY

Stanislaw A. Warcholek[1], Joseph R. Milanovich[1], Stanley E. Trauth[2]

[1]*Loyola University Chicago, Chicago, IL, USA,* [2]*Arkansas State University, State University, AR, USA*

Can Premaxillary Teeth in *Desmognathus* Be Used to Determine Gender in a Field Setting?

When examining demography of a species a useful metric is the ratio of males to females. However, for many species where sexual dimorphism is not expressed strongly by morphology this metric can be difficult to quantify. Stream-dwelling plethodontid salamanders (e.g., *Desmognathus* spp.) are a group of species whose gender is difficult to accurately quantify morphologically. Use of the mental gland expressed in males of many plethodontid species is seasonally effective during the breeding season, but this feature cannot be used year round. Teeth are sexually dimorphic in *Desmognathus* due to their use in courtship during the breeding season; however, the use of these teeth as a tool to determine gender in the field has not been fully examined. Our objective was to determine if and when premaxillary teeth can be utilized to identify gender of two species of *Desmognathus* (*D. quadramaculatus* [*Dq*] and *D. brimleyorum* [*Db*]). We examined museum specimens, which included various sizes and collections, during several seasons. A trained observer identified if premaxillary teeth were present by touch, photographed the upper mandible using a stereomicroscope, and determined

sex by examination of testes or ovaries. Trained observers correctly identified gender of individuals by touch in 87 and 66% of the *Dq* and *Db* samples, respectively. Season, not size, had measurable influence over whether premaxillary teeth were felt by a trained observer for *Db*, but neither season nor size influenced this metric in *Dq*. These results suggest this method cannot concretely be used to identify gender in *Desmognathus* spp. consistently.

0467 Conservation, Banquet Room F, Friday 1 August; ASIH STOYE AWARD CONSERVATION

Dane Ward, Walter Bien

Drexel University, Philadelphia, PA, USA

The Effect of Roads on the Movement and Landscape Structure of the Northern Pine Snake, *Pituophis melanoleucus* in the Pinelands of New Jersey

New Jersey, the most densely populated state in the nation, has a dense complex of roads. Both paved and unpaved roads fragment the globally rare Pine Barrens occupied by the Northern Pine Snake (*Pituophis melanoleucus*), a state threatened species. *P. melanoleucus* is a large bodied vagile species that is impacted by roads in New Jersey. Of 536 reported occurrences for *P. melanoleucus* in the NJ biotics database, 23%, were dead on road. We examined the mean rate of movement of the *P. melanoleucus* across three different substrates: sand, asphalt, and concrete. We tested twelve snakes (n=12) seasonally 2012 at the Warren Grove Gunnery Range (WGR), Burlington County, NJ. We analyzed the NJ Pinelands landscape (FRAGSTATS 4.2) to identify suitable habitat patches utilizing road type and land use/land cover (LULC) data as delimiting factors of patches. Road type was scored utilizing substrate type, width, and vehicular density. Snakes had the fastest rate of movement across sand (mean = 0.11m/s) compared to paved substrates: asphalt (0.09m/s) and concrete (0.06m/s). These data suggest that coarser substrates facilitate increased mobility of snakes. Using the snake's mean rate of movement of asphalt, we estimated that it would take an adult *P. melanoleucus* a minimum 2.07 minutes to cross an asphalt road at a 90 degree angle. Pairing this information with NJDOT data for three roads intersecting the study site, we calculated the number of cars a snake would encounter during one traverse. We identified 3,872 total habitat patches with 156 greater than 200ha.

0483 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Dane Ward, Walter Bien

Drexel University, Philadelphia, PA, USA

Estimating Population Densities from Radio-telemetry Data for the Northern Pine Snake in New Jersey

Understanding population dynamics is paramount for successful management and long-term conservation of rare species. The Northern Pine Snake, *Pituophis melanoleucus*, is a state-threatened species that is declining in New Jersey. Unfortunately, quantitative population data is lacking as this semi-fossorial and cryptic species is difficult to census. *P. melanoleucus* remains vulnerable as a result of potential status delisting, habitat loss, habitat fragmentation, and isolation. We have developed a "population density model" for estimating the number of Northern Pine Snakes at the Warren Grove Gunnery Range (WGR). The model estimates the number of snakes per-unit-area (density) within preferred Northern Pine Snake habitat (pine-oak forest) from radio-telemetry (spatial ecology) data. We estimate that an average of 229 adult snakes occurred in the local population on WGR, a site of 3880 hectares. The average estimated density is one individual per 16.9ha. These data were extrapolated to estimate the current, historical, and rate of decline of the Northern Pine Snake population in New Jersey. We estimated that the northern pine snake has declined from an average of 16,476 snakes in 1986 to 15,188 snakes in 2007, a decline of 61 adult snakes per year. We plan to test how landscape fragmentation and patch size alter our estimate by reducing habitat availability and site carrying capacity throughout the Pinelands of New Jersey, for better resolution and precision of population estimates. Understanding population size and trends is imperative for improved conservation management of this threatened species.

0076 Lizard Ecology, Banquet Room H, Friday 1 August 2014

Daniel Warner[1], Alexis Harrison[2], Aaron Reedy[3]

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Adult Population Density is a Strong Selective Force on Juvenile Body Size in the Lizard *Anolis sagrei.*

Populations often experience substantial spatial and temporal variation in environmental and demographic features. This variation can impact the strength and form of natural selection on fitness-relevant phenotypes, and therefore could result in broad phenotypic variation through space and time. We performed a large-scale

manipulative study on island populations of the invasive brown anole (*Anolis sagrei*) in Florida. We established six experimental island populations and manipulated the adult sex ratio (an important demographic parameter that should affect the level of intra-sexual competition) on each island. Subsequent mark-recapture studies over the following three years enabled us to quantify survival and assess the strength and form of viability selection on body size over the reproductive and non-reproductive seasons. Our results reveal substantial spatial and temporal variation in adult and juvenile survival across islands. Moreover, the strength of selection operating on body size also varied spatially and temporally. Our data could not explain this variation in selection on adult body size. However, variation in juvenile survival was explained by adult density, and selection on juvenile body size was explained by adult male density. Our results suggest that adult males are an important selective force on juveniles and that male density might play an important role in juvenile recruitment to older age classes and overall population growth.

0443 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Jason R. Warner, Robert E. Espinoza

California State University, Northridge, Northridge, CA, USA

Comparative Cold Hardiness Capacities of Lizards (Genus *Liolaemus*) Living Along an Elevation Gradient in Argentina

Despite the thermal challenges imposed by cold environments, reptiles have evolved diverse strategies to cope with subzero temperatures. These strategies include behavioral freeze avoidance, physiological freeze avoidance (supercooling), and freeze tolerance. Freeze avoidance is typically a behavioral strategy involving taking refuge below the frost line. Reptiles that supercool physiologically avoid freezing by maintaining body fluids in their liquid state despite exposure to temperatures below the freezing point. Freeze tolerance allows some reptiles to recover after significant portions of their tissues have frozen. We studied the cold-hardiness capacities of six species of *Liolalemus* living along an elevation gradient (1550–4075 m) in northwestern Argentina. We hypothesized that species from colder regions (>3000 m) will have greater capacities to supercool and tolerate freezing vs. their low-elevation congeners. Environmental temperature data confirmed the need for species living >3000 m to cope with extremely low temperatures (to –9 ºC). Laboratory experiments confirmed that species from colder regions (higher elevations) were more susceptible to freezing and tended to survive longer during freezing events. Independent contrast analyses indicated that phylogeny was a stronger predictor of supercooling capacity than elevation. In sum, our study found that the cold-coping strategy of freeze tolerance in these lizards is best explained by the cold climates at the high-elevation regions the lizards inhabit. Conversely,

physiological freeze avoidance (supercooling) appears to be the result of phylogenetic conservatism, suggesting that this cold-coping strategy is ancestral for the group.

0572 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Peter Warth[1], Eric Hilton[2], Peter Konstantinidis[2]

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Ontogeny of Skeletal Elements in Two Species of Sturgeon

Acipenseriformes is a group of basal actinopterygian fishes that are distributed across the Northern hemisphere. Two extant families are recognized: the paddlefishes (Polyodontidae) with two monotypic genera and sturgeons (Acipenseridae) with 25 extant species in currently four genera. The species of the genus *Acipenser* are often hard to distinguish morphologically and a high degree of intraspecific variation has been documented, making them an interesting object of study. We investigated the ontogeny of skeletal structures in two species of the genus *Acipenser* from the onset of skeletogenesis on. Therefore freshly fertilized eggs of Siberian and Russian Sturgeons (*A. baerii* and *A. gueldenstaedti*) were obtained from a local hatchery and raised in the lab under equal conditions. Specimens were euthanized and fixed daily to obtain a close ontogenetic series. For the study of the skeleton, the specimens were cleared and stained after Taylor & van Dyke (1985) and documented. Histological sections of critical stages were produced for a detailed view. The differences in development and phylogenetically important characters are highlighted in our description.

0514 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Mark Waters[1], Paul Andreadis[2], Debra Andreadis[2]

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Effects of Gordon Burghardt and his Scientific Work on the Behavior of Herpetologists and Ethologists

This year marks the 50th anniversary of Gordon Burghardt's first peer-reviewed publication. Fittingly, it appeared in *Copeia* (1964 (3): 576-578). Over the last half-century, many researchers would agree that Gordon has made significant contributions to the

fields of herpetology and animal behavior. But what has his impact been on these fields broadly? Our quick answer is that his influence has been tremendous. However, we took a more objective approach to answering this question and bolstering our assertion about his impact on herpetology. We focused on three areas of Gordon's research: chemosensation in reptiles, reptile learning, and iguanian biology. With the databases Web of Science and PsycINFO, we documented how Gordon's publications influenced the direction of research in the field. An author search in Web of Science returns 198 publications, which have been cited 2,598 times (excluding self-citations). The citations of Gordon's work show a wide geographic footprint, and reveal a broad disciplinary influence. On a per-paper basis, the number of citations per year has remained stable from 1960's to the present. Not only has Gordon's work had a significant impact, but his work remains relevant, and through it he continues to inspire and challenge our thinking.

0043 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jessa Watters, Cameron Siler

Sam Noble Museum, University of Oklahoma, Norman, OK, USA

Quantifying Curator Success in Life Science Natural History Collections

In an era when budgets are tight for families, businesses, universities, and governments, it is sometimes difficult to see the value in museums and their curators. Museums provide a necessary service to scientists and the public by housing specimens in a long-term stable environment, providing specimens and data for research, training new generations of scientists, bridging the gap between research, education, and public outreach, and working to develop new technologies to track speciation, biodiversity, and environmental change, just to name a few. The curators who conduct research in museums are integral to our overall understanding of the life sciences, yet their livelihood is being challenged. In an effort to quantify the incredible resource represented by a museum curator, we conducted a survey, sent to email list-serves and online groups, asking natural history curators to respond with details on museum and university affiliation, time in position, collections overseen, grant and publication success, teaching breadth, and students mentoring involvement. Our research indicates that curators have a great deal of scientific and monetary value to add to museums, affiliated universities, and our general education system through contributions from research publications, grants, and teaching, and student mentorship.

0324 Fish Morphology, Histology, & Development, Banquet Room F, Saturday 2 August 2014

Jacqueline Webb, Jason Ramsay

University of Rhode Island, Kingston, RI, USA

3-D Configuration of Lateral Line Scales and the Lateral Line Canal Contained Within Them: The Textbooks are Wrong.

The lateral line (LL) scales of teleost fishes are a source of important meristic characters, but they are an important functional component of the mechanosensory lateral line system. Each LL scale contains a tubular LL canal segment, and the scales overlap so that the segments in the linear series of scales form a continuous canal. The configuration of the overlapping scales that compose the LL canal in teleosts has been illustrated in the primary literature, but the representation of the 3-D relationship between adjacent lateral line scales, the way in which the LL canal segments are integrated into the LL scales, and the location of the neuromast receptor organs within the canal segments are portrayed inaccurately, especially in textbooks. We will provide new illustrations of LL scales in several representative taxa derived from cleared and stained and histological material to reveal the unappreciated 3-D relationship between overlapping scales and between LL canal segments and canal pores, the location of the neuromasts (in the canal lumen) and the LL nerves that innervate them, and the relationship of the LL scales, to the epidermis, dermis and underlying trunk musculature.

0086 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER HERPETOLOGY AWARD

W. David Weber, Nicola Anthony, Trent Santonastaso, Gabriel Fiorini

University of New Orleans, New Orleans, LA, USA

Multiplexing of *A. carolinensis* Microsatellite Loci for Cross Species Amplification

The American green anole (*Anolis carolinensis*) has become an exciting model for studies in behavioral ecology. As a species, they have been extensively studied in the laboratory and in their natural environment. Much has been leaned about their ecology, more is surely to be learned and now they have the potential to give us insights into other closely related species. Using the sequenced genome of *A. carolinensis* and microsatellite primers designed by Claire Wordley et al. we have designed a multiplex PCR protocol for *A. carolinensis* microsatellite loci. We have demonstrated their effective amplification in five species of anoles from the northern Antilles, *A. gingivinus, A. pogus, A.*

bimaculatus, A. sabanus and A. *schwartzi*. We successfully genotyped ten individuals from each species and showed that none of the alleles exhibited linkage disequilibrium of deviation from Hardy Weinberg equilibrium. Now pedigrees can be constructed on a species and relatedness studies can be carried without knowing details of its genome. This preliminary investigation showed that closely related species can be genotyped by the use of a reference species' genome (microsatellites), thereby reducing the cost of large behavioral ecology studies with a genetic component.

0317 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR EVOLUTION, GENETICS, & SYSTEMATICS

Johanna E Wegener[1], Kevin P Mulder[2], Tyler R Kartzinel[3], Jonathan B Losos[4], Robert M Pringle[3], Jason J Kolbe[1]

[1]University of Rhode Island, Kingston, RI, USA, [2]Smithsonian Conservation Biology Institute, Washington, DC, USA, [3]Princeton University, Princeton, NJ, USA, [4]Harvard University, Cambridge, MA, USA

Relative Contribution of Genetic and Ecological Factors to Morphological Differentiation of Island Populations of *Anolis sagrei*

Morphological differentiation among populations can be influenced by a number of evolutionary mechanisms, including gene flow, genetic drift and adaptation to local environmental conditions. We evaluate the relative contributions of genetic and ecological factors to morphological differences among 16 island populations of Brown Anoles (*Anolis sagrei*) near Staniel Cay in the Bahamas. We measured 20 morphological characters related to feeding, locomotion, and male-male interactions. To assess genetic mechanisms, we genotyped 10 microsatellite loci and sequenced the mtDNA gene COI. To evaluate environmental conditions on each island, we measured three structural habitat variables and estimated population densities using mark-recapture methods. Using a multivariate analysis, we found morphological differences among islands, but they did not correspond to distance from the main islands or distance among the small focal islands. Ongoing analyses of the genetic data will likely clarify the role of gene flow and genetic drift to morphological differences among island populations.

0647 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Nicholas Wegner, Owyn Snodgrass, Heidi Dewar, John Hyde

NOAA Fisheries, Southwest Fisheries Science Center, La Jolla, CA, USA

Evidence for Pectoral Endothermy in the Opah, *Lampris guttatus*

Unlike most pelagic fishes, the opah, *Lampris guttatus*, uses the pectoral fins for continuous swimming. The insulation of the large, red (aerobic) pectoral muscles by a thick layer of fat and connective tissue has led previous researchers to speculate concerning their possible function in heat production and retention. However, temperature measurements have been lacking and there has been no evidence of a countercurrent heat exchanger required to insulate muscle temperatures from convective blood heat loss at the gills. Here we report pectoral muscle temperatures that are significantly elevated above ambient for freshly decked opah and for fish outfitted with intramuscular temperature loggers swimming at depth. We also describe *retia mirabilia* in the gills of the opah that appear to function as countercurrent heat exchangers to conserve heat derived from the pectoral muscles. These *retia* (composed of extensions of the afferent and efferent filamental arteries embedded in adipose tissue within thick gill arches) allow for cold blood leaving the respiratory exchange surfaces to be rewarmed by blood entering the gill filaments. The unique placement of these countercurrent exchangers in the gills potentially allows for warm blood to be distributed throughout the body. In addition to the pectoral muscle, temperatures in the heart, gut, and cranial region are all significantly elevated above ambient.

0130 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Kyle Weichert, Emily Taylor

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

Lizard vs. Spirochete SmackDown! Fat Females Take the Bactericidal Title.

The Western Fence Lizard (*Sceloporus occidentalis*) is a major host of juvenile stages of the Western Black-legged Tick (*Ixodes pacificus*), which is the vector for the Lyme disease causative spirochete bacterium *Borrelia burgdorferi* in the western United States. Because *S. occidentalis* is reservoir incompetent and capable of cleansing spirochetes from infected ticks, it has been implicated as a major factor in the ecology of Lyme disease in the West. Although complement protein in lizard blood has been established as the borreliacidal factor, no studies have examined intraspecific variability in host lizard borreliacidal capacity. In this study, we tested the hypothesis that host lizard physiological state impacts their borreliacidal capacity. Blood plasma of lizards was challenged against cultured *B. burgdorferi*, and the complement-mediated killing was quantified. Spirochete

mortality was higher for adult female lizards than males, which is consistent with many studies indicating that immune function is compromised in male animals. Adult lizards had higher spirochete mortality than first-year juveniles, suggesting that complement-mediated killing develops with age and/or exposure to parasite antigen. Also, spirochete mortality was positively associated with lizard tick load and body condition. Data like these may be helpful in informing disease ecology models examining spread of the emerging infectious Lyme disease in the West.

0388 Herp Ecology & Phylogeography, Banquet Room E, Sunday 3 August 2014

Jeffrey Weinell, Christopher Austin

Louisiana State University, Baton Rouge, LA, USA

Phylogeography of the Scarlet Snake (*Cemophora coccinea*)

The scarlet snake, *Cemophora coccinea*, is a fossorial snake species distributed across south-central and southeastern United States, and mimics the color pattern of venomous coral snakes (genus *Micrurus*). This species is also remarkable in that it possesses enlarged posterior maxillary teeth specialized for eating reptile eggs. Three subspecies are currently recognized: *C. c. coccinea*, found in sandy habitats of southern and central peninsular Florida; *C. c. copei*, from New Jersey to eastern Texas and Oklahoma; and *C. c. lineri*, which has an allopatric distribution within the southern Coastal Bend region of Texas. There is strong support for a sister relationship between the monotypic genus *Cemophora* and the speciose genus *Lampropeltis*. Intraspecific patterns of genetic variation across the geographic range of *Cemophora coccinea* have not previously been explored. Therefore, we sequenced 3 loci (2 mitochondrial and 1 nuclear) from 60 samples of scarlet snakes from across their range in order to assess whether currently recognized subspecies are monophyletic lineages, and to test previous phylogeographic hypotheses for *Cemophora coccinea*.

Scott Weir[1], Shuangying Yu[1], Ami Knox[1], Larry Talent[2], Todd Anderson[1], Jonathan Maul[1], Gad Perry[1], Christopher Salice[1]

[1]Texas Tech University, Lubbock, TX, USA, [2]Oklahoma State University, Stillwater, OK, USA

The Oral and Dermal Toxicity of Several Pesticides to the Western Fence Lizard (*Sceloporus occidentalis*)

Reptiles remain under-represented in the ecotoxicological literature, despite calls for more reptile toxicity research. A lack of reptile toxicity data, in part, limits the certainty of ecological risk assessments. Our goal was to provide additional oral and dermal toxicity data for several pesticides to reptiles. We dosed western fence lizards (*Sceloporus occidentalis*) via oral (gelatin capsule) and dermal (no solvent) exposure to endosulfan, lambda-cyhalothrin, chlorothalonil, and brodifacoum. Neither brodifacoum nor chlorothalonil caused mortality in our exposures. Endosulfan was very toxic from oral exposures (LD50 = 9.8 μg/g) but not dermal exposure (LD50 > 1750 μg/g). Lambda-cyhalothrin was slightly toxic (LD50 = 916.5 μg/g) via oral exposure. We also performed oral and dermal toxicity with acetone. For lambda-cyhalothrin using acetone resulted in much greater oral toxicity (LD50 = 9.8 μg/g) and dermal toxicity (LD50 = 17.5 μg/g). For endosulfan, oral and dermal toxicity with acetone was similar to the capsule dosing. We combined our current data with previous reports of reptile LD50s and performed correlation analyses with available avian data from the USEPA. A strong correlation was found between avian and reptile LD50s when using "true" LD50s, but no significant correlation was found when using all data (e.g, LD50 > 1750 μg/g). Our results suggest it is possible to build predictive relationships between avian and reptile LD50s, but much more research is needed to understand trends associated with chemical classes and modes of action and to determine when it is appropriate to build relationships between avian and reptile LD50s.

Shane Welch[1], Jayme Waldron[1], John Holloway[2]

[1]*Marshall University, Huntington, WV, USA,* [2]*United States Marine Corps, Parris Island, SC, USA*

Coastal Island Eastern Diamondback Rattlesnake Habitat Selection and Landscape-scale Spatial Fidelity

In light of concerns about the conservation status of eastern diamondback rattlesnake EDB (*Crotalus adamanteus*) populations, we used radio telemetry data to examine eastern diamondback rattlesnake (EDB) movement ecology for a coastal sea island population. Specifically, we estimated home-range size and inter-annual home range overlap to examine habitat selection at full and core home ranges. On average, EDBs exhibited small home ranges (males = 11.96 ± 4.87 ha; females home range = 5.34 ± 4.17 ha). The EDB home ranges observed in this study were dramatically smaller than those reported for other populations. Our observations of home-range size and overlap suggest that EDBs restrict their activity to naturalized areas with low human activity and actively avoid areas that increase exposure to risks. For example, the home range configurations exhibited by our coastal sea island population of EDBs indicate that adult EDBs avoid areas that, 1) lack concealing vegetative ground cover (avoidance of mowed, open spaces), 2) have high human activity (e.g., golf course greens), and 3) high vehicular traffic volume. Our study population had a high degree of inter-annual home range overlap, which supports prior research findings that mature EDBs exhibit high spatial fidelity at the landscape-scale. This information is important because it suggests that EDB movement ecology may allow populations to persist in anthropogenic landscapes.

0254 ASIH Burghardt and Behavior Symposium, Banquet Room I, Friday 1 August 2014

Paul Weldon[1], Matthew Kramer[2], Robert Vender Meer[3], Yasmin Cardoza[4], Ulrich Bernier[3], Russell Coleman[5], John Carroll[2], Clint Hoffmann[6], Scott Gordon[7], Thomas Spande[8]

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Anuran Skin Secretions Contain Contact Toxins Against Arthropods.

Arachnids, biting flies, hymenopterans, and centipedes profoundly affect the fitness of amphibians and reptiles acting as predators, ectoparasites, and vectors of pathogens. Chemicals associated with the skin of amphibians and reptiles often are suspected to deter offenders, but tests of this have been hampered by the limited availabilities of relevant compounds. We examined the responses of ants, mosquitoes, and ticks to peptides, bufadienolides, and alkaloids from the integument of amphibians, using purified fractions of skin extracts or commercially available compounds in microassays of repellence and/or toxicity with individual arthropod subjects. Alkaloids from New World poison frogs (Dendrobatidae) were effective feeding deterrents of mosquitoes and ants. The pumiliotoxins (PTXs), which are known widely from several dendrobatid genera and other frogs, are particularly potent contact toxins, as shown in tests with mosquitoes, which shed their legs after contacting chemically treated surfaces, and ants, which violently convulsed. The natural enantiomer of PTX 251**D** is significantly more toxic than the unnatural (synthetic) enantiomer of this compound. Estimates of the concentrations of PTX 251**D** on the skins of some dendrobatids indicate that it is effective below the concentration threshold of toxin sensitivities demonstrated in laboratory tests; hence this and possibly other compounds plausibly are used in defense against arthropod offenders in nature. The demonstration of contact toxins against arthropods in the skin secretions of dendrobatids, as opposed to distasteful agents or ingested toxins chiefly targeting vertebrate predators, offers potential insight into the rich chemical diversity for which these frogs are celebrated.

0192 Fish Systematics & Taxonomy II, Banquet Room G, Sunday 3 August 2014

Stuart Welsh[1], Dean Jerry[2], Damien Burrows[3]

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A New Species of Freshwater Eel-tailed Catfish of the Genus *Tandanus* (Teleostei: Plotosidae) from the Wet Tropics Region of Eastern Australia

Tandanus tropicanus, new species, is described based on specimens from streams in the wet tropics region of northeast Queensland. Previously, two species were recognized in the genus *Tandanus*; *T. tandanus* of eastern Australia and *T. bostocki* of Western Australia. A combination of meristic and morphometric characters distinguishes the new species from all congeners. Further, taxonomic distinctness based on morphologic differences between the new species and all congeners is corroborated by genetic analyses.

0025 Herp Biogeography & Phylogeography, Banquet Room J, Sunday 3 August 2014

Fernanda Werneck[1], Rafael Leite[2], Silvia Geurgas[3], Miguel Rodrigues[3]

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Diversification of the Neotropical Rock Specialist Lizards from the *Tropidurus semitaeniatus* Species Group (Squamata: Tropiduridae)

Phylogeography research has advanced throughout South America, with increasing efforts on the dry diagonal biomes taxa. However, the diversification of endemic fauna from the semi-arid Caatinga biome in northeastern Brazil is still poorly known. Here we use the endemic *Tropidurus semitaeniatus* species group widely distributed across the Brazilian Caatinga to understand this biome history. Based on four genes (16 S, cytb, BDNF, and Pho) we inferred time-calibrated phylogenies, genetic distances, and the species limits within the group. We also devoted a denser phylogeographic sampling of the *T. semitaeniatus* complex to explore migration patterns, and the dispersal history to verify a possible role for the São Francisco River as a promoter of differentiation in this saxicolous group of lizards. Results show high cryptic genetic diversity, occurrence of

microendemic lineages, and a speciation history that took place during the Pliocene-Pleistocene transition. The phylogenetic and population structures are intrinsically associated with landscape rearrangements, mainly the establishment of drainage basins located to the northern and southern distribution ranges. The *T. semitaeniatus* complex preserves high genetic diversity during range expansion, possibly as a result of frequent long-distance dispersal events. Our results indicate that both the current SFR course and its paleo-courses had a main role in promoting diversification of the endemic *T. semitaeniatus* species group.

0666 Fish Systematics & Taxonomy I, Banquet Room G, Saturday 2 August 2014

Mark Westneat

University of Chicago, Chicago, IL, USA

Parrotfishes are Wrasses: Large Scale Phylogeny, Morphology, Taxonomy and Evolution of Labrid Fishes

Phylogenetics and taxonomy may or may not agree in the short term, but they should converge on agreement over the long haul. Multiple analyses of the wrasses, parrotfishes, and weed whitings (odacids) have shown that scarids and odacids are subgroups within the wrasses, and this shared evolutionary history is supported by a new analysis of 10 genes in over 300 species in this group. A new densely sampled, species-level phylogenetic hypothesis is presented for the Labridae and the genus-species composition for a new, phylogenetically informed taxonomy for this diverse assemblage is proposed. A single family Labridae is retained, containing multiple subfamilies. Beyond the DNA, anatomical characters from the skull and axial skeleton are presented that support the shared ancestry of scarids and odacids with clades of wrasses. The high-resolution, species-level topology for the Labridae is used as a framework for mapping the evolutionary diversification of function in the feeding apparatus of labrid fishes, enhancing our understanding of functional convergence in the group. Finally, the synthesis of densely sampled, species-level phylogenetic analyses of fish families is an important component of the effort to build a complete phylogeny for all percomorphs, all teleosts, all fishes.

0618 AES Ecology, Banquet Room E, Saturday 2 August 2014

Bradley Wetherbee[1], Mahmood Shivji[2], Michael Byrne[3], Guy Harvey[2], Malcolm Francis[4], Clinton Duffy[5], Warwick Lyon[4]

[1]University of Rhode Island, Kingston, RI, USA, [2]Guy Harvey Research Institute, Nova Southeastern University, Fort Lauderdale, FL, USA, [3]University of Georgia, Athens, GA, USA, [4]National Institute of Water and Atmospheric Research, Wellington, New Zealand, [5]Department of Conservation, Aukland, New Zealand

Mako Migratory Movements … mmm

Mako sharks (*Isurus oxyrinchus*) are a highly migratory, circumglobal species that occurs as bycatch in many pelagic fisheries and is also targeted by recreational fishers as a game fish in a variety of locations. Lack of information about movements, migrations and population structure has led to uncertainty about the status of mako stocks in multiple locations and raised concern about sustainability of fisheries in which mako sharks occur. Understanding of movements of mako sharks will aid in identifying migratory pathways, habitat use, potential interactions with fisheries and will clarify management jurisdictions for this international species. Satellite tracking of mako sharks in three locations, off the US East Coast, the Yucatan Peninsula and New Zealand and application of state space models are revealing characteristics of searching and transiting behavior over long distances, correlation of areas searched with environmental conditions and variable patterns in each location.

0568 Ecology & Ethology, Banquet Room F, Thursday 31 July 2014, ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Lynne Wetmore[1], Jay Rooker[2], William Heyman[3]

[1]Texas A&M University, College Station, TX, USA, [2]Texas A&M University, Galveston, TX, USA, [3]LGL Ecological Research Associates, College Station, TX, USA

Watershed Impacts on Food Web Dynamics and Trophic Productivity for Nursery-Associated Juvenile Snappers in Belize

The objectives of this study were to (a) identify the main sources of primary production supporting juvenile snappers in nurseries across the Belize continental shelf, (b) model the effects of seasonal runoff and watershed impacts (i.e. anthropogenic influence) on primary production within these nurseries, and (c) evaluate seasonal and spatial variability in the nutritional condition of snappers based on muscle lipid content. To accomplish this, juvenile snappers and primary producers were collected from inner- and outer-shelf sites across two latitudinal regions in southern Belize (north, south). All sites were sampled separately during the dry and rainy season, and $d^{13}C$ and $d^{15}N$

values of producer and snapper tissue were used to model organic matter contribution in Isosource. At both sites with limited exposure to anthropogenic runoff (north outer, south inner), food web dynamics were similar between seasons, and juvenile snappers were supported by organic matter derived from both benthic sources (seagrass/diatoms) and the water column (phytoplankton). In contrast, juvenile snappers at both sites heavily influenced by anthropogenic runoff (north inner, south outer) experienced a marked decrease in water column-based production during the rainy season, accompanied by significant rainy season decreases in muscle lipid content (i.e. condition) for all three species examined. In contrast with previous studies linking riverine discharge to increased estuarine nursery production, our results indicate that net effects of freshwater nutrient input may not be homogenous across all systems, and that coastal runoff from impacted watersheds has the potential to significantly decrease nursery productivity across the Belize continental shelf.

0577 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; ASIH STORER ICHTHYOLOGY AWARD

Lynne Wetmore[1], Jay Rooker[2], William Heyman[3]

[1]Texas A&M University, College Station, TX, USA, [2]Texas A&M University, Galveston, TX, USA, [3]LGL Ecological Research Associates, College Station, TX, USA

Otolith Stable Isotopes as a Natural Marker Quantifying Relative Contribution of Inner- and Outer-Shelf Nurseries for Juvenile Snappers in Belize

Three species of juvenile snappers (dog snapper *Lutjanus jocu*, gray snapper *L. griseus*, and schoolmaster *L. apodus*) were collected from inner-shelf and outer-shelf mangrove keys across two latitudinal regions in southern Belize in 2009 in order to evaluate the utility of otolith $d^{13}C$ and $d^{18}O$ as a marker of nursery origin. All species showed similar patterns of spatial variability in $d^{13}C$ and $d^{18}O$ that appeared to be strongly related to freshwater input and salinity within the Belize coastal lagoon. Both isotopes were both consistently enriched in snappers collected from outer-shelf keys, where freshwater influence was minimal, and $d^{18}O$ was enriched for snappers collected from the northern sampling region, where precipitation was low. Although classification success to specific study sites was varied (58-81%), discrimination to shelf position was consistently high for all species (74-92%), indicating that otolith $d^{13}C$ and $d^{18}O$ may be useful in determining relative nursery contribution from inner- and outer-shelf locations. Mixed stock analysis performed on age-4+ adult snappers collected in 2013 and matched to the 2009 juvenile baseline revealed distinct differences in nursery classification among species. For *L. griseus* and *L. apodus*, the majority of adult fishes in both regions originated from outer-shelf nurseries (North: 78%, 86%; South: 62%, 77%, respectively),

while for *L. jocu*, the majority of adults originated from the inner shelf (North: 91%; South: 100%). These results indicate that utilization of juvenile nursery habitat may vary markedly even among congeners, and that cross-shelf population connectivity may be extremely high for some species (e.g. *L. jocu*).

0641 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014

Lindsay White, Mark Meade

Jacksonville State University, Jacksonville, AL, USA

Effect of Elevated Temperature on Metabolic Physiology of Endemic Alabama Fishes and an Exotic

In recent years, the Asiatic weatherfish, *Misgurnus anguillicaudatus*, has been observed inhabiting springs and streams in the Choccolocco watershed in Northeast Alabama. The weatherfish is exotic which raises concern for possible biotic and abiotic competition against sensitive endemics like the Coldwater darter, *Etheostoma ditrema*, and the Banded Pygmy sunfish, *Elassoma zonatum*. In this study we compared the effects of increasing temperature on the physiology of weatherfish and several endemic spring species to determine potential abiotic competitive advantages of the weatherfish. Intermittent-flow respirometry was used to determine oxygen consumption rates (MO_2) in fishes at 15, 20, and 25ºC. Temperatures were chosen to reflect mean temperature variations in Choccolocco Creek and surrounding tributaries. Once collected, fish were acclimatized to lab conditions followed by acclimation to experimental temperatures. Oxygen consumption rates for fishes were used to determine mean metabolic rates at the various temperatures. Oxygen consumption rates for weatherfish did not significantly increase from 20 to 25ºC (mean 133.4±15.4, and 166.8±26.8 mg O_2/kg*hr, respectively). Oxygen consumption rates for Coldwater darters from 20 to 25ºC (mean 605.4±35.7, and 1294.1±86 mg O_2/kg*hr, respectively) and Banded pygmy sunfish from 15 to 20ºC (mean 978.8±63.6 and 1976.0±114 mg O_2/kg*hr, respectively) showed significant increase. Higher oxygen consumption rate in spring species, as well as highly variable consumption rates, suggest elevate temperature were stressful to the animals. This data suggests that weatherfish can tolerate a wider range of temperatures than observed in spring sites.

0636 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Mary White[1], Mark Merchant[2]

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Complement Component 3 (C3) and the Innate Immune Response of Crocodilians

Crocodilians are commonly exposed to pathogens due to injury, and yet they rarely display consequences of these exposures. The serum complement system has been shown to be an important part of the immune response in crocodilians and may be integral to their resistance to pathogens. Physiological experiments have supported antibacterial and/or antiviral activity of the complement system in alligators, crocodiles, and caimans. Complement C3 is a major component of the innate immune system and is encoded by a single gene in mammals. Some teleost fish, however, have multiple C3 genes. No other species has been shown to have more than one C3 gene, although elapid snakes have a very closely related protein known as cobra venom factor. In light of the importance of the complement system to crocodilians, we have used genomic analysis to investigate complement C3 in these animals. We compare the crocodilian C3 genes with homologues from fish, amphibians, birds, turtles, snakes and mammals.

0682 Conservation, Banquet Room F, Friday 1 August; ASIH STOYE AWARD CONSERVATION

A. Brigid Wieman[1], Peter Berendzen[2], Mark Myers[2]

[1]University of Arkansas, Fayetteville, AR, USA, [2]University of Northern Iowa, Cedar Falls, IA, USA

Demographic Parameters and Conservation Units for Longnose Dace, *Rhinichthys cataractae*, in Northeast Iowa from Ecological and Genetic Perspectives

A pressing issue in conservation is to determine if present day demographic and population genetic patterns are the result of recent anthropogenic impacts or of historical factors such as geologic history. *Rhinichthys cataracatae*, the longnose dace, is a fish species of greatest conservation need listed in the Iowa Wildlife Action Plan. Within Iowa, the distribution of longnose dace is primarily isolated to four drainages in the northeastern portion of the state. This distribution largely coincides with the Paleozoic plateau landform region which was not glaciated during the last glacial maximum. The aim of this study was to use ecological, genetic and GIS data to elucidate the demographic patterns of this species and the environmental factors impacting its

distribution and population structure in Iowa. Multiple sites within each of the four drainages were sampled for habitat and genetic data. Landscape level variables were obtained and evaluated with GIS techniques and an ecological niche model (ENM) was constructed with these data to predict suitable habitat and environmental variables influencing suitability of habitat for the longnose dace. Both statistical analyses of habitat data and ENM suggest that geologic factors (e.g., geologic history, depth to bedrock, in-stream substrate type) play a key role in determining the distribution and abundance of *R. cataractae* in Iowa. These data along with preliminary results of population genetic analyses will be presented. Pending genetic results, conservation strategies should focus on preserving current habitat in the region as a whole.

0268 HL Lizard and Tuatara Reproduction Symposium, Banquet Room H, Saturday 2 August 2014

John Wiens

University of Arizona, Tucson, Arizona, USA

Phylogeny of Lizard Families: Resolving Relationships, Overcoming Controversy

I will summarize the current state of knowledge of higher-level lizard phylogeny, focusing on relationships among extant families. Despite recent suggestions that lizard phylogeny is unresolved due to conflicts between molecular and morphological data, the phylogeny of extant lizard families is actually becoming increasingly well resolved and well supported. First, simply pointing out differences between molecular and morphological trees does not help us resolve phylogeny. Instead, the best way to resolve these conflicts is through combined analysis and identification of misleading signals. I will argue that combined analyses of large-scale molecular and morphological datasets clearly support the estimate of higher-level phylogeny from molecular datasets (i.e. placing iguanians with snakes and anguimorphs), and that there is strongly misleading signal that dominates the morphological datasets (i.e. placing most burrowing, limb-reduced squamates in a clade, contrary to both molecular results and traditional morphology-based classifications and phylogenetic hypotheses). I will then review our current knowledge of higher-level squamate phylogeny, emphasizing those aspects that are now agreed upon by large-scale datasets, and those aspects that are still uncertain. I will also discuss new results that should help resolve many of the remaining controversies and uncertain relationships.

0605 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR CONSERVATION & MANAGEMENT

Kristoffer Wild[1], Corey Osborn[1], Christopher A.F Howey[2], C.M Gienger[1]

[1]*Austin Peay State University, Clarksville, TN, USA,* [2]*The Pennsylvania State University, University Park, PA, USA*

The Impacts of Prescribed Fire on Eastern Fence Lizards

Fire disturbance plays a key role in maintaining biodiversity in forest communities in the southeast, and fire is an essential management technique used to help maintain the persistence of oak-hickory savanna prairie at Land-Between-the-Lakes National Recreation Area (LBL). The fence lizard (*Sceloporus undulatus*) is a sexually dimorphic forest lizard that is relatively common throughout LBL, which makes it a good study organism for understanding the effects of prescribed fire on lizard ecology. Our objective is to quantify the effect of burned landscapes on 1) locomotor performance (maximum sprint speed), 2) body condition, and 3) ventral patch size. Locomotion is essential for survival (to escape predation, find food), and slower individuals may have lower survivorship. With burned landscapes being more open, predation intensity may be higher. Body condition is a surrogate for estimating the overall health of an organism, and ventral patch size and coloration can relay this fitness information to a female; and thus, relate to reproductive potential. Combined, these three variables will offer an opportunity to help understand how *S. undulatus* fitness is influenced by fire altered habitats. Our results will provide valuable insight into the effects of prescribed fire on various traits of *S. undulatus*.

0589 Ecology and Ethology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD ECOLOGY AND ETHOLOGY

Laura Jay Williams, Stephen Szedlmayer

Auburn University, Fairhope, AL, USA

Fishery Independent Estimates of Red Snapper, *Lutjanus campechanus*, Mortality Using Ultrasonic Telemetry in the Northern Gulf of Mexico

Red snapper, *Lutjanus campechanus*, support important commercial and recreational fisheries in the Gulf of Mexico. In recent years, extensive management efforts have been undertaken to protect the red snapper population for future generations. One life history parameter that has been particularly difficult to estimate yet critical for proper management is mortality (*i.e.* fishing and natural). In the present study, we used acoustic telemetry, VR2W Positioning System (VPS, Vemco Ltd, Nova Scotia) to examine the fine-scale movements (~1 m accuracy) and mortality of red snapper on unpublished

artificial reef sites in the northern Gulf of Mexico. We used telemetry detection data to estimate fishing mortality rates of red snapper independent of fisher reported recaptures in 2012, 2013, and 2014. In 2012, a high instantaneous mortality rate of the transmitter tagged red snapper (n = 14) was observed (Z = 0.57). During the recreational fishing season of the 7 fish were caught. Anglers reported 5 fish and 2 fisher captures were identified based on VPS data but not reported. In 2013, additional red snapper were tagged with transmitters (n = 36). A lower instantaneous mortality rate was observed (Z = 0.15) with 4 fish reported by anglers and 1 fish was identified as caught using the VPS data but not reported. In 2014, the recreational red snapper fishing season will begin in June and is projected to last a maximum of 44 days. We will continue to monitor the movements and mortality of tagged fish (n = 30) through this fishing season.

0216 Ich & Herp Physiology, Banquet Room I, Saturday 2 August 2014

Amanda Williard[1], Leigh Anne Harden[2], Stephanie Chavez[1]

[1]University of North Carolina Wilmington, Wilmington, NC, USA, [2]Davidson College, Davidson, NC, USA

Effects of Temperature on Metabolism and Osmotic Balance in the Estuarine Diamondback Terrapin

The diamondback terrapin (*Malaclemys terrapin*) is the only North American turtle entirely restricted in distribution to estuarine habitats. Populations of this unique turtle have experienced a decline in numbers over the past several decades, and terrapins are currently listed as a Species of Special Concern throughout their range. An understanding of the environmental factors that affect the physiology and ecology of this species is essential for crafting sound management plans. We conducted a series of laboratory experiments to investigate the effects of temperature on metabolism and osmotic balance of terrapins. Responses to an acute increase in salinity from 12 ppt to 35 ppt were measured in terrapins acclimated to either 10°C or 25°C. An acute increase in salinity did not have a significant effect on blood inorganic ion concentration at either 10°C or 25°C. For terrapins acclimated to 10°C (N=6), the average oxygen consumption (VO_2) after 3 days exposure to 35 ppt (0.008 $mlO_2\ g^{-1}\ h^{-1}$) was approximately 20% lower than VO_2 at 12 ppt (0.010 $mlO_2\ g^{-1}\ h^{-1}$), although this difference was not statistically significant. In contrast, VO_2 after 3 days exposure to 35 ppt (0.132 $mlO_2\ g^{-1}\ h^{-1}$) was significantly higher than VO_2 at 12 ppt (0.113 $mlO_2\ g^{-1}\ h^{-1}$) for turtles acclimated to 25°C (N=5). Preliminary results suggest that physiological mechanisms of salt excretion (i.e. active secretion via lachrymal salt glands) may be activated during high salinity exposure at warm temperatures, but that behavioral means of maintaining water balance may prevail at cooler temperatures.

0033 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Philip Willink

Shedd Aquarium, Chicago, IL, USA

Mottled Sculpin *Cottus bairdii* in Illinois; A Motley Tale of Subspecies, Invasive Species, Habitat Degradation, and Climate Change

There has been discussion that Mottled Sculpin *Cottus bairdii* in the Great Lakes can be divided into two subspecies, the Northern Mottled Sculpin *Cottus bairdii bairdii* and the Great Lakes Mottled Sculpin *Cottus bairdii kumlieni*. The distinction is based on lateral pores and caudal peduncle proportions, but there is not 100% agreement among ichthyologists concerning the validity of this taxonomy. In Illinois, the Great Lakes Mottled Sculpin is restricted to nearshore Lake Michigan. The Northern Mottled Sculpin is found in the Des Plaines and Fox drainages. Mottled Sculpin have not been found along the Illinois shoreline of Lake Michigan for over a decade, and it is believed that the invasive Round Goby *Neogobius melanostomus* is responsible for the dramatic decline. The Des Plaines River population is declining due to habitat loss. The Fox River population is stable, but climate modeling is predicting declines in the future. Regardless of one's opinions about subspecies, Mottled Sculpin management in Illinois requires the recognition of different Operational Taxonomic Units and the distinct threats they face.

0722 General Herpetology, Meeting Room 4 & 5, Friday 1 August 2014

John Willson[1], Michael Dorcas[2]

[1]University of Arkansas, Fayetteville, AR, USA, [2]Davdison College, Davidson, NC, USA

Effects of Python-Associated Mammal Declines on Nesting Success of Turtles in South Florida

The Burmese python (*Python molurus bivittatus*) is firmly established as an invasive species over a large portion of southern Florida. Pythons have apparently caused severe declines in several species of once common mammals (e.g., raccoons, opossums, rabbits, bobcats) but the overall impacts they will have on ecosystems remain unknown. We evaluated potential indirect effects of pythons on nesting success of freshwater turtles by monitoring artificial turtle nests (N=183) at multiple sites (N=13) spanning the spatial gradient of the python invasion. Specifically, we selected sites that fell into three treatment groups: 1) 'core' areas where pythons have been established the longest

(Southern Everglades); 2) 'peripheral' areas where pythons have been documented more recently (Big Cypress and Key Largo); and 3) 'extralimital' areas where established python populations have not yet been confirmed. Game camera records from artificial nests confirmed that the spatial pattern of mammal abundance is inversely correlated with spatial expansion of the invasive python population in South Florida. After excluding crow predation, nest predation rates at core sites were low (average score = 1.5). Predation rates were higher at peripheral sites (average score = 2.3) and very high at extralimital sites (average score = 4.6). Our results suggest that python-associated mammal declines in South Florida are having a positive effect on turtle nesting. Our study represents the first documentation of indirect effects of pythons on species that are not typically considered prey and suggests that loss or decline of mid-sized mammals will result in changes to the overall Everglades ecosystem.

0501 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Mark Wilson[1], Terry Grande[2]

[1]University of Alberta, Edmonton, Alberta, Canada, [2]Loyola University Chicago, Chicago, Illinois, USA

What's New With Old Fish?

Since the last edition of Joe Nelson's *Fishes of the World*, many new fossil discoveries have changed our understanding of fish evolution. Here we review the more far-reaching advances of recent years. The new discoveries concern agnathans, placoderms, acanthodians, chondrichthyans, and osteichthyans. Agnathan discoveries show how dermal bones grew in Heterostraci and Osteostraci. Fossil evidence again casts doubt on the hypothesis that conodonts are vertebrates. Placoderms are no longer universally thought to be monophyletic, but are suggested to be paraphyletic stem gnathostomes. Acanthodians show how teeth could have evolved from scales near the mouth, and suggest revised homologies of fins. Acanthodians are no longer considered monophyletic; although some are still grouped with osteichthyans, others are grouped with chondrichthyans, and still others may be stem eugnathostomes. The explosion of fossil shark taxa continues, including survivors of the Permo-Triassic extinction and Cretaceous examples of large lamniforms with near-global geographic ranges. New discoveries in China include early, primitive osteichthyans and sarcopterygians. The diversity of Mesozoic halecomorphs has increased greatly, as has our understanding of stem teleosts. Fossil studies had suggested that elopmorphs, not osteoglossomorphs, are sister to other crown teleosts, and molecular studies now support that hypothesis. Much has been learned about early ostariophysans, especially gonorynchiforms, and early clupeomorphs, especially ellimmichthyiforms. The oldest known acanthomorphs are increasingly diverse, and all of the most basal forms are of mid-Cretaceous age. The new

data revolutionize the way we think about fish evolution, and are of particular interest to researchers needing to accurately date evolutionary events.

0427 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Thomas Wilson[1], Paul-Erik Bakland[1], Nyssa Hunt[1], Simone Madsen[1], Tabitha Wilson[2], Team Salamander[1]

[1]University of Tennessee at Chattanooga, Chattanooga, TN, USA, [2]Battle Academy, Chattanooga, TN, USA

Nest Site Selection by Marbled Salamanders (*Ambystoma opacum*) in an Isolated Wetland in Southeastern Tennessee: In the Shadows of a Brownfield at the Dawn of Gig City

Amphibians have complex life cycles and most require unrestricted access to both upland and wetland habitats. A critical component of amphibian life history is nest site selection, and this can be fairly dynamic at a variety of spatial and temporal scales. We examined biophysical aspects of nest site selection of Marbled Salamanders (*Ambystoma opacum*) at a wetland adjacent to an industrial development in southeastern Tennessee. We conducted nest site surveys using timed area constrained searches over six days from 10/15/13 to 10/31/13. We targeted all representative habitats in the wetland, yet most nests were detected in the vicinity of the wetland-upland transition zone. We generated random points based on each nest as a means to compare the biophysical conditions in areas where nests were detected versus undetected. We recorded data for 40 nests over a suite of biophysical variables that included, water depth, distance from nearest water, distance from hydrologic boundary, percent cover, soil type, elevation, and aspect. After we described the physical nest site and surrounding landscape, we constructed a predictive model using regression and Akaike Information Criterion to rank and evaluate the associations between nest sites and biophysical features. Marbled Salamanders selected nest sites that had hydric soils with abundant cover but not ranging too far from standing water. Our data suggest that Marbled Salamanders select sites in a non-random fashion, and did not nest in all available microhabitats. Stakeholders can use this information that incorporates hydrology and vegetation structure to make informed decisions that benefit this species.

0421 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Thomas Wilson, Jose Barbosa, Ethan Carver, Brad Reynolds, Team Salamander

University of Tennessee at Chattanooga, Chattanooga, TN, USA

An Assessment of *Batrachochytrium dendrobatidis* Infection in Two Species of Ranid Frogs on a Former United States Department of Defense (DoD) Installation in Southeastern Tennessee

Chytridiomycosis is a leading cause of amphibian declines around the world, and once it becomes established in the landscape it cannot be eradicated. Therefore, studies investigating its prevalence, epidemiology and long-term impacts are warranted. During the fall 2012, we sampled 53 Bull Frogs (*Lithobates catesbeianus*) and 26 Green Frogs (*L. clamitans*) from an isolated wetland (LT6) on a former DoD installation in southeastern Tennessee. LT6 ranges in size from 2-5 hectares depending on precipitation, and is encompassed by a mix of residential, industrial and multiuse green space areas. We followed biosecurity protocols that were adapted from the literature in an effort to minimize cross contamination of the samples. All animals were captured by hand at the periphery of the wetland. Using a PCR assay adapted from Boyle et al. (2004), we detected the prevalence of Bd in both ranid species. Specifically, Bd was detected in 5.66% and 61.5% of the Bullfrog and Green Frog samples, respectively. Although Green Frogs had higher relative intensities of infection when compared to Bullfrogs, all animals sampled were outwardly healthy and, so far, there has been no evidence of unusually high rates of mortality that would be associated with a Bd epidemic. Therefore, further investigation is warranted to better determine if Bd is endemic and widespread spread across the amphibian community at LT6.

0669 Herp Conservation III, Banquet Room J, Saturday 2 August 2014

Thomas Wilson[1], Andy Carroll[1], Joe Simpson[1], Christopher Manis[2], Team Salamander[1]

[1]University of Tennessee at Chattanooga, Chattanooga, TN, USA, [2]Dalton Public Schools, Dalton, GA, USA

Amphibians, Wetlands and the Faces of Development: Who gets the Gig?

Amphibians are underrepresented in habitat alteration studies even though habitat alteration is cited as the leading cause for declines. In 2004, we began assessing land use change and other growing ecological problems by studying an amphibian community mostly consisting of mole salamanders (*Ambystoma maculatum* and *A. opacum*) in a wetland complex adjacent to a brownfield site in southeastern Tennessee. We collected data on life history, community structure, and persistence by using traditional methods

for measuring and monitoring populations of amphibians. We integrated these data into a geodatabase using decision support and geo-processing tools on a gig speed fiber optic network. The end product is a "geotrellis" that can be used to map and predict corridor suitability for a variety of taxa. The implementation of geospatial tools is not without precedent and can be advantageous when making land use decisions. Our study is the first to use green-printing, circuit theory, corridor models, and life-history data to characterize and map habitat connectivity for two syntopic species of mole salamanders in southeastern Tennessee. Our data suggest that the stability of the current community may be imperiled and that future species will be at risk given the current rate of habitat alteration. We have communicated our research findings to elected officials, regional planning agencies, governing bodies, and developers at large in hopes that they will use this information to make sound environmental decisions. In closing, we have had some successes in minimizing ecological impacts but we have had some setbacks too.

0560 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Thomas Wilson[1], Joseph Simpson[1], Brad Reynolds[1], Paul-Erik Bakland[1], Nyssa Hunt[1], Simone Madsen[4], Robert Altonen[4], Brittany Bird[4], Maria Cooksey[4], Wes Grigsby[4], Micah Taylor[4], Mark Dillard[1], Mark Wisdom[4], Ardyce Mercier[1], George Szarka[1], Jeremy Hooper[1], Christopher Manis[2], Tabitha Wilson[3], Team Salamander[4]

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Team Salamander and Its Evolution in Becoming the Longest Running Group Studies Initiative at the University of Tennessee at Chattanooga (UTC)

Since 2004, over 350 students have participated in the longest running group studies project at UTC, entitled "Team Salamander". Most curriculums are based on predetermined benchmarks that have to be met and the Team Salamander experience is no different. However, it is more than just a traditional syllabus based lecture/laboratory course. Rather, it is a hands-on-cooperative experience that forces students to become independent and forward-thinkers. Ultimately, we strive for them to become natural science practitioners and informed citizens, and several have followed the path to graduate or professional school. Team Salamander gets recharged and reinforced every time a former member becomes a medical doctor, lawyer, pharmacist, engineer, geologist, school teacher, environmental consultant or even an academic. No matter their individual path, the team has collectively contributed to UTC and Chattanooga. Specifically, they have contributed to the research and education efforts at

UTC, Tennessee River Gorge Trust, City of Chattanooga, Hamilton County Public Schools, Hamilton County Parks and Recreation, Thrive 2055, Tennessee Aquarium, Challenger Center, Chattanooga Arboretum and Nature Center, and others. The team has organized wetland clean-ups, restorations and has been instrumental in starting a new UTC sanctioned club, entitled, "Wildlife-Zoology Club". They have also contributed materials to a new UTC course, entitled, "Amphibian Conservation", and have shared educational materials with interested parties using multimedia and the internet. The list goes on, but their greatest contribution has been educating others about the science and conservation issues involving amphibians and reptiles in the Southern Appalachians and in their own backyard.

0263 Fish Ecology II, Banquet Room F, Saturday 2 August 2014

Kirk Winemiller, Chouly Ou

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

Fishes and Food Webs in the Mekong River and Its Tributaries: A Preview of Life after New Dams Are Constructed

The Mekong River ranks among the world's largest and biologically diverse rivers, and has tremendous cultural and economic importance for Southeast Asia. The Mekong's fishes currently are threatened by overexploitation and hydropower development, and knowledge of ecosystem and fish ecology will be essential for management of impacts. We investigated fish assemblages and food web structure of the Mekong and four of its major tributaries in Cambodia. Stable isotope ratios of carbon and nitrogen from tissues of fishes and other food web components were analyzed to estimate primary production sources supporting stocks during wet and dry seasons, and to examine vertical trophic positions. Food web structure in all four rivers revealed major seasonal shifts. Seston and benthic algae were the most important production sources supporting fish biomass during the dry season, and riparian plants were more important during the wet season when connectivity between the river and floodplains is greatest. Species restricted to floodplain habitats revealed low seasonal variation in isotopic space. In the Sesan River, which already is subjected to strong flow regulation, seston and benthic algae assumed even greater importance as sources supporting fishes during the dry season. Large migratory fishes were notably absent from the Sesan. Relationships between body size and trophic position contradicted the popular concept of fishing down food webs, with heavily exploited fish stocks representing diverse trophic guilds. Preparations are underway for construction of the Lower Sesan 2 Dam, which will impact fish diversity and fishery production in rivers throughout the region.

0349 Conservation, Banquet Room F, Friday 1 August; ASIH STOYE AWARD CONSERVATION

Megan Winzeler[1], Cara Love[1], David Scott[1], Schyler Nunziata[2], Stacey Lance[1]

[1]Savannah River Ecology Lab, University of Georgia, Aiken, SC, USA, [2]Department of Biology, University of Kentucky, Lexington, KY, USA

Prevalence of Two Amphibian Diseases at Contaminated Wetlands on the Savannah River Site, SC

A variety of natural and anthropogenic stressors have been hypothesized to increase the emergence of disease in amphibians by increasing host susceptibility. On the Savannah River Site (SRS) multiple, heavy metal contaminants are mitigated through retention and natural wetlands used by native amphibians for breeding and habitat. However, few studies to date have examined the linkages between metal contaminants and presence of disease in amphibians, and this knowledge gap impedes our understanding of disease transmission in disturbed systems. We opportunistically sampled 22 species of adult and larval amphibians on the SRS from 3 contaminated and 7 reference wetlands for a total of 998 samples tested for both *Batrachochytrium dendrobatidis* (Bd) and ranavirus using quantitative PCR. We found a 15% site-wide prevalence of Bd and significantly higher prevalence at contaminated wetlands relative to reference wetlands. For Bd, there is a 70% greater chance of infections in contaminated sites. Site-wide ranavirus prevalence is significantly higher across wetlands and species. Importantly, co-infection was also common—something that has received almost no attention in amphibian disease studies. Our results suggest that sublethal infection of both Bd and ranavirus in contaminated and reference wetlands is more common than currently believed.

0250 Herp Genetics, Banquet Room I, Sunday 3 August 2014

Jared Wood[1], Todd Campbell[2], Robert Page[3]

[1]University of Louisville, Kentucky, USA, [2]University of Tampa, Florida, USA, [3]College of St. Benedict & St. John's University, Minnesota, USA

Population Genetic Analysis Enables Insights into the Introduction Histories of Two Florida Invasives: The Nile Monitor (*Varanus niloticus*) and the Argentine Black & White Tegu (*Tupinambis merianae*)

Florida is currently home to the most introduced species of herpetofauna in the United States. Two of these species, the Nile monitor (*Varanus niloticus*) and Argentine black and white tegu (*Tupinambis merianae*), are believed to have been introduced to Florida through the exotic pet trade in the early 1990s and 2000s, respectively. Both species have

established populations on Florida's southern Gulf and Atlantic Coasts and are generalist predators that pose direct threats to sensitive coastal and Everglades ecosystems. At present, the histories of these species' introductions to the Florida peninsula are largely unknown, and it is unclear whether there is movement between populations in different regions of the state. To address these issues, we generated data on 17 microsatellite loci isolated from *V. niloticus* and 14 loci isolated from *T. merianae*. These data show that all of the populations sampled (*V. niloticus*: Cape Coral, West Palm Beach, and Homestead Air Reserve Base; *T. merianae*: Riverview and Florida City) are well differentiated, suggesting that there is no gene flow between populations for either species. As expected for recently introduced invasives, all populations from both species have limited genetic diversity and exhibit signatures of recent founder effects. Collectively, these results suggest that *V. niloticus* and *T. merianae* have both been introduced to the Florida peninsula on more than one occasion and that population establishment from a limited number of founding individuals has occurred for both species more than once.

0625 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Jeremy Wright

New York State Museum, Albany, New York, USA

A New Paedomorphic Genus and Species of Catfish from Lake Tanganyika (Siluriformes: Clariidae)

The ichthyofauna of Lake Tanganyika is marked by extraordinarily high levels of morphological and taxonomic diversity, including no fewer than six previously recognized endemic catfish lineages. The examination of material representing one of these lineages has revealed the presence of an additional genus of clariid catfish in Lake Tanganyika. This genus is represented by a single species, which is distinguished from all other clariids by its complete lack of an infraorbital series, the presence of multiple osseus connections between the swim bladder capsules and elements of the neurocranium, the absence of an ethmoid notch, the presence of a very large, egg-shaped occipital fontanelle, and the extension of the lower lip beyond the margin of the upper jaw. A combination of additional external and molecular characters serves to further distinguish this taxon from all currently recognized clariid species. Phylogenetic analysis of mitochondrial (cyt b) and nuclear (18S-ITS1-5.8S-ITS2-28S) sequence data supports the creation of a new genus for this species, as it appears to represent an independent, monophyletic lineage within the family Clariidae.

0732 Herp Behavior II, Banquet Room I, Sunday 3 August 2014

Melissa Wright[1], Luciano Chiaverano[2], Brenden Holland[2]

[1]Department of Biology, University of Hawaii, Honolulu, HI, USA, [2]Pacific Biosciences Research Center, Center for Conservation Research & Training, University of Hawaii, Honolulu, HI, USA

Role of Social Interaction and Habitat Suitability in Movement Behavior of Jackson's Chameleons in Hawaii

The Jackson's chameleon (*Trioceros jacksonii xantholophus*) is a social, arboreal east African lizard that has become established in the forests of a number of Hawaiian Islands where they have been shown to prey on native taxa. In this study, we used radio-telemetry to assess movement behavior of chameleons under varying habitat suitability, hypothesizing that in an unsuitable habitat chameleons will: 1) move longer daily distances, 2) follow straighter paths, 3) continuously move away from release point, and 4) cover larger areas than in suitable habitats. After 21 days, home range, daily distance traveled, total cumulative distance, and total net displacement did not vary significantly among the three habitats. However, chameleons showed a tendency to decrease daily distances traveled and increase path tortuosity under suitable conditions, while the opposite pattern was displayed under unsuitable conditions. This study demonstrates that, in general, chameleons traveled short distances following non-directional paths, reflecting a sedentary life history. Movement behavior exhibited by small males and breeding pairs suggests that social cues may play an important role in long-distance dispersal. As a second phase of this study, movement behavior under varying social scenarios will be assessed to determine the effects of age and gender on dispersal and home range overlap. Results will provide important information to guide management decisions concerning this invasive species in Hawaii, but may also reveal insights into the social behaviors of this complex and intriguing reptilian family.

0091 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Thursday 31 July 2014

Molly Wright[1], Sara Brown[1], Steven Sallinas[1], Justin Saiz[1], Rick McNeil[2], Edward Martinez[1], Jesus Rivas[1]

[1]New Mexico Highland University, Las Vegas, NM, USA, [2]New Mexico Forest and Watershed Restoration, Las Vegas, NM, USA

The Impacts of Wildfire on the Population Dynamics of Amphibians in Northern New Mexico and Southern Colorado

Climate models suggest that the planet will become hotter and drier, especially in arid regions. Therefore, natural disturbance cycles such as forest fires have been altered across ecosystems, including the American Southwest. Recent wildfires in the southwest have burned more severely, and at larger spatial extent, which has a profound effect on wildlife including amphibians and their habitat. One such fire was the Track Fire, which burned 11,247 ha in 2011, on the border of New Mexico and Colorado. The purpose of this study is to understand the impacts of the Track Fire on amphibian populations within northeastern NM and southern CO. We identified two research sites, one unburned (Control) and one burned (Treatment). At each site we selected similar reaches of river (500m long) for surveys conducted in 2013. We posed the following question: How did the Track Fire impact amphibian populations and their habitat? We studied presence and abundance of amphibians using minnow traps, day and night visual surveys, and frog call surveys. We also monitored water quality parameters and changes in vegetation by comparing the treatment to the control. Our results suggest the burned areas have far fewer amphibians than the control, likely related to differences found in several vegetation parameters and TOC at both sites. Our work indicates that amphibians may take several years to recover after a severe wildfire. Under climate change predictions, wildfire is expected to increase in frequency and severity and could be expected to significantly influence the future distribution of amphibian populations.

0590 Climate Change & Disease, Meeting Room 4 & 5, Friday 1 August 2014

Vanessa Wuerthner, Jason Hoverman

Purdue University, West Lafayette, IN, USA

Prior Exposure to the Trematode *Echinostoma trivolvis* Increases Ranavirus Infection Prevalence in Gray Tree Frogs (*Hyla versicolor*)

Epidemiological research has traditionally focused on interactions between a single host and pathogen, yet growing evidence suggests that coinfections can alter disease

patterns. A central question concerns how interactions between co-occurring pathogens affect disease severity and pathogen transmission. We explored whether prior exposure to the trematode *Echinostoma trivolvis* increased the susceptibility of larval gray tree frogs (*Hyla versicolor*) to ranavirus infection (frog virus 3, FV3). We conducted a 3 x 2 factorial experiment with three trematode treatments (0, 20, or 40 parasites) and two virus treatments (0 or 10^6 PFUs) for a total of 120 experimental units. Tadpoles were individually exposed to the trematode treatments for four days prior to virus exposure. After 24 days, tadpoles were euthanized and trematode load and viral infection were quantified. Trematode load increased with parasite dosage; an average of 4 and 14 trematodes encysted in the 20 and 40 parasite treatments, respectively. Interestingly, ranavirus infection prevalence was influenced by prior exposure to trematodes. In the absence of trematodes, ranavirus infection prevalence was 10%. Infection prevalence increased to 35% and 45% within the 20 and 40 trematode treatments respectively, suggesting that prior exposure to trematodes can increase susceptibility to ranavirus infection. Because *E. trivolvis* and ranaviruses target the amphibian kidney, it is possible that damage from encysting trematodes facilitated ranavirus infection. Alternatively, this effect may be mediated by immune system trade-offs; responses to macroparasites reduce the host's ability to fight microparasites. Collectively, our results underscore the need to explore the implications of coinfection for amphibians.

0576 AES Genetics, Genomics, & Systematics, Banquet Room E, Saturday 2 August 2014

Jennifer Wyffels[1], Benjamin King[2], James Vincent[3], Chuming Chen[1], Shawn Polson[1], Cathy Wu[1]

[1]University of Delaware, Newark, DE, USA, [2]Mount Desert Island Biological Laboratory, Salisbury Cove, ME, USA, [3]University of Vermont, Burlington, VT, USA

Transcriptome Sequencing, *De novo* Assembly, and Annotation of Three Chondrichthyan Fishes, *Leucoraja erinacea*, *Scyliorhinus canicula*, and *Callorhinchus milii*

The little skate genome project is an initiative that seeks to characterize the complete genome of the little skate, *Leucoraja erinacea*. The project includes whole transcriptome shotgun sequencing to characterize stage-specific gene expression and alternative gene isoforms that serve to guide genome annotation efforts. We have sequenced, assembled and annotated the embryonic transcriptome of the skate using three individual stage 29 embryos with paired-end high-throughput RNA sequencing and compared it to embryonic transcriptomes from a chimera (*Callorhinchus milii*) and a shark (*Scyliorhinus canicula*). *De novo* assemblies of Illumina sequence data were generated using Trinity software and subsequently annotated using the Trinotate pipeline. Assembly quality

was evaluated using Core Eukaryotic Genes Mapping Approach (CEGMA) and resulted in 90.3-99.2% coverage. Annotation of the transcriptomes includes Gene Ontology categories, protein domains, and pathway and ortholog mapping. Skate, shark and chimera assemblies shared 64.6% (5,492/8,494) of orthologous gene groups as defined by OrthoDB (http://orthodb.org). Comparison of skate genes with other organisms showed 11,102 predicted orthologs are shared with humans and 8,699 are shared with lamprey (*Petromyzon marinus*). Biological findings include transcripts for ornithine-urea cycle enzymes in all three species at an embryonic stage that coincides temporally with eclosion. The immune system, at this point in time, does not express transcripts for cytokines IL-2, 5, and 7 whose role in more recently evolved vertebrates includes hematopoiesis and lymphocyte development. Further development of SkateBase (http://skatebase.org) includes the infrastructure necessary to disseminate these newly acquired and annotated sequences.

0760 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Daniel B. Wylie[1], Matthew C. Allender[2], Sarah J. Wylie[1], Michael J. Dreslik[1], Christopher A. Phillips[1]

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

A Test of Non-Invasive Detection Methods for Snake Fungal Disease

The emerging fungal pathogen, *Ophidiomyces ophidiicola,* (snake fungal disease; SFD) has been recently reported in wild pit viper populations from at least ten states. Specifically, SFD has affected two species of conservation concern, the Timber Rattlesnakes *Crotalus horridus* and and Eastern Massasauga *Sistrurus catenatus*. Symptoms reported for SFD include scabs or crusty scales, subcutaneous nodules, cloudiness of the eyes, skin ulcers, lesions, and swelling of the face. Although biopsies of infected tissue are the preferred diagnostic technique, they are not practical given conservation, logistical, and safety concerns. Non-invasive methods to detect SFD in wild individuals have produced inconsistent results. Therefore, to determine the most effective method for detecting SFD in the field, we performed a laboratory challenge study in which we infected the Cottonmouth (*Agkistrodon piscivorous*), with a cultured strain of *O. ophidiicola*. Our goal was to assess efficacy of two sampling methods: cotton tipped swabs and saline flushes of the loreal pits. To evaluate each technique, we sampled each pit using cotton swabs and saline flushes twice weekly for a period of 120 days. Only cotton-tipped swabs were found to be an effective means of DNA collection. Gross necropsy and histopathology were performed on all individuals following the study to confirm infection and identify internal effects of SFD.

0696 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Sarah Wylie, Daniel Wylie, Michael Dreslik, Christopher Phillips

Illinois Natural History Survey, Champaign, IL, USA

Translocation as a Conservation Tool for an Endangered Rattlesnake in Illinois

Habitat loss and degradation are the primary cause of global declines in reptile populations, thus this threat is of immediate conservation concern. The severe decline of the Eastern Massasauga (*Sistrurus catenatus*) in Illinois was initiated by the conversion of prairie habitats to agriculture and subsequent small population dynamics. As a result of this drastic loss of habitat, populations became widely isolated in either an agricultural or urbanized matrix with little potential for natural dispersal. Although habitat restoration projects are ongoing, the high degree of fragmentation precludes dispersal into even nearby patches. Now reduced to only one extant population in Illinois, the recovery of this endangered rattlesnake can only be accomplished by translocating individuals to suitable habitat areas. Because translocation programs have low success rates using adult snakes, we tested their feasibility using captive born naïve neonates. Our goals were to determine if control (released with mother at natal site) and translocated (released without mother at non-natal site) neonates exhibited differences in survival, spatial ecology, and behavior. To accomplish our objectives, we attached ~1 g radio-transmitters to neonates then radio-located them at least every other day from release through first over-wintering. Our results indicate that translocation of neonates may be feasible if not for high predation rates. We therefore recommend translocation as an effective tool for population augmentation, however, it would be unsuitable to take individuals from existing populations, and efforts need to be coupled with mesopredator control strategies at translocation sites.

0308 AES Morphology & Reproduction, Banquet Room E, Sunday 3 August 2014

Kara Yopak[1], Thomas Lisney[2], Shaun Collin[1]

[1]University of Western Australia, School of Animal Biology and the UWA Oceans Institute, Crawley, WA, Australia, [2]Queen's University, Department of Psychology, Kingston, ON, Canada

Wake Up and Smell the Evolution: Variation in Olfactory Bulb Size in Cartilaginous Fishes

Olfaction is a universal modality by which all animals sample chemical stimuli from their environment. In cartilaginous fishes, olfaction is critical for various survival tasks, including localizing prey, avoiding predators, and chemosensory communication with conspecifics. Little is known, however, about interspecific variation in olfactory capability in these fishes, or whether the relative importance of olfaction in relation to other sensory systems varies with regard to ecological factors. In this study, we have quantified interspecific variation in the size of the olfactory bulbs (OB), the region of the brain that receives the primary sensory projections from the olfactory nerve, in 58 species of cartilaginous fishes. Our results show that the OBs maintain a substantial level of allometric independence from the rest of the brain across this group and that variability in OB size is correlated with ecological niche. The relatively largest OBs were found in pelagic-coastal/oceanic sharks, especially migratory species such as *Carcharodon carcharias* and *Galeocerdo cuvier*. Deep-sea species also possess large OBs, suggesting a greater reliance on olfaction in habitats where vision may be compromised. In contrast, the smallest OBs were found in the majority of reef-associated species, including sharks from the family Carcharhinidae. These results suggest that there is great variability in the degree to which these fishes rely on olfactory cues. The OBs have been widely used as a neuroanatomical proxy for olfactory capability in vertebrates, and we speculate that differences in olfactory capabilities may be the result of functional rather than phylogenetic adaptations.

0168 Herp Ecology II, Banquet Room E, Sunday 3 August 2014

Megan Young, Toby Hibbitts

Biodiversity Research and Teaching Collection, Texas A&M University, College Station, TX, USA

Home Range and Movements of the Dunes Sagebrush Lizard (*Sceloporus arenicolus*) in Fragmented Habitat

The Dunes Sagebrush Lizard (*Sceloporus arenicolus*) is a habitat specialist, endemic to the Mescalero-Monahans sand dunes of eastern New Mexico and west Texas. Increasing oil and gas development in the area has resulted in direct habitat loss and fragmentation from the construction of caliche roads and well pads. In order to determine how fragmentation affects *S. arenicolus* movements and home range, we conducted radiotelemetry on 36 *S. arenicolus* in fragmented and unfragmented habitats during the summers of 2012 and 2013. We measured home range size values using three different measures, minimum convex polygon (MCP), 95% kernel density estimator (KDE), and 50% KDE, and the distance moved per day by lizards. We conducted a two-way ANOVA to assess the effects of sex and habitat type (unfragmented vs. fragmented) on each parameter. *S. arenicolus* in fragmented habitat had significantly larger MCP home ranges than *S. arenicolus* in unfragmented habitat (P=0.028). Males had significantly larger 50% KDE home ranges than females (P=0.005), but the parameter was unaffected by habitat type. Distance moved per day was affected by both sex and habitat type; males moved significantly longer distances per day than females (P=0.034) and individuals in fragmented habitat moved significantly longer distances per day than those in unfragmented habitat (P=0.017).

0510 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Banquet Room H, Friday 1 August 2014

Melissa Youngquist

Miami University, Oxford, OH, USA

Utility of Human-made Ponds for Amphibian Conservation: Effects of Land-use on Tadpole Growth and Survival

With habitat loss as the number one cause of biodiversity loss, it is imperative that we assess methods to reconcile the habitat needs of species with those of humans. Across the Midwestern United States large areas of native habitats have been lost due to conversion for human use; wetlands and wetland species in particular have suffered great losses. Human-made ponds within anthropogenic landscapes could serve as habitat for aquatic organisms. However, the effects of land-use surrounding ponds on

amphibian larval development and juvenile recruitment, and therefore population persistence, are relatively unknown. The goal of this study was to assess how land-use affects tadpole growth and survival of two species, cricket frogs (*Acris blanchardi)* and bullfrogs (*Lithobates catesbeianus).* While both species are commonly found inhabiting human-made ponds, cricket frogs prefer open canopy habitats and bullfrogs are generalists in terms of land-use. We reared tadpoles in *in-situ* enclosures in either agricultural, CRP grassland, or forested habitats. Preliminary analyses revealed high inter-pond variability and no overall habitat effects on growth and survival of either species. Furthermore, tadpoles in ponds with higher levels of phosphorous and phytoplankton also had the fastest growth. Our study suggests that with proper management, human-made ponds in anthropogenic landscapes can benefit amphibian populations and may be a useful tool for amphibian conservation.

0447 Physiology & Physiological Ecology, Banquet Room F, Friday 1 August; ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY

Jeffrey N. Zeyl, Carol E. Johnston

Auburn University, Auburn, AL, USA

Examining Amphibious Hearing in Turtles: Auditory Evoked Potentials in the Box Turtle, *Terrapene carolina* Relative to the Stinkpot, *Sternotherus odoratus*

Acoustic stimulation of the ear differs underwater versus in air due to medium differences in acoustic impedance. Auditory performance in vertebrates has repeatedly evolved to optimize detection according to the environmental medium. Turtles are a useful taxon for examining hearing evolution in response to the air-water boundary because its members are found across the aquatic-terrestrial lifestyle continuum. Despite most extant turtles being primarily aquatic, most audiograms to date have been conducted in air. Here we tested for differences in auditory sensitivity between the terrestrial box turtle, *Terrapene carolina* (Emydidae) and the fully aquatic stinkpot, *Sternotherus odoratus* (Kinosternidae). Auditory evoked potentials were collected in response to tone pips to generate threshold audiograms in air as well as with tympana submerged underwater. Sensitivities and bandwidths of both species were similar underwater and in air, but the thresholds of *T. carolina* were 9-20 dB more sensitive than *S. odoratus* in air across the entire frequency range. The results suggest an association between enhance aerial hearing and terrestrial living in turtles.

0145 Herp Conservation II, Banquet Room I, Saturday 2 August 2014

Lu Zhang[1], Andrew Kouba[1], Hongxing Zhang[2], Qijun Wang[2], Hu Zhao[2], Wei Jiang[2], Scott Willard[3]

[1]Memphis Zoo, Memphis, TN, USA, [2]Shaanxi Institute of Zoology, Xi'an, Shaanxi, China, [3]Mississippi State University, Starkville, MS, USA

Post-release Movement of Captive-reared Chinese Giant Salamanders (*Andrias davidianus*) in the Qinling Mountains, China

The Chinese giant salamander is critically endangered in the wild and reintroduction of captive-reared animals would help to augment declining wild populations. For this study, we reintroduced n = 32 juvenile salamanders (3-5 year-old) at the Heihe and Donghe rivers in the Qinling Mountains (n = 16 / river), and monitored their movement using radio transmitters from May 2013 to May 2014. Excluding those salamanders washed downstream by floods, the average home range (95PVC) was 4187.8 ± 1603.0m^2 (n = 6) at Heihe and 1829.7 ± 492.9m^2 at Donghe (n = 13). Distance from the release site to the core home range was 89.4 ± 36.2m (range = 11.9 - 197.3) at Heihe, and 86.4 ± 22.1m (range = 2.5 - 215.5) at Donghe. All salamanders moved into their later core home ranges within 3 months post-release. The salamanders' mean daily movement distance within the first 3 months was greater than that in months afterwards, both at Heihe (15.3 ± 1.0m vs. 9.2 ± 1.3m, P = 0.001) and Donghe (8.8 ± 1.0m vs. 7.2 ± 0.2m, P = 0.028). Most of the salamanders had overlapping home ranges, with a mean distance to their nearest neighbor of 26.3 ± 11.5m at Heihe and 10.3 ± 3.9m at Donghe. Captive-reared juvenile giant salamanders had a relatively high fidelity to their release sites. Overlapping home ranges indicated juvenile salamanders may have a high tolerance of other individuals, or the period monitored was not long enough for them to disperse greater distances.

0665 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR PHYSIOLOGY & MORPHOLOGY

Mingna Zhuang, Timothy E. Higham

University of California Riverside, Riverside, CA, USA

Foot Use During Arboreal Locomotion in the Giant Day Gecko (*Phelsuma madagascariensis*)

By using adhesion, geckos move in a variety of challenging habitats. The evolution of adhesion was accompanied by morphological changes in the foot, such as modifications for digital hyperextension. These changes are thought to facilitate adhesion. Given the importance of the foot in transmitting forces to the substrate, these changes in morphology are also likely to affect kinematics. *Phelsuma madagascariensis* has feet that

are not symmetrical (within the foot) and not as shortened as that of other geckos, suggesting a constraint on the surface area in which the adhesive system can engage. This is important given the directionality of adhesion. In order to accommodate varying inclines and substrates, we expect *P. madagascariensis* to rotate its feet towards or away from the body and change the within foot symmetry (angles between its toes). To test this, we obtained 3D movements (with high-speed video) of geckos running on a range of ecologically relevant inclines (0°, 45°, 90 °) and perch diameters (1.5cm, 10cm and flat). We focused on measuring instantaneous within-foot symmetry and foot alignment relative to the body. The modulation of within-foot symmetry and foot alignment suggests that aspects other than adhesion are important for moving on a variety of arboreal substrates. In addition to better understanding the unique morphology in *Phelsuma*, our study reveals foot usage in arboreal locomotion and the constraints of the adhesive system in geckos. This is essential to understanding how biomechanics responds to the evolution of novel adaptations and morphologies. Supported by NSF IOS-1147043.

0207 Poster Session II, Exhibit Hall C & D, Saturday 2 August 2014

Julie Ziemba, Alex Cameron, Kim Peterson, Cari-Ann Hickerson, Carl Anthony

John Carroll University, University Heights, OH, USA

The Presence of an Invasive Asian Earthworm (*Amynthas* spp.) Alters Terrestrial Salamander (*Plethodon cinereus*) Microhabitat Use in Laboratory Microcosms.

Invasive earthworms are rapidly transforming detrital communities in North America. Recent studies have investigated the effects of European earthworms, whereas Asian earthworms, such as *Amynthas* spp., remain understudied. *Amynthas* is a surface-dwelling earthworm that voraciously consumes the litter layer of temperate forest-floor habitats. The accumulation of detritus is important for terrestrial salamanders, including *Plethodon cinereus*, because this microhabitat serves as a source of invertebrate prey. We examined the effect of *Amynthas* on the activity and body condition of "naïve" (no history of co-occurrence with *Amynthas*) and "experienced" (recent co-occurrence with *Amynthas*) salamanders in laboratory microcosms. We hypothesized that earthworms would disturb the foraging behavior of salamanders through reductions in leaf litter, resulting in greater movement and mass loss. We also hypothesized that the naïve salamanders would be more negatively affected by the presence of a "novel" invasive species than experienced salamanders. Consistent with published studies, earthworm presence significantly decreased leaf litter mass over time. Earthworm presence had a significant effect on salamander activity, with salamanders exhibiting increased movement, cover object use, and co-occurrence under cover objects with earthworms as

the study progressed. Prior experience with worms did not appear to influence salamander response and we were unable to detect an effect of earthworms on salamander mass. We postulate that unnecessary movement has the potential to incur fitness costs to salamanders in the form of energetic expenditure and increased exposure to predators.

0604 Poster Session I, Exhibit Hall C & D, Friday 1 August 2014; SSAR ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Joseph Zigler, Stephen Mullin

Eastern Illinois University, Charleston, IL, USA

Relationships Between Body Size and Migratory Movements of Midland Brownsnakes (Colubridae: *Storeria*) Within an Activity Season

General biophysical principles predict that larger individuals within populations of an ectothermic species, having lower surface area-to-volume ratios, should experience slower rates of change in body temperature, in comparison to smaller individuals. Such differences in the rates of body temperature change might influence the date on which individuals of different body sizes emerge from their hibernacula, or initiate movements between habitats. We collected standard morphometric data for Midland Brownsnakes (*Storeria dekayi wrightorum*) throughout the activity season – intercepting individuals as they migrated between their hibernacula and foraging habitats. We used regression analyses to compare measurements of body size for each gender, as a function of date of encounter. Whether male or female, smaller snakes were not detected earlier in the activity season than larger snakes. Neonate snakes tended to be smaller and encountered later in their activity season, perhaps indicating that they remained active for longer periods, when compared to larger members of the same cohort. The thermal characteristics of each hibernation site might obscure any differences in the initiation of activity as a function of either gender or body size of this snake species.

0051 Fish Ecology I, Banquet Room F, Saturday 2 August 2014

J. Jaime Zuniga-Vega

Universidad Nacional Autonoma de Mexico, Facultad de Ciencias, Ciudad Universitaria, Distrito Federal, Mexico

Superfetation and the Terminal Investment Hypothesis. Does Superfetation Increase with Age in Poeciliid Fishes?

Superfetation is the ability of females to simultaneously carry multiple broods at different developmental stages. One hypothesis that attempts to explain the origin and maintenance of superfetation suggests that superfetation increases the rate of offspring production as a result of overlapping different broods. In addition, a longstanding hypothesis in life-history theory suggests that old females should invest a larger proportion of available energy in reproduction compared to young females (the terminal investment hypothesis). In this study I searched for a connection between these two processes: if reproductive investment should increase as females grow old and if superfetation provides a way to increase the rate of offspring production, then superfetation should exhibit a hyperallometric relationship with female age. In other words, older females should exhibit a larger level of superfetation than that expected for their age. I examined the relationship between the number of simultaneous broods and female size in different populations of four fish species of the family Poeciliidae. I used female size as a proxy for female age because in organisms with indeterminate growth, size is positively correlated with age. In most cases, the association between superfetation and female size was weak or even inexistent. In those cases where the two traits were statistically associated, the relationship was hypoallometric (contrary to what I expected). My results indicate that superfetation is not the mechanism used by older females to increase their reproductive output. This represents preliminary evidence that partially rejects the hypothesis that superfetation increases the rate of offspring production.

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