

0232 Herp Population Genetics/Herp Coloration, Symphony I & II, Monday 11 July 2011; ASIH STOYE GENERAL HERPETOLOGY AWARD

Vincent Farallo

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Predation and the Maintenance of Color Polymorphism in a Habitat Specialist Squamate

In general, taxa exhibit color polymorphism when two or more morphs occur within a single population. However, there are instances where selection or limited gene flow can cause entire populations to become fixed for a single morph, resulting in separate populations of the same species exhibiting distinct color morphs. Morphs can be maintained through numerous mechanisms, one of which is natural selection via selective predation. The mottled rock rattlesnake is a montane species that exhibits striking levels of color polymorphism correlated with two distinct substrate types. Habitat substrate in the eastern part of their range is composed primarily of light colored limestone, whereas in the western region the substrate is primarily dark volcanic rocks. We hypothesized that predation on high contrast color and blotched patterns maintain these distinct color morphs. To test this we performed a predation experiment by deploying model snakes at 12 sites evenly distributed within the two regions where the different morphs are found. Two color and two blotched treatments were used to mimic the eastern and western morphs. We found that models contrasting with substrate coloration suffered significantly more avian attacks relative to models mimicking substrates. In regards to the two regions, neither of the blotched treatments was damaged by avian predators or non-predator disturbers more or less often. These results are consistent with the hypothesis that color pattern has, at least in part, been maintained by selective predation, and indicate that selective predation may also maintain blotching patterns but only when combined with differential behaviors.

0289 Poster Session II, Saturday 9 July 2011; STORER ICHTHYOLOGY AWARD

Stacy Farina

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The Evolution of Restricted or Siphon-Like Opercular Openings in Bony Fishes

Restricted or siphon-like opercular openings occur in many groups of bony fishes. These undoubtedly represent many instances of convergent evolution, yet little has been done to characterize the phylogenetic distribution of such gill openings or to evaluate the different possible functions that they may reflect. For example, do the siphon-like opercular openings typical of some mormyrids function like those of lepidosirenid lungfishes? Do the restricted opercular openings in heavily armored pegasids function

in the same way as those of boxfishes? To answer such questions, it is first important to examine the trait in an evolutionary context. To accomplish this, I defined a measurement that can be used to determine the extent of opercular opening restriction relative to the circumference of the head in the gill region. I analyzed eight additional body measurements to determine the diversity of body plans of fishes with restricted opercular openings. A broad survey of more than 300 families of bony fishes reveals more than 10 widely dispersed clades in which restricted opercular openings have independently evolved. Classification and Regression trees were used to analyze the morphometric data and categorize the diverse body plans represented within these clades. This survey will provide a basis for future comparison of the anatomy and function of the opercular apparatus across all fishes with restricted opercular openings.

0162 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

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Museum Specimen Records Indicate the Timber Rattlesnake is Expanding its Geographic Range in Florida

Many North American viperids have suffered anthropogenic declines in geographic range and population density. We reviewed museum records for *Crotalus horridus* in Florida to document how the species fared during the 20th Century. Several lines of evidence indicate that this rattlesnake has significantly expanded its Florida range and abundance over the last 60 years. In the region from which *C. horridus* is recorded, the pattern of initial county discovery is highly contiguous: each county in which it was discovered was typically adjacent to a county in which it had previously been discovered. We ran computer simulations to generate null models for expected levels of contiguity, and the models typically yielded lower levels of contiguity. *C. horridus* also shows an aberrant sequence of initial county discovery compared to 22 species of abundant, widespread snake species from northern Florida. While the widespread species show a strongly concordant sequence of initial county discovery that reflects collecting effort, *C. horridus* does not. The spatial pattern of discovery within Alachua County, the most heavily collected region in Florida, shows evidence of a north-to-south expansion. The abundance of *C. horridus* relative to *C. adamanteus* is also increasing, though competitive causes are unlikely. Possible explanations for the expansion of *C. horridus* include fire suppression and declines in ophiophagous snake species. Museum collections hold great promise for documenting range changes. Care must be taken to develop appropriate null expectations and comparisons to widespread species are especially helpful in that effort.

0340 Poster Session II, Saturday 9 July 2011

Richard Feeney, Camm Swift

Natural History Museum of Los Angeles County, Los Angeles, CA, USA

Descriptions of Hybrid Sucker Larvae (*Catostomus fumeiventris* x *santaanae*) and Owens Sucker Larvae (*C. fumeiventris*) from Sespe Creek, Santa Clara River, Ventura County, California.

Santa Ana suckers (*C. santaanae*) and Owens suckers (*C. fumeiventris*) are known to hybridize in the Fillmore area of the Santa Clara River system, including a tributary, Sespe Creek. Over 1940 sucker larvae and juveniles were collected in Sespe Creek in 2005. While they were predominately *C. santaanae*, some exhibited many intermediate characteristics between *C. santaanae* and *C. fumeiventris* including the amount of dorsolateral pigmentation, the extent and number of ventral gut melanophores, and the size of the larvae at various developmental stages. These hybrid larvae typically have less dorsolateral trunk pigment and a more continuous line of ventral gut melanophores; they are also larger at various stages than *C. santaanae*. Owens sucker (*C. fumeiventris*) larvae have even less dorsolateral pigment, a nearly continuous line of ventral gut melanophores and may be 5-10% larger than Santa Ana sucker larvae at key developmental stages. Continuous variation of the larval characters from *C. santaanae* to intermediate hybrids to *C. fumeiventris* types support the hypothesis of multiple backcrossing in adults.

0265 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Shobnom Ferdous

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Geometric Morphometrics as a Tool to Elucidate Phylogenies

The use of morphometric data in phylogenetic analyses has long been debated. The disagreement primarily concerns whether or not morphometric data could be used to estimate phylogeny. With the development of geometric morphometrics, a better assessment of shape is available, reigniting debate over whether or not shape carries phylogenetic information and on how one can express that information. The phylogenetics of the genera of the North American minnows, dace, chubs, and shiners of the tribe Phoxinini have been well-studied with largely consistent results suggesting the phylogeny of the phoxinins is reasonably well-established. We developed a geometric morphometric database of representative phoxinins from each of the major clades in order to test methods of phylogenetic construction based on geometric morphometrics and whether there is phylogenetic signal in the data. We developed a set of 18 homologous landmarks for 29 genera, 44 species, and 362 specimens. The result shows that significant phylogenetic signal is present in the geometric morphometrics data set, but mostly at the tips of the tree. The overall pattern across phoxinins suggests

reticulate evolution. The tree computed from landmark data of the phoxinins is not very consistent with the well-supported phylogenetic tree from molecular data. Although several studies have found congruence between shape and phylogeny, the phoxinins are likely more indicative of general patterns in organisms towards convergence in morphotypes. Thus, geometric morphometric data might not provide reliable information to infer phylogeny at larger scales.

0360 Poster Session III, Sunday 10 July 2011

Camila Rudge Ferrara, Richard C. Vogt, Renata S. Sousa-Lima

INPA, Manaus, Brazil

When do Hatchling Turtles Begin to Vocalize?

Until recently aquatic turtles were thought to be deaf and mute. The function of the sounds produced by freshwater turtles have yet to be put into behavioral contexts. The present study was initiated to discover when young *Podocnemis expansa* begin to emit sounds. We recorded 5 hours of sounds emitted by the young in 7 natural nests while the young were within the egg. We detected vocalizations commencing a mean of 14 hours before hatching (8-36, sd 12). Fifty one sounds were classified into 5 different groups according to their sound and visual characteristics. The minimum frequency encountered was 50.5 Hz and the maximum 2,245.2 Hz. We hypothesize that the young begin to vocalize within the egg to synchronize hatching and by so doing organize a greater number of individuals to help dig out of the nest simultaneously. This may also increase survivorship of hatchlings moving from the nest to the water by swamping potential predators and soliciting parental care by the females once they enter the water to travel with them in their migration to the flooded forests. Traveling as a group with the females may help to protect them from predators during the migration as well as lead them within the current of the river to the feeding habitats.

0243 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Camila Ferrara¹, Richard Vogt¹, Renata Sousa²

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Communication in Turtles

Olfaction, pheromones, visual, and tactile cues were considered to be the principle forms of communication for chelonians. Recently sound and vocal communication have been shown to be more important than was believed possible in turtles. The courtship roars of Galapagos tortoises and the grunts and groans of mating tortoises are well known. We are now discovering that the social interactions of freshwater turtles are governed by vocalizations both in and out of the water. About 35 species in the families

Testudinidae, Tryonichidae, Emydidae and Bataguridae communicate during copulation. There was little known about communication in Pleurodires, they were thought to be deaf mutes. Giles, in her study of *Chelodina oblonga* verified that males and females emitted sounds under water at low frequencies (100Hz - 3.5 Hz). We found that two species of the family Podocnemidae are vocalizing within the nest. *Podocnemis expansa* are communicating while they are still in the egg. *Podocnemis* females and hatchlings are using low frequency sounds (36.8 Hz a 4.5 KHz) both below the water and on land. Our recent research demonstrates that turtles are much more socially active than suspected. Major questions about how turtles congregate to form arribadas, group basking and migrations, feeding groups, and communal hibernation may all be related to vocal communication between individuals. Behavior that was thought to be innate or due to pheromones could actually be related to direct vocal communication between turtles. All behavioral studies must now be reevaluated taking the possibility of vocal communication in context.

0344 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

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Masticatory Myosin Expression in Jaw Adductor Muscles of the Chimaeroids

Holocephalans were probably the dominant hard prey specialists of the late Paleozoic, and are uniquely derived in this aspect. The upper jaw is fused to the neurocranium. Further, all chimaeriform holocephalans possess(ed) tooth plates thought to have evolved specifically in response to the durophagous habit. However, bite force estimates from computational models of *Callorhynchus callorhynchus* and *Hydrolagus collei* cast doubt on the force producing abilities of these species. This prompted the study of the myosin isoforms in *Callorhynchus* and *Hydrolagus* jaw adductor muscle, along with other elasmobranchs and teleosts for comparison. SDS-PAGE and immunoblotting with an anti-masticatory myosin heavy chain (MHC) antibody (anti-MHC-M) were used to probe homogenates of jaw adductor muscles, as well as epaxial muscle and pectoral fin muscle as controls. Jaw adductors of *Callorhynchus* and *Hydrolagus* have an abundant MHC isoform (masticatory myosin) that is not present in the epaxial muscle or pectoral fin muscle, plus two other much less abundant MHC isoforms. Anti-MHC-M reacted strongly with jaw-adductor samples but did not react with epaxial or pectoral fin muscles. Consistent with other vertebrate species that express MHC-M, the myosin light chain isoforms (MLC) in the jaw adductor muscles also appear to differ from those in epaxial and pectoral fin muscles in the chimaeras. We conclude that jaw-closing muscles of *Callorhynchus* and *Hydrolagus* express masticatory myosin, which, in other vertebrate species, is associated with high force generation. Interestingly, these isoforms were present in the elasmobranch species included here, but were completely absent from any of the teleosts studied.

**0187 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E,
Friday 8 July 2011**

Chester Figiel, Jr.

U. S. fish and Wildlife Service, Warm Springs, GA, USA

Cryopreservation of Sperm from the Axolotl *Ambystoma mexicanum*

Captive management can play an important role in the conservation of amphibian species; however, substantial challenges regarding reproductive information are needed. Reproductive technologies such as the cryopreservation of gametes can assist in these efforts by preserving genetic material, providing for the transfer of genes from wild populations to captured stock, and by assisting in dispersing genetic material among wild populations. In this study, I examined a 'field-friendly' technique for the cryopreservation of sperm from the axolotl, *A. mexicanum*, which serves as a surrogate for other *Ambystoma* salamanders. Specifically, I examined the effects of freezing rate (-10 °C/min; -23 °C/min; -300 °C/min), thawing rate (5 °C/min; 12 °C/min) and cryodiluent (sucrose; amphibian ringers solution) on the post-thaw sperm survival in two experiments. I collected spermatophores into cryovials and dropped them into nitrogen dry-shipping dewars that are designed to safely transport cells and tissues at -190 °C temperatures. I examined post-thawed sperm using a fluorescence-based assay for analyzing the viability of sperm. Overall, percent of intact sperm alive was 65% and 87% in the two experiments respectively. There were no significant effects of cryodiluents, freezing rates or thawing rates on the percent of sperm alive. Based on these techniques, it is possible to cryopreserve spermatophores from *A. mexicanum*; however, experiments are needed to ensure that post-thaw sperm can fertilize eggs. Use of dry-shipping dewars may provide a quick and safe way to freeze spermatophores in the field.

0221 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

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The Rajidae of the Southwestern Atlantic, an Overview

The Rajidae of the Southwestern Atlantic shows at the genus level an astonishing endemic diversity related to its ecology. Two biogeographic provinces constitute the southwestern Atlantic: the northern warm-temperate Argentinean Province and the southern cold-temperate Magellan Province. Skates from the former are endemic of southern South America; instead, genera from the latter are cosmopolitans related to the Antarctic ichthyofauna, with Gondwanic distribution, and one of its genus is invader of

the Argentine Province. The Argentine continental shelf, one of the largest in the world, possesses ideal conditions for the development of skates: smooth slopes, little relief, 65% sand-covered, located in a temperate transition zone. However, since this region is one of the youngest in the world, its colonization is also recent. Considering the environmental features from its formation in the Cretacic --where Chondrychthyes Batoid teeth are already found-- to nowadays, its evolution has been traumatic. At the beginning, temperate waters arrived to Antarctica and even Oceania, the opening of the Drake Passage in the Paleogene permitted the entrance of cold waters that severely affected the South American cone, and lastly, during the Pleistocenic ice age, the subtropical sub Antarctic convergence zone moved farther north than at the present time. The endemic skates of the Argentine Province could be the most ancient settlers of the region. The wide temperature and salinity tolerance range they exhibit is really surprising.

0618 Poster Session I, Friday 8 July 2011

Aimee Finley

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Whale Community and North Atlantic Bluefin Tuna Population Correlation with Highly Concentrated Marine Debris, Lobster Traps and Buoys at Jeffrey's Ledge, Gulf of Maine

In the Gulf of Maine a significant area of wind-driven coastal upwelling occurs off of Jeffrey's Ledge. Cold, nutrient rich waters surge from the ocean depths through deep canyons on the edge of the continental shelf. At Jeffrey's Ledge, we investigated the spatial dynamics of the whale community and North Atlantic bluefin tuna populations to assess (i) feeding habits, and (ii) how these species are affected by anthropogenic objects: marine debris, buoys and lobster traps. Spatial dynamics were analyzed in ArcGIS. We hypothesize a strong association between these prominent marine taxa and anthropogenic factors, which may be related to the movement of the upwelled water at Jeffrey's Ledge. This information provides new insight into the role of wind-driven upwelling systems projected upon whales and bluefin tuna populations. From this information we will be able to better protect these endangered animals and further educate people about the dangers of marine debris.

0230 Poster Session III, Sunday 10 July 2011

Justin Fisher, Kevin Purcell, Craig Stockwell

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Survey of the Genetic Diversity of Northern Leopard Frog Populations in North Dakota

The western population of the northern leopard frog (*Rana pipiens*), once considered widely abundant, is now being considered for protection under the Endangered Species Act. Research and monitoring programs in the western half of the United States indicate widespread population declines that may impact the genetic health of local populations. Our research aims to evaluate the genetic structure and diversity of northern leopard frog populations throughout North Dakota. During 2010, we surveyed a total of 50 populations representing the 7 biogeographical regions within North Dakota. We optimized and screened previously published microsatellite markers by Hoffman et al. (2003). A survey of 16 populations indicates a range of heterozygosity from 0.72 to 0.88, with high levels of heterozygosity in eastern North Dakota and a longitudinal decline toward the more arid western portion of North Dakota. In addition we found a decline in allelic richness, again with eastern populations having 12.4 alleles per loci and declining to 6.6 alleles in the west. Future work aims to further evaluate this geographic distribution of genetic diversity and to also evaluate how genetic structure is correlated with various natural and anthropogenic landscape features. These results of this project should allow managers to identify at risk populations and to develop a genetic management plan for northern leopard frogs in North Dakota.

0228 Fish Conservation, Symphony III, Saturday 9 July 2011 ASIH STOYE GENETICS, DEVELOPMENT & MORPHOLOGY AWARD

Brook L. Fluker

The University of Alabama, Tuscaloosa, AL, USA

Spring-adapted Species as a Model for Understanding the Genetic Consequences of Aquatic Habitat Fragmentation

As aquatic species' distributions become increasingly fragmented due to habitat destruction and alteration, there is an urgency to better understand the genetic consequences associated with these actions. Our previous work has shown that most spring-adapted darters (Percidae: *Etheostoma*) have island-like distributions, with naturally low genetic diversity, high population structure, and low migration capabilities. Because of these characteristics, we hypothesize that spring-adapted darter species should serve as exceptional models to better understand the effects of habitat fragmentation on the genetic composition of other darters and stream fishes. To assess this hypothesis, we used mitochondrial (mt) DNA and microsatellite (m) DNA to compare levels of genetic diversity, dispersal ability, and gene flow among common stream inhabiting darters, imperiled stream inhabiting darters, and spring-adapted

darters. Results from the mDNA revealed an overall significant difference among the three groups in allelic diversity (A , $P < 0.01$) and expected heterozygosity (H_e , $P < 0.01$). Pairwise comparisons revealed no significant differences between imperiled and spring darters (A , $P = 0.56$; H_e , $P = 0.61$), while common darters were different from spring darters (A , $P < 0.001$; H_e , $P < 0.001$), and marginally different from imperiled darters (A , $P = 0.095$; H_e , $P = 0.052$). Overall, our results revealed several similarities in the genetic composition of imperiled stream inhabiting darters and spring-adapted darters. Although both share low genetic diversity, thus reduced evolutionary potential, imperiled stream inhabitants do not have the luxury of stable spring habitats, rendering them more susceptible to local extirpation.

0229 Poster Session I, Friday 8 July 2011

Brook L. Fluker, Bernard R. Kuhajda, Phillip M. Harris

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The Effect of Reservoirs on Gene Flow in Stream Fishes: Analysis of Two Species from the Tallapoosa River System in Alabama

It is hypothesized that impoundments impede natural migration in stream fishes, resulting in spatially and genetically fragmented populations. The objective of this project was to determine if there is detectable interruption in gene flow between populations of fishes isolated in tributaries due to the construction of Martin Reservoir on the Tallapoosa River, which was completed in 1926. We selected two species with putatively differing migration capabilities, the Tallapoosa Darter (*Etheostoma tallapoosae*) and Tallapoosa Shiner (*Cyprinella gibbsi*), to examine the effect of the reservoir on genetic structure, migration, and gene flow. The sample strategy included four tributaries that enter the reservoir, two each from the eastern and western sides of the reservoir. In addition, two eastern and two western tributaries that enter the Tallapoosa River upstream of the reservoir were included as the control to represent a setting of natural, unimpeded migration. Preliminary analysis of microsatellite DNA data suggests significant genetic structure (average $F_{st} = 0.22$, $P < 0.001$) between reservoir and riverine populations of *E. tallapoosae* separated by only 26 km. This suggests the possibility of recent isolation of these populations due to Martin Reservoir, especially given previous studies that revealed gene flow between *E. tallapoosae* populations separated by > 100 km from unimpeded reaches upstream of the reservoir. Results from *C. gibbsi* and additional populations of *E. tallapoosae* will be incorporated into our study to better understand the effects of impoundments on stream fishes.

0282 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Brook Fluker, Bernard Kuhajda

University of Alabama, Tuscaloosa, AL, USA

Phylogeography of the Subgenus *Fuscatelum* (Percidae: *Etheostoma*) Based on Mitochondrial and Nuclear DNA Sequences

The subgenus *Fuscatelum* of *Etheostoma* (Percidae) contains only two species. The Goldstripe Darter *Etheostoma parvipinne* is wide-ranging across the Coastal Plain from the Colorado River, Texas, east to the Altamaha River, Georgia, and north into southern Missouri and western Kentucky. The imperiled Rush Darter *E. phytophilum* is restricted to two disjunct populations in the Black Warrior River drainage (Mobile Basin) above the Fall Line in north-central Alabama. Scale or fin-ray counts and male breeding pigmentation vary across populations for both species, yet little is known about molecular variation within and among populations. Phylogenetic analysis of mitochondrial (mt) ND2 and nuclear S7 sequences recovered two major clades within *Fuscatelum*, however neither species was recovered as monophyletic. The "western" clade included all but one population of *E. parvipinne* west of the Mississippi River, exhibited shallow within-group divergence, and 9.1% mt divergence from an "eastern" clade. Within the "eastern" clade, *E. parvipinne* from Crowleys Ridge, Missouri, was basal with 2.7% divergence. Multiple well-supported clades were recovered within the "eastern" group, but their relationships were largely unresolved. For example, samples of *E. phytophilum* were contained within a polytomy that included a monophyletic clade of Locust Fork specimens and a clade including Sipsev Fork *E. phytophilum* and *E. parvipinne* from western Mobile Basin drainages, eastern tributaries to the lowermost Mississippi River, and intervening Gulf Slope drainages. These results reveal two uniquely diverged lineages of *E. phytophilum* (2.6% divergence) with further differentiation among Locust Fork populations (Turkey and Cove creeks, 1.5%), mirroring differences in underlying physiography.

0702 Poster Session II, Saturday 9 July 2011

Brian Folt¹, Kelsey Reider¹

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Herpetofaunal Richness, Density, and Community Composition in Plantation Monocultures and Primary Forest of La Selva Biological Station, Costa Rica.

As Neotropical forests diminish in area due to anthropogenic effects, tree plantations have emerged as a sustainable source of lumber and pulp as well as a potential avenue to conserve biodiversity. To better understand how agroforests might be utilized as conservation tools, we compared amphibian and reptile species richness, density, and community composition in three native tree species plantations (*Pentaclethra maculoba*,

Viola koschnyi, *Vochysia guatemalensis*) to primary forest at La Selva Biological Station in the Caribbean lowlands of northern Costa Rica. Species richness varied from 9 to 13 species among plantations; primary forest supported 14 species. Primary forest and *Vo. guatemalensis* supported significantly more species-rich communities than *P. macroloba* and *Vi. koschnyi*. Herpetofaunal density was significantly higher in primary forest ($5.83 \pm .59$ individuals/100 m²) than in *P. macroloba* (2.66 ± 1.68 individuals/100 m²). We compared community composition using non-metric multidimensional scaling and Analysis of Similarity. Community composition differed significantly; analysis of similarity percentages (SIMPER) indicated that average similarity between *P. macroloba* and primary forest was 52.9%. Average similarity between *Vo. guatemalensis* and primary forest 66.0%, while average similarity between *Vi. koschnyi* and primary forest was 66.6%. Because *Vo. guatemalensis* and *Vi. koschnyi* supported a herpetofaunal assemblage most similar to primary forest, these plantations may be of considerable conservation value to the herpetofauna of the Caribbean lowlands of Costa Rica.

0557 Poster Session I, Friday 8 July 2011

Ryan Ford¹, James Gelsleichter¹, Bryan Frazier², Carolyn Belcher³, R. Dean Grubbs⁴, Andrew Piercy¹

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Preliminary Analysis of Reproductive Periodicity of the Blacknose Shark (*Carcharhinus acronotus*) within its Atlantic Range

The blacknose shark (*Carcharhinus acronotus*) is a common small coastal shark species found in nearshore waters along the southeast coast of the United States, from North Carolina into the Gulf of Mexico and extending further south into the Bahamas. There has been some debate in recent years over the reproductive periodicity of *C. acronotus* in waters off the U.S. coast. Earlier studies have suggested that Gulf *C. acronotus* reproduce on an annual basis whereas the Atlantic populations of this species may reproduce biennially. The goal of the present study was to re-evaluate the reproductive periodicity of the Atlantic populations of *C. acronotus* with the intent on clarifying these differences. This was accomplished by examining male and female reproductive tracts in animals caught via fishery dependant and fishery independent gillnet and longline surveys conducted throughout the Atlantic range of *C. acronotus*. Based on preliminary data, spermatogenesis appears to occur between late May to early July with peak sperm production occurring in June and July. In females, follicular development is likely complete by late June-early July with ovulation occurring shortly afterwards. Mating appears to occur between mid-June and early July based on the presence of fresh mating scars on females captured during this time. Current data suggests that gestation begins late July with parturition occurring late May to early June the following year. Data are

currently being collected to fill in crucial time gaps and bring to light any population differences through the use of molecular analyses.

0642 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Alicia Fox, Aaron Schrey, Earl McCoy, Henry Mushinsky

University of South Florida, Tampa, FL, USA

Comparison of Genetic Structure of the Florida Sand Skink, *Plestiodon reynoldsi*, in Homogeneous and Heterogeneous Scrub on Lake Wales Ridge in Central Florida

The Florida Sand Skink, *Plestiodon reynoldsi*, is a threatened fossorial lizard that occurs in the scrub found throughout the central ridges in Florida. Florida scrub is a highly heterogeneous habitat, including areas of continuous scrub and areas with a mosaic of scrub and wetlands. Genetic differentiation is known to exist among distinct geographic samples across its distribution; however, fine-scale analyses of genetic structure are needed to fully describe spatial genetic differentiation in this species. The goal of this study was to compare genetic structure of Florida Sand Skink populations in continuous and heterogeneous scrub. Multiple microsatellite loci were screened in individuals sampled from two sites: 1) a large homogeneous scrub location near Davenport, Florida, and 2) a large heterogeneous scrub at the Archbold Biological Station near Lake Placid, Florida, which has habitat heterogeneity and numerous small wetlands throughout the scrub. Samples at Davenport were collected from four sites (less than 2 km apart), each with multiple transects of pitfall arrays, while samples at Archbold were obtained from pitfall traps in 30 enclosures located in scrub patches. We determined the number of genetic clusters that occurred at each location in a similar geographic area. STRUCTURE revealed only one cluster at Davenport, while multiple clusters were present at Archbold. Our study reveals that Florida Sand Skinks exhibit more genetic differentiation in a heterogeneous scrub than in a homogeneous scrub. These differences in genetic structure may have implications for the conservation and management plan for this threatened species.

0735 Poster Session II, Saturday 9 July 2011

Austin Francis

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Larval and Juvenile Fish Recruitment to a Georgia Estuary

To better understand the role of Georgia's estuarine nursery areas in the recruitment of larval and juvenile fishes, the temporal occurrence and abundance of ichthyoplankton entering the Moon River, a tidal creek south of Savannah, was investigated. Collections

consisted of deploying an ichthyoplankton net one night a week from April 2009 until December 2010. Two deployments of 30 minutes were made during a flood tide. Measurements of oceanographic conditions included water depth, salinity, temperature, dissolved oxygen, and pH. Ichthyoplankton was fixed in the field using 10% formalin. After one week, samples were sorted, transferred to 70% ethyl alcohol, and identified to the lowest possible taxon. Over a 20 month period, a total of 18,956 fishes were collected, 16,932 in 2009 and 2,024 in 2010. In 2009, representatives of 14 families were collected with 87.9% of the fishes caught (14,876) engraulids. An additional 3.7% of fishes were gobiids of several species. The remaining 12 families each represented less than 1% of the total catch. In 2010, representatives of 14 families were caught, but only eight families had been previously collected in 2009. Sciaenids represented 32% of the catch, engraulids 31.7%, gobiids 23.5%, and cynoglossids 9.5%. All other families each represented less than 1% of the total catch. Despite a shorter sampling period in 2009, 88% fewer fish were caught in 2010 compared to 2009. The difference in abundance is attributed to the sea level anomaly experienced along the eastern United States in June and July of 2009.

0173 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

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Sex Determination and Hatchling Orientation of Snapping and Blanding's Turtles in Agricultural Fields

Anthropogenic changes to the environment have the potential to impact natural systems, particularly in organisms that exhibit phenotypic plasticity. Turtles are very susceptible to changes in the stimuli that affect sexual development, potentially leading to maladaptive sex ratios. Furthermore, because they do not receive post-ovulatory parental care, hatchling turtles are greatly impacted by variation in the local environment when orienting from the nest site to the water or overwintering site. We studied the factors affecting sex ratios in the common snapping turtle in an area heavily impacted by agricultural practices and examined movement of hatchling Blanding's and snapping turtles during initial dispersal from artificial nests in crop fields. Females often chose to nest in agricultural fields over sand prairie sites, and nest temperatures and depredation rates were significantly impacted by field type. Nest sex ratios were almost entirely male in sunflower and corn fields, and were less male-biased in soybean fields. Agricultural fields also altered initial naïve hatchling dispersal from the nest, as environmental cues used for orientation were blocked by dense crop canopies. In contrast to naïve hatchlings, we found that experienced hatchlings were able to maintain headings while traversing agricultural fields located between nests and wetlands. Our results suggest that agricultural practices may directly impact turtle populations, and need to be considered in management decisions.

0570 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

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Not Just a Chastity Belt: The Role of Copulatory Plugs in Red-sided Garter Snakes Revisited

During the spring emergence of Red-sided garter snakes (*Thamnophis sirtalis parietalis*) in Manitoba, Canada, the operational sex ratio is strongly skewed toward males who scramble to locate and court newly emerged females. Litters usually exhibit multiple paternity suggesting that the females are promiscuous; males deposit copulatory plugs suggesting mate-guarding is a wise investment. However, precopulatory female choice is limited in the largest mating aggregations, thus sexual conflict may place a premium on preventing females from ejecting male sperm. In snakes, sperm are produced in the testes and delivered through the ductus deferens, and the copulatory plug is thought to be produced by the renal sexual segment and conveyed through the ureter. We manipulated the delivery of the two fluids separately by ligating the ducts. We found that the CP is not formed in ureter-ligated males and that *sperm leaks out* immediately after copulation. The CP is analogous to a spermatophore as the protein matrix contains most of the sperm which are liberated over time as the plug dissolves within the female's vagina. We have found this to be a convenient way to collect whole ejaculates for a number of techniques including sperm counts, mobility assays, and artificial insemination.

0144 Fish Conservation, Symphony III, Saturday 9 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY AWARD

Bridgette Froeschke

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

Comparison of Spatio-temporal Predictive Models for Juvenile Southern Flounder (*Paralichthys lethostigma*) along the Northern Gulf of Mexico Using Boosted Regression Trees and Artificial Neural Networks

Southern flounder is an important multi-million dollar commercial and recreational fishery. Despite the economic and ecological importance of southern flounder, we have failed to manage a sustainable fishery for this species. Since southern flounder are declining and habitat loss and climate change are occurring, it is important for resource managers to understand and predict the future status of juvenile southern flounder. The main objectives of this study were to provide information needed for the fishery management plan of southern flounder by using statistical modeling techniques to understand how environmental factors influence the temporal and spatial patterns of

juvenile southern flounder and to compare a relatively new modeling technique (Boosted Regression Trees; BRT) with a well accepted technique (Artificial Neural Network; ANN). Data were acquired from the Resource and Sport Harvest Monitoring Program conducted by Texas Parks and Wildlife Department. BRT indicated juvenile southern flounder were associated with low temperatures, low salinity levels, and high dissolved oxygen. Both spatio-temporal models consisted of high predictive performance with slight spatial differences. Both models suggest high probability of occurrence in Galveston Bay and East Matagorda Bay where as the ANN also indicated high probability of occurrence in Sabine Lake. Our results provide valuable tools for fisheries managers to enhance management and ensure sustainability fisheries. The results identified a predictive framework for proactive approaches to ecosystem management. These models will allow managers to more accurately conserve nursery habitats for the fishery, by conserving appropriate habitat and understanding relationships between abiotic and biotic factors.

0434 Poster Session I, Friday 8 July 2011

John Froeschke¹, Bridgette Froeschke¹

¹*Gulf of Mexico Fishery Management Council, Tampa, FL, USA*, ²*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*

A Habitat Model for Juvenile Spotted Seatrout in Texas, USA Estuaries Using Boosted Regression Trees

Long-term, fisheries independent bag seine surveys conducted in Texas, USA estuaries from 1977-2009 were used to develop spatio-temporal estuarine habitat use models for juvenile spotted seatrout, *Cynoscion nebulosus*. Relationships between environmental predictors and juvenile spotted seatrout distribution were investigated using boosted regression trees (BRT). Results showed good model performance and suggested that in relation to environmental factors, juvenile spotted seatrout distribution is most closely linked to salinity, temperature, and distance from tidal inlets. There was also a strong seasonal pattern, where capture rates increased from May to October and declined precipitously after November. Juveniles were rarely captured between January and April. By interpolating the environmental predictors, monthly maps of the probability of capture were produced using ordinary kriging. Spatial patterns were also evident. Probability of capture began increasing first in Upper Laguna Madre peaking in Baffin Bay. Probability of capture was consistently higher in this region than other regions within the study area. Predicted catch rates were also high in portions of Corpus Christi, Aransas, San Antonio Bays, and the southern portion of Galveston Bay. Overall, probability of capture increased with increasing distance from tidal inlets. The development of spatially explicit models allows for prioritization and conservation of areas in a region that has great potential for human disturbance and climate change impacts. These results provide new insight into the habitat requirements of spotted seatrout in the northwestern Gulf of Mexico and practical information for managing this resource.

0521 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

John Froeschke¹, Bridgette Froeschke²

¹*Gulf of Mexico Fishery Management Council, Tampa, FL, USA*, ²*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*

Long-term Demographic Trends of Coastal Sharks in the Northern Gulf of Mexico: Evidence of Increasing Trends

Dramatic declines in elasmobranch populations have been reported worldwide. In addition to supporting fisheries, many shark species may affect a broad range of community interactions thus; demographic trends of sharks may provide evidence about both the fishery and ecosystem status of ecosystems they inhabit. To assess population status and trends of coastal sharks off the Texas, USA coast, fisheries independent gill net surveys were used to examine long-term patterns of abundance. Data were collected in a stratified random design (1977-2009) and trends were examined across nine bays systems along the Texas coast using generalized additive models. Results suggest that abundance varies substantially among bays due to differences in environmental conditions and there is evidence of increasing catch rates for some species in the central and northern bay systems of Texas. Additional research is necessary to determine if regional increases are related to changes in management or environmental conditions in the study area.

0657 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Conrad B & C, Thursday 7 July 2011

Allison Fuiten, Linda Trueb, Rafe Brown

University of Kansas Natural History Museum and Biodiversity Institute, Lawrence, KS, USA

Skeletal Variation Underlying Ecomorphology in Melanesian Forest Frogs

Melanesian forest frogs of the family Ceratobatrachidae include 85 species from insular Southeast Asian the southeastern Pacific. In this study, we sampled taxa widely across the family and examined osteological variation correlated with switches from a terrestrial to arboreal life style. In particular, we asked whether coincident changes to the skeletal morphology occur in unrelated lineages utilizing the same type of microhabitat. We utilized a multilocus molecular estimate of phylogeny to infer putative cases of evolutionary convergence and we demonstrated numerous cases of evolutionary transitions in osteological characters in closely-related lineages. In this talk, we will discuss extensive convergent evolution across phylogeny in Ceratobatrachidae and relate this character variation to ecomorphology of island lineages of frogs in the Pacific.

0299 Poster Session I, Friday 8 July 2011

Keisuke Furumitsu, Atsuko Yamaguchi

Nagasaki University, Nagasaki, Japan

Reproductive Biology of the Whip Stingray, *Dasyatis akajei* (Myliobatoidei: Dasyatidae) in Ariake Bay, Japan

The whip stingray, *Dasyatis akajei*, is the most common stingray in Asian coastal waters. Recently, we examined the abundance and biomass of demersal fish species in the central region of Ariake Bay, Japan and understood that whip stingray is one of the abundant species. However, the knowledge on reproductive biology of the whip stingray is limited. We investigated reproductive biology of the whip stingray in Ariake Bay. A total of 989 specimens (475 males and 514 females) were collected by trawls, gill nets, longline and set nets in Ariake Bay from April 2003 to February 2011. Maturity stages were assessed based on the degree of development of the testes and claspers for males as well as the presence of yolky ova in the ovaries and eggs or embryos in the uterus for females. Females reached greater maximum DW and weight (900 mm and 25100 g) than males (466 mm and 4010 g). Size at 50% maturity was estimated at ca. 322 mm DW for males and ca. 520 mm DW for females. Reproductive mode of *D. akajei* display aplacental viviparity with uterine trophonemata. The uterus and ovary were functional of only left side from dorsal perspective. The mature females carrying uterine eggs or embryos were collected from May to August. The number of uterine eggs and embryos ranged from 4 to 25 (mean 11.9) increasing with maternal size. The parturition occurred between July and August, after a gestation period of ca. 3 months.

0748 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Austin Gallagher¹, Neil Hammerschlag¹

¹*University of Miami, Abess Center for Ecosystem Science and Policy, Miami, FL, USA,*

²*University of Miami, Rosenstiel School of Marine and Atmospheric Science, Miami, FL, USA*

Stressed-out: Species-Specific Responses to Angling Pressure Among Various Coastal Sharks

The sustainability of catch-and-release fishing relies upon the major assumption that all caught individuals will survive and recover when released. While there have been a wide range of studies covering this issue in various game fishes, similar studies on elasmobranchs-particularly threatened species of shark-are lacking. We employed two quantitative methods to provide insights into the physiological and metabolic stress responses of various shark species subjected to fishing pressure in the Florida Keys and Bahamas. Results from both blood-acid base analyses and nictitating membrane reflex

impairment provided a relative species-specific framework of sensitivities and tolerances to angling pressure. Great hammerhead (*Sphyrna mokarran*) and blacktip (*Carcharhinus limbatus*) sharks represented the most physiological sensitive species across fight regimes and season. Accordingly, we discuss potential recommendations for the recreational angling community, and discuss the need to focus specific conservation approaches on species may be at a higher risk of post-release mortality.

0751 Fish Conservation, Symphony III, Saturday 9 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY AWARD

Grantly Galland

Scripps Institution of Oceanography, La Jolla, CA, USA

Historical Ecology and Conservation of Blennioid Fishes in the Gulf of California, Mexico

Historical ecology has made significant recent contributions to the marine science literature, with several landmark papers describing the decline of marine ecosystems and biodiversity over a timescale longer than those typically utilized by resource managers. To date, these studies have concentrated on important fisheries species (e.g., cod and groupers), charismatic megafauna (e.g., marine mammals and sea turtles), and coral reefs. I will present my study of historical changes to the rocky reef blennioid fishes in the Gulf of California, a group that is not captured as the target or bycatch in any commercial or artisanal fishery, including those for the aquarium trade. By examining thousands of specimens from the 1970s, archived in fish collections at Scripps Institution of Oceanography and University of Arizona, and quantitatively resampling several sites throughout the Gulf during expeditions in 2009 and 2010, I have documented both subtle and dramatic changes to the community. In addition to reporting on these changes, I will discuss trends in total abundance, relative abundance (=species ratios), sex ratios, size class frequencies, and ratios of Gulf endemic to Mexico and Panama province species. Finally, I will discuss the necessity of understanding life history strategies, phylogenetic relationships, and biogeographical affinities when planning conservation strategies and comment on the importance of undertaking basic natural history expeditions, especially in the marine environment, in order to document trends in marine ecosystems and biodiversity over large areas and across a broad gradient of human-nature interactions.

0587 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Tony Gamble, David Zarkower

University of Minnesota, Minneapolis, MN, USA

Geckos as a Model Clade to Study the Evolution of Sex Determining Mechanisms

Geckos possess diverse sex determining mechanisms with some species using genetic sex determination, with both male and female heterogamety, while other species have temperature dependent sex determination. We reconstructed the minimum number of transitions among sex determining mechanisms onto a multi-locus gecko phylogeny. We inferred numerous changes among mechanisms even though the sex determining mechanisms from only a small number of gecko species have been characterized. This diversity, coupled with the high frequency of transitions, makes geckos excellent candidates as a model clade for the study of vertebrate sex determination and evolution.

0486 Poster Session III, Sunday 10 July 2011

Anthony Gandara, Stephen Mackessy

University of Northern Colorado, Greeley, CO, USA

Intraspecific Variation in the Venom of Two Montane Rattlesnake Species: The Rock Rattlesnake (*Crotalus lepidus*) and the Ridge-nosed Rattlesnake (*Crotalus willardi*)

Rattlesnake venoms are complex mixtures of biologically active proteins which exhibit distinct interspecific, intraspecific, ontogenetic and geographical variation. The venom characteristics from Mexican highland rattlesnakes have not been systematically studied and little is known about their natural history. The purpose of this study was to investigate intraspecific variation in venom characteristics of two montane species, the Rock Rattlesnake (*Crotalus lepidus*) and the Ridge-nosed Rattlesnake (*Crotalus willardi*). Samples were obtained from four subspecies of *C. lepidus* and four subspecies of *C. willardi*. All venoms were analyzed using SDS-PAGE, enzymatic, and toxicity assays. Additionally, coagulopathy and fibrinogenolytic assays were conducted to characterize venoms further. Gel banding patterns revealed significant variation between the northern and southern subspecies of *C. lepidus*, but very little variation, other than in band intensity of higher mass compounds (nucleases, LAAO), was seen among *C. willardi* venom samples. PI metalloproteinases with a molecular mass of ~23 kDa were present in southern subspecies and noticeably absent in northern subspecies of *C. lepidus*. Venoms from southern subspecies of *C. lepidus* also showed significantly higher metalloproteinase activity. Venoms with higher metalloproteinase activity were less toxic, whereas venoms with lower metalloproteinase activity were more toxic, indicating that type I/II venoms occur within a species. In general, venom characteristics of *C. lepidus* showed greater intraspecific variation, while venom from *C. willardi* subspecies showed little variation. Observed differences in venom characteristics are likely related

to differential prey utilization, but many aspects of the natural history of these montane rattlesnakes remains incompletely known.

0452 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Jayne M. Gardiner¹, Jelle Atema³, Robert E. Hueter², Philip J. Motta¹

¹*University of South Florida, Tampa, FL, USA*, ²*Mote Marine Laboratory, Sarasota, FL, USA*, ³*Boston University, Boston, MA, USA*

Making Sense of Shark Senses: Multimodal Integration in Prey Tracking and Capture

Our understanding of elasmobranch sensory biology is largely due to studies of individual senses rather than multiple senses working together, leading to important advances in our comprehension of the sensory systems in isolation, but not their complementary and alternating roles in difficult behavioral tasks, such as feeding. We investigated three species from different ecological niches: benthic, suction-feeding nurse sharks hunt nocturnally for fish; ram-suction feeding bonnetheads scoop crustaceans off the bottom of seagrass beds; ram-biting blacktip sharks rapidly chase down midwater piscivorous prey. We deprived animals of information from the senses (olfaction, vision, mechanoreception, and electroreception), alone and in combination, to elucidate their roles in precisely localizing, striking at, and capturing live prey (capture kinematics). Nurse sharks rely primarily on olfaction. They may orient to prey using other senses, but will not ingest food if olfaction is blocked. Bonnetheads use olfactory-based tracking until they are close to the prey, vision to line up a strike, and electroreception to time the jaw movements for capture. Blacktip sharks also use olfactory tracking, but demonstrate sensory switching at a greater distance from the prey, focusing on visual cues to strike. Both bonnethead and blacktip sharks strike visually in the absence of odor cues and can use non-visual cues to locate and capture prey, but either olfaction or vision is required for feeding. If both are blocked, feeding behaviors cease altogether, suggesting that vision or olfaction is needed to identify targets as prey, while vision, lateral line, and electroreception are used for locating them.

0491 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Jim Gelsleichter, Jessie Livingston, Vito D'Angelo

University of North Florida, Jacksonville, FL, USA

Relaxin While Reproducin' II: Characterization of Relaxin Receptor-like Activity in Male Elasmobranchs

Relaxin is a 6-kd polypeptide hormone that is responsible for regulating several reproductive processes in female vertebrates, but its role in male reproduction remains

unclear. Prior research on male bonnethead sharks *Sphyrna tiburo* has demonstrated that serum relaxin concentrations increase in this species during late spermatogenesis and the mating period, suggesting a role for relaxin in regulating processes such as spermiation, sperm transit through the male reproductive tract, and/or copulation. In this study, immunocytochemistry was used to detect relaxin receptor-like immunoreactivity in the reproductive tract of the male *S. tiburo* and a variety of other species including the Atlantic stingray *Dasyatis sabina* and the blacknose shark *Carcharhinus acronotus*. The results of the study suggest that relaxin receptor-like activity is primarily localized in late stage and evacuated spermatocysts in the testis of male elasmobranchs, strongly supporting a role for this hormone in regulating some aspect of spermiation and perhaps testicular remodeling. Possible relationships between relaxin and cellular actions that would mediate sperm release and spermatocyst turnover, such as increased production of extracellular matrix-degrading enzymes, will be discussed. In addition, evidence of relaxin receptor-like immunoreactivity in other components of the testis, the gonaducts, and in the stingray epigonal organ is presented.

0568 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Anthony J. Geneva, Jared D. Hilton, Julianne Ng, Richard E. Glor

The University of Rochester, Rochester, NY, USA

A Multi-locus Molecular Phylogeny of Distichoid Anoles

Distichoids are a clade of 6 trunk ecomorph anoles species distributed across Hispaniola and adjacent satellite islands as well as a number of islands from the northern Bahamian bank. This group has long been of interest as these species provide a replicated model system for character displacement, adaptation, and ecological speciation but analyses of the evolutionary dynamics of these processes have been hindered due to the lack of a fully sampled and well-resolved phylogeny for this group. For example, the taxonomic status of the small island endemic, *Anolis altavelensis* is unresolved as it has been alternatively assigned to a subspecies of *A. distichus* or as a distinct lineage sister to all other distichoids. The phylogenetic affinities of Bahamian *A. distichus* populations are similarly undetermined. Recent phylogenetic analyses of Hispaniolan *A. distichus* subspecies based on mitochondrial DNA (ND2) supported the elevation of many of these subspecies to full species rank. Here we use a combination of concatenation and species-tree estimation techniques to elucidate the evolutionary relationship of all distichoid species. We employ mitochondrial and nuclear loci, as well as increased taxon sampling including all nominal species as well as increased subspecies sampling within *A. distichus* to assess species boundaries.

0484 Fish Conservation, Symphony III, Saturday 9 July 2011

Anna George¹, Brett Albanese², David Neely¹, Lee Friedlander¹, Katharine Owers², Josh Smith³

¹Tennessee Aquarium, Chattanooga, TN, USA, ²Georgia Department of Natural Resources, Social Circle, GA, USA, ³Conasauga River Alliance, Calhoun, GA, USA

Spring Habitat Restoration in the Conasauga River Drainage for an Endemic Darter

Colvard Spring, in the Conasauga River drainage in Whitfield County, GA, is home to the imperiled coldwater darter (*Etheostoma ditrema*). Logging immediately adjacent to Colvard Spring during the 1980s resulted in deposition of deep (to 1m) deposits of silt, with anecdotal reductions in darter abundance. We undertook a joint project to remove this sediment to increase habitat for coldwater darters. For one year prior to treatment, we monitored habitat availability and the population size of coldwater darters in Colvard Spring and a nearby control spring, Cohutta Spring. An estimated 408 individuals (95% CI of 357-459) occupied Colvard Spring prior to treatment, compared with 262 individuals (95% CI of 247-277) in the smaller Cohutta Spring. Sediment removal was conducted in October 2009 and 2010 using an 8 cm trash pump to entrain and pipe the sediment slurry into a section of neighboring field surrounded by straw or recycled carpet erosion control structures. All fishes and brownback salamanders (*Eurycea* sp. cf. *aquatica*) collected in a three-pass depletion survey were moved to a hatchery facility for the duration of the sediment removal process and were returned in November 2009 or 2010. We continue to monitor both springs to determine the response of aquatic vegetation, darters and salamanders to treatment.

0151 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Jennifer Germano², Natalie Calatayud¹, Phillip Lyons³, Matt Dowling², Andrew Kouba²

¹Mississippi State University, Starkville, MS, USA, ²Memphis Zoo, Memphis, TN, USA, ³Rhodes College, Memphis, TN, USA

Conservation of Sexually Dimorphic Second-to-fourth Digit Ratios in Amphibians

The second-to-fourth digit ratios (2D:4D) are sexually dimorphic in humans as well as other species of mammalian, reptilian, and avian genera. Sexual dimorphism of digit ratio in amphibians is less conspicuous and has not been studied in detail. In anurans, the Strawberry Poison Dart frog (*Oophaga pumilo*) has evident sexual 2D:4D dimorphism, while the Maud Island frog (*Leiopelma pakeka*) has no sexual 2D:4D difference.

Physiological evidence suggests the involvement of androgens and Hox genes in the determination of directional asymmetry in mammals and in some reptile and bird

species. The aim of this project was to test for sexual differences in 2D:4D ratios in three different amphibian species (striped newts *Notophthalmus perstriatus*, Fowler's toads *Bufo fowleri*, and boreal toads, *Bufo boreas boreas*) to look for broader taxonomic patterns. In striped newts, there were no significant differences between sexes in 2D:4D ratios. However, in both Fowler's and boreal toads, there was a significant difference in the 2D:4D ratio between sexes but only in the front left foot ($P < 0.05$). Though this difference was in the same limb for both toad species, females had a larger digit ratio in boreal toads while males had the larger ratio for Fowler's toads. With the added evidence collected in amphibians it seems that 2D:4D ratios are conserved across vertebrates. Species-specific differences, particularly between amphibians and reptiles may also depend on the mode of reproduction (internal vs. external fertilization) and the possible association between androgen exposure and gene expression during development and into adulthood.

**0051 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E,
Friday 8 July 2011**

Jennifer Germano¹, Michael Drake¹, Matthew Dowling¹, Michelle Wilkes Martin², Sara Hasenstab¹, Sheena Townsend³, Andy Kouba¹

¹Memphis Zoo, Memphis, TN, USA, ²University of Memphis, Memphis, TN, USA,

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**Hormone-induced Spermiation in the Northern Leopard Frog (*Rana pipiens*)
and Endangered Dusky Gopher Frog (*Rana sevosa*)**

Though amphibians possess ideal natural history traits for captive breeding and release programs, many species fail to reproduce in captivity. Attempts to naturally breed the dusky gopher frog, North America's most endangered amphibian, have been unsuccessful. This study used leopard frogs as a model species for gopher frogs to test 9 different luteinizing hormone releasing hormone (LHRH) and human chorionic gonadotropin (hCG) treatments, at different doses and combinations, to determine optimal protocols for non-invasive sperm collection. There was a significant difference in the proportion of frogs responding to the 9 treatments, with 500 IU hCG, 15 ug LHRH, and 500 IU hCG + 15 ug LHRH cocktail being the best treatments. These top three dosages were then applied to male dusky gopher frogs held at the Memphis Zoo. In gopher frogs, 100% and 83% of males responded to the LHRH and cocktail treatments respectively, while only 16% responded to hCG alone. The concentration of sperm collected in these three groups was also significantly different. While sperm concentration peaked at 1 hour post-administration for all treatments, the LHRH/hCG cocktail elicited the highest concentration response. Protocols developed during this study have been applied to the management of dusky gopher frogs in captivity and have led to improved *in vitro* fertilization protocols and the transfer of non-invasively collected sperm between institutions, a world first for amphibians.

0749 Poster Session II, Saturday 9 July 2011

Jennifer Germano¹, Paula Kahn¹, Ron Swaisgood²

¹Desert Tortoise Conservation Center/San Diego Zoo Global Institute for Conservation Research, Las Vegas, NV, USA, ²San Diego Zoo Global Institute for Conservation Research, San Diego, CA, USA

Conserving the Mojave Desert Tortoises Through Recovery, Repatriation, and Education: Efforts from the Desert Tortoise Conservation Center

The Mojave population of the desert tortoise (*Gopherus agassizii*) is listed as a threatened species under the Endangered Species Act. In order to help protect this species, the US Fish and Wildlife Service has teamed with the San Diego Zoo to operate the Desert Tortoise Conservation Center (DTCC) outside of Las Vegas, Nevada. The goals of the DTCC include: 1) using the Center productively and strategically in terms of experimental research on site and population augmentation with an applied research component, 2) conducting health research on current and incoming animals, 3) training professionals, teachers, and community members on issues related to tortoise recovery, as well as conservation of desert flora and fauna, 4) cultivating a community of tortoise supporters, 5) producing and distributing outreach materials to start building support, and 6) developing science-based relocation methodology to include criteria for selecting sites, determining the ideal density for release sites, and a strategic monitoring plan. Through the rescue of desert tortoises, their recovery at the DTCC, and their eventual release back into the wild to augment depleted populations and as well as, through the knowledge gained from experimental releases, the DTCC aims to help preserve current desert tortoises and improve the conservation management and mitigation efforts aimed to protect these animals for generations to come.

0478 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Jeffrey Gersch¹, Harold Pratt², Theo Pratt², Jeffrey Carrier³, Edward Heist¹

¹ Southern Illinois University Carbondale, Carbondale, IL, USA, ²Mote Marine Laboratory, Summerland Key, FL, USA, ³Albion College, Albion, MI, USA

Microsatellite and Mitochondrial DNA Analyses of Genetic Structure in the Nurse Shark, *Ginglymostoma cirratum*, from the Western Atlantic Ocean

The nurse shark, *Ginglymostoma cirratum*, is a large but relatively sedentary shark found in the littoral tropical and subtropical Atlantic and Pacific coast of the Americas. This species has a small home range compared to other shark species of only a few hundred square kilometers making it possible for genetic structure to be developed across relatively small geographic distances. We tested for genetic structure using genotypes from 10 DNA microsatellite loci in populations from the Bahamas (n=32), Belize (n=30), and the Florida Keys (n=91) and found a small and non-significant amount of genetic structuring among populations ($F_{ST} = 0.0017$, $p = 0.068$). We sequenced the entire 1048 base pair mitochondrial DNA (mtDNA) control region in 44 nurse sharks and found a

1048 base pair segment with only three variable sites and four haplotypes, three of them rare (nucleotide diversity = 0.000087). Thus the nurse shark has one of the lowest, if not the lowest, mtDNA diversity in any shark species reported to date. The low levels of mtDNA variation were insufficient for a powerful test of genetic structure. Based on these data we are unable to confidently reject the hypothesis that there is sufficient gene flow throughout the sampled region to homogenize genetic polymorphisms.

0030 Poster Session II, Saturday 9 July 2011

Marina Gerson

California State University, Stanislaus, Turlock, CA, USA

Diet of Blainville Horned Lizards (*Phrynosoma blainvillii*) on the Arena Plains Unit of the Merced National Wildlife Refuge, Merced Co., CA, USA

The diet of the Blainville horned lizard (*Phrynosoma blainvillii*) has been characterized as less specialized than that of other *Phrynosoma* species. This study documents the diet of a protected population of Blainville horned lizards in the central valley of California, determined through microscopic examination of individual fecal pellets. The most abundant prey by number of individuals was the native harvester ant, *Pogonomyrmex californicus*, followed by two genera of carabid beetles. By weight, the carabid beetles represented the highest proportion of the diet. Other prey included two other families of beetles (Tenebrionidae and Cerambycidae), hemipterans, dipterans, lepidopterans, non-ant hymenopterans, and additional ant species. Seeds were also observed in the feces of individuals who had consumed harvester ants, but it is likely these were incidentally ingested. Juveniles and adults showed significant differences in prey diversity. The diet of juveniles was less diverse than that of larger individuals. This is likely the result of larger lizards being capable of incorporating a greater breadth of prey sizes in the diet. For example, carabid beetles were rarely found in the fecal pellets of juveniles while they were a major component of the diet of larger lizards. These preliminary data suggest that maintenance of native ant species may be especially critical for recruitment of juveniles to the adult population, but that adults have more flexibility in meeting their energetic requirements.

0392 Poster Session I, Friday 8 July 2011

Sonia Ghose¹, Steven Whitfield²

¹Occidental College, Los Angeles, CA, USA, ²Florida International University, Miami, FL, USA

Toxic Effects of Current-Use Pesticides in Costa Rica on Amphibians: Acute Toxicity Assays and Meta-Analysis Identify Gaps in Tropical Ecotoxicology

Amphibian populations are declining worldwide, and declines are particularly severe in the Neotropics where amphibian diversity is very high. Environmental pollutants such as agricultural pesticides have been identified as one potential contributor to declines, yet ecotoxicological studies in tropical regions are extremely rare. This study assesses toxic effects on amphibians of the ten most commonly used pesticides in Costa Rica using two approaches. First, we conducted 8-day toxicity assays with commercial formulations of each pesticide using individually reared Red-Eyed Treefrog (*Agalychnis callidryas*) tadpoles. We assessed daily survival, and growth and activity at day 8. Secondly, we conducted a meta-analysis of available LC₅₀ data from the EPA ECOTOX database to allow comparison of findings with our own. LC₅₀ values from our assays ranged from 59.36 µg/L for chlorothalonil to 536.2mg/L for 2,4-D. The nematicides terbufos and ethoprophos and the fungicide chlorothalonil were very highly toxic, with evident effects below 100 µg/L. Our LC₅₀ estimates for *A. callidryas* were consistent with existing data from well-studied herbicides, but our toxicity estimates for two of our three poorly studied fungicides differed by orders of magnitude from published LC₅₀ estimates, and no published data were available for comparison with either of our two nematicides. Our findings emphasize the great need for research into the effects of many commonly-used yet widely unstudied pesticides in tropical countries.

0170 Poster Session II, Saturday 9 July 2011

Teresa Giannini¹, Christopher Swarth², Marilyn Fogel³, Roxane Bowden⁴

¹Jug Bay Wetlands Sanctuary, Lothian, MD, USA, ²Jug Bay Wetlands Sanctuary, Lothian, MD, USA, ³Geophysical Lab., Carnegie Institution of Washington, Washington, DC, USA, ⁴Geophysical Lab., Carnegie Institution of Washington, Washington, DC, USA

Using Stable Isotopes to Investigate Niche Characteristics of Eastern Mud Turtles (*Kinosternon subrubrum subrubrum*) and Common Musk Turtles (*Sternotherus odoratus*)

Eastern mud turtles (*Kinosternon subrubrum subrubrum*) and common musk turtles (*Sternotherus odoratus*) are similar in size and external morphology, are broadly sympatric, and often occupy the same habitats where they co-occur. These closely-related turtles may compete for resources. To determine the level of overlap, we studied species' habitat use and diet at Jug Bay Wetlands Sanctuary, Patuxent River, Maryland.

Musks were almost twenty times more abundant than muds in a non-tidal habitat (beaver pond), whereas muds were three times more abundant than musks in the adjacent tidal marsh, based on hoop trapping. We collected toenail samples from 50 musk and 24 mud turtles, along with 50 potential food items. These were analyzed for carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotopic compositions. Isotopic compositions of diet items (mean \pm sd) differed significantly between the beaver pond ($\delta^{15}\text{N}=7.2 \pm 3$) and tidal marsh ($\delta^{15}\text{N}=12.1 \pm 4$). Beaver pond turtles had $\delta^{15}\text{N}$ values that were 5‰ more negative than tidal marsh turtles. Mud turtles in both locations had more positive $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values than musks. A sequential Bonferroni correction was used with a Mann-Whitney pairwise comparison of turtle samples. $\delta^{13}\text{C}$ differed significantly between habitats, suggesting different carbon sources in these habitats. When N and C isotopes of food items were compared with turtle tissue, both species had omnivorous diets, with muds incorporating more animal matter in their diet. Juvenile diet did not differ significantly from adults. Our study indicates these two species may avoid competition by selecting different habitats and having slightly different diets.

0763 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Whit Gibbons

University of Georgia/SREL, Aiken, SC, USA

What Do We Really Know about Slider Turtles?

The following question was posed more than two decades ago: "Why are there so many unanswered questions about freshwater turtles?" The question was from "Recommendations for Future Research on Freshwater Turtles" in *Life History and Ecology of the Slider Turtle* (1990). The same question can be asked today. Can satisfactory answers really be provided by turtle biologists in areas as diverse as systematics, taxonomy, genetics, reproductive patterns, growth and size phenomena, movement patterns, bioenergetics, geographic variation, survivorship, longevity, and population demographics? Progress has been made in many of the categories, some in part because of long-term studies, but for the most part, vast areas remain unexplored beyond what was known in 1990. Who will take on the challenge and how should it be done?

0259 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Melissa Gibbs

Stetson University, DeLand, FL, USA

Age and Growth Patterns of the Loricariid *Pterygoplichthys disjunctivus*, in Volusia Blue Spring, Florida

Pterygoplichthys disjunctivus (Loricariidae) has been a highly successful invader of tropical and semi-tropical ecosystems around the world, but age and growth parameters

have not been studied. We have collected over 6,000 individuals of this species from Volusia Blue Spring (FL) over the past 12 years and found it reaches a maximum of 51 cm SL. We examined thin sections of over 200 otoliths and found length to be an accurate indicator of age. The youngest fish (12 cm SL) was approximately 1 year old, and the largest (51 cm SL) just under 5 years. Growth rates in Blue Spring are linear. Marginal increment analysis indicates that maximum growth occurs in late summer/early fall, immediately following peak spawning activity. Length-frequency analyses confirm the annual growth patterns calculated with the otoliths, and the annual periodicity of alternating opaque and translucent rings.

**0231 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Sarah Gibson

University of Kansas, Lawrence, KS, USA

**A New Species of Semionotid (Neopterygii: Semionotiformes) Fish from the
Upper Triassic Chinle Formation, Southern Utah**

Fossilized remains of ganoid semionotiform fishes from the Upper Triassic Chinle Formation (southwestern United States) are abundant, yet poorly studied and understood. The extinct family Semionotidae has been the subject of taxonomic confusion and is in need of further study. In this investigation, I describe a new species of *Semionotus* from specimens recently collected from Triassic deposits (approximately 210–205 Ma) in Lisbon Valley, Utah, as well as undescribed material from the nearby localities that were collected by the American Museum of Natural History. The morphological study and description of these specimens includes osteological and meristic data. These specimens display characters previously attributed to genera of the family Semionotidae (specifically *Lepidotes* and *Semionotus*), among these including: the presence of a dorsal ridge scale row, approximately 6-7 infraorbitals, three supraorbitals, large frontals that compose the majority of the skull roof, tapering snout with a small mouth, deep body with predorsal elevation, dense tubercles on the skull roof that continue on the dorsal scales, and a narrow crescent-shaped preoperculum. These specimens possess a unique combination of character states that distinguish them from other semionotids. In addition, further morphological autapomorphies diagnose these specimens as a new species.

0768 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Sean Giery¹, Craig Layman¹, Brian Langerhans²

¹Florida International University, Miami, FL, USA, ²North Carolina State University, Raleigh, NC, USA

Effects of Anthropogenic Estuarine Fragmentation on a Colorful Sexual Trait in Bahamas Mosquitofish (*Gambusia hubbsi*)

Human-mediated ecological change such as climate change, over-exploitation, and habitat alteration have been implicated as important agents of adaptive evolution in natural populations. Despite a burgeoning interest in anthropogenically-mediated evolution, our understanding of evolutionary responses to altered selection regimes is not particularly well developed. Questions regarding the direction, magnitude, and overall consistency of evolutionary responses to anthropogenic change remain unanswered. In this study we investigated effects of anthropogenic ecosystem fragmentation on the evolution of a colorful trait in the Bahamas mosquitofish (*Gambusia hubbsi*) across six different islands of The Bahamas Archipelago. Specifically, we asked: 1) does fragmentation affect male dorsal-fin coloration, and 2) are these effects consistent between island populations? Five adult males from 47 populations differing in fragmentation were sampled for this study. Color measures were taken from digital photographs. Components of fin coloration were analyzed with ANCOVA models that test for shared and unique aspects of phenotypic divergence among fragmented and unfragmented systems for the six islands. We found that male coloration differed among islands, as well as within islands due to fragmentation. However, effects of fragmentation on coloration were not consistent among islands. These results show that fragmentation can generate significant divergence in phenotypes, but the magnitude and direction of divergence appears to depend on island-specific differences in evolutionary history and/or ecological conditions. The unique phenotypic responses that we illustrate in this study are important for understanding the evolutionary fate of species and populations faced with pervasive human-mediated ecological change.

0454 Poster Session III, Sunday 10 July 2011

Matthew Gifford¹, Kenneth Kozak¹

¹University of Arkansas at Little Rock, Little Rock, AR, USA, ²University of Minnesota, St. Paul, MN, USA

Variation in the Thermal Sensitivity of Physiological Performance Between High and Low Elevation Plethodontids

Elevational replacement is a common theme in the distributions of salamanders in the genus *Plethodon*, perhaps most evident in the distributions of *P. jordani* and *P. teyahalee* in the Great Smoky Mountains. This phenomenon has traditionally been interpreted as a consequence of interspecific competition, where each species is competitively excluded from the alternative habitat. However, recent research challenges this paradigm and

suggests that physiological constraints may play a role in limiting the lower elevation range limit of the high elevation species, *P. jordani*; whereas competition appears important in limiting the upper range limit of the low elevation species, *P. teyahalee*. Based on these new results we expect *P. jordani* to exhibit a broader physiological performance breadth than *P. teyahalee*, which may function to limit the distribution of the former species. We test this hypothesis by examining the thermal sensitivity of physiological performance in these taxa.

0461 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Matthew Gifford¹, Kenneth Kozak¹

¹University of Arkansas at Little Rock, Little Rock, AR, USA, ²University of Minnesota, St. Paul, MN, USA

Potential Impact of Climate Change on Competing Salamander Species in the Southern Appalachian Mountains

Impacts of climate change have been documented for organisms across broad taxonomic scales. Many of these studies focus on potential changes in the distributions of single species. However it is clear that species will not respond individually, unaffected by interactions with other species. In this study we examine the potential impact of climate change on a pair of well-known interacting species from the Great Smoky Mountains, *Plethodon jordani* and *P. teyahalee*. We employ mechanistic physiological modeling while incorporating species interactions to predict how increasing temperatures may affect patterns of abundance and distribution of these species. Although previous, models using correlative niche modeling indicate widespread loss of high elevation species; our physiologically based models predict lesser impacts. Our data, however, indicate unexpected consequences once competition is incorporated into the models. We will discuss the importance of considering biotic constraints into climate change projections as well as the scale of the data used to make predictions.

0539 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Bethan Gillett, George Burgess, Yannis Papastamatiou

Florida Program for Shark Research, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA

An Evaluation of Ecotourism-Based Shark Feeding Practices

Marine ecotourism businesses offer exhilarating opportunities for thousands of people every year, bringing clients in close proximity with wildlife. With tourists worldwide seeking more extreme and interactive experiences, dives with charismatic megafauna has been growing in popularity in many areas of the world. Shark diving charters increasingly use chum, bait, or decoys to guarantee their clients' satisfaction. Practices

differ widely, from tourists observing shark behaviors aboard a tour boat, to operators hand feeding sharks with tourist divers present. Policy concerning attracting and feeding these marine predators ranges from complete prohibition, such as in the United States and Egypt, to legal indifference, seen with Mexico and Bahamas. South Africa exemplifies a middle ground, with regulation of the industry through a permit system. Speculation, opinion, and conjecture are often the basis of debates and lawsuits on the topic. Fervent controversy regarding the attracting or feeding these potentially dangerous predators necessitates the scientific review of arguments for stakeholders both in favor of and against shark dive operations. This study evaluates the empirical and observational evidence for the economic, cultural, ecological, public safety, and ethical concerns through a review of *in situ* studies, captive experiments, and case studies involving sharks, other large marine animals, and terrestrial models. Assessment of existing evidence brings proposals for further investigation and suggestions for sustainable industry practices.

0562 Poster Session I, Friday 8 July 2011

Melissa Giresi, David Portnoy, Mark Renshaw

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

Preliminary Assessment of Stock Structure in *Mustelus canis* in US Waters

Mustelus canis (smooth hound) is a small shark in the family Triakidae, which inhabits inshore marine waters from Maine to Brazil. Currently, the IUCN conservation status of this species is near threatened (nt) because of its k-selected life history traits and susceptibility to overfishing, but to date, there has not been a complete stock assessment of the species throughout their US range. We have developed polymorphic microsatellite markers and sequenced the ND2 gene from between 20 and 50 individuals in several locations throughout *M. canis*' US range to test the hypothesis that there will be multiple distinct populations throughout their US range. Preliminary analysis from nuclear encoded microsatellites and a mitochondrial gene, ND2, will be discussed. At the completion of this project, we hope to provide additional information on stock structure for the effective management of smooth hound resources in US waters.

0548 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Richard Glor

University of Rochester, Rochester, NY, USA

Phylogenetics and Diversification of Anolis Lizards

Anolis is a species-rich clade of lizards found throughout the neotropics and into temperate North America. Reconstruction of phylogenetic relationships among major

anole lineages has been a long-standing challenging, apparently because anoles experienced a burst of rapid species diversification early in their history. I discuss a new phylogeny for anoles generated from a multilocus sequence dataset. This phylogeny recovers many long-standing anole clades, as well as improving resolution among basally branching lineages.

0769 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Maria Eugenia Leone Gold

University of Iowa, Iowa City, IA, USA

Geometric Morphometrics of the Crocodylian Eustachian System and its Phylogenetic Implications

The Eustachian system in crocodylians is well known and has been extensively explored morphologically. In particular, the Indian gharial (*Gavialis gangeticus*) has been argued to have a plesiomorphic condition relative to other crocodylians, which bears on conflicts between morphological data (which support a basal position between *Gavialis* and other living crocodylians) and molecular data (which draw *Gavialis* close to the false gharial, *Tomistoma schlegelii*). Modern data collection tools, such as high-resolution computed tomography (CT), provide non-invasive techniques that allow us to internally visualize both modern and extinct species without harming the actual specimen. I performed a geometric morphometric analysis on the Eustachian system using midsagittal slices of ten modern crocodylian species (including hatchlings, juveniles, and adults) and one extinct species with 5 landmarks (Type 1 and Type 2) and 14 sliding semi-landmarks. The relative warp analysis shows a clear grouping between adult *Eosuchus* (a putative basal gavialoid of Paleocene-Eocene age) and *Tomistoma* in two of the plots, and a distinct group formed by a hatchling *Gavialis* and adult *Tomistoma*, but not the adult specimen of *Gavialis*. The condition in *Eosuchus* resembles that of other mature crocodylians and is dissimilar to that of *Gavialis*. These results suggest that structures within the braincase, which are presumed not to be ecophenotypically plastic, support a relationship between *Tomistoma* and *Gavialis* that was previously drawn only with molecular data. Due to the grouping of *Eosuchus* with *Tomistoma*, morphological characters seen in *Gavialis* may be secondarily reversed instead of being plesiomorphic relative to other crocodylians.

0681 Poster Session I, Friday 8 July 2011

Thomas A. Gorman, Carola A. Haas

Virginia Tech, Blacksburg, VA, USA

Experimental Restoration of Reticulated Flatwoods Salamander Breeding Habitat

Although fire is recognized as an important driver in longleaf pine savannas, less is known about the importance of disturbance in wetlands embedded in this system. Reticulated flatwoods salamander larvae are less likely to occur in wetlands with higher amounts of canopy cover and lower amounts of herbaceous vegetation, conditions that occur after fire suppression. We implemented an experiment to evaluate mechanical removal of shrubs as a substitute for fire, because of difficulty burning these wetlands. We studied some wetlands that have recently supported flatwoods salamander breeding (i.e., control) and some that have no recent history of use by flatwoods salamanders and had a dense midstory and lower amounts of herbaceous cover. In 2009, we collected pretreatment data on vegetation and amphibians and in 2010 we conducted mechanical and herbicide treatments and collected post-treatment data. Before treatment, reticulated flatwoods salamanders and ornate chorus frogs were documented at 4/4 control sites and at 0/7 (salamander) and 2/7 (frogs) dense-midstory sites. Calling anurans were 1.6 times more likely to occur at control sites. Our treatments successfully reduced canopy cover to similar levels as controls (41.1%), however herbaceous cover had not recovered (18.1% compared to 48.2% on controls). More time will be required to assess the response of herbaceous cover and whether mechanical methods function as a surrogate for fire.

0220 Poster Session III, Sunday 10 July 2011

Terry Grande, Cal Borden

Loyola University Chicago, Chicago, IL, USA

Comparative Morphology and Phylogenetic Significance of the Paracanthopterygian Caudal Fin

The Paracanthopterygii have historically included a diverse assortment of taxa such as Percopsiformes, Gadiformes, Lophiiformes, Gobiesociformes, and Batrachoidiformes. Caudal fin anatomy such as a fusion of the upper hypurals to ural centrum 2, a complete spine on preural centrum 2, and a reduction of epurals (2) helped to diagnose the clade. Since 1966 however, various groups have been removed leaving the Gadiformes as the only consistent member of paracanthopterygians. The most recent molecular study of paracanthopterygian relationships based on eight gene fragments (12S, tRNA-Val, 16S, 28S, histone H3, ENC1, RAG1) found *Stylephorus* as sister to all gadiforms, and together, sister to zeiforms. Percopsiformes [percopsids (aphredoderids amblyopsids)] and polymixiids were each monophyletic and sequential clades to gadiforms-zeiforms. In light of this novel taxonomic composition and phylogeny, we reexamined the caudal

fin musculature and skeleton. Particular attention was paid to the gadiform/zeiform clade with respect to the taxonomic distribution and homology of “extra” (X and Y bones) caudal fin elements. Gadiform developmental material included in this study allowed for a better understanding of the compound terminal caudal centrum in taxa such as *Bregmaceros*. We also found new characters in the caudal fin musculature that supported the monophyly of both Gadiformes and Zeiformes, including their sister group relationship. Putative fossil paracanthopterygians such as *Asineops*, *Amphiplaga* and *Erismatopterus* provide a historical context for this study and a better understanding of the distribution of “extra” caudal fin elements.

0136 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Matthew Gray

University of Tennessee, Center for Wildlife Health, Knoxville, TN, USA

Are Ranaviruses Capable of Contributing to Amphibian Species Declines?

Ranaviruses have caused mass mortality in wild and captive amphibians on 5 continents, affecting at least 12 families (8 Anura, 4 Urodela). Despite widespread die-offs, the prevailing thought remains that ranaviruses are incapable of contributing to amphibian species declines. Epidemiological theory specifies that local extirpation of a host by a pathogen is possible under three conditions: (1) frequency dependent transmission, (2) broad host range with asymptomatic carriers, or (3) existence of an environmental reservoir. For ranaviruses, it is possible that all three conditions are met. Condition (1): Frequency dependent transmission can occur through direct contact between breeding adults and among larvae especially for species that exhibit schooling behavior. Condition (2): Laboratory and field studies confirm that ranaviruses infect multiple amphibian species, with susceptibility differing among species. Further, sublethal infections are possible in clinically normal individuals. Condition (3): Interclass transmission of ranaviruses occurs among fish, reptiles and amphibians, thus providing multiple possible vertebrate reservoirs for viral persistence. Virions also have been cultured from water and dry surfaces for >90 days, indicating that survival outside the host may be significant. Two long-term studies provide evidence that local extirpation and amphibian species declines caused by ranaviruses are possible. Future research directions should include expanding controlled studies on the: (1) susceptibility of amphibian species to various ranavirus isolates, (2) occurrence of interclass transmission among relevant ectothermic vertebrate species, and (3) environmental persistence of ranavirus virions. Long-term population monitoring and pathogen surveillance also is needed at sites with reoccurring die-offs, especially where uncommon species occur.

0336 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

D. Earl Green

USGS National Wildlife Health Center, Madison, WI, USA

Comparative Pathology of Ranavirus Infections in Wild Amphibians

Ranavirus infections in amphibians in the USA occur predominantly in larvae and metamorphs. Infections are consistently fatal to larvae; ranaviruses are rarely isolated from normal-appearing amphibians. Onset of a die-off is explosive; often hundreds or thousands of sick and dead larvae suddenly appear. Sick larvae are lethargic, swim erratically and have pinpoint or paint-brush hemorrhages in their ventral skin. Accumulation of fluids in lymphatic sacs and body cavity may be mild or severe. Internally, hemorrhages may occur in many organs and tissues of some larvae, and may be seen in muscles, heart, stomach, liver and mesonephroi. Skin ulcers may be present in some larvae and metamorphs; ulcers may be single or multiple, irregular in shape, white with red margins, and may appear on head, body or appendages. Histologically, changes are present in many organs, but especially the skin, gastro-intestinal tract, liver, pancreas, spleen and mesonephroi. Ranaviruses have tropisms for endothelium (blood vessel cells), epidermis, liver, and lympho-hematopoietic cells in the spleen, liver and renal interstitium. Vascular necrosis is detected in the lungs, sinusoids of the liver, spleen, glomeruli and submucosa of the stomach and intestine. Liver changes present as multifocal or diffuse necrosis of endothelial cells lining the sinusoids or necrosis of liver cells. Skin abnormalities begin as swelling of basal cells, thickening of the epidermis, cell necrosis and erosions or ulcers. Changes in the spleen and mesonephroi involve necrosis of glomerular capillaries, macrophages, lymphocytes and renal hematopoietic cells. Characteristic intracytoplasmic inclusion bodies are best detected in liver and skin cells.

0549 Poster Session III, Sunday 10 July 2011

Brian Greene

Missouri State University, Springfield, MO, USA

An Empirical Test of PIT Tag Retention in Juvenile Snakes

The value of data generated in mark-recapture studies is dependent on the retention and recognition of marks assigned to sampled individuals. However, the permanency of marks is not always appropriately tested. Passive integrated transponder (PIT) tags are often considered superior to external marking methods which can be altered or obscured by healing, tag loss, or natural injuries. Due to concerns over possible tag loss in an ongoing demographic study of snake populations, I implanted PIT tags in juvenile cottonmouths (*Agkistrodon piscivorus*) and Great Plains Ratsnakes (*Pantherophis emoryi*) and monitored tag retention rates in a laboratory environment. Of 140 PIT tags implanted, 13 (9.3%) were shed by snakes. All lost tags were shed within one week of implantation. Tags initially lost from snakes were all reimplanted and subsequently retained. Tag retention rates were improved by sealing injection sites with a topical

liquid bandage solution compared to unsealed controls. However, even when injection wounds were sealed, some tags were expelled through the digestive system. No evidence of significant injury or infection due to PIT tags was observed in any of the snakes monitored. To maximize retention of PIT tags for field studies of snakes, it is recommended that injection sites be sealed and that subjects be monitored for several days for tag loss prior to release of marked animals.

0551 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Brian Greene

Missouri State University, Springfield, MO, USA

Demography of the Cottonmouth (*Agkistrodon piscivorus*) Near the Northwest Range Limit

The secretive nature of snakes has impeded the collection of quantitative demographic information on many species. I conducted a 10 year mark-recapture study of *Agkistrodon piscivorus* occupying a spring-fed stream system in southwest Missouri near the northwestern edge of the species' range. The percentage of recaptured snakes increased throughout the study, approaching 60% in 2010. Recaptures of known-age individuals indicated that minimum age at reproductive maturity was 4 years. Adult annual survival rates were estimated to be 80% and were very consistent from year to year and between sexes. Adult snakes had higher recapture probabilities than juveniles and adult females were the most likely to be recaptured. Year-to-year individual recapture probabilities varied substantially with some snakes exhibiting multi-year gaps between recaptures while others were captured in multiple consecutive years. Recapture records revealed that many large adult snakes exceeded 10 years of age. These observations document the value of long-term continuous sampling effort in estimating survival and recapture probability. Estimates of survival for my population are consistent with values reported for *A. piscivorus* in other locations using similar methodologies.

0102 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

Patrick Gregory¹, Kryisia Tuttle²

¹*University of Victoria, Victoria, BC, Canada*, ²*LGL Limited, Sidney, BC, Canada*

Reproduction and Growth of Female Plains Garter Snakes (*Thamnophis radix*) Near the Species' Northern Distributional Limit: Does Latitude Matter?

High-latitude environments are challenging for terrestrial ectotherms because short and cool active seasons presumably limit the time available for foraging and growth, thereby negatively influencing life-history parameters such as age at maturity and frequency of reproduction. Although some species show latitudinal clines in life-history traits, others do not. We estimated growth rates and reproductive output of female Plains Garter

Snakes (*Thamnophis radix*) at Miquelon Lake near the northern limit of the species' range in central Alberta and compared our findings to similar estimates for more southerly populations. Despite a short growing season, female *Thamnophis radix* at Miquelon Lake grew rapidly, reaching maturity in one or two years and attaining greater maximum sizes than snakes in southern populations. Litter sizes also were comparatively large. Not all adult females reproduced every year, but confidence limits on the proportion breeding in consecutive years were very wide. Overall, growth and reproduction in this high-latitude population are comparable to what is seen in other conspecific populations. Possible reasons for lack of marked latitudinal effect include longer days at high latitudes, highly productive aquatic habitats for foraging, effective thermoregulation, and/or countergradient variation in growth rate.

0353 Poster Session II, Saturday 9 July 2011

Iwo Gross¹, Lorin Neuman-Lee², Andrew Durso¹, Stephen Mullin¹

¹Eastern Illinois University, Charleston, IL, USA, ²Utah State University, Logan, UT, USA

Assessing the Relationship Between Parasite Loads and Limb Deformities in Small-mouthed Salamanders (Caudata: Ambystomatidae).

The various factors implicated in the observed declines in the population sizes of many amphibian species can operate synergistically. The relatively high probability of exposure to agricultural pesticides experienced by Small-mouthed Salamanders (*Ambystoma texanum*) in the Midwest means that these populations might also exhibit greater susceptibility to other environmental stressors. We investigated the link between parasitism in members of a Small-mouthed Salamander population and the occurrence of limb deformities in that population. We trapped salamanders in two ponds during consecutive breeding seasons and determined the presence and location of limb deformities and parasitic cysts. We compared the incidence of both phenomena as a function of gender, body size, year, and pond of origin. We used a relationship between snout-vent length and mass to establish an index of body condition and compared that index to the parasite loads for each subject. Parasitic cysts were more common in collected salamanders than limb deformities, and the latter was much more likely to affect the posterior limbs. Multiple cysts were found on a majority of the animals affected, and cysts were found in differing proportions over the regions of the body. Male and female salamanders did not show differences in frequency or pattern of cysts, or of limb deformities. Already stressed by reproductive demands, the salamanders might be experiencing higher parasitism rates because decreased water quality is further compromising the functioning of their immune system. Salamanders having either cysts or limb deformities likely experience reduced individual fitness, which could negatively impact long-term population health.

0429 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Justin Grubich, Sarah McTee

American University in Cairo, New Cairo, Egypt

Red Sea Lionfishes: Patterns of Distribution and Notes on Behavior in their Native Range.

Lionfishes (Scorpaenidae) are endemic to the Indo-Pacific, Indian Ocean and Red Sea regions, where they are voracious coral reef predators armored with flamboyant, venomous spines. In late 1990's, the common lionfish, *Pterois volitans*, was documented in the Atlantic Ocean off the coast of Florida, USA. In less than a decade, *P. volitans* rapidly spread throughout the Western North Atlantic. The successful invasion of the lionfishes into these ecosystems has raised considerable concern over its potential ecological and economic impacts to sensitive coral reefs and important fisheries in the region. Scant scientific information is available on lionfishes, especially from their native biogeographic ranges. To address this information gap, we have surveyed coral reef habitats in four geographic regions of the Egyptian Red Sea coast: Dahab, Sharm El Sheik, Hurghada and Marsa Alam, to document densities, distributions, and behaviors of lionfishes within part of their native range. *Pterois miles* and *P. radiata* are the most common species of lionfish observed in the Red Sea region with densities ranging from 3.6 – 87.3 and 10 – 36.4 fish per hectare, respectively. Foraging behavior and body sizes of Red Sea lionfishes also appear to differ from reports of Western Atlantic invasive populations. Recent literature indicates lionfish in the Atlantic and Caribbean get larger (avg. TL = 21.85cm) and actively forage during the day, while Red Sea lionfishes are generally smaller (10-20cm TL) and diurnally inactive. Instead, they primarily forage at night over sandy habitats and coral patches adjacent to fringing reefs.

0323 Poster Session II, Saturday 9 July 2011

Jenny Gubler, Kirsten Nicholson

Central Michigan University, Mount Pleasant, MI, USA

Investigation of the Evolutionary Relationships Among Species of the *Anolis limifrons* Complex

The phylogenetic relationships among mainland *Anolis* lizards are still not completely resolved and new species continue to be described every year. Recently, widespread species in Central America are being split off, and populations elevated to species level. All of these recent descriptions have been on the basis of morphological data, but no phylogenetic analyses have been conducted to explore how these species are related. Here we report on the genetic variation of *Anolis limifrons* throughout its range, one purportedly closely related species (*A. rodriguezii*), and several new species that have been recently split from *A. limifrons* (*A. cryptolimifrons*, *A. apletophallus*, *A. zeus*, *A. godmani*, *A. biscutiger*, and a new species) to determine if each species is supported by

molecular data. We also analyzed these data to infer the phylogenetic relationships of these species in the context of all mainland *Norops* clade species. We found molecular support for three species: *A. limifrons*, *A. zeus*, and a soon to be described new species. Two recently described species from Panama [*A. cryptolimifrons* and *A. apletophallus*; described by Köhler and Sunyer (2008)] are supported as being distinct from *A. limifrons*, but are not supported as two independent species. As of this writing the placement of *A. godmani*, *A. biscutiger*, and *A. rodriguezii* have not been completed but will be added by presentation time.

0095 Poster Session II, Saturday 9 July 2011

Michelle Guidugli, Michelle Smith, Stephen Richter

Eastern Kentucky University, Richmond, KY, USA

Pattern of Reproductive and Post-Metamorphic Movements in Relation to Meteorological Factors for Two Ephemeral Pond-Breeding Amphibians (*Ambystoma jeffersonianum* and *A. maculatum*)

For many amphibian species, temporal patterns of migration are poorly understood. To better understand these processes, an ephemeral pond-breeding amphibian community was studied using a drift fence-pitfall trap array that completely encircled the pond. Meteorological variables including daily rainfall and mean, minimum, maximum, and maximum changes in air temperature, humidity, and barometric pressure were measured. Several amphibian species including *Rana catesbeiana* (American Bullfrog) inhabited this pond; however, *Ambystoma jeffersonianum* (Jefferson Salamander) and *A. maculatum* (Spotted Salamander) were the only species that bred in large enough abundance for analysis. The environmental cues influencing breeding migrations for the *Ambystoma* species were only somewhat similar between them with rainfall and maximum changes in pressure, temperature, and humidity the most common cues. For exiting migrations, mean temperature was the only cue shared between species and the only factor explaining adult *A. jeffersonianum* exiting migrations. Post-metamorphosis movements for *Ambystoma* species showed no commonality in their use of cues. Similar to adults, the exiting movements for *A. jeffersonianum* metamorphs were influenced only by mean temperature. Variables explaining exiting movements for *A. maculatum* metamorphs were much more varied and more similar to the cues for their respective adult breeding migrations. Overall, the most common cue for movements was mean temperature for *A. jeffersonianum*, and cumulative precipitation for *A. maculatum*; however, many other variables were significant in explaining movements. These results exemplify how closely movements of amphibian species are linked to their environment, yet how species, even closely-related ones, respond differently to the same suite of environmental factors.

0779 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

George Guillen, Emma Clarkson, Kevin Young

University of Houston – Clear Lake, Environmental Institute of Houston, Houston, TX, USA

Multi-scale Temporal and Spatial Patterns in Movement and Habitat Utilization by the Diamondback Terrapin, *Malaclemys terrapin littoralis*, as determined by Radio and Acoustic Telemetry

The Diamondback terrapin (*Malaclemys terrapin*) is the only species of turtle that resides exclusively in brackish water. Seven subspecies are recognized. The Texas Diamondback Terrapin, *M. terrapin littoralis* is found 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 that assess both land and water movement and habitat utilization have been conducted. Our study focused on the movement of terrapin within the West Galveston Bay island complex. To evaluate short-term and long-term movement and habitat utilization of Texas Diamondback Terrapin in both water and land we utilized a combination of acoustic and radio-telemetry. An acoustic telemetry receiver array was established to document terrapin movement within tidal creeks and adjacent open bay habitat once every three minutes over a three year (May 2009-May 2011) period. This effort was coordinated with weekly to monthly active terrestrial radio-telemetry tracking of terrapin on two small islands (South and North Deer Island) and adjacent mainland and barrier island wetlands. The combined use of radio and acoustic telemetry provided unique insight into both short-term (hourly) and long-term (daily-monthly) terrestrial and aquatic movement of terrapin. We observed previously undocumented long-distance movement between islands and mainland habitats. Short-term small scale movement within tidal creeks and adjacent open bay habitat was documented using acoustic telemetry. These data indicate that some terrapin exhibit persistent residency in local aquatic habitats within tidal creeks, while others undergo long distance movement. Our findings highlight the need for multiple complementary monitoring approaches to characterize terrapin behavior and habitat use over multiple spatial and temporal scales. This approach will in turn lead to more informed decisions regarding protection and conservation of essential terrapin habitat.

0445 AES Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Simon Gulak, John Carlson

National Marine Fisheries Service - Panama City Laboratory, Panama City Beach, FL, USA

Movements and Habitat Use of Dusky Shark, *C. obscurus*, in the Northwest Atlantic Ocean: a Preliminary Study Based on Archival Satellite Tags

In an attempt to improve the conservation status of dusky shark, the National Marine Fisheries Service established a time-area closure off North Carolina from January to July to reduce bycatch of neonate and juvenile dusky sharks. To better evaluate the closed area and determine critical habitat of dusky shark, we are deploying pop-off archival satellite tags (PAT). To date, seven tags have been deployed: two tags are pending pop-off, two tags transmitted unusable data, and three provided data that could be analyzed. Based on geolocation data, sharks generally traveled about 10 km day⁻¹ with an average of 691 km in total. Overall, mean proportions of time at depth revealed dusky sharks spent the majority of their time in waters 20-40 m deep but did dive to depths of 400 m. Dusky sharks occupied temperatures of 24 °C over 50% of the time. Tagged sharks had varied movement patterns. One shark that was tagged off Key Largo, FL (USA) in January moved north along the US east coast to the North Carolina/Virginia border in June. A second shark also tagged off Key Largo, FL in March traveled south towards Cuba. The third shark, tagged off North Carolina in March, moved little from where it was initially tagged but problems with estimating the geolocation precluded fully determining its movement patterns in and around the closed area. Data from this study, along with future deployments, will be used to determine the efficacy of the time area closure for dusky sharks.

0677 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011; ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD

Alex Gunderson

Duke University, Durham, NC, USA

Geographic Variation in the Thermal Ecology and Physiology of *Anolis cristatellus* and its Implications in a Changing World

Thermal environments can vary greatly across the ranges of ectothermic species, with potential impacts on these species ecology and physiology. We investigated how ecological and physiological parameters co-vary with habitat thermal variation in the Puerto Rican lizard *Anolis cristatellus*. On Puerto Rico, *A. cristatellus* occurs in two distinct habitat types: moist mesic forest and dry desert scrubland. To characterize the mesic and xeric thermal environments, we measured lizard body temperatures and operative thermal environments at nine sites across Puerto Rico. We found that mesic and xeric habitats present distinct thermal environments, and that the thermoregulatory

strategy of *A. cristatellus* differs between habitat types. Next, we measured temperature-dependent sprint performance curves for mesic and xeric lizards and estimated performance capacities in the field. Mean sprint performance capacities were over 90% in both habitats, although capacities were slightly higher in the xeric habitat. We integrated information on behavioral thermoregulation, operative thermal environments, and thermal physiology to predict habitat-specific consequences of increased global temperatures over the next 100 years on *A. cristatellus*. In the xeric habitat, performance capacities are predicted to decrease by an average of 20-30%, and mean operative temperatures will increase to within 3°C of the upper lethal temperature threshold (CT_{max}). However, in the mesic habitat mean performance capacity is predicted to increase slightly with warming, and mean operative temperatures will remain over 5°C from CT_{max}. Our results reinforce the utility of detailed sampling of the habitats and physiological capacities of multiple populations across a species range.

0611 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Jackie Guzy¹, Anna Deyle¹, Neal Halstead¹, Shannon Gonzalez¹, Earl McCoy¹, Henry Mushinsky¹

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Urbanization Interferes with the Use of Amphibians as Indicators of Wetland Health

Understanding the responses of wetland species to human perturbations is essential to the effective management of water resources. We undertook a study to determine if anuran calling diversity and intensity is a useful way to assess the relative health of wetlands affected by groundwater withdrawal, and if urbanization interferes with the potential to use anurans as indicators of groundwater over-pumping. We monitored calling anurans at 42 wetlands located across central Florida from 2001-2009. The distribution of species among wetlands was examined with a two-way cluster analysis, using PCORD, and the differences among clusters in multivariate structure were examined with the similarity profile (SIMPROF) test, using PRIMER. We examined the effects of urbanization with the mean proximity index (MPX) generated by the FRAGSTATS spatial pattern analysis program. This index assesses the amount and distribution (from clumped to uniform) of a particular land use type within a specified area. Using PRESENCE we estimated occupancy and detection probabilities and examined the relationship between occupancy and ten habitat variables expected to influence individual species occurrence; variables included MPX, percent of forest, distance to next natural wetland, and hydroperiod. Our results indicate that the group of species including *Anaxyrus quercicus*, *Anaxyrus dorsalis*, *Hyla femoralis*, *Hyla gratiosa*, and *Pseudacris ocularis* is a reliable indicator of wetland health. Our results also indicate, however, that the same group of species is selectively excluded from highly-urbanized wetlands. Thus, the usefulness of anurans in monitoring wetland health is substantially reduced as a consequence of urbanization.

0315 Fish Morphology, Symphony I & II, Friday 8 July 2011

Laura Habegger, Philip Motta, Gray Mullins, Michael Stokes, Danny Winters

University of South Florida, Tampa, FL, USA

Feeding Biomechanics of the Swordfish (*Xiphias gladius*) Rostrum

The importance of feeding in organismal life is unquestionable. Feeding is crucial for organismal fitness because survival depends on food acquisition. The feeding apparatus of the swordfish, *Xiphias gladius*, as in other billfish species, is characterized by the presence of an elongated rostrum or bill composed mostly of the premaxillary bones. Despite the prominence of this structure, the function of the rostrum remains controversial. The goal of this study is to characterize the structure and the mechanical properties of the rostrum of this species to ultimately infer its feeding behavior. Strain gauges were applied along the bill and different loading events were tested in two planes. Mechanical variables such as stress, strain, stiffness and second moment of area were estimated using theoretical and experimental approaches. Additionally, histological samples were obtained to characterize the components that constitute the rostrum in this species. Preliminary results showed an increase in the second moment of the area towards the base of the rostrum. Overall stresses appeared to be distributed homogeneously along the rostrum suggesting no particular point of failure. Young's modulus values ranged from 4.7 to 17.9 GPa from the base to the tip, and the increase in stiffness towards the tip coincided with the major concentration of bone. Histology revealed acellular bone as the main component of the rostrum, however hyaline cartilage and adipose tissue were also present. The mechanical properties and the material composition of the bill are discussed with regards to the feeding mechanism of this species.

0655 Poster Session II, Saturday 9 July 2011

Nicholas Haertle

University of Louisiana at Lafayette, Lafayette, LA, USA

Effect of Prey Type on Growth Rates in Juvenile Cottonmouth Snakes (*Agkistrodon piscivorus*).

Acquiring energy is one of an organism's most important activities, and must be successfully performed to survive, grow, and reproduce. Although generalist predators may be capable of consuming a variety of prey, not all prey types will be optimal. For example, a prey type may be suboptimal because it has poor nutrient quality, or because morphological constraints of the predator increase the time or energy required to capture and consume the prey. Consequently, understanding how consuming different prey affects aspects of life history is essential to understanding patterns of survival,

growth, and reproduction. Cottonmouth snakes (*Agkistrodon piscivorus*) are excellent generalist models because they typically feed on both aquatic and terrestrial prey including fish, amphibians, reptiles, and mammals. I compared growth rates of captive born, juvenile cottonmouth snakes raised on different prey types. Snakes were randomly assigned to feeding groups (fish, frogs, or mice), and fed 15% of their body mass approximately every two weeks. Preliminary data suggests that in cottonmouth snakes, individuals consuming mammalian prey will have higher growth rates compared to individuals consuming fish or anuran prey. Therefore, in nature, changes in available prey types that differ in nutritional quality can affect the life history of a generalist predator.

0395 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Travis Hagey, Luke Harmon

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Dynamics of Gecko Evolution

Geckos, best known for their sticky feet, can be used to investigate patterns of morphological adaptation and macroevolution. Current phylogenies suggest geckos were one of the earliest Squamates groups to diverge, more than 200 million years ago (Townsend 2004, Vidal and Hedges 2005), evolving and losing adhesive toe pads multiple times. Geckos have also invaded many different environmental biomes on nearly every continent. We assessed morphological trends in body shape and toe pad structure across geckos to identify rates and modes of evolution as well as potential adaptive and non-adaptive radiations within geckos using the new R package AUTUER. We also investigated changes in diversification rates across geckos to identify clades of interest using an updated version of the R package MEDUSA.

0137 Poster Session I, Friday 8 July 2011

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Variation in Susceptibility to Ranavirus among Anuran Developmental Stages

Ranaviruses have caused catastrophic die-offs of ectothermic vertebrates across the globe. In North America, this group of pathogens causes more amphibian mortality events than any other pathogen. Field observations suggest that ranavirus epizootics in amphibian communities are common during metamorphosis, presumably due to changes in immune function. However, few controlled studies have comparatively examined the relative susceptibility of amphibians to ranaviruses among life stages.

Our objectives were to measure differences in mortality and infection rates following exposure to ranavirus among four developmental stages (embryo, hatchling, larvae, and metamorphosis) and determine whether the differences were consistent among seven anuran species. Counter to our hypothesis, there was inconsistent support that pathogen susceptibility was greatest at metamorphosis; four of the species were most susceptible to ranavirus during the larval or hatchling stages. The embryo stage had the lowest susceptibility among species probably due to the protective membranous layers of the egg. Our results indicate that generalizations should be made cautiously about patterns of susceptibility to pathogens among amphibian developmental stages and species. Further, if early developmental stages of amphibians are susceptible to ranaviruses, the impact of ranavirus epizootic events may be greater than realized due to the greater difficulty of detecting morbid hatchlings and larvae compared to metamorphs.

0555 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Dominik Halas

University of Minnesota, Saint Paul, MN, USA

Phylogeography of the Darter *Etheostoma lynceum* in the Lower Mississippi and Gulf of Mexico Coastal Drainages

The Brighteye Darter, *Etheostoma lynceum*, is a fish found in rocky riffles of streams and small, low-gradient rivers draining into the Mississippi River and the Gulf of Mexico throughout Mississippi and western Tennessee, and parts of Kentucky, Louisiana, and Alabama. It is sister to *Etheostoma zonale*, a highland species found throughout the Appalachian, Ozark, and Ouachita Mountains. While some morphological variation in *Etheostoma lynceum* throughout its range is known, no detailed study of its molecular variation has yet been conducted. Using the mitochondrial cytochrome *b* gene and seven nuclear introns, I have examined the phylogeography of the species. Mitochondrial data suggest that *Etheostoma lynceum* is paraphyletic with respect to *Etheostoma zonale*: one clade, found in the southern Gulf drainages, is sister to all remaining clades in the group, while those *E. lynceum* found in Mississippi drainages are nested within *E. zonale*. The nuclear introns, however, reveal a more complex history: some introns mirror the pattern found in the mitochondrial data, but with the geographical break between clades shifted to the north, while other introns reveal a monophyletic *E. lynceum*, sister to *E. zonale*. Taken together, the data suggest introgression of *E. zonale* genes into *E. lynceum*. The mitochondrial data also indicate a high degree of divergence among populations of *E. lynceum* on a fine geographical scale, suggesting that effective population sizes within the species might be quite small.

0073 Poster Session III, Sunday 10 July 2011

Alexander Hall, Benjamin Pierce

Southwestern University, Georgetown, TX, USA

Call Latency in Anuran Breeding Call Surveys in Central Texas

Concern over global amphibian declines has increased the use of amphibian monitoring programs such as the North American Amphibian Monitoring Program (NAAMP). The NAAMP protocol has been widely used to determine anuran (i.e., frog and toad) species distribution and relative abundance using volunteer-based auditory surveys of male breeding calls. The goals of this study were to monitor anuran breeding habitats in central Texas using the NAAMP protocol and to investigate the utility of a new measure of anuran calling behavior, call latency, the latency of a species to call after the beginning of a call survey. Four routes with ten listening sites per route were surveyed once a month between February and July from 2007 to 2010. Nine species of anurans were heard across all surveys and for six species, annual percent site occupancy changed significantly between years. Call latency and call index (a measure of calling intensity) varied significantly across species. For seven of the nine species, higher call index was associated with shorter call latency. Neither call latency nor call index differed significantly between surveys with low road noise and surveys with high road noise. Call index was not associated with wind velocity, but for two species, call latency was longer in surveys conducted under high-wind conditions than surveys conducted under low-wind conditions. Call latency is more reliably quantified than call index and is a simple measure that can be incorporated into the NAAMP call survey protocol.

0757 Poster Session I, Friday 8 July 2011

Carol Hall, Jeffrey LeClere

Dept. of Natural Resources, St. Paul, MN, USA

Experimenting with GPS Transmitters to Track Wood Turtles (*Glyptemys insculpta*) in Minnesota

The use of Global Positioning System (GPS) transmitters has become increasingly popular in the last several years due, in part, to a reduction in unit size allowing for a wider application to smaller organisms. The obvious advantage of GPS transmitters over the standard radio tracking method of Very High Frequency (VHF) transmitters is the possibility of collecting similar movement data while spending less time in the field and the reduction of intrusion on the study organism. We used a combination of VHF and glue-on micro GPS transmitters (Sirtrack® Hawkes Bay, New Zealand) on each of three adult Wood Turtles (*Glyptemys insculpta*) in southern Minnesota from spring 2009 through 2010. Turtles were periodically relocated using VHF transmitters and removed from the field to download location data and recharge batteries. Download intervals were based on duty cycle settings, which were adjusted according to seasonal activities. Data collected from two male and one female *G. insculpta* found movement and habitat

usage differed among males and females, with males moving in a linear fashion and remaining close to a river system and the female utilizing a somewhat oval home range perpendicular to and farther from the river. Nesting areas and overwintering sites were identified, providing important sites to focus conservation efforts. Results from this study found GPS transmitters to be a valuable tool in identifying travel patterns and habitat use for individual turtles, however, the loss of VHF signals for extended periods required additional time searching for turtles.

0111 Herp Ecology, Symphony I & II, Sunday 10 July 2011

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Abundance and Survival of the San Francisco Gartersnake in Coastal San Mateo County, California

The San Francisco Gartersnake (*Thamnophis sirtalis tetrataenia*) has been federally listed as endangered since 1967, but little demographic information exists for this species. We studied the San Francisco Gartersnake from 2007 through 2010 in coastal San Mateo County, California, to examine its abundance, survival, and sex ratio. The best-supported Jolly-Seber model indicated annual variation in daily capture probability, with constant annual survival rates. Abundance increased throughout the study period, with a mean total population across all study years of 495 (95% CI = 352 - 720) individuals. Annual survival was greater than that of other gartersnakes reported in the literature, with a mean annual probability of survival of 0.85 (0.68 - 0.96). From 2008 through 2010, the posterior probability of an increase in abundance at this site was 0.895. Although this population appears to be doing well, long-term studies of the status of the San Francisco Gartersnake at other sites are required to determine long-term population trends and mechanisms that promote the recovery of this charismatic member of our native herpetofauna.

0593 Poster Session I, Friday 8 July 2011

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Effects of Right-of-Way Mowing on Nesting and Larval Development of the Four-toed Salamander (*Hemidactylium scutatum*) in Northeast Tennessee

Over 2.8 million acres of electrical transmission right-of-ways (ROWs) are managed in the United States, but limited data exists on potential impacts to Plethodontid

salamanders. We investigate ROW mowing effects on four-toed salamander (*Hemidactylium scutatum*) nest success and larval development. The ROW is mowed every 5 years and bisects nesting habitat. Nests were located prior to mowing (2007) and subsequent years to document female presence and clutch size. Nests prior to and one year after mowing were as likely to be abandoned by females (35% and 19% respectively) as nests within the forest (19% and 30%). However, 2 and 3 years after mowing, ROW nests were significantly more likely to be abandoned (41% and 39%) than forested areas (11% and 13%). To determine the effects on larval development experimental plots were established in the ROW and control plots within the adjacent forest. One ROW plot was mowed annual (2008-10) while the other was mowed every 5 years (2008) and allowed to revegetate. Larvae developed in mesocosm pools centered on the Forest/ROW edge and extended 9 meters into both the forest and ROW treatment. Percent survival was measured for each pool. In 2009, larvae in the annual treatment and 5-year treatment had significantly less survival (19.17% and 20%) than forested pools (53%). In 2010, larvae from the 5-year treatment had significantly less survival (34%) than forested pools (68%). After 2 years of vegetative growth four-toed nests and larvae in a mowed ROW were not as successful as in a forest.

0762 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

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High-resolution Movements of Large Coastal Sharks Satellite-tagged in the Subtropical Atlantic

Wide spectrums of behavioral and ecological processes are innately related to movement, including migration, dispersal, predator avoidance, mating and foraging. Quantifying animal movement provides spatial and temporal information on how animals interact with-and respond to-changes in their surrounding environment. The oceans have strong spatial and regional differences in prey fields; however, an understanding of how marine predators, particularly sharks, navigate toward and respond to resources remains poorly understood. In the present study we used Smart Position and Temperature Transmitters (SPOT tags) and movement analysis to examine the habitat use patterns of large coastal sharks in the subtropical Atlantic. Sharks demonstrated a combination of direct, straight-line movements and or complex searching patterns, at varying spatial scales and resource patches. These findings are compared with general principles of foraging ecology and discussed in terms of identifying areas important to the life history of these threatened species.

0553 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Paul Hampton

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Macroecological Patterns Associated with Diet Breadth in Snakes

Dietary breadth in vertebrates is associated with several aspects of macroecology including body size and geographic range. While snakes have received considerable attention to feeding performance and trophic morphology, broad scale studies of their foraging ecology are relatively rare. Using up to 64 species, I calculated phylogenetic and conventional regressions among diet diversity, area of geographic range, maximum body size (SVL), and relative gape. Preliminary data indicates a positive relationship between maximum body size and geographic range. A positive association was also observed between both maximum body size and range size with prey diversity; however relative gape size was not correlated with diet diversity. Given the available models, differences among Akaike's Information Criterion values suggest that geographic range is the best indicator of diet diversity, followed by a model of both range and maximum body size. One explanation for these results is that compared to relatively small species, larger species have a larger geographical range throughout which a high diversity of prey is encountered.

0049 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

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Interactive Effects of the Fungicide Thiophanate Methyl and *Batrachochytrium dendrobatidis* in Culture and on Southern Leopard Frogs (*Lithobates sphenoccephalus*)

Increasing evidence suggests that both abiotic contaminants and disease-inducing pathogens have independently contributed to global amphibian declines. Chytridiomycosis, an emerging infectious disease of amphibians caused by the pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*), as well as numerous pesticides, have played major roles in such declines over the past three decades. However, the interactive effects of such perturbations are largely unknown. We conducted laboratory studies to test for interactive effects between the broad-spectrum fungicide thiophanate-methyl (TM) and *Bd* in culture and in tadpole hosts. In culture, *Bd* growth was significantly inhibited as compared to control when grown on TM plates. Total *Bd* zoospore concentrations were significantly reduced when TM was applied to pre-established *Bd*. In hosts, larvae exposed to TM alone were significantly larger and more developed than control and *Bd* exposed animals. Additionally, these effects carried over through metamorphosis with newly metamorphosed adults displaying increased growth

and development as compared to all other treatments. Surprisingly, larvae exposed to both TM and *Bd* were significantly larger and more developed than all other larval treatments; however, these interactive effects were lost at metamorphosis. These results indicate that TM negatively affects *Bd* in both culture and hosts while facilitating larval growth and development through metamorphosis. Further studies are required to elucidate the impacts of TM on *Bd* and amphibian health.

0595 Poster Session III, Sunday 10 July 2011

Kerry Hansknecht, Jason Magnuson

Lander University, Greenwood, SC, USA

A Preliminary Investigation of the Tongue Morphology of *Nerodia clarkii*

Mangrove Saltmarsh Watersnakes (*Nerodia clarkii compressicauda*) use their tongue as a predatory lure to attract fish. This behavior involves temporally extended protrusion of the tongue combined with extensive curling at the distal tip. Because it is conceivable that this behavior might have coevolved with a lengthening of the tongue, we compared several measures of tongue length (relative to snout-vent length and head length) between *N. c. compressicauda* and the conspecific Gulf Saltmarsh Watersnake (*N. c. clarkii*). The exhibition of lingual luring by the latter has not yet been observed but is currently under investigation. Relative tongue length was significantly greater in *N. c. compressicauda*, and this might be an indication that *N. c. clarkii*, which occurs in grassy salt marshes rather than in mangroves, does not use the tongue to lure prey.

0157 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

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Geographic Differences in Diet of the Poison Frog *Oophaga pumilio* from Costa Rica and Panama

Alkaloid-based chemical defenses in poison frogs are sequestered entirely from a natural diet of certain alkaloid-containing arthropods. Increasing evidence suggests that mites and ants are responsible for the majority of frog alkaloids. Alkaloid defenses vary significantly among poison frog species as well as among populations of the same species. One of the fundamental questions in this system involves explaining the observed differences in alkaloid defenses of frogs. Arthropod abundances are known to vary spatially and temporally, suggesting that the availability of arthropods could be responsible for variation in chemical profiles of poison frogs. One expectation of this hypothesis would be significant differences in diet among populations of poison frogs.

The strawberry poison frog *Oophaga pumilio* is known to exhibit extreme variability in alkaloid defenses among locations throughout its geographic range, and represents a model species in which to begin testing this hypothesis. Herein, we describe differences in dietary composition among three populations of *O. pumilio* from Costa Rica and Panama. The diet of *O. pumilio* at each location consists largely of mites and ants, which is consistent with previous studies of this species. Dietary composition varied significantly among populations (Global $R = 0.739$; $p < 0.001$), largely due to differences in the dietary composition of mites and ants. The results of our study suggest that there is significant variation in diet among populations of *O. pumilio*, providing some of the first direct evidence that differences in frog alkaloid defenses are due to differences in diet.

0207 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Meagan Harless¹, Casey Huckins¹, Jacqueline Grant², Thomas Pypker¹

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Comparative Toxicity of Six Chemical Road Deicers to Larval Wood Frogs (*Rana sylvatica*)

Widespread application of road deicers, primarily road salt (NaCl), in cold climates of North America threatens water quality and health of freshwater ecosystems. Exposure to road salt runoff can be harmful to sensitive members of freshwater ecosystems such as amphibians. The number of negative effects of NaCl application on the environment has prompted the search for alternative chemical deicers. We conducted a series of 96 hour acute toxicity tests to determine the tolerance of larval wood frogs (*Rana (Lithobates) sylvatica*) to six deicing chemicals: urea (CH₄N₂O), sodium chloride (NaCl), magnesium chloride (MgCl₂), potassium acetate (CH₃COOK), calcium chloride (CaCl₂), and calcium magnesium acetate (C₈H₁₂CaMgO₈). Acetates are sometimes touted as 'environmentally friendly' alternatives to road salt, but have not been examined in enough detail to warrant this designation. When exposed to a range of environmentally realistic concentrations of these six chemicals, larvae were least sensitive (i.e., lowest rate of mortality) to CH₄N₂O, NaCl, and MgCl₂ and most sensitive to acetates (C₈H₁₂CaMgO₈, CH₃COOK) and CaCl₂. Our observed LC₅₀_{96-h} values for NaCl were over two times higher than values presented in previous studies, which suggests variability in NaCl tolerance among *R. sylvatica* populations. The deicers varied greatly in their toxicity and further research is warranted to examine the differential effects of this suite of deicers to other species and the environment.

0160 Poster Session II, Saturday 9 July 2011

Jeremy Harris, Theresa Grande

Loyola University of Chicago, IL, USA

The Pectoral Girdle in Triglidae and Other Scorpaeniform Fishes and its Phylogenetic Implications

Scorpaeniform fishes have evolved a variety of pectoral fin adaptations designed to support their benthic lifestyle. One such trait, termed pectoral “free rays,” is a set of 1-3 pectoral fin rays that have been modified to act independently of the main fin. These free rays are operated by a complex of muscles that have received little attention from morphologists and are poorly understood. Free rays are most often associated with the Triglidae (sea robins), but are also found in four other Scorpaeniform families (Peristediidae, Hoplichthyidae, Apistidae, and Synanceiidae) encompassing over 200 species of fishes. This study examines the skeletal structure and musculature of free rays in 30 scorpaeniform species representing 17 genera and five families. The origins and insertions of the free ray muscles are described, including novel divisions of the abductor superficialis, adductor superficialis, and adductor profundus. The skeletal morphology of the free rays is described, with particular attention given to the processes at the base that allow for the attachment of these extra muscles. Some of these muscles, such as the adductor superficialis, have subdivided multiple times such that each free ray has two independent branches of this muscle. Some possible functional roles for each new subdivision are discussed. While the form of these rays is conserved at the species and generic level, significant variation is found among different families. This character complex is considered in light of current phylogenetic hypotheses for these groups, and may serve as an important source of characters for phylogenetic reconstruction within Scorpaeniformes.

0296 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Elizabeth Harrison¹, Timothy Collins¹, Joel Trexler¹, Ella Vazquez², Ulises Razo Mendivil²

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Determining the Source(s) for *Cichlasoma urophthalmus* (Mayan Cichlid) in South Florida

Invasive species are a major threat to biodiversity and ecosystem function, and are of increasing economic concern. Nevertheless, biologists have struggled to explain why some species become established and spread in new habitats while others do not. One hypothesis is that populations with high genetic diversity are able to adapt more quickly to new environments than genetically depauperate populations, thus enhancing invasion success. The Mayan cichlid (*Cichlasoma urophthalmus*) is native to the Atlantic slope of Central America. It was first recorded in Everglades National Park in 1983 and

is now well established throughout most of south Florida. We examined genetic structure of introduced and native populations of Mayan cichlids by examining six loci, both mitochondrial and nuclear, to evaluate source populations, genetic diversity, and number of introductions. We have obtained 504 specimens from within the Florida Everglades, Mexico, Belize, Honduras, and Guatemala. We have screened 100 specimens representing all geographic locations sampled to date. Preliminary results indicate six single nucleotide polymorphisms (SNPs) within cytochrome b that distinguish between samples from Mexico and Honduras (native range), and the Everglades (introduced range). We located two indels and a substitution within the S7 intron 1 gene. These results show that cytochrome b and S7 intron 1 genes can help to identify source populations for Mayan cichlid introductions in south Florida. Future work will use GenBank to identify additional nuclear and mitochondrial genes that can be used to locate SNPs for Mayan cichlids.

**0535 SSAR SEIBERT CONSERVATION AWARD, Session II, Conrad B & C,
Friday 8 July 2011**

Anna Hathaway, Thomas Hentges, Earl McCoy, Henry Mushinsky
University of South Florida, Tampa, FL, USA

**Relocating Gopher Tortoises onto a Working Cattle Ranch: How Does
Available Vegetation Correlate with Burrow Placement**

As part of a state-funded Gopher Tortoise (*Gopherus polyphemus*) conservation project, we are determining if actively grazed pastures can serve as suitable recipient sites for translocated tortoises. Translocating tortoises to cattle ranches poses several problems, one being that differences in vegetation type and quality may significantly affect juvenile growth to sexual maturity. Beginning in August 2009, tortoises have been moved to a working cattle ranch in west-central Florida. We sampled vegetation, using 0.25m x 0.25m quadrats along transects, from April 2010 to April 2011. Our results show that, across the entire study site, four herbaceous dicot species, *Chenopodium* sp., *Conyza* sp., *Desmodium* sp., and *Richardia* sp., were dominant, although dominance varied between fields. *Lepidium* sp. also was common across the entire study site. Four of these species are known to be important to the diet of the Gopher Tortoise and are thought to be preferentially selected by sexually mature females and juveniles. Positive selection does not necessarily correlate with high nutritional content in all cases, however. Our data were analyzed using GIS software to create a "probability of encounter surface" (location and density) for each of the five plant species. We then examined the correlation of burrow placement with probability of encounter of plants, and with frequency of use by cattle. These factors may play an important role in the long term success of translocations of the Gopher Tortoise to actively grazed pastures.

0138 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Malorie Hayes, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

From the Bottom to the Top: Comparative Phylogeography of Two Gulf Coastal Plain Fishes

The Gulf Coastal Plain is a biogeographically interesting region. The widespread distribution of many species across the Gulf Coastal Plain offers the opportunity to examine comparative phylogeographic structure of co-distributed taxa and to assess the responses of sympatric species to common, well documented historical phenomena. *Labidesthes sicculus vanhyningi* (Atherinopsidae) and *Percina nigrofasciata* (Percidae) have similar, widespread distributions across the Gulf Coastal Plain, but are dissimilar in terms of their preference for pelagic and benthic habitats, respectively. This study attempts to test the current hypotheses of phylogeographic breaks across the Gulf Coastal Plain using two widespread freshwater species with divergent life history patterns. Specifically, we used mtDNA and nDNA to determine whether the evolutionary histories of these sympatric - and often syntopic - species reflect similar responses to historical events in the region. Using an array of phylogeographic analyses and fossil calibrated gene trees, we investigated the shared and divergent patterns observed between these pelagic and benthic freshwater fishes. The results suggest these species have experienced unique evolutionary histories that are due, in part, to their respective habitat preferences.

0139 Poster Session II, Saturday 9 July 2011

Malorie Hayes, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Gene Trees, Species Trees, and Molecular Dating of the Tribe Chapalichthyini

The Central Mexican Plateau is a dynamic and complex highland region which has been shaped by volcanic and geologic activity since the Miocene. It is relatively depauperate in terms of its ichthyofauna, however, one group, the Goodeidae, represents one of the most diverse groups in this region, with 19 genera, approximately 40 species, and five tribes (Girardinichthyini, Goodini, Ilyodontini, Charachontini, and Chapalichthyini). The phylogenetic relationships among all goodeid fishes previously have been investigated using mtDNA, providing a robust hypothesis of the tribes and genera of goodeid fishes. However, due to discrepancies of previous mitochondrially based studies, we tested the monophyly of the Tribe Chapalichthyini using additional mtDNA and nDNA markers. In addition to developing concatenated multi-gene phylogenies, we summarize the collective information using a coalescent species-tree approach. Furthermore, we estimate the timing of divergence of the Tribe using related molecular clocks and fossil calibrations methods. The monophyly of the Tribe Chapalichthyini as well as hypothesized dates of divergence will be discussed.

0069 Poster Session III, Sunday 10 July 2011

Blair Hedges

Penn State University, University Park, PA, USA

CaribHerp: A New Web Resource for Caribbean Herpetology

With color images and distribution maps, caribherp.org functions as a checklist and quick identification guide to the >750 species of amphibians and reptiles of the West Indies. Sounds and video are included for selected species. An initial list of species accounts is first generated by the user, for all species or only those on one island, or those having a search term in their account. The list may be further sorted in many different ways (taxonomy, common name, etc.). A new journal, Caribbean Herpetology, is integrated with the database. The initial journal section, Sightings, uses an online form to record new and significant information on distribution, behavior, and other categories. After review and acceptance, these short articles are published online and the information is integrated with the database. Photos, video, and sounds (frog calls) can accompany article submissions. As the journal develops, longer articles will be published. Two other related Caribbean web resources have been released as well: caribmap.org and caribnature.org. CaribMap is a resource for exploring historical map images of the Caribbean, now numbering more than 600 maps dating back to the early 1500s. Map images are fully sortable and searchable. Each map is scanned at high resolution so that details map be examined. CaribNature is a conservation site that presents multimedia essays on the natural history of the islands and difficulties facing the biodiversity, starting with Haiti. The mediography is mostly from the work of professional videographers and photographers. The site is available in English, Spanish, and French.

0025 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Blair Hedges¹, Angela Marion², Nicolas Vidal³

¹Penn State, University Park, PA, USA, ²Penn State, University Park, PA, USA,

³Museum National d'Histoire Naturelle, Paris, France

Blindsnake Evolution: Tracing the Deep History and Biogeography of a Mega-Radiation of Burrowing Snakes

Worm-like snakes (scolecophidians) are small, burrowing species with reduced vision. Although largely neglected in vertebrate research, knowledge of their biogeographical history is crucial for evaluating hypotheses of snake origins. A recent analysis of molecular data in diverse lineages of scolecophidians showed that they have had a long Gondwanan history, and that their initial diversification followed a vicariant event: the separation of East and West Gondwana approximately 150 Ma. Two new families were discovered and described, both distributed on the palaeolandmass of India+Madagascar

(Indigascar). Their later evolution out of Indigascar involved vicariance and several oceanic dispersal events, including a westward transatlantic one, unexpected for burrowing animals. Since then we have gathered additional data that bear on the early evolutionary history of these enigmatic snakes. Their broad distribution, deep history, and close association with continental drift have made scolecophidans an exemplar of historical biogeography.

0343 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Matthew Heinicke, Aaron Bauer, Todd Jackman

Villanova University, Villanova, PA, USA

Phylogeny and Patterns of Diversification in the *Pachydactylus* Group (Gekkota: Gekkonidae)

The gekkonid genus *Pachydactylus* and its close relatives *Chondrodactylus*, *Colopus*, *Elasmodactylus*, and *Rhoptropus* (the *Pachydactylus* group) together constitute among the more diverse squamate radiations in Africa, with 66 nominal species. These genera exhibit a large degree of variation in morphology and ecology, and one or more species are common elements of local herpetofaunas throughout most of southern Africa. Thus, they are a good group for studies of evolutionary processes at the historical level. We have produced a comprehensive molecular dataset including all but one named species plus several others undescribed or in synonymy. Phylogenetic and divergence timing analyses based on sequences of multiple nuclear and mitochondrial genes were performed to estimate the pattern and tempo of divergence in the *Pachydactylus* group, with the comprehensive taxon sampling allowing for direct estimates of diversification rates through the Cenozoic. Phylogenetic analyses recover a well-resolved tree with most branches receiving significant support, and suggest that several currently-recognized genera of the *Pachydactylus* group are not monophyletic. Divergence timing and diversification analyses reveal significant shifts in diversification rate of the group. These shifts are correlated with reconstructed shifts in morphology and ecology, suggesting that speciation rate may be linked with shifts in niche during the evolutionary history the *Pachydactylus* group.

**0389 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday
10 July 2011**

Heather Heinz, Todd Jackman, Aaron Bauer

Villanova University, Villanova, PA, USA

Comparative Phylogeography of two Wide-ranging Geckos: Cryptic Species in Southern Africa

The *Pachydactylus* group is a speciose clade of African geckos, most of which are characterised by small, highly circumscribed distributional ranges corresponding to particular substrate types or geographic features. Two conspicuous exceptions to this generality are *Chondrodactylus turneri*, a large-bodied, rupicolous climbing species, and *Pachydactylus punctatus*, a typically small-bodied, terrestrial species. The overlapping ranges of these two species span 20+ degrees of latitude and nearly the width of the Southern African subcontinent, including a variety of ecological and topographical regions such as the Great Escarpment and the Kalahari Desert. Such broadly distributed species represent a challenge to biogeographers trying to explain patterns of speciation via isolation and adaptation to local environments. We used DNA sequence data from both nuclear and mitochondrial markers from individuals throughout the ranges of two focal species and their closest relatives to evaluate whether *C. turneri* and *P. punctatus* are truly widespread, single species or if their anomalous distributions are artifacts of current taxonomy and to compare and contrast their patterns of genetic diversity in a biogeographic context. We present clear and similar substructure within both, including diverse North to South structuring in Namibia, strong East to West structuring across the Southern African subcontinent (albeit with a sampling gap in the Kalahari), and deep divergences between putative conspecifics are as great as those between some recognized sister species pairs in *Pachydactylus*. In Namibia, we found evidence of gene flow among multiple scalation and coloration morphotypes, warranting further investigation.

0680 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Jill Hendon¹, Eric Hoffmayer¹, Christian Jones², Gregg Poulakis³, Joseph Quattro⁴, Justin Lewandowski⁴, William Driggers², Matthew Ajemian⁵

¹University of Southern Mississippi, Ocean Springs, MS, USA, ²NOAA Fisheries, Pascagoula, MS, USA, ³Florida Fish and Wildlife Conservation Commission, Tallahassee, FL, USA, ⁴University of South Carolina, Columbia, SC, USA, ⁵University of South Alabama, Dauphin Island, AL, USA

Evidence of a Second *Rhinoptera* Species Inhabiting the Northern Gulf of Mexico

In 2007, three rays were collected during a Mississippi fishing rodeo that were tentatively identified as the Brazilian cownose ray, *Rhinoptera brasiliensis*; a species not known to inhabit the northern Gulf of Mexico. Phylogenetic analyses of the mitochondrial COI locus revealed the specimens putatively identified as *R. brasiliensis* were genetically distinct from the Atlantic cownose ray, *R. bonasus*, which is the only member of the genus reported to be indigenous to the region. We have been unable to obtain tissue samples from vouchered *R. brasiliensis* specimens for comparison with our molecular data set, therefore, the identity of the rays is still unresolved. To investigate the broad scale distribution/occurrence patterns of the *R. cf. brasiliensis* in the northern Gulf of Mexico, cownose rays were collected with gillnet and trawls off Texas, Louisiana, Mississippi, and Florida. Thirty-five *R. cf. brasiliensis* have been collected to date with individuals occurring off the coasts of all four states. The ratio of *R. cf. brasiliensis* to *R. bonasus* in collections increased from east to west in the northern Gulf of Mexico, with the percentage of occurrence being lowest off Florida (2%), intermediate off Mississippi (20%) and highest in waters off Louisiana and Texas (69%).

0226 Poster Session III, Sunday 10 July 2011

Dean A. Hendrickson¹, Adam E. Cohen¹, Ben Labay¹, F. Douglas Martin¹, Sahotra Sarkar², Blake Sissel², Michael Ciareglio², Jeremy Harrison¹, Melissa Casares¹, Gary P. Garrett³, Robert J. Edwards⁴

¹University of Texas Austin, Texas Natural Science Center, Texas Natural History Collection, Austin, TX, USA, ²University of Texas Austin, Section of Integrative Biology, Austin, TX, USA, ³Texas Parks and Wildlife Department, Heart of the Hills Fisheries Science Center, Mountain Home, TX, USA, ⁴University of Texas - Pan American, Department of Biology, Edinburg, TX, USA

The Fishes of Texas Project - Status of Compilation and Standardization of Museum-Vouchered Fish Collection Data, Online Database, and Related Research

Distributions of Texas' freshwater fishes were documented by compilation and normalization of museum records from 33 institutions. The 81,218 records produced in the first round of data processing ("Track1") include nearly all of ~280 species found in Texas at 5,729 localities sampled by 10,954 collecting events from 1854-2009. Precise manual georeferencing of 87% of records with placement error estimates facilitated mapping for discovery/flagging of 3,789 geographic outliers / probable identification errors. Inspection of all flagged specimens revealed up to 70% misidentification rates (of flagged specimens) in some collections and resulted in previously unreported major basin records for 28 species. Species Distribution Models (SDMs) generated using Maxent proved to be powerful predictors of distributions that we used in explorations of faunal reactions to future climate scenarios and in computerized conservation network planning incorporating climate change and socio-economic data. Track1 data can be searched and downloaded at www.fishesoftexas.org along with scans of collectors' fieldnotes and an extensive gallery of fish images. "Track2" data are now compiled and will increase occurrence records to > 103,000 following processing through the same quality control process as Track1. Track2 includes data from 7 new institutions but is primarily the result of rapid growth in our own (TNHC) collection (including orphaned collections). New, interactive, extensively illustrated identification key is in development, as are species accounts that link dynamically to independent online information. Please explore and help improve the database/website by commenting and uploading additional photos, fieldnotes, etc. and vouchering any Texas collections in contributing collections.

**0152 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday
10 July 2011**

Sujan Henkanaththegedara, Craig Stockwell

North Dakota State University, Fargo, ND, USA

Intraguild Predation Mediates Co-existence of Native and Invasive Fish

Understanding mechanisms that allow co-persistence of natives with non-natives may provide important insights on how best to manage highly altered systems. Here we report a case of intraguild predation as a mechanism to facilitate co-persistence of endangered Mohave tui chub (*Siphateles bicolor mohavensis*) with invasive western mosquitofish (*Gambusia affinis*). We established experimental sympatric and allopatric populations of Mohave tui chub and western mosquitofish to evaluate reciprocal trophic interactions between these two fish species. Mosquitofish had a significant negative effect on Mohave tui chub recruitment ($W=142$; $P<0.01$). Reciprocally, tui chub had a significant negative effect on mosquitofish recruitment ($W=137.0$; $P<0.05$). One unexpected outcome was reduced survival of adult mosquitofish in the presence of tui chubs. Allopatric mosquitofish populations were significantly larger (157.2 ; $SE \pm 26.9$) than mosquitofish populations sympatric with tui chubs (22.1 ; $SE \pm 4.0$) ($W=155.0$; $P=0.0002$) with extremely low survival of male mosquitofish in sympatry. Additionally, sympatric female mosquitofish survivors were significantly larger than allopatric populations suggesting predation by tui chubs was gape-limited. These experimental results show intraguild predation (IGP) between invasive western mosquitofish and endangered Mohave tui chub which is structured based on size stages of interacting species. Thus, IGP is an apparent mechanism facilitating persistence of Mohave tui chub in the presence of non-native western mosquitofish. Our results also suggest mosquitofish control may not be necessary for the conservation management of endangered Mohave tui chub and sites harboring mosquitofish should not be overlooked as potential refuge sites.

0450 Poster Session II, Saturday 9 July 2011

Patricia Hernandez

George Washington University, Washington, DC, USA

Palatal Organ Origin, Development, and Evolution Within Cypriniformes

The palatal organ plays a key role in separating edible from inedible prey items during benthic feeding. Located in the anterior pharyngeal roof, the palatal organ is a muscular cushion composed of a tangled mass of differently sized muscle fibers covered by an epithelium studded with mucous cells and taste buds. While the requisite neurobiological circuitry required to use this structure has been well documented little, if any, data address either the embryological origin of this muscular organ or the ontogenetic stage at which it first develops. Here we describe the ontogeny of the palatal organ in several ontogenetic stages of the zebrafish. Moreover, we compare the

muscular structure of this organ in a number of cypriniform species to determine interspecific differences that characterize this feeding structure. While relatively few cypriniforms have the well-developed palatal organ that characterizes goldfish and carp, it is possible that although smaller in many other species, the palatal organ may still be involved in different trophic functions. The palatal organ, while less well-developed in zebrafish than in other cypriniforms, is apparent from very early larval stages. Moreover, the combination of muscle fiber types seen in the adult may reflect the complex embryological origin of this organ. Identifying the developmental mechanisms responsible for the origin of this feeding adaptation may enhance our understanding of how functional novelties arise and evolve.

**0756 Invasive Species, Symphony I & II, Sunday 10 July 2011; ASIH STOYE
ECOLOGY & ETHOLOGY AWARD**

Caleb Hickman

University of Wisconsin, Madison, WI, USA

Indirect Effects of an Invasive Shrub (*Lonicera maackii*) on Larval Amphibians

Non-native invasive species have the potential to indirectly impact native populations through non-trophic and non-competitive links. Invasive species as novel stressors can be particularly threatening when coupled with a natural stressor such as predation. My research focuses on how a habitat altering shrub (Amur Honeysuckle, *Lonicera maackii*) can exacerbate the effects of natural predator stressors and promote novel responses of larvae of four amphibian species (the toad *Anaxyrus americanus*, and the frogs *Hyla* sp., *Lithobates clamitans* and *L. blairi*). Invasive plants provide novel leaf input to aquatic systems. Leachates from leaves can influence native chemical processes, thereby increasing mortality and altering behavior of some larval amphibians. I developed lab and field experiments to determine how honeysuckle can impact larval amphibian survival and antipredator traits. These results emphasize a new perspective on how invasive plants indirectly impact native amphibians through non-trophic and non-competitive means.

**0422 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH
STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD**

Benjamin Higgins

California State University, Fullerton, Fullerton, CA, USA

**Feeding Meets Reproduction: Jaw Mechanics and Dietary Breadth in the
Beach-spawning California Grunion (*Leuresthes tenuis*) and its Atherinopsine
Relatives (Teleostei: Atherinopsidae)**

We compared jaw mechanics and dietary breadth in the sister atherinopsids *Leuresthes tenuis* (California grunion) and *L. sardina* (Gulf grunion) along with three other members of the Atherinopsini to test whether the two grunion species have evolved a novel jaw protrusion that might be associated with feeding narrowly on abundant prey near the spawning beaches. Clear-and-stained specimens of *L. tenuis*, *L. sardina*, *Atherinops affinis* (topsmelt), *Atherinopsis californiensis* (jacksmelt) and *Colpichthys regis* (false grunion) were analyzed for dentary, premaxillary and maxillary bone shapes, protrusion distance, lower jaw rotation, and premaxillary-vomer spacing. For dietary analysis, adult *L. tenuis* and *A. affinis* were collected offshore, simultaneously with zooplankton samples to represent prey availability. Compared to their relatives, the sister *Leuresthes* taxa have evolved longer, more downward premaxillary protrusion and expanded dentary and premaxillary bones, with *L. tenuis* showing increased divergence in these features. *L. tenuis* fed heavily on mysid crustaceans, and, as predicted, had a narrower diet than *A. affinis* in the same habitat, as shown by higher L selectivity (0.5 vs. 0.1) and lower H' diversity (0.81 vs. 1.58), and J evenness (0.48 vs. 0.80) values. Information available on *As. californiensis* and *C. regis* indicate that these species have broad diets associated with benthic feeding. The diet of *L. sardina* remains largely unstudied. *L. tenuis*, especially, appears to have evolved a unique jaw mechanism that may allow efficient feeding on common, evasive prey near spawning sites.

0262 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011

Eric Hilton, Nalani Schnell

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

**Osteology and Ontogeny of the Wrymouth *Cryptacanthodes maculatus* and the
Dwarf Wrymouth *C. aleutensis* (Perciformes: Zoarcoidei: Cryptacanthodidae)**

The four species included in the family Cryptacanthodidae are eel-like, burrowing fishes distributed in the cold-temperate coastal waters of the North Pacific and the Western North Atlantic. This study describes for the first time the osteology and the ontogenetic development of two species, *Cryptacanthodes maculatus* from the Western North Atlantic and *C. aleutensis* from the North Pacific. On the basis of cleared and double stained ontogenetic series (13.7 mm – 227 mm SL for *C. maculatus* and 8 mm – 32.4 mm SL for *C. aleutensis*) and an adult skeleton of *C. maculatus* (345 mm SL) we present a character matrix that is used in a comparative analysis of the so far poorly resolved zoarcoid

interrelationships. The Cryptacanthodidae have been previously included in the Stichaeidae, but removed and classified as a separate family based on the skull, pectoral radial and cephalic lateral line morphology. Our preliminary observations (similarities in gill arch and pectoral girdle morphology; specifically a thin sheet like flange of bone from the posterior margin of the supracleithrum) suggest a close relationship to at least some of the members of the family Stichaeidae.

0743 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Andrew Hines

Old Dominion University, Norfolk, VA, USA

Phylogeography of two Emperor Snappers (Lethrinidae: Percoidei) in the Coral Triangle

Many questions remain regarding the origins of the peak in marine biodiversity found in the Coral, despite many years of research. The Coral Triangle-Partnership in International Research and Education, is a research project that examines population structure of marine organisms in the Indonesian, Malaysian, and Philippines areas of the Coral Triangle. Potential barriers to gene flow are being examined as a means to infer that lineage diversification and speciation may be an origin of diversity in this area. As part of this project, population structure was examined in two species of Emperor Snappers, *Lethrinus harak* and *L. lentjan*, both of whom are important in artisanal fisheries, have the same life-history traits, and share similar geographic distributions. Specimens were collected both within the Coral Triangle and from other localities across the Indo-Pacific. A hypervariable portion of the mtDNA Control Region was amplified, sequenced and analyzed for phylogeographic structure among and within populations. *Lethrinus lentjan* has strong genetic structure showing phylogeographic isolation at two sites in Indonesia; Gaung in northern Sumatra, and Donggala in western Sulawesi. This pattern corroborates previous studies on different species and demonstrates that consistent patterns of lineage sorting, is occurring within the Coral Triangle.

0347 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Silvia Hinojosa-Alvarez¹, Xavier Chiappa-Carrara¹, Felipe Galvan-Magaña²

¹UNAM, ICMYL, Distrito Federal, Mexico, ²CICIMAR, La Paz, Mexico

Trophic Ecology of Giant Manta (*Manta birostris*, Walbaum 1792) Using Stable Isotopes of $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ in the Northeast of the Yucatan Peninsula

Although mantas are available worldwide, there are surprisingly few data pertaining to their basic biology. Protective measures preclude analysis of gut contents, so a non-invasive technique uses stable isotopes to quantify ^{13}C and ^{15}N . Supported by the isotopic values of $\delta^{13}\text{C}$ the study verified that manta rays are feeding in the area to

exploit the upwelling resulting from the Yucatan Current. When manta ray arrived its average ^{13}C isotopic signal was -12‰ and when leaving -14.5‰ , this value was similar to those of the prey and of the water in the area. The ^{13}C values suggested that the zoëas of crustaceans contribute the largest proportion of manta ray diets; this was most evident in July when the zoëas ^{13}C values switch from oceanic to coastal (-17‰ to -14.5‰) and correspond to the values found in manta rays the following month. Using Iso Source™ to verify our isotopic data also supported the conclusion that zoëas were the main prey source with 91% and fish larvae with 0.08% in carbon composition. Previous elasmobranch studies have reported a switch in the values of $\delta^{15}\text{N}$ due to dietary changes during a year round due to prey availability, but in this case the isotopic values did not exhibit this pattern.

0625 Poster Session I, Friday 8 July 2011

Silvia Hinojosa- Alvarez¹, Diaz-Jaimes Píndaro¹, Galvan-Magaña Felipe²

¹UNAM, ICMYL, Mexico City, Mexico, ²CICIMAR, La Paz, Mexico

Genetic Characterization of Giant Manta Ray (*Manta* sp.) in the Mexican Caribbean

Based on coloration and morphological differences, the existence of a possible third species for the genus *Manta* has been suggested in previous studies by Dr. Marshall. At least two morphotypes with variations in mouth, ventral and dorsal colorations as well as in some key morphological features has been observed in the giant manta of the Mexican Caribbean. In order to test the hypothesis about whether those differences are produced by environment or have a genetic basis we used several mitochondrial DNA sequences and one nuclear, to determine if there are enough differentiation levels to further contribute to the definition of the possible third manta ray species previously reported. The sequences of the mitochondrial genes cytochrome b, ND5, 16s, 12s and the nuclear gene RAG1 used widely to differentiate between species of sharks and rays, will be used to search for genetic differences at the species. The DNA from 30 samples collected at Holbox Mexico, are being used for amplification of these genes to determine if there exists enough genetic variation between the Mexican populations and the previously reported species (*Manta birostris* and *Manta alfredi*). The sequences for each mtDNA region, are being compared with those of Pacific and Atlantic populations in order to estimate the mean genetic divergence and their correlation with isolation processes.

0417 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Shotaro Hirase, Minoru Ikeda, Manami Kanno, Akihiro Kijima

Integrated Center of Field Sciences, Graduate School of Agricultural Science, Tohoku University, Onagawa, Miyagi, Japan

Spatial Patterns of Genetic Variation in Japanese Common Intertidal Goby, *Chaenogobius annularis*, Formed by the Cycles of Vicariance and Dispersal

Reconstructing the history of vicariance and dispersal during species range expansion provide important insights into the determinants of species distribution, because these processes form the spatial patterns of genetic variation underlying species adaptive evolution. *Chaenogobius annularis* is an intertidal goby which ranges widely in Japanese and Korean rocky coasts. Our preliminary study has suggested the high genetic differentiations among populations which are not relevant to geographic distance in this species, and vicariance and dispersal may have affected the genetic structure during the range expansion. Here, we reconstructed this history by phylogeographic and population genetic approaches. Phylogenetic trees based on mitochondrial DNA *cytb*, ND2 and the surrounding tRNA sequences showed that two distinct lineages range in Pacific Ocean and Japan Sea respectively, and that they diverged 1.7 MYA. Additionally, the Bayesian clustering analysis based on eight microsatellite DNA loci showed that all individuals are clearly assigned into two clusters consistent with the two lineages. These two groups were closely related to the pathways of the two warm currents, Tsushima Current and Kuroshio Current, flowing past Japanese Archipelago which formed in the early Pleistocene. Since the phylogenetic trees also revealed the existence of geographical sub-lineages within Pacific Ocean group, vicariance and dispersal likely affected the genetic structure of Pacific Ocean group after 0.3MYA. This study indicates that the cycles of vicariance and dispersal during the early to middle Pleistocene result in the current distribution area and genetic structure of *C. annularis*.

0610 Fish Morphology, Symphony I & II, Friday 8 July 2011; ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY AWARD

M. Vincent Hirt

University of Minnesota, St. Paul, MN, USA

Gill Raker Morphology in Suckers (Cypriniformes: Catostomidae)

Gill rakers are bony, finger-like projections that line the interior surface of the gill arches and serve in food selection and retention in most fishes. It has been hypothesized that gill rakers can filter food particles in three ways; by dead-end, cross-flow, and mucosal filtration. As expected, gill raker morphology appears to be correlated with diet in at least some species but exactly how gill rakers interact with food items is still unclear. Although gill rakers are important trophic structures, there has been a challenge, historically, to quantify and describe gill raker morphology in a biologically meaningful

way. This problem is compounded by the fact that more than one type of filtration may occur simultaneously and the exact mechanisms of filtration are still not completely understood. Catostomidae, the suckers, is a family of freshwater fishes that occur almost exclusively in North America. Suckers are named for their sucker-like mouths and tend to be fairly large fish that feed on a wide range of primarily small, benthic food items. This study examined and quantified gill raker morphology from across the family Catostomidae from species that exhibit different diets and evolutionary histories. Measurements taken include number of gill rakers, spacing between gill rakers, width of gill rakers, and length of gill rakers. This study focused on how gill rakers vary in the family, how gill raker morphology correlates with diet, and how have gill raker morphology and diet co-evolved in suckers.

0168 Poster Session I, Friday 8 July 2011

Erica Hoaglund¹, Liz Harper², Amy Kizer³

¹Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Nongame Program, St. Paul, MN, USA, ²Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Nongame Program, St. Paul, MN, USA, ³Lexington Pet Clinic, Eagan, MN, USA

Use of Harmonic Radar Tracking Technology to Study Plains Hog-nosed Snakes (*Heterodon nasicus*) in Minnesota

Habitat use and movement in Plains Hog-nosed Snakes on two public lands in Minnesota are being studied using harmonic radar tracking technology. This species' small size and secretive habits have previously made it difficult to study. Because harmonic radar tags are passive devices, they do not require batteries. This allows for a very small size (<0.5 grams) and theoretically unlimited functional life. The first of two field seasons was completed in 2010. Two tag styles were tested. The tags were implanted subcutaneously using a customized surgical procedure. The tags were implanted in 13 snakes ranging from 19 to 240 grams. Snakes were tracked throughout the active season of 2010 using the RECCO harmonic radar detection system. This system was successfully used to determine the locations of snakes a maximum of 41 times per snake, detect movements of up to 200 meters, and locate snakes at known depths of 3 to 45 cm below the surface. The data collected were used to calculate preliminary minimum convex polygon home range estimates for snakes with sufficient locations. Home range estimates varied from 1059 to 7068 m². Field protocols were established for using harmonic radar in tracking a fossorial snake species. The use of this new tracking technique will help to broaden our knowledge and understanding of Plains Hog-nosed Snakes in Minnesota, and can help inform the study of other small species. Work will continue throughout the 2011 active season.

0498 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Eric Hoffmayer¹, Jill Hendon², Lisa Jones¹, William Driggers¹, Madison Walker², Travis Holland², James Sulikowski³

¹National Marine Fisheries Service, Mississippi Laboratories, Pascagoula, MS, USA,

²University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS, USA, ³University of New England, Biddeford, ME, USA

Reproductive Biology of the Atlantic Sharpnose Shark, *Rhizoprionodon terraenovae*, in the Northern Gulf of Mexico

Recently, significant variability in the reproductive biology of at least two species of sharks within the family Carcharhinidae has been observed in the western North Atlantic Ocean. While elasmobranchs, as a group, are typically characterized by having slow growth and late age at maturity, relative to other carcharhinids, the Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, is an exception. As such, the Atlantic sharpnose shark is an ideal candidate for examining temporal fluctuations in reproductive parameters such as age and size at maturity, gametogenesis, gestation time, fecundity, size-at-birth and time-at-parturition in a coastal shark species. The objective of this study was to provide an updated synopsis of the reproductive biology of Atlantic sharpnose sharks in neritic waters off Mississippi, compare our findings with those of studies conducted in the past and provide contemporaneous baseline data that could be critical to examinations of potential reproductive effects of future perturbations.

0608 Fish Conservation, Symphony III, Saturday 9 July 2011

Jessica Hoffstatter¹, Aimee Finley¹, Joe Strande¹, Gerrick Meyer¹, Marty Engel², Michael Bessert¹

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Brook Trout (*Salvelinus fontinalis*) in the Northern Driftless Area: Are There Any Natives Left?

The brook trout (*Salvelinus fontinalis*) inhabits coldwater streams throughout the Driftless Area of western Wisconsin. These fishes are native to the area and reproduce naturally; however, streams throughout the region have also been augmented via stocking of eastern strains since the early 1900s. Presumably, a great deal of hybridization between strains has occurred and it is unknown whether any non-introgressed populations remain. In a collaborative effort with the Wisconsin Department of Natural Resources, nine streams were sampled during 2009, including some that have never been stocked but harbor self-sustaining populations. We have genotyped specimens from all these sites plus an outgroup population from New Jersey

at 10 hypervariable microsatellite loci. In addition to classical measures of genetic diversity and connectedness (FST), results of Bayesian assays for population structure, including assignment tests and hybridization, will be presented. This information provides the Wisconsin DNR with valuable baseline data to direct management strategies.

0117 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Nancy Holcroft

Johnson County Community College, Overland Park, KS, USA

A Survey of Euteleost Supracleithrum Synapomorphies

The supracleithrum is a dermal bone in the euteleost pectoral girdle that typically articulates dorsally with the post-temporal and ventrally with the cleithrum. Supracleithral characters have been proposed as synapomorphies for five euteleost clades (Acanthuriformes, Adrianichthyoidei, Atherinomorphae, Batrachoidiformes, and Gobiesocoidei). However, to date, these characters have not been broadly surveyed to determine how widely these states might be distributed across euteleosts as a whole. Such a survey was the goal of this study. The supracleithrum was examined in 217 species representing 38 orders and 150 families of euteleosts plus five outgroup taxa. Most of the proposed synapomorphies are corroborated by this survey, but one is more widely distributed; possible interpretations and phylogenetic implications of this will be discussed. In addition, other potentially phylogenetically informative characters discovered during the survey will be presented.

**0526 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011; ASIH
STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD**

Matthew Holding

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

**Altered Navigational Demands Induce Changes in the Cortical Brain
Region of Free-ranging Northern Pacific Rattlesnakes (*Crotalus o. oreganus*).**

The hippocampus of birds and mammals has been shown to play a crucial role in spatial memory and navigation. The hippocampus exhibits plasticity in size during adulthood in response to diverse environmental factors associated with spatial demands placed on an animal. The cortical telencephalon of squamate reptiles has been implicated as a functional homologue to the hippocampus. This study sought to experimentally manipulate the navigational demands placed on free-ranging northern Pacific rattlesnakes (*Crotalus o. oreganus*) to provide direct evidence of the relationship between spatial demands and neuroplasticity in the cortical telencephalon of the squamate brain.

Twenty-two adult male snakes were radio-tracked for two months during which one of three treatments was imposed weekly. Treatments consisted of the following: 225 meter translocation in a random direction, 225 meter walk and release at that day's capture site (handling control), and undisturbed control. Snakes were then sacrificed and brains were removed and processed for histological analysis of cortical features. The volume of the medial cortex was significantly larger in the translocated group compared to undisturbed controls. No differences in dorsal or lateral cortical volume were detected among the groups. Average home range was larger in the translocated group compared to handled and undisturbed controls. A causal relationship between increased navigation in a free-ranging reptile and changes in brain morphology was established. Furthermore, sex differences previously described in the medial cortex of Crotaline snakes may be a function of an increased amount of movement in males and not a genetically determined dimorphism.

0530 Poster Session III, Sunday 10 July 2011; ASIH STORER HERPETOLOGY AWARD

Matthew Holding

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

The Physiological Ramifications of Short-distance Translocation in Reptiles: A Case Study Using the Northern Pacific Rattlesnake (*Crotalus o. oreganus*).

The use of translocation as a conservation strategy for reptiles has been a hot topic revisited many times. Previous studies have demonstrated the aberrant movement patterns and mortality caused by translocation and have established that short-distance translocation within an animal's home range is best for the animal. The current study elucidated the physiological impacts that repeated short-distance translocation and handling have on reptiles, which is essential knowledge if the efficacy of the technique is to be properly evaluated. Twenty-two adult male northern Pacific rattlesnakes (*Crotalus o. oreganus*) were separated into three groups: weekly 225 meter translocations, handling controls, and undisturbed controls. The stress response was measured before and after eight weeks of treatment as the change in the corticosterone (CORT) level in blood taken at capture and after one hour of confinement. Abdominal fat pad mass was measured. Hourly body temperatures were obtained from each snake via iButtons throughout the study. Movement parameters were compared between the groups. The frequency at which an observer received a rattling response to approach was also considered. Neither baseline CORT level nor the magnitude of the acute stress response were impacted by translocation or handling. The amount of stored fat was not altered either. Translocated animals had larger MCP activity ranges than handled and undisturbed animals, but no other commonly measured movement parameters differed among the groups. Probability of rattling was not altered. We suggest that rattlesnakes are quite resistant to potential impacts on their physiology enacted by frequent short-distance translocation and handling.

0652 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

Pedro Hollanda Carvalho, Sergio Lima, Claudio Zawadzki, Claudio Oliveira, Mario Pinna

MZUSP, Sao Paulo, SP, Brazil

Speciation in the Upper Parana River as Exemplified by the *Hypostomus ancistroides* (Siluriformes, Loricariidae) Complex

The Parana-Paraguay drainage is the second largest of the neotropics. The upper course of the Parana river hosts about 300 species of fish and has been traditionally treated as a region of endemism. In the past decades extensive surveys and the description of a number of new species uncovered intrinsic biogeographic patterns for several groups of fishes in this basin. We chose *Hypostomus ancistroides* (Siluriformes, Loricariidae), widely occurring in this region, to address the hypothesis of whether drainage morphology in the upper Parana may be associated with taxonomic diversification. We used 310 mitochondrial sequences of ATPase 6,8 to assess the phylogenetic position of *H. ancistroides* within *Hypostomus* and 162 sequences (48 haplotypes) to infer its population structure. The phylogenetic tree topology using NJ, MP and ML recovered three broadly sympatric phylogroups of *H. ancistroides*, with genetic divergence ranging from 0.8% to 2.7%. A parsimony network revealed that sampled localities hosted both high frequency and dispersed haplotypes as well as low-frequency and range-restricted haplotypes. AMOVA, SAMOVA and NCA analysis suggested that population structure agrees with the widespread phylogroups recovered in the phylogeny, which probably emerged after isolation by distance or allopatry. Results suggest that the species has undergone at least one vicariant event and its populations are currently in secondary contact in roughly all its distribution area. The occurrence of *H. ancistroides* in the Rio Ribeira is the result of a single colonization event from the upper Tiete. FAPESP 2010/07149-1; CNPq 140108/2007-6 and 307207/2009-9

0575 Poster Session I, Friday 8 July 2011

Lisa Hollensead¹, John Carlson², Dana Bethea², Dean Grubbs¹

¹Florida State University, Tallahassee, FL, USA, ²NOAA National Marine Fisheries, Panama City, FL, USA

Monitoring Movement Patterns of Juvenile Smalltooth Sawfish (*Pristis pectinata*) Using Acoustic Monitoring and Tracking in a Nursery Habitat in Southwest Florida

Historically, the U.S. range of smalltooth sawfish stretched from North Carolina to Texas including the Gulf of Mexico. Due to fisheries bycatch, habitat loss, and a low

productivity, the US population has declined leading to their inclusion on the U.S. Endangered Species Act in 2003. Necessary to their recovery is a description of critical habitat, mandated in the Smalltooth Sawfish Recovery Plan. Using passive acoustic telemetry and active tracking, precise delineation of smalltooth sawfish activity space and patterns of habitat use can be determined. Juvenile smalltooth sawfish less than 1 meter total length are fitted with dual-coded transmitters and tracked for given time periods while an array of acoustic receivers is anchored in and around Turner River, Mud Bay, and the Lopez River system within Everglades National Park as well as Faka Union Bay for continuous monitoring,. In 2010, 6 juvenile sawfish were fitted with acoustic tags. One animal was tagged with in the Everglades National Park array, and was detected only a few number of times in the array by five receivers. Five juvenile sawfish were tagged in the Faka Union Bay system. One of these tagged animals was recaptured two months later, on the same location of a spoil island. For better coverage, the array in Everglades National Park as been doubled and three acoustic listening stations have been installed in Faka Union Bay. From this telemetry data, we will construct resource selection function models in an effort to delineate areas of essential fish habitat for juvenile sawfish.

0115 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Randy Honebrink¹, Robert Buch², Peter Galpin³, George Burgess⁴

¹Hawaii Division of Aquatic Resources, Honolulu, HI, USA, ²NOAA Fisheries Service, NERO, Gloucester, MA, USA, ³Maui Memorial Hospital, Wailuku, HI, USA,

⁴University of Florida, Gainesville, FL, USA

First Documented Attack by a Cookiecutter Shark on a Human

Anecdotal reports of bites by the cookiecutter shark (*Squaliodes*, *Dalatiidae*, *Isistius* sp.) on people in various waters have been made, but are rare and undocumented. The International Shark Attack File database includes two incidents involving *Isistius* bites which were judged to have occurred postmortem. In this case, an adult long-distance swimmer attempting to cross the Alenuihaha Channel between the Hawaiian islands of Hawai'i and Maui was twice bitten by a cookiecutter shark (*I. brasiliensis* Quoy and Gaimard 1824). One of these bites presented as an open, round, concave wound typically observed in cookiecutter shark bites inflicted by members of this genus on a broad spectrum of large biota such as marine mammals, elasmobranchs, and bony fishes. The open wound was debrided, subjected to negative pressure wound therapy, and a split thickness skin graft harvested from the left thigh. Post-operative recovery was complicated by delayed healing of the inferior portion of the graft, and cultures and biopsy were normal skin flora and normal tissue, respectively. At six months following the incident, the area appeared to be healing with a stable eshcar, and by nine months the wound was healed. Humans entering pelagic waters at twilight and nighttime hours in areas of *Isistius* sp. occurrence should do so knowing that cookiecutter sharks are a potential danger, particularly during periods of strong moonlight, in areas of man-made illumination, or in the presence of bioluminescent organisms.

0622 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

Jan Hoover, Ellen Wakeley, Krista Boysen

US Army Engineer Research and Development Center, Vicksburg, MS, USA

Physical Training and Swimming Performance of Juvenile Sturgeon (*Acipenser* spp.)

Training improves performance in free-swimming fishes but effect is uncertain in sturgeon with complex locomotor behaviors. We evaluated hatchery-reared Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), from the St. John River, NB (200-330 mm TL), using a 100-liter Blazka swim tunnel: one group was acclimated in non-flowing water, another group in slow-flowing water (10-12 cm/s). Most individuals (> 90%), in both groups, exhibited positive rheotaxis, orienting headfirst into flow. Sustained swimming (> 200 min) occurred at 30-40 cm/s, burst swimming (< 0.5 min) at 90-100 cm/s. For prolonged and burst swimming, endurance decreased linearly with increasing velocity, but variation was higher in trained ($R^2 = 0.27$) than for untrained fish ($R^2 = 0.59$). Escape speed (1 min endurance) was higher for trained (77.2 cm/s) than for untrained fish (61.5 cm/s). Benthic station-holding behaviors were consistently more frequent in trained than untrained fish at velocities > 60 cm/s. Results were consistent with those of other sturgeon tested in the same tunnel, using the same holding tanks, and the same feeding and training regime. Lake sturgeon (*A. fulvescens*), from the Wisconsin River WI (120-175 mm FL), and white sturgeon (*A. transmontanus*), from the Sacramento River CA (65-121 mm TL), were both strongly rheotactic (> 85%) and exhibited linear declines in endurance with increasing water velocity. For both species training was associated with higher escape speeds (< 45 vs 57.8 cm/s, 41.3 vs 72.3 cm/s, respectively) and increased benthic behavior. Training effects appear characteristic of sturgeon as a group.

0021 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Marlys L. Houck, Allison Alberts, Oliver Ryder

San Diego Zoo Institute for Conservation Research, Escondido, CA, USA

Biobanking Amphibian Cells for Research and Conservation

Since 1975 San Diego Zoo Global has supported the establishment and maintenance of a frozen cell repository of viable fibroblasts from endangered and other threatened species. Improvements in primary culture techniques and media development have made it possible to optimize growth conditions of cell lines from a wide variety of taxa. The "Frozen Zoo"® bioresource collection at the Institute for Conservation Research (www.sandiegozoo.org/conservation) contains somatic cell lines from over 8,500 individuals providing access to the genomes of approximately 800 species and

subspecies. The largest and most diverse of its kind, this collection currently contains cell lines from 46 vertebrate orders. Efforts to establish, propagate, and cryopreserve viable amphibian cell lines at the San Diego Zoo began in 2006. Although amphibian tissues have historically proven more challenging to culture than other taxa, cell lines from several species have been successfully accessioned into the Frozen Zoo®, including fibroblasts from a White's tree frog (*Litoria caerulea*) that died of chytridiomycosis. Biobanking amphibian cell lines provides a unique resource for studies that have direct application to the conservation and management of this group and is a crucial component for combating the amphibian extinction crisis. It is especially critical to establish and cryopreserve cell lines from amphibian species that might not be available in the future. The living cells can be utilized to obtain chromosome preparations, expanded to generate large quantities of DNA/RNA, and could potentially be used for future somatic cell nuclear transfer or generating induced pluripotent embryonic stem cells.

0086 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Jason Hoverman¹, Matthew Gray², Debra Miller²

¹University of Colorado, Boulder, CO, USA, ²University of Tennessee, Knoxville, TN, USA

Amphibian Susceptibilities to the Emerging Amphibian Pathogen Ranavirus

Ranaviruses have been implicated as a major cause of reported amphibian die-offs in the United States. One of the hypothesized factors in the recent emergence of ranaviruses in amphibian populations is novel strain introduction (i.e., pathogen pollution). While pathogen pollution has been identified as a significant concern, the role of species-susceptibility to novel versus endemic strains is just beginning to be explored. For example, when 19 larval amphibian species from 7 families were challenged with two ranavirus isolates: endemic frog virus 3 (FV3) and an isolate from an American bullfrog culture facility, susceptibilities varied markedly among species. The isolates showed little host specificity and all but one species experienced mortality or infection following exposure. Moreover, 53% of the species experienced over 50% mortality following exposure to the ranaculture isolate. Mortality post-exposure to the ranaculture isolate was on average 2.3X greater than post-exposure to FV3, the type species for ranavirus. These findings suggest that amphibian culture facilities may be sources of novel ranaviruses, and highlight the potential threat of pathogen pollution associated with the international and interstate commerce of amphibians. Currently, there is limited information on the occurrence or spread of novel ranavirus isolates in wild amphibian populations and whether pathogen pollution is a driver of disease outbreaks. There is a need for studies to characterize the species/strains of ranaviruses involved in die-off events to help guide conservation and management efforts.

0771 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011

Heath Howell, Phil Harris

University of Alabama, Tuscaloosa, AL, USA

Variation in the Tombigbee Darter (*Etheostoma lachneri*) Species Complex

The Tombigbee Darter is a member of the subgenus *Ulocentra*. Members of this subgenus are commonly referred to as snubnose darters and the males are remarkable for their bright coloration during spawning season. These fishes are distributed throughout the southeastern United States and generally prefer small to medium sized streams. The snubnose darters are a diverse group with additional species still being described in recent literature. Tombigbee Darters are found throughout the Tombigbee River drainage preferring small streams with slow to moderate current. While most populations are found below the Fall Line in lowland habitats there are several populations in the upper portions of the Sipsey River which occur above the Fall Line in upland habitats. Previous researchers have anecdotally noted some differences in breeding male coloration and color pattern between populations of *E. lachneri* found in different physiographic provinces. In this study we investigate the genetic, morphological, and meristic variation between the upland and lowland populations of the Tombigbee Darter. Molecular mitochondrial ND2 sequence data show as much as 3.6% sequence divergence between upland and lowland populations. General body shape differences include the upland populations having shorter, stouter bodies while the lowland populations have longer, more slender bodies. Differences in male breeding coloration include a complete red band in the second dorsal fin in upland populations versus a red band covering only the posterior half of the second dorsal fin in the lowland populations. Upland populations have red pigment above the lateral line instead of orange in lowland populations.

0227 Poster Session I, Friday 8 July 2011

Christopher Howey, Willem Roosenburg

Ohio University, Athens, OH, USA

The Effects of Prescribed Burning on the Black Kingsnake (*Lampropeltis nigra*): Going Beyond the Demographic Data

Species responses to habitat alteration are most frequently studied by estimating changes in population numbers. However, subtle changes in the habitat may cause indirect effects that go unnoticed in the short term, yet can cause adverse population effects in the long term. The objective of this on-going project is to determine how the Black Kingsnake (*Lampropeltis nigra*) is affected by prescribed burning. In the summer of 2010, I began this project at Land-Between-The-Lakes National Recreational Area in southwestern Kentucky. Four study plots were set up in a burn unit and 4 study plots of equal size in an adjacent unburned unit. The burn unit was burned in 2007 and again in 2010. Drift fences with funnel and pitfall traps were erected in the center of each plot

and an array of coverboards were placed throughout each plot. During the summer of 2010, 848 reptiles, amphibians, and small mammals were captured and marked; reptile species richness and diversity indices (DI) were lower in burned plots (13 species, DI = 2.03) than in control plots (17 species, DI = 2.37). Biophysical copper models were deployed in each plot to measure the potential body temperatures a Black Kingsnake could achieve and mean temperatures in burned plots were warmer than in control plots and more frequently exceeded the critical thermal maximum of Black Kingsnakes (42°C). Available habitat within burn plots was characterized by fewer understory trees, less leaf litter, and shallower depths of leaf litter than control plots.

0210 Fish Morphology, Symphony I & II, Friday 8 July 2011

Peter Hundt, Andrew Simons

University of Minnesota, St. Paul, MN, USA

Evolution of Dental Morphologies in Blenniid Fishes (Teleostei: Perciformes: Blenniidae)

Blenniid fishes are small (most < 100 mm) fishes found worldwide in most tropical and subtropical shallow marine communities. This group (6 Tribes, 57 genera and 387 species) exhibits a unique array of dental morphologies including two types of teeth, feeding teeth and canine teeth used for aggression and defense. The feeding teeth are in a single row that range from 25 (small conical or chisel-like teeth) to more than 300 (fine, comb-like teeth); these teeth may be fused to or unattached to the jaw bones, and exhibit both modes of described tooth replacement. The recurved caniniform teeth, may or may not be present and in one taxon are extremely large and associated with a venom gland. Many of these dental morphologies have been described, some have not, but little is known about how these unique features have evolved. In order to answer evolutionary questions about dental morphologies of blennies, one must first have a well-resolved phylogenetic hypothesis. Our understanding of relationships within this family is based on either morphological characters, not yet analyzed in an explicitly phylogenetic context, or based on one mitochondrial gene analyzed in phylogenetic context, but from limited blenniid taxa. Herein, I use phylogenetic analyses of mitochondrial and nuclear loci, from 16 blenniid genera, representing 6 tribes, to begin to address the relationships within Blenniidae and the evolution of dental morphologies.

0149 Poster Session II, Saturday 9 July 2011

Christina Hupy¹, Chad Montgomery³, Julius Frazier², Nathan Reid¹, Roger Schultz¹

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A GIS-based Predictive Habitat Model for *Boa constrictor* in the Cayos Cochinos Archipelago, Honduras

The Cayos Cochinos *Boa constrictor* (CCB) is an endemic form of *B. c. imperator* which inhabits the Cayos Cochinos Archipelago off the north coast of Honduras. CCBs exhibit morphological and color differences from mainland populations, likely related to thermal and dietary limits imposed by the island's ecology. The goal of our research was to develop and analyze a GIS-based habitat model for the CCB on Cayos Cochinos Menor. This model will be used to better understand the physiology and ecology of the CCBs, assess thermoregulatory responses in CCBs, as well as to assist with conservation management strategies. We developed a geospatial database of explanatory habitat variables for Cayos Cochinos Menor including: temperature, humidity, wind speed, elevation, and light intensity. Spatial capture data on CCBs spanning 7 years were aggregated, separated by season, sampled and input into the model as the independent variable. Discriminant analysis using Mahalanobis Distance measure was used to identify key habitat characteristics and then predict CCB distribution. Probability values were then mapped for the island and tested using CCB capture data.

0443 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Nigel Hussey¹, Aaron MacNeil², Jill Olin¹, Bailey McMeans¹, Demian Chapman³, Michael Kinney⁴, Aaron Fisk¹

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Stable Isotope Dynamics in Elasmobranchs: Methods and Assumptions

Stable isotopes can function as powerful chemical tracers enabling the examination of diet, trophic position and movement as well as more complex questions concerning community dynamics and feeding strategies/behaviour of both terrestrial and aquatic organisms. The inherent difficulty of studying large, highly mobile marine predators such as sharks has led to the increased use of stable isotope analysis (SIA) in answering such questions. We provide a review of the current state of SIA in sharks, focusing on

modes of application and methodological issues relating to effects of lipid extraction, tissue type, and diet-tissue discrimination factors. We discuss these in terms of assumptions made in SIA and the requirement that investigators standardise analytical approaches. Recommendations are made for future stable isotope experiments and fieldwork that would improve our understanding of isotope dynamics and advance their application in the study of these ecologically important species.

0638 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Alex Hyatt

Australian Animal Health Laboratory, Geelong, Australia

Ranaviruses: Where to Next?

Ranaviruses belong to the genus *Ranavirus* and family Iridoviridae. They are a discrete group of viruses that in the main encode a cytosine DNA methyltransferase and show serological cross-reactivity between most members of the genus. They infect the lower vertebrates (Reptilia, Amphibia, Osteichthyes) and are present on most continents (Asia, Europe, Australia, Americas, Africa). The infections can be benign (present within apparent healthy animals) to pathogenic causing major population crashes. To date, many reviews of this genus have concentrated on taxonomy, sequencing - identification of genes, biological control, and involvement in population declines. Perhaps it is now time to ask further scientific questions about the evolution of ranaviruses (relationship with poxviruses and African Swine fever virus), spread (geographical) and transmission (animal to animal), the virus-host ecology including their role in the natural regulation of host population numbers, immunology, viral identification and diagnosis of associated disease, and identifying the drivers for emergence. Furthermore are there other iridoviruses that biologists should consider in investigating the health and conservation of both the lower and higher aquatic vertebrates? These are just a few of the questions that draw attention for the need to understand the complex biological systems involved in infectious diseases associated with ranaviruses. It is this acquired understanding that will enable us to understand the role and putative impact of infectious diseases in respect to animal conservation and sustainable aquaculture.

0669 AES Behavior & Ecology, Minneapolis Ballroom, G, Thursday 7 July 2011

Johanna Imhoff¹, Jason Romine¹, George Burgess¹

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Use Of Passive Acoustic Telemetry To Track Juvenile Bull Sharks In The Indian River Lagoon System, FL, USA: Culmination Of A Three-Year Study

The Indian River Lagoon system (IRL), consisting of the Indian River, Banana River and Mosquito Lagoon, is an estuary on the east coast of FL, USA, connected to the Atlantic Ocean only by five inlets, spaced greater than 20 km apart. The IRL is known to be a nursery area for juvenile bull sharks (*Carcharhinus leucas*), but little is known about movements, habitat use and residence time within this estuary. We used passive acoustic telemetry methods to monitor the movements of juvenile bull sharks within the IRL system. Since December 2008, 26 juvenile bull sharks (61-137 cm FL) have been tagged with Vemco V13 and V16T acoustic tags, and 21 of these tagged sharks have been detected within the acoustic array. All sharks were tagged inside the IRL, but eleven sharks were also detected in inlets, and five sharks were detected on offshore receivers in the Atlantic Ocean. Preliminary reports of this dataset discussed the use of the IRL as a winter refuge for juvenile bull sharks, movements of sharks between lagoons of the IRL, and emigrations from the IRL through inlets, including sudden emigrations during the severe cold snap of January 2010. Diel activity patterns, seasonal movements and migrations, and residence times will be further investigated. Abiotic factors influencing shark movements, such as temperature, salinity and tidal flow in inlet areas will also be examined.

0431 Herp Population Genetics/Herp Coloration, Symphony I & II, Monday 11 July 2011

Mohammed Mafizul Islam¹, Md. Mukhlesur Rahman Khan², Mitsuru Kuramoto³, Tjong Hon Djong⁴, Masayuki Sumida¹

¹Hiroshima University, Higashihiroshima shi, Hiroshima, Japan, ²Bangladesh Agricultural University, Mymensingh, Bangladesh, ³3-6-15 Hikarigaoka, Munakata, Fukuoka, Japan, ⁴Andalas University, Padang, West Sumatra, Indonesia

Genetic Divergence and Reproductive Isolation among the Frogs of the Genus *Fejervarya* from Several Asian Countries

In order to elucidate the genetic divergences and reproductive isolating mechanisms among different frogs of the genus *Fejervarya*, we have conducted mtDNA gene sequence analyses, crossing experiments, spermatogenesis and histological observations using the *Fejervarya* frogs from Bangladesh, India, Sri Lanka, Thailand, Malaysia, Indonesia, the Philippines and Japan. Molecular analyses showed that there were four groups among the frogs within the genus *Fejervarya*; the cancrivora group, limnocharis group, iskandari group and Indian group. Based on the crossing experiments,

spermatogenesis and histological observations, we also found the same four isolated groups, among which the cancrivora group was isolated from the iskandari group by gametic isolation, the Indian group was also isolated from others by complete hybrid inviability, although the iskandari and limnocharis groups were not completely reproductively isolated from each other, but they showed significant abnormalities in spermatogenesis suggested hybrid sterility. Frogs belonging to the limnocharis group showed no isolation among different localities from Japan but isolated by abnormality in spermatogenesis between Japan and Malaysia. Within the iskandari group, Bangladesh large type was not isolated from Thailand or Kotakinabalu of Malaysia ones, but isolated from Indonesian *F. iskandari*. Within the Indian group, Bangladesh small type showed no isolation with Sri Lanka one or Indian *F. caperata*, but was isolated from Bangladesh medium type by hybrid sterility and characterized by extremely abnormal spermatogenesis. The present studies suggest that many frogs of the genus *Fejervarya* are wrongly named as *F. limnocharis*, and that there are several cryptic and possible undescribed species in this genus.

0182 Poster Session I, Friday 8 July 2011

Takeshi Ito, Keisuke Furumitsu, Atsuko Yamaguchi

Nagasaki University, Nagasaki, Japan

Aspects on the Life History of the Whitecheek Shark, *Carcharhinus dussumieri*, in Northwest Kyushu, Japan

Reproductive biology and feeding habits of the whitecheek shark, *Carcharhinus dussumieri*, were examined in Ariake Bay and adjacent waters, southwest Japan, from May 2006 to February 2011. Length at which 50% of population reached maturity was 892.8 mm total length (TL) for males and 909.8 mm TL for females, respectively. Histological observations showed that mature sperm the testes occurred from May to October when monthly GSI declined. The fertilized eggs were found in the uteri during June and early August, and near-term embryos occurred from June to July. These data indicate that mating, fertilization and parturition occurred from June to July. Additionally, almost all post-partum females possessed large pre-ovulatory ova, indicating that mature females become pregnant every year and the gestation period is 1 year. Fecundity ranged from 1 to 6, with an average of 3.4 embryos. In summer, the whitecheek shark migrates into the innermost area of Ariake Bay where is their parturition and nursery ground. The dietary analyses showed that their major prey components were fishes, crustaceans and cephalopods, and the ontogenetic dietary shifts were found.

0624 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Todd Jackman¹, Aaron Bauer¹, Matthew Heinicke¹, Eli Greenbaum²

¹Villanova University, Villanova, PA, USA, ²University of Texas, El Paso, El Paso, TX, USA

Phylogenetic Relationships of the "Gehyra Group" Geckos

The "Gehyra group" includes the gekkonid genera *Gehyra*, *Hemiphyllodactylus*, and *Perochirus*. These genera are similar in digital morphology but their relationships relative to genera in the "Gekko group" of geckos were unclear in morphology-based phylogenetic analyses. Using multiple nuclear and mitochondrial genes, we show that these genera together form a monophyletic group, although the inclusion of *Perochirus* in the group is based on the nuclear RAG1 gene only. The well-supported placement of *Gehyra* and *Hemiphyllodactylus* as sister taxa has been previously suggested. Within *Gehyra*, we have sampled most of the known species. *Gehyra* consists of three well-supported clades: a chiefly Australian clade, an Asian clade, and a widespread clade that occurs both in the Pacific and Asia. Parsimony and likelihood reconstructions of distributions place *Gehyra* ancestrally in Asia, then dispersing to Australia. Dating analyses show that both *Hemiphyllodactylus* and *Gehyra* are relatively old genera. *Gehyra* is estimated to be 43 million years old, making it older than other gekkonid genera that have radiated in the same area, but younger than the Australian diplodactylid radiation. *Hemiphyllodactylus* is nearly as old as *Gehyra*, but is species-poor by comparison. The relationships between *Hemiphyllodactylus* species suggested by our DNA sequence phylogeny complements a recent morphology-based study of the genus by Zug.

0199 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011; ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY AWARD

Alexis Jackson

University of California Santa Cruz, Santa Cruz, CA, USA

Conservation Genetics of Commercially Overexploited Grouper Species

Life history characteristics play an important role in understanding extinction risk for many fishes. In addition to being large-bodied top predators with late sexual maturity, Leopard grouper (*Mycteroperca rosacea*) and Nassau grouper (*Epinephelus striatus*) also form spawning aggregations comprised of a few hundred to a few thousand individuals. Increased fishing of aggregations is resulting in their rapid extirpation, and could result in losses of local and regional genetic diversity. It is the objective of this study to use molecular markers to recover the demographic history of these species in order to inform regional management and conservation efforts. Genomic DNA was extracted from samples collected from Nassau grouper aggregations in the Cayman Islands and U.S. Virgin Islands, and from major fishing communities in the Gulf of California for Leopard grouper. Three mitochondrial markers (12S, ATP synthase, cytochrome b) were sequenced. Statistical analyses were performed to determine

population structure and genetic connectivity. Preliminary results for Nassau grouper reveal high genetic connectivity and no statistically significant genetic structure at either the aggregation level or regional level between aggregations ($\phi_{st}=0.01283$, p-value=0.74585). Results suggest panmixia of the species in its geographic range. Preliminary results for Leopard grouper reveal genetic differentiation between the upper and central Gulf regions ($\phi_{ct}=0.03551$, p-value = 0.02346). Results confirm geographic breaks observed in other species in the Gulf.

0437 Poster Session II, Saturday 9 July 2011

Stephen Jacquemin, Mark Pyron

Ball State University, Muncie, IN, USA

Allometry, Sexual Dimorphism, and Spatial Variation in Freshwater Drum *Aplodinotus grunniens* Morphology

We examined allometric, sexual, and spatial morphological variation of freshwater drum *Aplodinotus grunniens* body shape within the Wabash River. We used geometric morphometrics (procrustes distances, relative warp analysis, and canonical variate analysis) to describe shape variation by size, sex, and river mile. We found that younger or smaller individuals had a more streamlined appearance with a reduced frontal head region, flattened back, and narrower caudal peduncle that become more pronounced with age. We found that at 250 millimeters total length the population becomes sexually dimorphic whereby females are differentiated from males by a more rotund appearance with distended abdomen, pronounced forehead, and shorter caudal fin length. Females ultimately attained larger sizes than males. Male and female shape did not coincide with river continuum, however, immatures tended to exhibit an elongated snout and head shape as river mile increased. We predict allometry, dimorphism, and spatial differences in this species are integral and coincide with the ecology of this species sex and age structure.

**0497 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD,
Minneapolis Ballroom E, Thursday 7 July 2011**

Robert C. Jadin¹, Gilson Rivas Fuenmayor², Laurie J. Vitt³, Cesar Barrio-Amoros⁴, Robert P. Guralnick¹, Frank T. Burbrink⁵

¹University of Colorado at Boulder, Boulder, CO, USA, ²La Universidad del Zulia, Maracaibo, Venezuela, ³University of Oklahoma, Norman, OK, USA, ⁴Institut de Biologia Tropical, Merida, Venezuela, ⁵City University of New York, New York, NY, USA

Systematic Revision of the Snake Genus *Pseustes* (Reptilia: Colubridae)

The genus *Pseustes* is composed of three Neotropical snake species (i.e., *P. poecilonotus*, *P. shropshirei*, and *P. sulphureus*) often to as the “puffing” or “bird-eating” snakes. None of these species has been included in any molecular phylogenetic analyses, thus knowledge regarding the evolutionary relationships within *Pseustes* and the phylogenetic position of *Pseustes* within the Colubridae is inadequate. Furthermore, *Pseustes poecilonotus* and *P. sulphureus* are both morphologically diverse with large, mostly sympatric, geographic distributions, ranging from Mexico to Bolivia, and may represent species “complexes” containing cryptic taxa requiring further systematic investigation. In this study, we used several nuclear and mitochondrial markers to conduct a Bayesian phylogenetic analysis of *Pseustes* and included 85 samples of other colubrid genera. Our analyses do not detect additional species within *Pseustes* but do find several phylogenetic breaks within this clade based on their biogeographic location. Our initial findings show strong support that *Pseustes* is paraphyletic with respect to *Spilotes*, which together form a clade within the Colubrinae. Our analyses show strong support for a sister relationship between *P. poecilonotus* and *P. shropshirei* and a sister relationship between *P. sulphureus* and *S. pullatus*. This relationship is additionally supported with several morphological characteristics including nasorostrals, which are shared by both *S. pullatus* and *P. sulphureus* and not found in *P. poecilonotus* and *P. shropshirei*. Therefore, in order to ameliorate the paraphyletic *Pseustes*, we recommend the taxonomic change of *P. sulphureus* to *S. sulphureus*.

0514 Poster Session III, Sunday 10 July 2011

Collin Jaeger, Jesse Ray, Jace Robinson, Richard King, Melvin Duvall

Northern Illinois University, DeKalb, IL, USA

Low Genetic Variation in a Midwestern Endemic Snake

Kirtland's Snake (*Clonophis kirtlandii*) is a small, secretive Natricine snake restricted to the Midwestern United States. It is the only extant member of the genus *Clonophis* and is listed as threatened or endangered throughout its range. In contrast, most other sympatric Natricines are more widely distributed and lack special conservation status. To compare genetic variation in Kirtland's Snake to that of other Natricines, we obtained tissue samples and sequence data for Kirtland's Snake, Northern Watersnake (*Nerodia*

sipedon), Common Gartersnake (*Thamnophis sirtalis*), Dekay's Brownsnake (*Storeria dekayi*), and Red-bellied Snake (*Storeria occipitomaculata*). We examined DNA sequence variation at two mitochondrial loci: NADH dehydrogenase subunit-II (ND2) and cytochrome B (CytB). To facilitate direct comparison, we restricted our analysis to include only samples collected from within the range of Kirtland's Snake. Further, we used rarefaction to estimate haplotype richness corrected for differences in sample size. Lastly, we calculated haplotype diversity and nucleotide diversity for each species. By all measures, Kirtland's Snake exhibited markedly lower genetic variation than other Midwestern Natricines. This low genetic variation may be related to Kirtland's Snake endemism and range restriction or to recent fragmentation and population decline. Results presented here provide baseline data for future genetic monitoring and management.

0035 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Kelsey James, David Ebert, Gregor Cailliet

Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, USA

Life History Characteristics of the Starry Skate, *Raja stellulata*, from the Eastern North Pacific.

Coastal skate species worldwide are subject to targeted and incidental fishing pressures. This has raised concerns since available data on elasmobranchs are generally limited. Research of life history characteristics is essential for estimating population size, age structure, and fecundity, which in turn can be applied toward effective fisheries and conservation management plans. This is the first study to examine the distribution and life history characteristics of the Starry Skate, *Raja stellulata*. Specimens were collected from 2002 to 2010 during trawl and longline surveys conducted by the National Marine Fisheries Service (NMFS) in the eastern North Pacific. Collection of *R. stellulata* occurred most often over hard substrate (68%), followed by soft sediment (22%) and mixed substrate (10%). Likelihood ratio tests indicated that there was no difference between female and male growth ($p = 0.688$) so sexes were pooled. The three parameter von Bertalanffy growth function best explained the growth of *R. stellulata* where $L_{\infty} = 861$ mm, $k = 0.174$ and $t_0 = -1.477$. Maximum age estimates for females and males were 9 and 8 years respectively. Age and size at 50% maturity were determined for females as 6.2 years and 632 mm TL and for males as 5.4 years and 603 mm TL. *Raja stellulata* exhibited no reproductive seasonality and therefore, is assumed to reproduce year-round. The life history characteristics presented in this study provide valuable insight into the species-specific variability of eastern North Pacific skates.

0277 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

James Jancovich¹, Michel Bremont², Jeffrey Touchman¹, Bertram Jacobs¹

¹Arizona State University, Tempe, AZ, USA, ²Institut National de la Recherche Agronomique, Jouy-en-Josas, France

Evidence for Multiple Recent Host Species Shifts among the Ranaviruses (Family Iridoviridae)

Members of the genus *Ranavirus* (family Iridoviridae) have been recognized as major viral pathogens of cold-blooded vertebrates. Ranaviruses (RVs) have been associated with amphibians, fish and reptiles throughout the world. At this time, the relationship between ranavirus isolates is unclear. To gain a better understanding of the relationship among ranavirus isolates and to gain insight into the evolution of the ranaviruses, we compared genomic sequences from all of the completely sequenced ranavirus isolates. Our findings suggest that the ancestral ranavirus was a fish virus and that several recent host shifts have taken place with subsequent speciation of viruses in their new hosts. The data suggesting several recent host shifts among ranavirus species increases concern that these cold blooded vertebrate pathogens may have the capacity to cross numerous poikilothermic species barriers and the potential to cause devastating disease in their new hosts. As RVs infect a wide variety of ecologically and economically important hosts, understanding RV evolution, including the importance of the unique genomic rearrangements found among RV isolates in relation to host specificity and viral evolution, will help predict and perhaps prevent further RV epizootics. While this study does give insight into RV evolution, more genomic sequence information is needed to continue our efforts to understand the role RVs play in the environment.

0329 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Fredric Janzen, Daniel Warner

Iowa State University, Ames, IA, USA

Miles to Go before I sleep: Temporal Patterns of Age-specific Selection on Female Reproduction

Theory predicts that senescence will evolve when selection operates less strongly on traits that are expressed at an old age relative to those expressed at a young age. Although identifying reproductive deterioration at old ages provides an indication of senescence, how age-related changes in reproductive output translate to actual fitness is largely unknown. We quantify the strength and direction of age-specific natural selection and its temporal consistency concerning reproductive output in 792 female painted turtles (*Chrysemys picta*) across 11 field seasons to further our understanding of how selection affects deterioration of reproductive function (or lack thereof) in long-lived organisms. Clutch size and choice of vegetation cover over nests did not differ with maternal age, but older females laid larger eggs and nested more frequently, earlier in the season, and farther from water than younger females. Despite these clear age-

related phenotypic patterns, both the magnitude and direction of selection in terms of hatching success varied considerably, and with no apparent pattern, with respect to maternal age and across years. Because selection is not operating against these traits at old ages (i.e., no documentable senescence), longer reproductive lifespan might increase overall individual fitness due to the positive relationship between fecundity and body size driven by indeterminate growth.

**0121 Herp Genomics, Morphology & Development, Symphony I & II, Monday
11 July 2011**

Andrea Jaszlics¹, Jason Pardo²

¹University of Texas at Arlington, Arlington, TX, USA, ²University of Illinois at Urbana-Champaign, Urbana, IL, USA

Ontogeny and Crocodylian Skull Diversity: A Geometric Morphometric Approach

Variation in ontogenetic trajectories plays a critical role in shaping morphological diversity of the vertebrate skull. Most previous work on this phenomenon has focused on mammals, where dissociation of ontogenetic modules is responsible for creating much of the observed morphological diversity. Crocodylians are a potentially informative group in which to study this phenomenon because they demonstrate a relatively large degree of morphological diversity in the skull, in spite of a relatively high degree of ecologic and phylogenetic constraint. In order to test whether the diversity of crocodylian skull morphologies is achieved through similar mechanisms of mammal-like dissociation of skull modules, we sampled growth sequences representing each of the four major extant lineages (Alligatoridae, Crocodylidae, Tomistominae and Gavialinae). We then used a geometric morphometrics-based approach to compare ontogenetic trajectories in these taxa. Principle components analyses show a tight integration of the entire skull, specifically between rostral length and the width of the suspensorium relative to the braincase in crocodylids, alligatorids and tomistomines. Gavialines however, show a strong disintegration of the suspensory module from the rostrum. We hypothesize that this dissociation is the result of the slender rostrum and 'snapping' feeding mechanism of true gharials, which places unique constraints on adductor morphology. This suggests that variation along even highly constrained ontogenetic trajectories can produce diverse morphologies.

0742 Poster Session III, Sunday 10 July 2011

Robert Javonillo

Coppin State University, Baltimore, MD, USA

Reinvigoration and Expansion of the Teaching Collection at an Urban HBCU

Coppin State University is a Historically Black College/University (HBCU) in Baltimore, Maryland. Many of the university's undergraduates are from disadvantaged backgrounds and have limited exposure to the biodiversity found outside the urban ecosystems of the Baltimore-Washington metropolitan area. Ichthyologists and herpetologists will likely agree that photographs, illustrations, and video footage are sometimes insufficient substitutes for the tactile learning experiences of examining specimens. Thus the goal of this project is to replace the small, long-neglected collection of zoological material in the university's Department of Natural Sciences. Courses that are currently offered (e.g., General Zoology, Vertebrate Structure) or other courses that may be offered at Coppin in the future, such as Biology of Fishes or Marine Biology, would incorporate use of preserved materials. Students will perform special preparations (e.g., clearing and staining, tissue sectioning, DNA extraction) when feasible. Such exercises will reinforce the assertion that organismal biology is a dynamic, integrative branch of science. Donations of small (<0.5 m total length) specimens and/or appropriate containers will be gladly accepted, even when locality data are unavailable for specimens. Formalin-fixed, alcohol-preserved animals are especially appreciated. An open-source software package for collections, such as CollectionSpace, CollectiveAccess, or Madrona, will be used to manage data. Attaining the project goal will greatly improve the learning environment for a population of minority students that is underrepresented in biology.

0734 Herp Population Genetics/Herp Coloration, Symphony I & II, Monday 11 July 2011

Jarrett Johnson¹, Brad Shaffer¹

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Nuclear and Mitochondrial DNA Concordance in Delineation of California Tiger Salamander Distinct Population Segments

The delimitation and preservation of evolutionarily distinct lineages is a primary goal of conservation genetics. We used single nucleotide polymorphisms (SNPs) to assess the geographic distribution of genetic variation across the range of the California tiger salamander (*Ambystoma californiense*). The California tiger salamander is a threatened mole salamander endemic to California that is at risk for decline from a variety of anthropogenic forces, including habitat modification and hybridization with an introduced congener. Previous investigations of mitochondrial DNA revealed at least three well-supported phylogenetic units consisting of one large central subpopulation representing the main range of the California tiger salamander and two geographically

isolated, endangered subpopulations in Sonoma and Santa Barbara Counties to the North and South, respectively. Our multilocus nuclear SNP data generally support these previous findings and provide a robust test of the mitochondrial DNA-derived null hypothesis regarding the pattern of evolutionary relationships among California tiger salamander subpopulations. However, we further argue that our data suggest the presence of additional genetically-based management units within the previously-identified central subpopulation. Our data provide a framework for evaluating the potential effects of local extinctions on range-wide genetic diversity and for directing mitigation and recovery efforts of California tiger salamanders. A firm understanding of the distribution of genetic variation is crucial for implementation of genetically-informed conservation initiatives aimed towards protecting unique, at-risk California tiger salamander populations.

0639 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Lucinda Johnson¹, Jennifer Olker¹, Patrick Schoff¹, Glenn Guntenspergen², Catherine Johnson³, Angela Wagner⁴, Jason Rohr⁵, Val Beasley⁶

¹NRRI University of Minnesota Duluth, Duluth, MN, USA, ²USGS Patuxent Wildlife Research Center, Laurel, MD, USA, ³USDA Forest Service Monongahela National Forest, Elkins, WV, USA, ⁴USDA ARS North Central Ag Research Lab, Brookings, SD, USA, ⁵University of South Florida, Tampa, FL, USA, ⁶University of Illinois at Urbana-Champaign, Urbana, IL, USA

Multi-Scale Approaches For Quantifying Effects of Multiple Stressors in Aquatic Ecosystems

Aquatic ecosystems are influenced in a hierarchical fashion by the climate and landform in which they are embedded, by land use and land cover in the catchment and the immediate vicinity, and by ecosystem-scale factors. Quantifying organismal and ecosystem responses to the multiple and interacting effects of human activities requires a multi-pronged approach. We have investigated the effects of land management and climate change on wetland ecosystems, amphibian community, and organismal health using such an approach. Data from laboratory and mesocosm experiments, intensive field studies, and extensive field campaigns spanning the upper Midwest have been assembled. In this presentation we will address the advantages of this multi-pronged approach and will focus on two case studies: 1) quantifying indirect effects of the chemical atrazine on ecosystem properties and subsequently, amphibian immune responses and health; and 2) quantifying effects of climate change and landscape pattern on persistence of amphibian populations. Lessons from these investigations emphasize the potential for subtle direct and indirect effects of chemicals on biota and the need to incorporate data from multiple study types to address such issues. Landscape attributes including wetland density and distribution also must be considered when planning, implementing, and refining restoration and conservation activities in light of changing climate.

0758 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Nathan Johnson¹, James Williams², James Austin¹

¹University of Florida, Gainesville, FL, USA, ²Florida Museum of Natural History, Gainesville, FL, USA

Phylogeographic Investigations of Freshwater Pearly Mussels (Bivalvia: Unionidae) Inhabiting Rivers of the Gulf-Atlantic Coastal Plain

Freshwater communities of the Gulf-Atlantic Coastal Plain (GACP) were greatly affected by changes in sea level during past climatic cycles. Identifying phylogeographic patterns and inferring the processes of diversification following glacial events are important for understanding present day species distributions. Previous geologic and phylogeographic studies have provided evidence that high sea level stands may result in range restrictions and extinctions for freshwater restricted taxa whereas lower sea levels likely connected previous isolated riverine systems, facilitating range expansion and recolonization. In the present study, we use mitochondrial DNA (mtDNA) sequence variation to test multiple hypothesis associated with the phylogeography of several freshwater mussel species (Bivalvia: Unionidae) inhabiting rivers of the GACP. In addition, we are using a HABC approach to analyze all the phylogeographic datasets at once in order to make across taxon-pair inferences about biogeographic processes. Preliminary results indicate the absence of a general phylogeographic patterns for all co-distributed taxon pairs. Instead, phylogeographic structure appears closely linked to the relative dispersal ability and host attraction strategy of each species. Final results will be presented in light of geologic history of the region and several biological features unique to each species under investigation.

0489 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Peter Jones, Richard King, Eastern Massasauga Radiotelemetry Group

Northern Illinois University, DeKalb, IL, USA

Rangewide Analysis of Eastern Massasauga Survivorship

The Eastern Massasauga (*Sistrurus catenatus catenatus*) is a candidate species for listing under the U.S. Endangered species act. It is afforded protection in every state and province within its range which extends from Iowa to New York and from southern Ontario to southern Illinois. Populations of Eastern Massasauga are fragmented and only a few areas harbor multiple, sizable populations. Eastern Massasauga research has usually focused on single populations or local metapopulations but suggest that demographic parameters may vary geographically. In this study, we use radiotelemetry datasets provided by Eastern Massasauga researchers to characterize geographic patterns of adult survival throughout its range. Twenty-one datasets consisting of 499

telemetered animals from 16 distinct locations were analyzed using the known-fate model in Program MARK. Annual adult survival averaged 0.68 (range = 0.35-0.95). Further analysis of five larger datasets indicated no consistent difference in survival between males and females. Annual survival increased along a geographic axis running from southwest to northeast through the range of the Eastern Massasauga. These analyses provide a better understanding of the relationship between survivorship and geographic location for the Eastern Massasauga and might be used for population viability analysis.

0590 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Laura Jordan¹, John Mandelman², Stephen Kajiura¹

¹Florida Atlantic University, Boca Raton, FL, USA, ²New England Aquarium, Boston, MA, USA

Behavioral Responses to Weak Electric Fields and a Lanthanide Metal in Two Shark Species

The unintentional catch of sharks on hooks intended for other fish is an economic, environmental and safety concern. Recent research has sought to capitalize on the electrosensory system in elasmobranchs to repel sharks from lines without affecting target teleost catch through experiments with various lanthanide metals and alloys. We present a standardized approach to testing sharks responses to an ideal lanthanide metal with a strong electric field and relatively slow dissolution in seawater. Sharks responses to prey-simulating weak electrical signals were quantified to establish the sensitivity of the electrosensory system in *Squalus acanthias* and *Mustelus canis*. Both species demonstrated sensitivity to electrical signals below 1nV/cm, and responded similarly to other elasmobranchs. Sharks were then presented with food affixed to 2.5mm² treatments of acrylic, stainless steel or Neodymium (Nd) metal pieces. *S. acanthias* only fed in groups and fed from Nd significantly less frequently than either control. *M. canis* were tested both individually and in groups and when alone fed less from Nd, however, in groups they ate food significantly more often from Nd. These results confirm variability in response to a lanthanide metal both across species and within a species in the presence of competition. Since observed differences are not due to differences in sensitivity, additional factors appear to influence behavioral responses and may compromise the effectiveness of lanthanide metals for the reduction of shark bycatch.

0701 Poster Session III, Sunday 10 July 2011

Michael Jorgensen

Ohio University, Athens, OH, USA

Evolution of Locomotor Traits in Frogs

Our knowledge of the evolution of locomotion in frogs comes from a few studies of fossil and extant taxa that document and compare variation in anuran-specific osteological traits, but to date, a comprehensive assessment of locomotor bony traits in frogs has not been performed. I measured anatomical variation in forelimb, hindlimb, and pelvic girdle morphology from x-rays of 265 species (representing 265 genera; 1350 individuals) of frogs and examined covariation of bony traits throughout the anuran phylogeny that are posited to be correlated with locomotor mode. Locomotor modes were assigned to taxa based on literature accounts. Principal components analysis of residuals of traits regressed on snout vent length show the majority of osteological variation in frogs observed was due to sacral diapophyseal shape (PC1; 62.7%), hindlimb length (PC2; 20%), forelimb length (PC3; 7%), and pelvis length (PC4; 4.5%). Wide sacral diapophyses are prevalent throughout the Archaeobatrachia and Mesobatrachia and are posited to be important in lateral-bending and pelvic-sliding behaviors such as walking, hopping, and swimming; two major neobatrachian groups (bufonids and microhylids) possess this state as well. Long legs are found in arboreal and long jumping taxa (hylids, hemiphractids, ranids) while shorter legs seem to be the generalized condition for most taxa (even shorter in burrowers). Terrestrial forest floor taxa (bufonids, dendrobatids, megophryids) and arboreal walkers (phyllomedusines) possess relatively long arms while arboreal jumpers, pipids, and microhylids possess relatively short arms. These results are discussed further in the context of locomotor performance and function in frogs.

0391 Poster Session III, Sunday 10 July 2011

Eric Juterbock, Jessy Heinemeier

Ohio State University, Lima, OH, USA

Using Plaster Models to Evaluate Evaporative Water Loss in Salamanders

Although, as is obvious to any herpetologist, water relationships are critical for amphibians, studying them in ecologically relevant situations is often difficult. We have extended the techniques used for anurans by Tracy et al (2007, J. Herp. 41:597-603) to include salamanders. We covered preserved specimens of plethodontids with several layers of liquid latex to obtain molds of individual salamanders. With these molds, we used plaster of Paris to make models of each individual. Live salamanders and models were then dehydrated under evaporative potentials quite similar to those experienced by active plethodontids in southern Appalachian woodlands. The technique involved placing the salamander or model in a small screened container, which was placed in a

larger closed container, on a shelf above water; by adjusting the degree of closure of the large container lid, humidity could be maintained appropriately. Most data were obtained from live *D. fuscus*, or models thereof; models of three sizes were used to cover the size range of live salamanders. The rates of evaporative water loss for live salamanders of similar size, dehydrated under similar conditions, overlapped the rates of water loss for the models. The rates of water loss for models also matched biologically predictable patterns. Large models lost significantly more water, but at a lower rate, than small models. For any given size of model, those dehydrated at lower relative humidity (89-91%) lost more water than those dehydrated at higher relative humidity (94-95%). Such models can thus be used to evaluate water loss in climbing salamanders.

0427 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

David Kacev¹, Rebecca Lewison¹, Andrew Bohonak¹, Daniel Cartamil³, Russ Vetter², John Hyde²

¹San Diego State University, San Diego, CA, USA, ²Southwest Fisheries Science Center, La Jolla, CA, USA, ³Scripps Institution of Oceanography, La Jolla, CA, USA

Characterizing Genetic Diversity of Two Species of Pelagic Shark

Both shortfin mako (*Isurus oxyrinchus*) and common thresher (*Alopias vulpinus*) are abundant worldwide and are highly exploited in temperate coastal seas of the north and south Pacific Ocean. These shark species experience high fishing pressure throughout the Pacific Ocean from commercial and recreational fisheries. Despite their economic and ecological importance, very little is known about their regional population structure. Satellite telemetry and conventional tagging studies indicate some regional partitioning of populations, which would make regional management prudent. The generally low level of genetic variation in elasmobranchs and mako and thresher species in particular has hampered a full understanding of the genetic structure underlying observed movement patterns. In this study, we present initial results for 15 new microsatellite markers per species for both mako and thresher. We describe genetic diversity for both species in terms of allelic diversity and heterozygosity across these loci. We then compare our findings to previous studies that used mtDNA to look at diversity in these two species from the same region. In addition, we look at the population structure of makos from various locations in the Pacific Ocean using these new microsatellite markers and compare to the results found in previous mtDNA analyses. We test to see if tropical seas serve as a barrier to gene flow for this species as suggested by previous mtDNA studies. Similarly, we look at whether these new markers support population structure between the eastern and western portion of the South Pacific, which was previously suggested by mitochondrial studies.

0664 Poster Session I, Friday 8 July 2011

Kristine Kaiser¹, John Pollinger²

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Validation of the Triplicate qPCR Assay for *Batrachochytrium dendrobatidis* (Bd) with Prevalence and Diversity of Bd in the Maya Mountains of Belize

The amphibian pathogen *Batrachochytrium dendrobatidis* (*Bd*) has been implicated in amphibian declines around the globe. Although commonly used PCR primers for *Bd* testing have been validated against various non-pathogenic chytrid fungi, other forms of validation of the protocol have been lacking, making interpretation of results complex, and comparison across studies difficult. For example, many authors have reported the existence of samples testing positive once or twice in triplicate assays, but no data exist on the identity of such samples, and there is no consensus on how to treat them. Thus, the identity of such samples has remained elusive. We set out to determine the prevalence and diversity of *Bd* in the Maya Mountains of Belize using quantitative PCR (qPCR), and to identify identities of samples testing positive in single or double samples. We collected 524 skin swabs; 86 tested positive at least once. We sequenced a subset of these, 72 of which had tested positive for *Bd* at least once; 29 of these were *Bd*. Only one sample which tested positive in triplicate was not *Bd*. We found that *Bd* was broadly distributed in Belize, and we found eight unique haplotypes, five of which were previously undescribed. In addition, the frequency with which samples testing positive singly or doubly were shown to be false positives suggests that these results may not be useful for diagnosing *Bd* presence at a site.

0542 Poster Session III, Sunday 10 July 2011

Taylor Kalmus, Paul Hampton

Carroll University, Waukesha, WI, USA

Single Large or Several Small: Prey Size Selection In Snake Foraging Strategies

Foraging theory suggests that a predator will select a prey item with the highest energetic return. Snakes are generally depicted as predators that consume very large prey, yet in nature small prey are often equally available, if not more so. The majority of snake feeding studies have made comparisons between single prey items of varying relative masses, yet many species consume multiple small prey that result in total meal masses comparable to the relatively large meals of infrequent feeders. For example, the western ribbon snake (*Thamnophis proximus*) can consume a single prey item of up to 40% of its own mass but may consume several prey constituting a larger relative meal size. Using ribbon snakes, we compared the effort, as time and number of jaw protractions, required to consume a single large prey item to that required to consume a meal of equal biomass but composed of several small prey. Preliminary data suggests

that the sum effort of consuming several small prey items is greater than that of single large. Taking into account the additional time it would be required to locate multiple prey, consuming a single large prey item appears to be the more stable foraging strategy.

0217 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Somkiat Kanchanakhan, Jaree Polchana, Wuthichai Wongchan

Inland Aquatic Animal Health Research Institute (AAHRI), Bangkok, Thailand

Ranaviruses in Frogs and Fish in Southeast Asia

Ranaviral disease was first documented in Asia in 1998. The disease occurred in *Rana tigrina* housed on frog culture farms located in central Thailand. The diseased frogs exhibited ulcerative lesions on the dorsal skin surfaces, similar to lesions observed in the United Kingdom. Histopathological examination revealed necrosis and chronic inflammation in skin, spleen, livers, gastro-intestinal tract followed by exuberant hematopoiesis. Thereafter, ranavirus surveillance was conducted on Thailand frog farms from 1998-2002, by attempting virus isolation on tissue extracts of diseased frogs. Virus was isolated from frogs of 8 of 9 provinces in central Thailand, with an overall prevalence of 65% ($n = 107$ individuals tested). Mortality was greatest in tadpoles, moderate in small frogs, and low in adults. All virus isolates displayed similar cytopathic effects. Sequence analysis supported a novel ranavirus: *Rana tigrina* ranavirus. In Thailand, the same or closely related ranaviruses have been isolated from diseased marble goby (*Oxyeleotus marmoratus*) in 2000 and diseased goldfish (*Carrasius auratus*) in 2002. Other ranaviruses have been reported in ornamental fish from Japan and in cage cultured fish in Singapore. Likewise, a similar ranavirus has been isolated from frogs imported from Cambodia in 2004. The scientific findings indicate that ranaviruses can infect and cause disease in fish and amphibians in Asia, and they have the potential to negatively impact the aquaculture industry. Trans-boundary movement of ranaviruses through international trade is a major concern to the Southeast Asia region and elsewhere in the world.

0332 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Matthew L. Karnatz, Ralph Ackerman

Iowa State University, Ames, IA, USA

Water Uptake by *Chelydra serpentina* (Common Snapping Turtle) and *Apalone spinifera* (Spiny Softshell Turtle) Parchment and Hard-shelled Eggs

Egg laying reptiles typically have either parchment shelled eggs or hard shelled eggs. We monitored *Chelydra serpentina* (common snapping turtle) and *Apalone Spinifera* (spiny soft-shelled turtle) egg weights over the summer of 2009 in Hennepin county, Minnesota

to determine amount of water taken up or released (mass change) during incubation in natural nests. *Apalone* typically nested near water in sand or sandy soil, especially beaches. *Chelydra* nested much further from water in substrate ranging from gravel to loam or mulch. Between these environments sandy soil may lose more water, and being near the waters' edge may have higher rates of flooding. We marked individual eggs (n=449 for *Chelydra* and n=210 for *Apalone*) in nests (n= 13 for *Chelydra*, n=9 for *Apalone*) and reweighed them over the course of incubation using different weighing intervals (some were weighed twice, others five times). Six *Chelydra* nests were weighed within hours of being laid: the average nest weighed 497.2 g, average egg mass was 12.4 g, and an average of 40 eggs/nest. The average mass change of hard-shelled eggs from *Apalone* decreased in mass slightly (6 mg/day, ± 4.7 mg/day) while the parchment shelled egg of *Chelydra* gained mass at an average rate of 40 mg/day (± 20 mg/day). It is clear that despite the eggshell water vapor conductance difference between the two species; their eggs may be incubated in different hydric environments even in close proximity to each other.

0335 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Conrad B & C, Thursday 7 July 2011

Matthew L. Karnatz, Ralph Ackerman

Iowa State University, Ames, IA, USA

Overwintering Behavioral Physiology of Hatchling Painted Turtles (*Chrysemys picta*) in Natural Nests

Chrysemys picta (painted turtle) have a unique habit of remaining in the natal nest cavity during their first winter post hatching. Behavior during overwintering is largely unknown, and physiology mostly focuses on freezing tolerance or lack thereof. We monitored nests (n=24) during the winter of 2008/2009 in Minnesota at Clifton E. French Regional Park in Hennepin County and Rice Creek Chain of Lakes in Anoka County. Random nests were chosen to be dug up at about 2 month intervals throughout the winter (5 nests per sample). Hatchling survival was estimated as well as other measurements including residual yolk mass, hatchling mass, height, carapace width and length, head width, and yolk scar width. Nest morphology and hatchling orientation were also recorded. Most measurements remained constant throughout the winter. Residual yolk mass appeared to decrease; however, increased variability was seen for yolk masses both between and within nests at the same point in the winter. Hatchlings were oriented in the nest cavity with heads up, and carapaces to the outside of the nest cavity. Eggshell remnants were at the top and sides of the nest cavity. Hatchling survival was 100% except for those nests under a layer of ice from either trail grooming or parking lot snow being piled up over them during the winter, where survival was 0%.

0238 Poster Session I, Friday 8 July 2011

Daryl Karns¹, Vimoksalehi Lukoschek², Jennifer Osterhage¹, John Murphy³, Harold Voris³

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Historical Perspectives on the Phylogeography of a Semi-aquatic Snake, *Enhydris subtaeniata* (Serpentes: Homalopsidae) in Indochina

We examine the role of current and historical geography in shaping the population genetic structure of a semi-aquatic snake, *Enhydris subtaeniata* (Serpentes: Homalopsidae) in Indochina. We collected *Enhydris subtaeniata* (n = 48) from seven locations from three river drainage basins. We used sequence data from three mitochondrial fragments (2785 bp) for phylogenetic and population genetic analyses; we also collected information about sexual size dimorphism, scalation, reproduction, and diet. Genetic diversities were typically low within locations, but high across all seven sampled locations. Each location had a unique suite of haplotypes not shared among locations and pairwise Φ_{ST} values (0.713-0.998) were highly significant between all location pairs. Relationships among phylogroups were well resolved and AMOVA revealed strong geographical partitioning of genetic variance among the three river drainage basins surveyed. Size and reproductive characteristics mirrored these genetic differences. The genetic differences observed among the populations of *E. subtaeniata* were likely shaped by the Quaternary landscapes of Indochina and the Sunda Shelf. Historically, the Middle and Lower Mekong consisted of strongly dissected river valleys separated by low mountain ranges and much of the Sunda Shelf consisted of lowland river valleys that served to connect faunas associated with major regional rivers. It is thus likely that the genetic pattern that we observe today among populations of *E. subtaeniata* is a product of their histories in a complex terrain that both created abundant opportunities for genetic isolation and divergence and that also provided lowland connections across now drowned river valleys.

0436 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

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Impacts of Mosquito Control Agents on Amphibians and an Aquatic Food Web in South China

Mosquito control agents are applied in many developed areas in Southeast Asia to control infectious diseases such as malaria and dengue fever. In South China, these agents include petroleum oil, the insecticide temephos, and the bacteria *Bacillus thuringiensis*. Mosquito control efforts most often target larval stages, potentially impacting other aquatic species occupying the same habitats. Using mesocosm

experiments, we evaluated the effects of these three measures on embryonic and larval survival in four wetland-breeding amphibian species. Embryonic survival exceeded 90% for the ornate pigmy frog (*Microhyla ornata*), paddy frog (*Fejervarya limnocharis*), and Asian common toad (*Bufo melanostictus*) in controls, temephos, and the bacteria treatment, but no embryos survived in the oil treatment. For the brown tree frog (*Polypedates megacephalus*), survival ranged from 65-75% for all treatments. For the larvae of all species, survival was $\leq 5\%$ in oil. Survival of larval *M. ornata*, *F. limnocharis*, and *B. melanostictus* was 56-66% in bacteria and 59-76% in temephos, but for *P. megacephalus* was 6% in bacteria. Survival in controls was $< 15\%$ for the three benthic feeders *F. limnocharis*, *B. melanostictus*, and *P. megacephalus*, and significantly lower than that (38%) of the mid-water column feeder, *M. ornata*. Presence of the odonate predator, *Pantala flavescens*, was associated with reduced survival in controls for the benthic-feeding amphibians. Temephos appeared to limit odonate populations thereby benefitting larval amphibians. Our study indicates that where conservation of amphibians is a priority, the use of petroleum oil for mosquito control should be avoided.

0678 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

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Dietary Study of Arboreal Lizard Community in Ankarafantsika National Park, Madagascar

Madagascar hosts nearly 400 species of reptiles and many of them are endemic to the island. Numerous systematic studies have been undertaken at different climatic zones, but ecological research in this country is urgently needed. In order to understand the guild structure of an arboreal lizard community in a dry forest of western Madagascar, we carried out a dietary study in Ampijoroa Forest Station, Ankarafantsika National Park, during the rainy season (November - December 2009 and January - February 2011). Ten arboreal lizard species in genus *Blaesodactylus*, *Furcifer*, *Geckolepis*, *Lygodactylus*, *Oplurus*, *Phelsuma*, *Uroplatus*, *Paroedura*, and *Zonosaurus* were captured by noosing or hand, and their stomach contents were flushed. Feces were also collected to supplement the stomach contents data, especially for the species that are too delicate to conduct stomach flushing. Food items in the stomach contents and feces were identified to the order level, showing that insects are the primary prey in all species. While not a large proportion, plant materials such as fruits and flowers were found in six of the species studied.

0601 Poster Session II, Saturday 9 July 2011

Matthew G. Keevil¹, Ronald J. Brooks¹, Jacqueline D. Litzgus¹

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Density Dependence in a Population of Snapping Turtles: Does a Decline in Density Reduce Emigration?

Models suggest that dispersal may be caused by inter-patch differences in resource competition (including kin competition) and/or on inbreeding avoidance. Additionally, dispersal may be conditional or unconditional relative to individual and population states. Using data from a long-term population study of Snapping Turtles (*Chelydra serpentina*) in Algonquin Park, Ontario, we will test whether a change in habitat saturation, and therefore presumed realized patch quality, affects emigration by examining observations of dispersal and by comparing survival rates, individual growth, and fecundity before and after a major mortality event. If dispersal in Snapping Turtles is mediated by resource competition, then we make two predictions: 1) vital rates will be sensitive to changes in density, and 2) emigration will be negligible after a decrease in density. Conversely, if inbreeding avoidance is the primary selective pressure causing dispersal, then vital rates need not be density-dependent, and emigration is predicted to occur independently of changes in patch saturation. An understanding of dispersal dynamics is important for evaluating the threats to populations that exist in patchy habitats. If dispersal is conditional on patch saturation, then decreases in dispersal rates in response to population declines may buffer subpopulations against some of the immediate demographic costs of emigration, especially where fragmentation and increasing dispersal mortality have reduced immigration. However, if emigration occurs despite a reduction in patch saturation, then subpopulations may be unable to compensate for declines and decreasing dispersal success by reducing emigration, which in turn could have serious consequences for population persistence.

0695 Fish Physiology, Minneapolis Ballroom G, Monday 11 July 2011

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The Extra-Ocular Muscles as a Possible Heat Source for Cranial Endothermy in Lamnid Sharks

Orbital *retia mirabilia* conserve metabolic heat in lamnid sharks, allowing elevation of eye and brain temperatures above ambient water temperature (cranial endothermy). Warm blood from the locomotor red muscle transported to the orbital *retia* contributes heat, but an additional heat source is needed to maintain cranial temperatures at levels previously reported. We hypothesized that one or more of the extra-ocular muscles serve as a heat

source for cranial endothermy in the shortfin mako shark (*Isurus oxyrinchus*). To test this hypothesis, eyes with the extra-ocular muscles attached were obtained from sharks captured by long-lining. The mass (g) and specific activity of the mitochondrial enzyme citrate synthase (CS units g⁻¹) were measured for each of the six extra-ocular muscles as an index of heat production capacity in *I. oxyrinchus*, and compared to values in the ectothermic blue shark (*Prionace glauca*). In *I. oxyrinchus*, the medial and lateral rectus muscles were larger than the other extra-ocular muscles, but CS activity did not differ significantly among the six muscles. The CS activity of only the medial rectus muscle was significantly greater in *I. oxyrinchus* than in *P. glauca*. As a percentage of total eye mass, all six extra-ocular muscles were larger in *I. oxyrinchus* than in *P. glauca*. These results suggest that contraction of all six extra-ocular muscles may generate heat for cranial endothermy in *I. oxyrinchus*, with the medial and lateral rectus contributing a greater proportion of that heat. Muscle mass contributes more than CS activity to interspecific differences in heat production capacity.

**0406 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday
10 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY**

Heidi R. Keller

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Trophic Study of Oilfish (*Ruvettus pretiosus*), Escolar (*Lepidocybium flavobrunneum*), Snake Mackerel (*Gempylus serpens*), and Lancetfish (*Alepisaurus* spp.) in the Gulf of Mexico and Western North Atlantic Using Stomach Content and Carbon-Nitrogen Stable Isotope Analyses

Pelagic marine ecosystems are the largest on earth and remain poorly understood. Trophic roles of large mesopelagic teleosts in pelagic marine ecosystems have been relatively unstudied due to inaccessibility and low density. Over 150 individuals of oilfish (*Ruvettus pretiosus*), escolar (*Lepidocybium flavobrunneum*), snake mackerel (*Gempylus serpens*), and lancetfish (*Alepisaurus* spp.) were collected from pelagic longline fishing operations in the Gulf of Mexico and Western North Atlantic over a period of three years. Stomach content and carbon and nitrogen stable isotope analyses were performed on these and various other species individuals for species and area comparisons. A strong, positive correlation of $\delta^{15}\text{N}$ value with fork length was found for all predators sampled, suggesting a strong size-structure to the ecosystems. An ontogenetic physiological change was observed in oilfish with a rapid increase in C/N from nearly 3:1 at 20 cm to nearly 6:1 at 45 cm fork length. Combined stomach content analyses and $\delta^{15}\text{N}$ values suggested differing ecological roles between species consistent with size and morphological characteristics. The crustacean-dominated diets of small oilfish (18-75 cm) placed them trophically near other small mesopelagic teleosts. The diverse diets of snake mackerel (65-114 cm) and lancetfish (56.5-134 cm), included crustaceans, various other planktonic invertebrates, squids, and teleosts placed them trophically above small mesopelagic teleosts. The squid- and teleost-dominated diets of

fast-swimming, large escolar (39.5-148 cm) placed them near other large, predatory, pelagic teleosts such as swordfish and tuna.

0119 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Jenny Kemper, David Ebert, Gregor Cailliet

Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, USA

Food Habits and Trophic Ecology of *Bathyraja interrupta* in Prince William Sound, Alaska

Skates play important trophic roles within benthic marine communities and, as possible upper trophic level predators, may influence the distribution and abundance of prey and co-occurring species. This likely interaction of skates with their prey and other groundfish species, both of which may be commercially important, highlights the need to better understand processes that influence the trophodynamics of marine ecosystems. Information on the food habits and trophic ecology of skates in Prince William Sound (PWS) is non-existent, yet skates are taken as both bycatch in groundfish fisheries, and were part of a limited skate fishery in 2009 and 2010 there. *Bathyraja interrupta*, the Bering Skate, is a common skate species in PWS. Specimens were collected in July 2007 during fishery-independent trawl surveys of the Alaska Department of Fish and Game within PWS. A quantitative assessment of the feeding habits and trophic ecology of *B. interrupta* was conducted to determine its trophic role in PWS. Crustaceans were the most important prey taxa by %N, %W, and %GII followed by teleosts. Within the crustaceans, decapod shrimps dominated, followed by unidentified shrimp-like crustaceans, amphipods, crabs, and euphausiids. Among the decapod shrimps, pandalid shrimps were consumed most frequently and contributed most to diet by %W and %GII. Other prey included polychaetes, cephalopods, mysids, isopods and copepods. Trophic level was estimated for each individual and plotted with total length to evaluate potential ontogenetic differences in trophic level. Dietary variation was examined and compared with total length, sex, depth of collection, and location in PWS.

0014 Fish Morphology, Symphony I & II, Friday 8 July 2011, ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY AWARD

Christopher Kenaley

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Dampening Drag and Paring Pressure: A Novel Hypothesis for the Function of Enormous Fangs in Deep-sea Fishes

Many deep-sea fishes possess spectacular morphologies that enable the capture of large prey in a seascape devoid of biomass. Perhaps the most distinctive feeding

morphologies of deep-sea teleosts are enormous fangs set on extremely long jaws. Although the functional significance of these phenotypes has long been assumed (e.g., caging or impaling devices), no single study has addressed what functional advantages enormous fangs confer. In recent years, a handful of studies have employed theoretical models to predict feeding performance and describe the dynamic forces associated with jaw adduction in deep-sea fishes. These studies have demonstrated that the most important forces opposing jaw adduction in long-jawed, deep-sea taxa, namely drag and intraoral pressure, differ substantially from those of shallow-water taxa, namely inertia. As a corollary, any prey item put in motion by the jaws of a deep-sea predator might impose much greater negative forces associated with drag and intraoral pressure and that these forces might alter adduction performance considerably. Based on these insights and a series of feeding simulations for several species of the dragonfish family Stomiidae, a new hypothesis is proposed for the function of enormous fangs of deep-sea fishes. A theoretical model that accounts for mass and the hydrodynamic properties of typical dragonfish prey items predicts that fangs function to optimally position prey in such a manner that reduces negative forces acting on the lower jaw. These results demonstrate that without optimal positioning by long teeth, the capacity of dragonfishes to consume large prey items is severely diminished.

0024 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Alicia Kennedy, Aaron Bauer

Villanova University, Villanova, PA, USA

An Example of Human Associated Faunal Change from a Late Quaternary Fossil Herpetofauna of New Caledonia

Excavations in the Pindaï Caves of New Caledonia, a large island in the South Pacific, have yielded a fossil assemblage rich in squamate remains. The fossiliferous deposits at Pindaï Caves are restricted to six caves along the northwest coast of the Grand Terre. The fossils examined in this study are from four of the caves and are derived from degraded Barn Owl (*Tyto alba*) pellets. Radiocarbon dating suggests dates of 1370 to 5590 YBP spanning the deposits. As humans are thought to have reached New Caledonia about 2800 YBP, this assemblage provides a unique opportunity to examine the effect human arrival had on the herpetofauna of New Caledonia. Approximately 25,000 squamate fossils, comprising chiefly maxillae, premaxillae, prefrontals, frontals, parietals, quadrates, dentaries, surangulars, and vertebrae have been recovered from Pindaï to date. All are attributable to Gekkota and Scincidae, with the diplodactylid gecko species *Bavayia* cf. *cyclura* and *Rhacodactylus trachyrhynchus* most common. Similar to the New Caledonian avifauna, which experienced elevated extinction rates upon the arrival of humans, the Pindaï fossil herpetofauna includes at least one extinct species. Additionally, *R. trachyrhynchus* is rare in the region today, being known from only a single recent specimen, and gekkonid geckos, which are widespread in coastal New Caledonia today, are lacking in our samples. Gekkonids may have been introduced as recently as 235 years ago with the arrival of Europeans, but the arrival of Melanesians

nearly 3000 years ago may have precipitated ecological changes that changed patterns of lizard abundance if not species composition.

0083 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Jacob Kerby¹, Andrew Storfer²

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Effects of Pesticide Exposure on Susceptibility to Ranavirus in Tiger Salamanders, *Ambystoma tigrinum*

Changing land use has forced several amphibian species to utilize wetland sites with large anthropogenic impacts. Several sites are in agricultural areas that are exposed to pesticides known to cause both direct and indirect negative effects to amphibian species. Little is understood on how pesticides alter amphibian host-pathogen dynamics, and we are in the infancy of these investigations. The few studies that have been done have revealed that pesticide exposure can increase mortality in *Ambystoma tigrinum virus* (ATV) exposed individuals. For example, the combined effects of the insecticide chlorpyrifos and the herbicide atrazine exhibited a monotonic effect of increased mortality with increasing pesticide concentrations. Although no synergistic effects were detected, survival was reduced from 70% in ATV only exposed treatments to 20% survival in the highest concentration chlorpyrifos/atrazine/ATV treatments. This effect was also found with another insecticide, carbaryl, when combined with ATV and a natural stressor of predator cue. Predator cue exposure alone produced no mortality, but survival was again dramatically reduced when combined with ATV and the insecticide (from 93% to 60%). These results suggest that natural stressors might play an important role in determining the effect of anthropogenic stressors on host pathogen dynamics and should be examined more closely. Further laboratory work examining other commonly used pesticides is essential, as are experiments conducted in more natural and larger mesocosms as is typical of many amphibian ecotoxicological studies. We also see a need for the long-term examination of field sites that might be influenced by both agriculture and ranavirus.

0511 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Steven Kessel¹, Samuel Gruber², Katie Gledhill², Mark Bond³, Rupert Perkins¹

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The Use of Aerial Survey to Estimate Population Abundance for a Carcharhinid Species

Aerial survey is a technique that has been widely used to assess species population abundance for both terrestrial and marine vertebrates. For marine species, the employment of aerial survey census techniques has been mainly limited to marine mammals and reptiles, and to date for sharks has been largely limited to whale sharks (*Rhincodon typus*) and basking sharks (*Cetorhinus maximus*). The Bimini lemon shark (*Negaprion brevirostris*) population, with high site-attachment to a shallow sandy lagoon, provided a very good opportunity to employ the aerial census technique to produce population abundance estimates. The aims of this study were to 1) obtain population abundance estimates; 2) define the distribution of individuals and the effects of tidal variations in water depth; 3) investigate seasonal variation in abundance, and 4) assess the effectiveness of the aerial survey technique for establishing population abundance estimates. Surveys were conducted from light aircraft with sharks counted by visual census. Results were corrected for 'availability', 'perception' and 'survey intensity' to produce abundance estimates. Abundance was found to be greatest in the central area of the lagoon, with a low tide shift in abundance to the east and west. Mean abundance was estimated at 50 individuals and monthly abundance was significantly correlated with mean water temperature. The aerial survey technique proved effective for establishing population abundance estimates. The successful implementation of the aerial survey technique highlighted the potential of further employment for shark population assessments in similar habitats.

0167 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Sora Kim¹, Tim Tinker³, James Estes³, Paul Koch²

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Dietary Specialization Among White Sharks in the Northeast Pacific

White sharks (*Carcharodon carcharias*) are top-level predators. Stomach contents, tooth morphology and coastal observations suggest that white sharks typically feed on pinnipeds off the California coast. However, the complete breadth of white shark diet is unknown. We focus on white shark diet using a stable isotope analysis. Stable isotope ratios of carbon (¹³C/¹²C) and nitrogen (¹⁵N/¹⁴N) elucidate feeding patterns in birds,

mammals, teleosts, and are gaining use in shark ecology. First, we established vertebrae-to-diet trophic discrimination factors for leopard sharks during a controlled experiment. We then applied this information to interpret data from 15 white sharks caught off the California coast from 1936 to 2003. White shark vertebrae record diet in accreted growth bands. The $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of collagen extracted from these bands allow us to track a shark's lifetime diet. Our results illustrate that the California white shark population has a generalized feeding structure with variable $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values rather than an exclusive focus on pinnipeds. Furthermore, many individuals undergo an ontogenetic dietary shift, but the extent of this trophic switch varies among individuals. Additionally, isotopic patterns reveal individual specialists and generalists within the California white shark population. These dietary patterns persist even as pinniped populations increased after the passage of the Marine Mammal Protection Act in 1972.

**0331 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis
Ballroom F, Thursday 7 July 2011**

Steve Kimble, Rod Williams

Purdue University, West Lafayette, IN, USA

**Conservation Genetics of the Eastern Box Turtle (*Terrapene carolina carolina*)
in Indiana, USA**

The Eastern Box Turtle *Terrapene c. carolina* is experiencing steep population declines across its range in the eastern United States. This decline is likely due to a combination of habitat loss and fragmentation, road mortality, disease and collection for the pet trade. Habitat destruction and fragmentation are particularly severe in the Midwestern United States. Generally, prolonged reproductive isolation leads to genetic differentiation. We sampled from eight putative populations across Indiana and one each in Michigan and Kentucky. Observed genetic diversity is high (mean N_A : 29.5), overall deviations from Hardy-Weinberg expectations low (mean H_E : 0.874, mean H_O : 0.767), and genetic subdivision within populations low (mean F_{IS} : 0.0096) in a library of eleven subspecies-specific microsatellite loci. Population differentiation is relatively low (pairwise F_{ST} range: 0.0000-0.0168) across Indiana, and is not increased by inclusion of the Michigan and Kentucky populations, despite separation of approximately 600km and spanning of large rivers such as the Ohio and Wabash. Understanding the population genetics of a declining species is an important early step in developing conservation efforts. We discuss several implications for low population differentiation at the statewide scale, including high apparent population sizes and gene flow despite large areas of inhospitable habitat separating habitat patches.

0578 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

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Factors Inducing Emergence from Over-Wintering for the Eastern Box Turtle, *Terrapene carolina*.

Factors which stimulate Eastern Box Turtles and other reptiles to emerge from over-wintering are poorly understood. This aspect of their biology is of general interest, but also has conservation value. We have found that turtles that have not emerged are less likely to be killed or injured by prescribed fire. Consequently, if land managers could predict emergence, they could potentially minimize impacts of this and other management activities. To explore factors which might influence emergence, we monitored body (carapace) and soil (surface, 15 and 30 cm) temperatures with iButton dataloggers. We also considered information from a local weather station and derivatives of Julian date to examine circannual rhythms. Emergence times varied by year and somewhat between individuals dispersed across the landscape in a given year. Thus, emergence appears not to be principally driven by a circannual rhythm, but by local temperatures. Later in winter body and soil temperatures were very stable and close to or below 0° C. Early in March, increased day length, rain, loss of snow cover and warmer air temperatures led to higher and more variable soil and body temperatures. Prior to emergence, body and all sub-surface soil temperatures became quite similar, while surface temperatures varied more widely. Cues most correlated with emergence include daily minimum soil temperatures and the inversion of deep versus shallow soil temperatures. We present the specifics of these relations and simplified means that would allow land managers to predict emergence in lieu of detailed on-site monitoring.

0063 Fish Conservation, Symphony III, Saturday 9 July 2011

Andrew Kinziger¹, Rodney Nakamoto², Eric Anderson³, Bret Harvey²

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Small Founding Number and Low Genetic Diversity in an Introduced Species Exhibiting Limited Invasion Success (Speckled Dace, *Rhinichthys osculus*)

Molecular evaluations of successful invaders are common, however studies of introduced species that have had limited invasion success or those that have died out are lacking for obvious reasons. We studied an introduced population of speckled dace that has rapidly increased in abundance but remained restricted to a 25-km stretch of river since its introduction in the mid-1980s. Field and laboratory analysis indicate

invasion success of speckled dace is constrained by the combined effects of multiple predators. The role of bottleneck effects associated with the introduction have not been studied. We assayed variation in seven microsatellite loci and one mitochondrial DNA gene in the introduced population and nine putative source populations to identify the source population and evaluate bottleneck effects. The Trinity River system was supported as the source owing to its genetic similarity and geographic proximity to the introduced population. Consistent with a bottleneck, the introduced population was estimated to be founded by 10 individuals and exhibited reduced allelic diversity in comparison to source populations. Limited invasion success of speckled dace may be due to loss of traits associated with predator avoidance as a result of bottleneck effects. Alternatively, loss of genetic diversity may have had no role because speckled dace could simply lack an instinctive ability to avoid the multiple predator situation they encountered upon introduction.

0275 Poster Session I, Friday 8 July 2011

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Prevalence of an Emerging Fungal Pathogen (*Batrachochytrium dendrobatidis*) among Eastern Hellbender (*Cryptobranchus a. alleganiensis*) Populations in the Allegheny River Watershed, Pennsylvania

Chytridiomycosis is an emerging infectious disease of amphibians associated with the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*). On a global scale, chytridiomycosis has been implicated in catastrophic population declines and several species extinctions. In Pennsylvania, we previously detected infected populations of the Eastern Hellbender salamander (*Cryptobranchus a. alleganiensis*) in streams of the Allegheny River watershed. Our objectives were to compare *Bd* prevalence (% of infected individuals) among hellbender populations and test for relationships between *Bd* prevalence and several measures of stream water quality. From June to October 2010, we hand captured 119 hellbenders in French, Tionesta, Little Mahoning, and Tubmill Creeks, collected skin swabs for disease testing, and quantified six water quality parameters at all sites. The fungal pathogen was detected at all sites and prevalence estimates for populations ranged from 7% to 21%. Low prevalence estimates were associated with streams with higher average pH and lower average dissolved oxygen content. Our study provides the first estimates of *Bd* prevalence for the Eastern Hellbender and indicates that infection levels for this species are relatively high compared to other salamanders. Identifying additional environmental conditions associated with chytridiomycosis is important for identifying populations at risk and modifying management plans.

0242 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

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Closing the Gap: Finite Element Modeling of Caecilian Skulls

Caecilians (Lissamphibia: Gymnophiona) are characterized by a burrowing lifestyle that is related to many anatomical specializations, e.g. the complete reduction of the limbs and an elongated wormlike body shape. The well ossified caecilian skull has received a great deal of attention, as it is a critical character in understanding caecilian evolution and amphibian relationships. Caecilians skulls either have a wide gap in the temporal region (zygokrotaphic condition), or the temporal region is closed (stegokrotaphic condition). We studied the transmission of applied load through the two skull types during burrowing by using finite element modeling from CT scans of six species of caecilian. We also performed experimental manipulations of the morphology with 3D visualization software. This allowed us to modify the temporal regions of the skulls to make zygokrotaphic skulls stegokrotaphic and vice versa. Under load, the ventral (palatal) aspect of the skull experiences the highest strains, while the skull roof is less affected. This explains the surprising result that both skull architectures show similar distributions of strains over the skull under load. Even modifying the original shapes from zygokrotaphy to stegokrotaphy, or vice versa, has almost no impact on stress distributions. These results suggest that the wide gap in the temporal region of the skull in some caecilians does not cause poorer performance during digging. Differences in the presence or absence of temporal openings between species might instead be related to differences in the size of the jaw closing muscles and thus feeding biomechanics.

0147 Poster Session I, Friday 8 July 2011

Jaimie Klemish, Brooke Johnson, Spencer Siddons, Erik Wild

University of Wisconsin-Stevens Point, Stevens Point, WI, USA

The Occurrence of *Batrachochytrium dendrobatidis* among Populations of *Lithobates pipiens* and *L. clamitans* in Wisconsin, USA

In spite of the global concern regarding the spread of the *Batrachochytrium dendrobatidis*, the fungus that causes amphibian chytridiomycosis, and the increasing number of studies documenting its presence and distribution, next to nothing has been reported from the state of Wisconsin. Herein we report the results of a survey for *B. dendrobatidis* performed throughout Wisconsin during September 2009 and June and July 2010. Swab sampling of *Lithobates clamitans* and *L. pipiens*, two species known to be susceptible to infection by *B. dendrobatidis*, occurred at 50 sites representing all 24 of Wisconsin's water management units. PCR analysis of swab samples revealed *B. dendrobatidis* to be widely

distributed in Wisconsin, infecting both *Lithobates clamitans* and *Lithobates pipiens*. Proportions of water management units, individual sites, and individual species testing positive for *B. dendrobatidis* will be discussed. Whereas *B. dendrobatidis* is apparently widespread and common in Wisconsin, none of the frogs sampled exhibited visible evidence of chytridiomycosis, nor could any such reports be found in the literature. The potential significance of these findings, suggestions for future research, and conservation implications will be discussed.

0274 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Jeff Kneebone¹, John Chisholm², Greg Skomal², Diego Bernal¹

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The Physiological Effects of Capture Stress, Recovery, and Post-release Survivorship of Juvenile Sand Tigers (*Carcharias taurus*) Caught on Rod and Reel

Current state and federal fishery regulations prohibit the retention of sand tigers in U.S. waters, effectively mandating that all sand tigers captured incidental to commercial and recreational fisheries be released immediately upon capture. Despite these protective regulations, it is unclear how these sharks are affected by the stress of capture and if they die as a result of angling stress. To quantify the physiological effects of capture stress on sand tigers, blood samples were drawn from 75 sharks immediately following capture on standard recreational rod and reel fishing gear. For each capture event, angling time, hook location, time out of water, and release condition were noted. Blood samples were analyzed to evaluate changes in blood acid base chemistry and plasma metabolites and electrolytes in response to the duration of the stress event. To examine post-release survivorship, 38 of the 75 sharks were tagged internally with acoustic tags and monitored using a fixed passive acoustic receiver array within the sampling area. In addition, baseline (i.e. unstressed) physiological conditions and post-release recovery were assessed by repeated blood sampling of captive sand tigers subjected to a simulated rod and reel capture event. Collectively, the results of our study suggest that though sand tiger blood biochemistry is markedly affected by the stress of rod and reel capture, sharks recover from angling stress within 24 hours and demonstrate high post-release survivorship.

0401 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Jason Knouft, Huicheng Chien

Saint Louis University, St. Louis, MO, USA

Integrating Species Distribution Data with Flow Estimates from Hydrologic Model Predictions to Quantify Hydrologic Niche Characteristics of Fishes in the Mobile River Drainage

Stream flow characteristics, including volume and intra-annual variability, are considered important regulators of freshwater fish distributions and assemblage structure. However, robust documentation of these relationships at relatively broad geographic scales is limited by access to appropriate hydrologic data. The hydrologic characteristics of watersheds are regulated by a variety of climate and landscape-level factors, including precipitation, air temperature, topography, soils, and land use. Thus, estimation of flow requirements for aquatic taxa across regions requires an integrated approach including climate, landscape, and biological data. The Soil and Water Assessment Tool (SWAT) is a GIS-based basin-scale, continuous-time hydrologic model designed to predict the impacts of precipitation, temperature, and landscape characteristics on watershed hydrology. The model components include routines that encompass variation in weather, topography, soil properties, and land management. We used the SWAT model to generate daily estimates of stream flow from 1970-2000 in all segments of the Mobile River drainage. These flow estimates were then used to calculate mean annual flow and mean intra-annual variability in flow throughout the drainage. Locality records from 140 species of fishes distributed throughout the drainage were intersected with the hydrologic variables to quantify aspects of the hydrologic niche of each species. Hydrologic niche breadth is compared among taxonomic groups while species traits are used to predict variation in niche characteristics among species. Hydrologic variables associated with individual species distributions will also be discussed in the context of predicted changes in climate during the coming century.

0501 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

L. Lacey Knowles

University of Michigan, Ann Arbor, MI, USA

Statistical Phylogeography: Virtues of a Unified Eclectic Perspective

For decades, phylogeographic studies have sought to understand the processes that have influenced the spatial distribution of genetic variation within species and among closely related taxa. The increased prospect of achieving such goals owe to developments at the molecular level, as well as computational advances that include the forging of diverse approaches. I will describe an approach that exemplifies the virtues of the integrative nature of statistical phylogeography and an application that requires the

unification of diverse perspectives – namely, estimating key demographic parameters and testing hypotheses about the genetic consequences of climate-induced distributional shifts. Studying the impact of climate-induced distributional changes is difficult because demographic expansion associated with the colonization process typically takes place across a heterogeneous environment, with population sizes and migration rates varying across the landscape. I will describe an approach for coupling ecological-niche models (ENMs) with demographic and genetic models to explore the genetic consequences of distributional shifts across a heterogeneous landscape. The approach provides a statistical phylogeographic framework for understanding which distributional shifts may (or may not) enhance species divergence and a comparative context for evaluating why co-distributed species may (or may not) show congruent patterns of genetic divergence.

0087 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

James Knuckey¹, David Ebert¹, George Burgess²

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***Etmopterus* sp. nov., a New Species of Lanternshark (Squaliformes: Etmopteridae) From Taiwan**

A new species of lanternshark, *Etmopterus* sp. nov., is described from the deep waters off north eastern Taiwan. The new species is similar to other species of the "*Etmopterus pusillus* group" in having concave, flattened dermal denticles that are scattered irregularly across the body, a lateral line that ends in an open groove, no posterior branches on the flank photo-markings and a relatively cylindrical body, but can be separated from its congeners based on the following characteristics: gill slit height, tooth morphology, fin size and shape, interdorsal space and flank photo-markings. The new species has a shorter preoral length and the gill slit height does not vary much compared to other members of the "*Etmopterus pusillus* group." The teeth in the lower jaw of *Etmopterus* sp. nov are slender, with relatively oblique cusps compared to those of its congeners. The pectoral fins of *Etmopterus* sp. nov are more squared posteriorly and the caudal fin is shorter than the other members of the "*Etmopterus pusillus* group." The pectoral axil to first dorsal fin origin measurement of *Etmopterus* sp. nov fits into the interdorsal space about three times. The new species possesses flank photo-markings which are distinctive when compared to its congeners.

0054 Poster Session II, Saturday 9 July 2011

Yosuke Kojima, Akira Mori

Laboratory of Ethology, Kyoto University, Kyoto, Japan

Seasonal Change and Sexual Difference in Habitat Use of a Japanese Snake *Rhabdophis tigrinus*: Does the Necessity for Toxins Lead Females to the Forest?

In species that depend on dietary source for defensive chemicals, the necessity for defensive chemicals would influence their ecology. An Asian natricine snake, *Rhabdophis tigrinus*, possesses defensive toxins on its neck. The toxins are derived from toads consumed as prey. In addition, females provide their offspring with toxins while they are gravid. Therefore, females are expected to require additional toxins to produce chemically defended offspring. We aimed to clarify the habitat use pattern of the snake, and explore its possible sexual differences due to biased requirement for toxins in females. Because toads generally occur in the forest, we predicted that females use forest more frequently than males to consume more toads. We radio-tracked 11 females and 13 males for up to 13 months in the temperate forest of Japan. Forty-eight percent of located points were grassland although grassland occupies only 2.4% of the study area. Especially in the spring, males predominantly used grassland (grassland, 82%; forest, 6%), which may reflect the superiority in thermal quality and food availability in the grassland. On the other hand, females used forest more frequently than males (grassland, 56%; forest, 36%) in the spring of their gravid season. Therefore, the result supported our prediction that females use forest more frequently than males to consume more toads and obtain additional toxins to provide their offspring.

0082 Poster Session I, Friday 8 July 2011; ASIH STORER HERPETOLOGY AWARD

Chelsea Korfel

The Ohio State University, Columbus, OH, USA

***Atelopus wampukrum*: Persistence of a Harlequin Frog and Community Involvement Toward Species Conservation**

Atelopus wampukrum, a newly described species from the eastern cordillera of the Ecuadorian Andes (830- 1200 masl), is one of the few persisting species of *Atelopus*. While many species of *Atelopus* have declined or gone extinct in Latin America due to a synergy of factors (habitat loss and destruction, introduction of non-native species, disease, climate change), this species is unique in its persistence. We focus on one of two known populations, a healthy population occurring on protected, indigenous land. Our research period, December 2009 - May 2010 and December 2010 - May 2011 has yielded 162 encounters to date (56 males, 74 females, 32 juveniles). *A. wampukrum*, named for its indigenous appellation, is a conspicuous species, dorsally yellow with a black spotted pattern and a brilliant red ventrum with matching palms. Females (SVL: 46.3mm, 10.9g) are approximately 30- 40% bigger than males (SVL: 33.3mm, 7.0g). They are commonly

encountered above leaf litter or on rotting stumps. Like other species of *Atelopus*, males (mean 47.9m) and juveniles (59.9m) were typically found near the river, while females (138.0) were more likely to be distant from the river. Currently, portions of their habitat are being selectively harvested for timber; however, community interest is in favor of protecting the land if income can be generated. We have initiated collaboration with the community to study the natural history and behaviors of the species, to identify goals for conservation, and to pursue avenues toward these goals.

**0081 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis
Ballroom F, Thursday 7 July 2011**

Chelsea Korfel¹, Eduardo Toral², Gabriella Maldonado³, Morley Read⁴, Thomas Hetherington¹

¹The Ohio State University, Columbus, OH, USA, ²Pontificia Universidad Catolica del Ecuador, Quito, Ecuador, ³ Cuenca, Ecuador, ⁴ Quito, Ecuador

Anticipated Extirpation of a Harlequin Frog from the Ecuadorian Andes Based on 25 Years' Experience

Montane species of the neotropical genus *Atelopus* have experienced dramatic declines and extinctions during recent decades. *Atelopus exiguus*, an Andean species occurring in Ecuador, fits this pattern of decline. Data collected at a single locality over a period of 25 years documents the decline of this population and suggests its eventual extirpation. In 1986-1987, *A. exiguus* was very common throughout the Mazan valley. In 1994, extensive searching produced 30 encounters. Similar search efforts in 2006 produced 31 encounters with 23 individuals. In 2009, extensive searches produced 22 encounters with 14 individuals. In 2010-2011, there have been 12 encounters with 6 individuals (to date). *A. exiguus* is a conspicuous, diurnal bufonid that deposits its eggs in fast moving streams and lives its adult life in the surrounding vegetation and rock piles. Major factors implicated in declines of other species of this genus do not appear to be involved in population declines of *A. exiguus*. Possibly the only remaining population, it occurs in a protected reserve so habitat loss/ degradation are not likely, and the fungal pathogen *Batrachochytrium dendrobatidis* has not been detected. One likely factor contributing to declines is the introduction of trout (*Onchocynchus mykiss* and *Salmo trutta*) in 1963. Here, we present evidence of decline, a description of the demographics and natural history of this species gathered from five periods of data collection during the past 25 years, and goals for conservation.

0520 Poster Session II, Saturday 9 July 2011

Brian W. Kot¹, Donald G. Buth², Julianne Kalman Passarelli³

¹Texas A&M University, Galveston, TX, USA, ²Univ. of California (UCLA), Los Angeles, CA, USA, ³Cabrillo Marine Aquarium, San Pedro, CA, USA

Macroparasites of the Yellowfin Goby, *Acanthogobius flavimanus* (Perciformes: Gobiidae), from Its Introduced Northeastern Pacific Range

The Yellowfin Goby, *Acanthogobius flavimanus*, is native to bays and estuaries along Japan, China, and the Korean Peninsula. It has been introduced, presumably via ship ballast water, to both northern and southern California coastal waters. Specimens from Tomales Bay in northern California and from the Cabrillo Salt Marsh (Salinas de San Pedro) in southern California were examined for external and internal macroparasites. None of the native numerous parasites reported for this host species from Asian waters were present in these California samples. However two local parasites, the cymothoid isopods, *Elthusa californica* and *Elthusa vulgaris*, were found to infect this introduced host and are new host records for these generalist parasites. The reduction of parasitism is not unusual for successful introduced species and may be part of the reason for their success in a new habitat. The two isopod species were found together in the opercular cavity of one host specimen, which may be providing an opportunity for isopod hybridization.

0053 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Andy Kouba

Department of Conservation and Research, Memphis Zoo, Memphis, TN, USA

A Review of the History, Current Research, and Future Considerations for Amphibian Genetic Cryoconservation

For over a thousand years scientists and naturalists have been collecting and preserving specimens in biological collections. However, it wasn't until 1949 when Dr. Christopher Polge discovered the use of glycerol as a cryoprotectant for living cells that the field of cryogenics was born. Although cryobiology has been extensively studied in domestic species its application for the conservation of wildlife is less well known. Most cryopreservation studies to date for endangered wildlife have focused on mega-charismatic mammal species, leaving amphibians, reptiles, birds and fish in greater danger of extinction, as our research society has no living cell repositories for these taxa. In 1972, Barton and Guttman conducted the first study on freezing amphibian sperm using the American toad as a model. Their work showed that the field of cryogenics no longer needed to be mammal-centric, thus opening the door to new possibilities for generating an amphibian gene bank. Since this initial study, investigations have been conducted for more than ten anuran species leading to an explosion of knowledge on the technology's feasibility for amphibian conservation. Unfortunately, urodeles and

caecilians have been completely ignored, due to various challenges and lack of knowledge associated with their reproductive strategies. On the other hand, aquatic breeding frogs and toads have been used as research models to study developmental biology for more than a hundred years making them ideal candidates for first developing this conservation tool. This presentation will summarize what we know about amphibian cryobiology, emerging trends and challenges for the future.

0250 Poster Session II, Saturday 9 July 2011

Trevor J. Krabbenhoft, Steven P. Platania, Thomas F. Turner

University of New Mexico, Albuquerque, NM, USA

Reproductive Phenology of Fishes of the Middle Rio Grande, New Mexico.

Fish species often exhibit differences in reproductive timing within a community. In arid-land river systems where resource availability is temporally variable, differences in timing can differentially affect reproductive success among species. Consequently, reproductive timing can be an important determinant of adult fish community composition. In this study, we ask two questions related to reproductive timing: (1) Is phenology consistent across years? (2) To what extent do environmental conditions (photoperiod, temperature, discharge) correlate with reproduction across species? We collected larval fishes over three years (2008-2010) in the middle Rio Grande, New Mexico, to determine species-specific spawning periodicity and address these questions. Spawning periodicity data were compared with environmental variables to test whether species differed in the suite of environmental conditions under which spawning occurs. We find that, while rank order of spawning is generally similar across years, the absolute timing of spawning varies in relation to interannual-variation in environmental conditions. These data have important implications for determining likely responses of fishes to environmental disturbance (e.g., global climate change). Knowledge of how fishes time reproduction, coupled with adaptive management practices, may assist restoration efforts of native fish communities in altered and regulated rivers.

0251 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Trevor J. Krabbenhoft, Thomas F. Turner

University of New Mexico, Albuquerque, NM, USA

Comparative Genomics of North American Minnows: Next-Generation Transcriptome Sequencing of Rio Grande Silvery Minnow, *Hybognathus amarus* (Cypriniformes: Cyprinidae)

Efforts toward advancing our understanding of adaptation of fishes to their environment are hampered by a lack of genomic resources for non-model species. For the post-genomics revolution to reach full fruition, we need to extend resources

developed for model organisms (e.g., zebrafish, *Danio rerio*) for use in non-model species. The recent advent of next-generation DNA sequencing has paved the way for genome-scale studies of local adaptation, gene expression, phylogeny, etc., in aquatic ecosystems. In this study, we used 454 FLX sequencing to characterize the transcriptome of Rio Grande silvery minnow (*Hybognathus amarus*), a federally endangered species for which no genomic resources were available. Next-generation sequencing of brain, liver and gonad cDNA yielded over 350,000 sequence reads which assembled into 50,680 contigs with a mean length of 359 base pairs. Contigs were subjected to Blast searches and gene-ontology mapping, and were searched for high-confidence single nucleotide polymorphisms (SNPs). Additionally, contigs were mapped to the zebrafish genome sequence and other cyprinid cDNA libraries (fathead minnow, common carp, etc.) to determine regions of conservation and divergence among species and assess utility of next-generation sequence data for phylogenomics studies of Cyprinidae. This study represents a critical first step toward developing a comparative genomics database for North American cyprinid fishes that will be an invaluable resource for future genetic studies.

0308 Herp Population Genetics/Herp Coloration, Symphony I & II, Monday 11 July 2011

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Temporal Color Changes in the Red-Backed Salamander While Kept in Captivity

Batesian mimicry is a compelling, yet ubiquitous interspecific relationship that has been observed in many disparate taxa. This model-mimic matching is often expressed through coloration, and as such, an important aspect of characterizing this relationship is to reliably and quantitatively measure subtle differences in coloration. The red-backed salamander (*Plethodon cinereus*) commonly displays two color morphs (red-backed and lead-backed), while a third (and rare) erythristic morph is thought to be a Batesian mimic of the red-eft. Here we collected spectral data from two color morphs (erythristic and red-backed) of the salamander *Plethodon cinereus* within a month of being in captivity and again after three months in captivity. We found that intensity in both color morphs decreased similarly through time, though the change was most pronounced in the erythristic morph. We then examined the overall coloration change over time using multivariate change vectors, and found that the magnitude (amount) of multivariate color change was significantly greater in the erythristic morph as compared to the striped morph (for lateral color patches). Most intriguing, the direction of color change in color space was oriented similarly within each morph, whereas the direction of color change differed between morphs. Our findings suggest that quantifying color from individuals held in captivity may lead to incorrect inferences concerning coloration differences in nature, and their relative importance for species interactions in the field.

0460 Poster Session I, Friday 8 July 2011

Amanda Kraft¹, Naomi Winburn¹, Kenneth Cabarle², Ryan Winburn¹,
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¹Minot State University, Minot, ND, USA, ²University of North Dakota, Grand Forks,
ND, USA

Tissue Integration of Cadmium in the Western Tiger Salamander, *Ambystoma mavortium*, in Northwest North Dakota Wetlands

Earlier sampling and testing for cadmium in wetland soils and water, and in the liver of the western tiger salamander, *Ambystoma mavortium*, indicated that salamanders in North Dakota wetlands may bioaccumulate cadmium and could represent an excellent vertebrate biomonitoring system. We have begun a set of experiments designed to more explicitly test the (1) the bioaccumulation hypothesis, (2) the hypothesis that salamanders that differ in age and life cycle expression will differ in cadmium accumulation, (3) the hypothesis that geographic variation in cadmium risk is associated with cadmium loads in salamanders, and (4) possible positive correlation between cadmium integration in liver and tail/skin samples (which can be harvested without killing the salamander). Cadmium tissue integration was examined using standard chemical analyses. Preliminary analyses suggest that (1) salamanders skin samples may not be a good predictor of liver cadmium load and (2) paedomorphic salamanders have lower cadmium loads than juvenile larval salamanders. These data suggest that younger salamander may be a more sensitive assay that older salamanders of water cadmium exposure.

0724 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Andrea Kroetz, Sean Powers

University of South Alabama, Dauphin Island Sea Lab, Dauphin Island, AL, USA

Ecology of Bonnetheads (*Sphyrna tiburo*) in the Northern Gulf of Mexico

Several marine fish species have life histories that include ontogenetic movements across estuarine habitats. For species that occupy dynamic coastal environments, such as bonnetheads (*Sphyrna tiburo*), a wide range of habitats may be encountered and occupied over a relatively small scale. Proper management of these species must be preceded with specific knowledge of habitat usage throughout their ontogeny. We used a combination of gillnet surveys, acoustic telemetry and gut content analysis to better understand the ecology of bonnetheads in the northern Gulf of Mexico. Our data show that bonnetheads demonstrate seasonality in their distribution only being present in the months of May-November in the coastal waters of Alabama. Bonnetheads demonstrate some degree of site fidelity to the saline waters around barrier islands, particularly to a

small area around the West end of Dauphin Island, AL where the capture success rate is the highest for this species. Our data show that blue crabs (*Callinectes sapidus*) and other crustaceans make up the majority of the diet. Stomach content analyses were used to correlate bonnethead distribution to prey availability. Our data show that blue crabs frequently occur around the West end of Dauphin Island in the months of July-September which coincides with the highest detection rate of tagged sharks in that area. Understanding aspects of this species' ecology is important for the implementation of proper management, not only for this small coastal shark, but also for commercially important blue crabs.

0333 Poster Session III, Sunday 10 July 2011

Randolph Krohmer

Saint Xavier University, Chicago, IL, USA

Does Aromatase Activity in the Forebrain of the Male Red-Sided Garter Snake During Low Temperature Dormancy Regulate Courtship Behavior?

The red-sided garter snake (RSGS) exhibits a dissociated reproductive pattern, suggesting control of reproductive behavior is independent of hormonal control. However, several studies have shown circulating androgens to be elevated upon emergence and sex steroid concentrating regions have been identified in the neural pathways controlling courtship. Furthermore, these sex steroid concentrating regions demonstrate greater hypertrophy in response to estrogens compared to androgens. However, the only stimulus found to initiate courtship in the RSGS, is an extended period of low temperature dormancy (LTD). Recently, we found that aromatase (ARO), the enzyme that converts androgens to estrogens, to be present in all regions of the male RSGS brain with the highest concentration in sex steroid concentrating regions critical for the control of courtship and mating. Therefore, the presence of sex-steroid concentrating regions and elevated circulating androgens upon emergence suggest that sex steroids may have a role in initiating reproductive behaviors. In this study we investigated the role of LTD and aromatization of androgens on the initiation of courtship behavior in the male RSGS. Animals, collected in the fall, received implants of either an empty silastic tube (control), 15mg of 1,4,6-androstatrien-3,17-dione (ATD, an aromatase inhibitor), or ATD + estradiol (ATD-E). Following a 12 week LTD, animals were tested for courtship using attractive females. Animals in the control and ATD-E groups exhibited normal courtship behavior while the ATD group exhibited no courtship behavior. This study suggests a possible mechanism by which testosterone produced during the summer can indirectly initiate courtship behavior as estrogens.

0566 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Chelsea Kross, Joel Price, Carl Alexander, Melissa Pilgrim

University of South Carolina Upstate, Spartanburg, SC, USA

The Changing Face of *Hyla* in the Piedmont of South Carolina

The North American Amphibian Monitoring Program (NAAMP) was developed in 1995 as an initiative to monitor amphibian population trends in Canada, Mexico and the United States. NAAMP uses breeding call surveys to inventory and monitor presence and persistence of amphibian species in a region. South Carolina joined NAAMP in 2008. USC Upstate's research group, Upstate Herpetology, is responsible for collecting call surveys along 11 routes that span 7 counties. Ten of our routes are located in the Piedmont physiographic region, while 1 is located in the Blue Ridge physiographic region. To date, we have documented the presence of 16 anuran species calling along our routes. Interestingly, four of the species we recorded were treefrogs in the genus *Hyla*: *Hyla chrysocelis* (Cope's Gray Treefrog), *Hyla cinerea* (Green Treefrog), *Hyla gratiosa* (Barking Treefrog), and *Hyla squirella* (Squirrel Treefrog). Historically, only *H. chrysocelis* was known to occur in the Piedmont counties we sampled. It appears we are documenting range expansions of the other three congeners. We suspect the range expansions are associated with climate change in the Piedmont and it will be interesting to investigate effects of the recent arrivals on *H. chrysocelis*.

0640 Herp Population Genetics/Herp Coloration, Symphony I & II, Monday 11 July 2011

Shawn Kuchta¹, Alexis Rose¹

¹*Ohio University, Athens, OH, USA*, ²*University of Wyoming, Laramie, WY, USA*

Disruptive Coloration in the Sierra Nevada Salamander, *Ensatina eschscholtzii platensis*

Camouflage coloration renders individuals inconspicuous against background objects in the habitat. One standard mechanism of camouflage is background matching, in which an organism's colors represent a random sample of the distribution of background colors. Another, less well documented mechanism uses bold, high contrast colors to break up the body outline. This is called disruptive coloration. A long-standing hypothesis in the polymorphic salamander *Ensatina eschscholtzii* is that the blotched subspecies (*platensis*, *croceater*, *klauberi*), despite their vivid appearance, benefit from disruptive coloration. We tested this hypothesis in the Sierra Nevada salamander (*E. e. platensis*) using two distinct approaches. First, we created clay models (n=1050) of three different phenotypes (splotched, striped, and plain), placed them in the field, and monitored predation rates on them. We found that the models painted to resemble *E. e. platensis* (splotched) were attacked less often than the other two phenotypes ($P = 0.037$). Second, we used a computer simulation to quantify whether the bold splotches on *E. e. platensis*, when viewed from above, were more likely to be located on the edge of the

animal than expected by chance. To do this, we measured the splotches on 45 individuals of *E. e. platensis* and used these measurements to parameterize simulations of the random placement of splotches. Results from this modeling exercise indicated that splotch location is strongly and significantly biased towards the edge of the body outline in almost all animals.

0174 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Gen Kume, Misako Handa, Tetsuya Narasaki, Toshikazu Suzuki, Hideaki Nakata, Atsuko Yamaguchi

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Feeding Habits of Three Species of Larval Fishes in Ariake Bay, Southwestern Japan

In Ariake Bay, the fish belonging to the Sciaenidae and Cynoglossidae families are commercially important. However, their catches have been drastically decreasing since the 1980s. We examined larval feeding habits of three subject species-*Nibea albiflora* and *Pennahia argentata* (belonging to Sciaenidae family) and *Cynoglossus lighti* (belonging to Cynoglossidae family). From May to September of years 2009 and 2010, larvae were collected with a larva net (mouth diameter, 80.0 cm; mesh size, 1.0 mm) at 11 stations in Ariake Bay. The gear was towed for 15 min horizontally in the middle or the bottom layers. Zooplankton samples were collected by a vertical tow of NORPAC net (mouth diameter, 45.0 cm; mesh size, 0.1 mm) from the bottom to the surface at all stations. Vertical profiles of temperature, salinity, and dissolved oxygen were recorded at each station. The gut contents of the fish were examined and compared with the composition of local zooplanktons. All 3 species were fed exclusively on copepods. Larval feeding differed in a number of aspects; differences in the taxonomic composition of the preferred prey, in particular, were apparent. During ontogeny, *N. albiflora* and *P. argentata* preferred large, but less common preys (*Pseudodiaptomus marinus* and *Temora turbinata*), whereas *C. lighti* consistently preferred a small-sized prey (*Microsetella norvegica*).

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Phylogeography of the Ryukyu Five-Lined Skink, *Plestiodon marginatus* (Reptilia: Scincidae) in the Ryukyu Archipelago, Japan, as Revealed by Mitochondrial DNA Analysis

The Ryukyu five-lined skink, *Plestiodon marginatus*, is distributed in the islands of Okinawa, Amami and Tokara Groups, Ryukyu Archipelago, which is included in the

Oriental Region. The boundary between Oriental and Palearctic Regions is the Tokara Gap, which is located within the Tokara Group and has prevented the dispersal of many terrestrial animals. Then, the northern islands of Tokara Group belong to Palearctic Region, and are usually inhabited by the animals of the Japanese Archipelago. However, recent genetic studies showed that *P. marginatus* occurs in the northern islands of Tokara Group. We studied the phylogeography of this species collected from 23 islands covering its range based on a part of mitochondrial cytochrome *b* gene. The monophyly of *P. marginatus* was not supported and three clades were recognized in the phylogeny. Two clades corresponded to two subspecies, *P. m. marginatus* and *P. m. oshimensis*. But the last clade consisted of *P. stimpsonii*, *P. elegans* and the population of *P. marginatus* from Kuchinoshima Island, northern Tokara Group. These clades were highly genetically diverged. The populations of Nakanoshima Island and Suwanosejima Island, northern Tokara Group, were closely related to *P. m. marginatus* and *P. m. oshimensis*, respectively. The distribution of these clades suggested the recent oversea dispersals after the formation of these clades by the vicariance events in islands in the Ryukyu Archipelago. Two subspecies have been recognized in *P. marginatus*, but subspecific division did not correspond with the phylogenetic relationships estimated by genetic data. Therefore, we reevaluated the classification of this species.