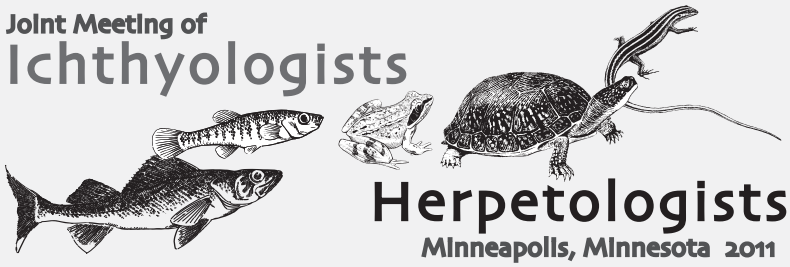
Joint Meeting of
Ichthyologists



Herpetologists
Minneapolis, Minnesota 2011

Abstract Book
JMIH 2011

Abstracts for the 2011
Joint Meeting of Ichthyologists & Herpetologists

AES – American Elasmobranch Society

ASIH - American Society of Ichthyologists & Herpetologists

HL – Herpetologists' League

NIA – Neotropical Ichthyological Association

SSAR – Society for the Study of Amphibians & Reptiles

Minneapolis, Minnesota

6-11 July 2011

Edited by

Martha L. Crump & Maureen A. Donnelly

0165 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

Amanda Ackiss[1], Shinta Pardede[2], Eric Crandall[3], Paul Barber[4], Kent Carpenter[1]

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Corroborated Phylogeographic Breaks Across the Coral Triangle: Population Structure in the Redbelly Fusilier, *Caesio cuning*

The redbelly yellowtail fusilier, *Caesio cuning*, has a tropical Indo-West Pacific range that straddles the Coral Triangle, a region of dynamic geological history and the highest marine biodiversity on the planet. *Caesio cuning* is a reef-associated artisanal fishery, making it an ideal species for assessing regional patterns of gene flow for evidence of speciation mechanisms as well as for regional management purposes. We evaluated the genetic population structure of *Caesio cuning* using a 382bp segment of the mitochondrial control region amplified from over 620 fish sampled from 33 localities across the Philippines and Indonesia. Phylogeographic analysis showed that sites in Western Sumatra formed a single population, resulting in pronounced regional structure between Western Sumatra and the rest of the Coral Triangle (Φ_{CT}=0.4596, p<0.0031). The species' range and measures of genetic diversity at these Indian Ocean localities point toward low effective population size west of Sumatra and indicate that historic changes in sea level and ocean currents during periods of Pleistocene glaciation may have led to divergence between *Caesio cuning* populations west and east of the Sunda shelf. East of Sumatra, there were significant genetic differences between the central sites sampled from the Philippines south to Java and Nusa Tenggara and the sites west of Halmahera to the edge of our sampling range at Cenderawasih Bay indicating haplotype frequency differences likely driven by regional ocean currents and isolation by distance.

0143 Invasive Species, Symphony I & II, Sunday 10 July 2011

Cory Adams, Daniel Saenz

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

Chinese Tallow (*Triadica sebifera*) Reduces Anuran Hatching Success and Hatchling Size

Chinese tallow (*Triadica sebifera*) is an aggressive invasive tree species found in the southeastern United States and California. It was first introduced into North America in the late 1700s. It has been suggested that Chinese tallow has increased in abundance as much as 500 percent in parts of its invaded range, in just the last two decades. The purpose of this study was to determine the effects of Chinese tallow leaf litter on the hatching of aquatic eggs of a common anuran, the Southern Leopard Frog (*Lithobates sphenocephalus*), compared to leaf litter of native tree species. In the lab, we observed that

hatchlings from eggs exposed to Chinese tallow leaf litter were significantly less developed at hatching and significantly smaller in total length than other treatments. Chinese tallow and red maple (*Acer rubrum*) reduced hatching success of *L. sphenocephalus* eggs compared to swamp chestnut oak (*Quercus michauxii*) and a control. Dissolved oxygen and pH of water, factors possibly affecting hatching success, were lower in treatments containing Chinese tallow and red maple leaf litter than other treatments. We suggest that underdevelopment and reduced hatchling size, caused by Chinese tallow leaf litter, may have lasting effects that negatively impact survival in the larval stage. Also, Chinese tallow can reduce amphibian hatching success, similar to red maple, however, Chinese tallow tends to occur in and around wetlands at much higher densities than many native tree species.

0142 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

Dean Adams, James Church

Iowa State University, Ames, Iowa, USA

Spurious Body Size Clines and Methodological Artifacts from Grid-cell Assemblages: Pattern and Process in Biogeography

A major goal in macroecology is to determine how body size varies geographically, and explain why such patterns exist. Recently, a grid-cell assemblage analysis found significant body size trends with latitude and temperature in *Plethodon* salamanders, and support for the heat-balance hypothesis as a possible explanation. Here we demonstrate that these patterns are methodological artifacts. Using data from 3,155 local assemblages, we find no relationship between body size and latitude, temperature, or elevation in *Plethodon* assemblages. These findings are in direct contrast to predictions of the heat-balance model. We then examined the various scenarios under which body size clines across grid-cell assemblages could evolve via heat-balance, and found that none were tenable in light of the existing data. Instead, a single, widely distributed species was responsible for the pattern across grid-cell assemblages. We conclude that there is no support for the heat-balance hypothesis as an evolutionary mechanism driving biogeographic trends in body size in *Plethodon*. Assemblage-level patterns are a useful means of assessing biogeographic trends, and are an important complement to within-species and cross-species patterns. However, while the use of grid-cell assemblage approaches from digital databases is expedient, their results must be examined critically, and whenever possible, compared with data obtained from local species assemblages (particularly for selective mechanisms that operate at the level of individuals). Finally, our results emphasize the importance of using corroborative data to evaluate alternative hypotheses, so that potential mechanisms that explain bioegeographic patterns are properly assigned.

0292 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

Collette Adkins Giese

Center for Biological Diversity, Minneapolis, MN, USA

Protecting Herpetofauna Under the Endangered Species Act

In the United States, about 20 percent of amphibians and 10 percent of reptiles are at risk of extinction. In response to the threats facing herpetofauna, the Center for Biological Diversity -- a non-profit, public interest environmental organization dedicated to the protection of all native species and their habitats -- recently hired the world's first attorney dedicated exclusively to the protection of amphibians and reptiles. As both a scientist and a lawyer, the herpetofauna staff attorney will discuss the Center's work to seek and implement protections for herpetofauna under the Endangered Species Act. For example, the Center is developing a database to gather information necessary to evaluate the status of all imperiled amphibians and reptiles in the United States. The Center will use the database to inform petitions for herpetofauna that warrant protection as threatened or endangered species but are not yet listed under the Endangered Species Act. The Center is also working to protect essential habitats for amphibians and reptiles, including the California tiger salamander, Ozark hellbender, and Virgin Islands tree boa. To address significant threats to herpetofauna posed by pesticides, the Center is using litigation to force the Environmental Protection Agency to consider pesticide impacts on listed species during its pesticide registration reviews. Finally, the presentation will address the Center's work to address unsustainable commercial harvest of herpetofauna, including freshwater turtles and the eastern diamondback rattlesnake.

0694 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Mia Adreani, Mark Steele

California State University, Northridge, Northridge, CA, USA

Estimating Fecundity, Spawning Frequency and Spawning Season Length of Temperate Reef Fish: A Comparison of Natural and Artificial Rocky Reefs

The reproductive output of fishes is often used as a measure of the health and productivity of a given population. This measure may be of particular importance when habitat is altered in some way. Artificial reefs may provide new space for fishes to inhabit, but it is unclear whether fishes reproduce at the same rate on natural and artificial reefs. We tested whether the overall reproductive output on a large artificial reef was similar to nearby natural reefs using three of the most abundant species on rocky reefs in the Southern California Bight (California sheephead, kelp bass and senorita). Fish were collected during their reproductive season and we measured a range of reproductive parameters, including batch fecundity, spawning frequency and the length of the spawning season using visual assessments, gonad histology and egg counts. While there was some variation in the specific measures, our estimates of reproductive output for each of the three species were similar across all of the reefs.

These results, along with additional estimates of overall reef productivity, suggest that artificial reefs have the potential to mitigate damages incurred to natural reefs and give us additional insight into the reproductive ecology of these ecologically important species.

0233 Poster Session III, Sunday 10 July 2011

Windsor Aguirre[1], Virginia Shervette[2], Ronald Navarrete[3], Paola Calle[4], Stergiani Agorastos[5]

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Morphological and Genetic Divergence of *Hoplias microlepis* (Characiformes, Erythrinidae) in Rivers and Artificial Impoundments of Western Ecuador

Little is known about the freshwater fishes of western Ecuador despite serious environmental threats including the creation of large artificial impoundments. Phenotypic and genetic differentiation of populations of a large predatory fish, the Guanchiche, *Hoplias microlepis*, is examined in rivers and artificial impoundments of the Guayas River drainage in western Ecuador. Despite the recent formation of the impoundments (~ 20 years prior to the sampling), *H. microlepis* in these habitats diverged morphologically from river populations. Impoundment fish tended to have larger eyes, longer dorsal and caudal fins, and thinner bodies than river fish. Classification rates for habitat of origin based on morphometric measures were relatively high (71.7-83.3%), and the magnitude of morphological divergence was substantial when contrasted with divergence from *H. malabaricus*, a congener from eastern Ecuador. Frequencies of mtDNA d-loop haplotypes differed significantly among all samples and genetic divergence between river samples implies that the genetic structure in the drainage predates the formation of the impoundments. There was no significant component of genetic variation between river and impoundment populations indicating that the difference between habitat types is not likely due to shared ancestry. Genetic diversity was higher in the river samples and the percentage of private alleles was higher in the impoundment populations, which is consistent with rapid population expansion from a limited number of founders in impoundments.

0267 Fish Morphology, Symphony I & II, Friday 8 July 2011

Windsor Aguirre, Kendal Walker, Shawn Gideon

DePaul University, Chicago, IL, USA

The Osteological Basis of Body Shape Evolution in Threespine Stickleback Fish

Body shape can vary tremendously in fishes. A common pattern of change in body shape involves the evolution of deeper or more elongate bodies in response to contrasting environmental conditions. How vertebrae are impacted by natural selection for different body shapes is not well understood. Vertebrae may change in number, length, or both. In addition, vertebral changes may vary regionally along the body axis. The threespine stickleback, *Gasterosteus aculeatus*, is highly variable morphologically and has repeatedly evolved elongate and deep-bodied forms independently in response to common ecological pressures. We examine the relationship between body shape and vertebral number and length in wild-caught stickleback from nine different populations, three anadromous populations representing the ancestral phenotype, three deep-bodied "benthic" populations adapted to shallow lake habitats and three elongate "limnetic" populations adapted to open water habitats in deep lakes. Body shape is examined for 30 male and 30 female stickleback per population using geometric morphometric methods. The same specimens were x-rayed and the x-rays were digitized. Abdominal and caudal vertebral counts were recorded and 12 vertebrae and the hypural plate were measured from each x-ray. This study provides insight into how ecological factors influence the evolution of the axial skeleton in vertebrates.

0746 Fish Conservation, Symphony III, Saturday 9 July 2011

Alberto Akama

Universidade Federal do Tocantins, Porto Nacional/Tocantins, Brazil

Damming the Amazon: Impacts on Fish Fauna

As one of the world's fastest growing economies, Brazil will require significant new sources of energy in the near future, on the order of perhaps 35000 MW over the next ten years. A likely source of new power generation, being pursued by both public and private entrepreneurs, are hydroelectric dams constructed in the Amazon basin. Proposals for Amazon energy sources that were previously rejected, in the Xingu, Tapajós, Tocantins and Araguaia rivers, have been recently resurrected. These discussions must be considered together with possible social and environmental consequences of dam construction, given expected negative impacts on the Amazon's enormous biological and cultural diversity. Unfortunately, political and economic priorities often overshadow evaluation projection of the costs of hydroelectric power to the world's richest freshwater fish fauna. A technical evaluation of proposed dam projects on Amazon tributaries is presented, with emphasis on impacts on amazon fish diversity.

0177 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Mohammad Shafiqul Alam[1], Mohammed Mafizul Islam[1], Md. Mukhlesur Rahman Khan[1], Masayuki Sumida[1]

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Reproductive Isolating Mechanisms and Genetic Divergences in the Genus *Hoplobatrachus* (Anura, Dicroglossidae) Based on Crossing Experiments, Chromosomal and Histological Observations, and Allozyme and Mitochondrial Analyses

Four species are listed in the genus *Hoplobatrachus* (Anura, Dicroglossidae): three from Asia and one from Africa. Despite several researches focused on the genetic relationships among these species, there is still no information about the reproductive isolating mechanisms among them. To investigate these issues, we performed crossing experiments using the available species from genus *Hoplobatrachus* and other related genera. The interspecific hybrids between female *H. tigerinus* and male *H. chinensis* (=*rugulosus*) became inviable at tadpole stage, but a small number of the hybrids developed normally and matured. These viable hybrids were found to be triploid by the chromosomal and histological observations, suggesting incomplete hybrid inviability. By contrast, the intergeneric hybrids between female *E. cyanophlyctis* and male *H. tigerinus* or *H. chinensis* became completely inviable at embryonic or tadpole stages, showing complete hybrid inviability among these genera. The allozyme study showed 9 diagnostic loci among 22 loci investigated in *H. tigerinus* and *H. chinensis*, and parental allele constitutions at these loci in the triploid hybrids. Furthermore, we investigated the genetic relationships among *H. tigerinus*, *H. chinensis*, and their hybrids by mitochondrial Cyt *b*, 12S and 16S rRNA genes. The maternal inheritance of mitochondrial genomes was retained in the hybrids. The molecular data also suggest the possibility of inclusion of several cryptic species in our samples of *Hoplobatrachus* genus, likewise some previous reports. Further study is necessary for elucidating the degree of isolating mechanisms between possible cryptic species of *Hoplobatrachus* by crossing experiments.

0337 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Laura Alberici da Barbiano[1], Zach Gompert[2], Caitlin Gabor[1], Andrea Aspbury[1], Alex Buerkle[2], Chris Nice[1]

[1]*Texas State University - San Marcos, San Marcos, TX, USA,* [2]*University of Wyoming, Laramie, WY, USA*

Phylogeography of a Unisexual-Bisexual Mating System

Poecilia formosa (Amazon molly) is a gynogenetic species of hybrid origin that requires sperm from males of its parental species, *P. mexicana* (Atlantic molly) and *P. latipinna* (sailfin molly). The three species are distributed along the coast of the Gulf of Mexico and *P. formosa* is sympatric with the parental species in Central and Northern Mexico. Although *P. formosa* was the first vertebrate to be recognized as unisexual, not much is known about its origins and historical biogeography. We used a large multi-locus population genomics dataset to investigate the phylogeographic patterns in *P. formosa*, *P. mexicana* and *P. latipinna.* We explored the history and geography of these species and tested hypotheses on historical and contemporary demographic events. We also analyzed the global phi statistics to compare levels of genetic differentiation across each species. These high-resolution data will be invaluable for understanding the historical biogeography of *P. formosa* and provide a historical context for studying the evolution of male mate preference in *P. mexicana* and *P. latipinna*.

0101 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Robert Aldridge, Dustin Siegel

Saint Louis University, St. Louis MO, USA

Frequency of Prenuptial and Postnuptial Spermatogenesis in Snakes and Lizards

Within the Squamata, sperm production may occur immediately prior to mating (prenuptial spermatogenesis) or following mating (postnuptial spermatogenesis). In postnuptial spermatogenesis mating occurs when the seminiferous tubules are regressed. We examined the frequency of pre- and postnuptial spermatogenesis in snakes and lizards to determine if the frequency of these patterns is related to phylogeny. We concluded that, although these groups may superficially appear to have similar reproductive adaptations, they differ in fundamental ways. The major difference between snake and lizard is the absence of postnuptial spermatogenesis in lizards. Our interpretation of lizard spermatogenic cycles indicate that all lizards have prenuptial spermatogenesis (i.e. sperm are produced prior to mating) and the female then stores the sperm for months until spring ovulation. In contrast, many species of snakes have true postnuptial spermatogenesis (i.e. sperm are produced during the summer totally independent of when mating occurs). We suggest that the evolutionary origin of snakes

may account for the differences observed in snake versus lizard reproductive cycles. We suggest that the evolutionary origin of snakes may account for these differences between snake and lizard reproductive cycles. If the earliest snakes evolved from lizards as burrowing forms perhaps the early snakes lost their reliance on heliothermy and in turn relied on thigmothermy. This adaptation for thigmothermy may have selected for individuals that could store sperm in the male ducts and female ducts for extended periods. The ability to store sperm for extended periods permitted the independent evolution of spermatogenic and vitellogenic cycles in snakes.

0100 Poster Session II, Saturday 9 July 2011

Robert Aldridge[1], Dustin Siegel[1], Chad Montgomery[2], Matthew Graves[3], Lynnette McGuire[4]

[1]Saint Louis University, St Louis, MO, USA, [2]Truman University, Kirksville, MO, USA, [3]Bowling Greene High School, Bowling Greene MO, USA, [4]Clopton High School, Louisiana, MO, USA

Do Amphibians Choose Ponds With Fewer Competitors/Predators?

The goal of this research was to determine if amphibians choose to lay eggs in ponds that have fewer competitors/predators than in adjacent ponds that have neither. Nine ponds, 4 x 4 m, 0.7 m deep, lined with a rubber pond liner, were constructed in a field along a tree line in Pike County, Missouri. The ponds received one of three treatments in a randomized order. Three of the ponds were stocked with 125 bullfrog tadpoles (*Rana catesbeiana*), three were stocked with 25 goldfish (*Carassius auratus*) and (later) bluegill sunfish (*Lepomis macrochirus*), and three served as controls. There was no statistical difference among the treatment and control ponds. The first amphibians to use the ponds for breeding were American toads (*Anaxyrus americanus*). The number of toad tadpoles in the three pond treatments was not statistically different for samples taken before mid-June. In the July sample, the vast majority of the tadpoles were treefrogs of the *Hyla versicolor* complex. Cricket frogs (*Acris crepitans*) tadpoles were also present. The distribution of these tadpoles was statistically different by treatment. In most of the samples *Hyla* and *Acris* tadpoles were absent from the fish treatment ponds. In only one sample were *Acris* tadpoles present in a fish treatment pond.

0644 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Dom Alioto-Jurado

UCLA, Los Angeles, CA, USA

Occurrence, Taxonomy, and Phenotypic Variation of Angel Sharks in the Eastern Pacific Ocean

Angel sharks are a primarily benthic group comprising the monotypic genus *Squatina*. Distinguishing the numerous individual species within this genus proves very difficult due to the general morphological homogeneity they exhibit. In the Eastern Pacific region the *Squatina* genus appears to have an anti-tropical distribution. In the North Eastern Pacific (NEP) described species *Squatina californica* occurs from off the coasts of southern Alaska to Mexico. In the South Eastern Pacific (SEP) described species *Squatina armata* occurs off the coasts of Ecuador down to southern Chile. It is not currently known if more distinct species occur and remain yet described throughout both these areas, particularly the understudied SEP. Even in the more studied NEP, previous studies suggest that a sub-population in the partially isolated Gulf of California may constitute a third distinct species. Throughout the entire range the degree of phenotypic variation exhibited by sub-populations has not been previously noted. Here the morphology of multiple sharks from across the Eastern Pacific region were measured and compared across varying degrees of geographic distances. Samples specimens were measured using a newly refined morphometric protocol specifically designed for angel sharks unique body plan. Groups of samples from the NEP and SEP were subsequently compared with the corresponding original species description for each area. Results are presented with up to the date results of corresponding ongoing genetic analysis.

0764 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Matt Allender

University of Illinoi, Urbana, IL, USA

Ranaviral Disease in Chelonians of North America

Ranaviruses have caused mass mortality events in wild fish, amphibian, turtle, and tortoise populations worldwide. However, compared to amphibians and fish, our understanding of the extent, impact, and transmission of ranaviral disease in chelonians is considerably less. In the United States, ranaviral disease has been diagnosed in seven chelonian species across thirteen states. Clinical manifestations of ranaviral infections in chelonians are not always present, but may include lethargy, dyspnea, ocular, nasal and oral discharges, oral plaques, and death. Other signs may include subcutaneous edema, hepatitis, necrotizing splenitis, conjunctivitis, and pneumonia. The duration of disease is short, and many wild animals likely die prior to their presentation at wildlife rehabilitation centers or clinics. Current diagnostic methods primarily utilize conventional PCR and histopathology, but use of an ELISA in gopher tortoises and blood smears demonstrating the presence of inclusion bodies in circulating white blood

cells of box turtles are other potential tools. Ranaviral disease has been shown to be highly fatal in turtles during transmission studies, but the natural route of transmission has not been identified. While prevalence has been investigated for gopher tortoises, little is known about the prevalence of this disease in other species, specifically the eastern box turtle – a species frequently observed in ranavirus die-offs. Future research directions need to focus on elucidating the epidemiology of infections in wild reptiles, improving diagnostic assays, and determining the drivers and routes of transmission.

0381 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011; ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD

Joshua Amiel

University of Sydney, Sydney, Australia

Temperature Dependent Control of Blood Distribution in Snakes.

At low ambient temperatures, snakes display large temperature gradients along the lengths of their bodies. The heads are kept warmer than the "torsos" (base of skull to cloaca) and the torsos are warmer than the tails. Researchers often assume regional control of blood distribution as the mechanism for establishing these temperature differentials, although this assumption has not been tested. We injected garter snakes with the radioactive tracer ^{99m}Technetium to map the flow of blood throughout bodies of snakes at both hot and cold ambient temperatures. At high ambient temperatures the snakes reduced blood flow to their heads while they increased blood flow to their tails. At cold ambient temperatures the situation is reversed and snakes increased blood flow to their heads while they reduced blood flow to their tails. This confirms that snakes alter the flow of warm arterial blood to establish regional thermal gradients along their bodies in response to shifts in ambient temperature. This physiological mechanism allows snakes to maintain optimal function of their central nervous system and their internal organs at both hot and cold ambient temperatures. Thus, this mechanism acts as a safeguard against thermal extremes and broadens the range of active temperatures in snakes.

0089 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

John Anderson

Rice Univesity, Houston, Texas, USA

Eustatically-Controlled Evolution of the Gulf of Mexico Coastal Plain

Approximately 120,000 yrs BP, sea level was situated ~+5 meters and a barrier island chain separated by bays extended along the coast. Sea level fell episodically for the next

80,000 years and the Apalachicola, Perdido/Escambia, Mobile, Mississippi, Brazos, Colorado and Rio Grande rivers constructed deltas on the shelf with delta plains similar in size to the modern Mississippi Delta plain. Between~20,000 and 17,000 BP, the shoreline was situated at ~ -120 m and there was a virtual absence of continental shelf habitats. Between ~17,000 and 4,000 BP, sea level rose at a declining rate (9 mm/yr to 2 mm/yr). The advancing shoreline eroded ancestral deltas, producing sand that nourished islands and peninsulas. Fine-grained sediments from the Mississippi River, combined with sediment derived from erosion of deltas, was transported to the west by prevailing coastal currents and deposited in a vast mud blanket on the Texas shelf. The Florida and Alabama continental shelves were mostly blanketed in sand eroded from the ancestral Apalachicola and Perdido/Escambia deltas. Incised river valleys were flooded to create bays with "back-stepping" sedimentary facies, reflecting rapid, episodic landward shifts in bay environments. Modern coastal environments formed mainly in the past 5,000 years as the rate of sea level rise slowed. The historical acceleration of sea-level rise due to global warming is approaching rates that existed during the time coastal environments were undergoing rapid change.

0239 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Matthew Anderson[1], Cybil Cavalieri[1], Stanley Fox[1], Felipe Rodríguez-Romero[2]

[1]Oklahoma State University, Stillwater, OK, USA, [2]Universidad Autónoma del Estado de México, Toluca, México, Mexico

Tail Autotomy Induces Differential Effects on Sprint Performance between the Sexes in the Lizard *Uta stansburiana*

Autotomy of an appendage, especially the tail in lizards, can aid in escape from predators, but it comes with associated costs. In previous studies, decreases in sprint performance often follow from tail loss in lizards. We measured the impact of tail autotomy on sprint performance in the lizard *Uta stansburiana,* a species with intense predation pressure and consequently frequent natural tail loss. Sprint performance was measured using both maximal sprint speed and average stride length. We examined the impacts separately for each sex, as this species is strongly molded by sexual selection and tail autotomy is known to affect the social status of subadult *U. stansburiana* differently. To first check for sexual differences in native sprint performance, we assessed both sexes with intact tails. Neither sprint speed nor stride length significantly differed between the sexes before tail autotomy. Following tail loss, male performance was not affected; individuals maintained their previous maximal sprint speed and average stride length. However, females significantly decreased both maximal sprint speed and average stride length following tail autotomy. Males maintained sprint speed after tail loss (but not by an increase in stride length) and females decreased in both measures of performance. We suggest that tailless males compensate for tail loss and maintain performance for the benefit of high speeds used for repulsion of male rivals

from their territories. Females may well adopt an alternate social role following tail autotomy and thus not require fast sprint speed to defend territories.

0384 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Conrad B & C, Thursday 7 July 2011

Michael Anderson, Brian Miller

Middle Tennessee State University, Murfreesboro, TN, USA

Iron Deposition in First-Generation Teeth of the Streamside Salamander, *Ambystoma barbouri*

Iron-rich molecules are sequestered in the enamel and enameloid layers of teeth in some salamander species. In adult teeth the presence of iron can be detected visually via orange-brown cusp coloration; whereas, embryonic and early-stage larval teeth are too small to be efficiently visually analyzed. Consequently, the earliest ontogenetic stage during which iron is deposited in salamander teeth remains unknown. A combination of scanning electron microscopy and energy dispersive X-ray spectroscopy was used to examine the teeth of embryonic and larval streamside salamanders, *Ambystoma barbouri*, to determine what developmental stage iron deposition begins in teeth. Additionally, the relative iron concentration along a longitudinal axis was quantified. Iron was detected in first-generation teeth of embryos, suggesting that yolk, rather than an external diet, is the source of iron deposited in teeth of early-stage salamanders. Furthermore, like adult salamanders of other species, iron was most concentrated at the apex of the tooth crown, suggesting that the process of iron deposition may be similar throughout ontogeny.

0396 Poster Session III, Sunday 10 July 2011

Michael Anderson, Eric Salmon, George Benz

Middle Tennessee State University, Murfreesboro, TN, USA

Cranial and Pectoral Osteology of the Common Carp, *Cyprinus carpio* Linnaeus, 1758: A Laboratory Manual

The vertebrate cranium is an important apparatus that has been modified numerous times throughout the course of evolution. In addition to its primary function of exogenous feeding and prey capture, the cranium is housing for the nervous, optic, otic, olfactory, and respiratory systems. Perhaps more important to biologists, phylogenetic relationships between groups of organisms can be elucidated by evaluating conserved regions of articulation, homologous bones, and the general arrangement of skeletal components. The fish syncranium, in particular, is useful in explicating the foregoing

because of the presence of several contiguous bone families. With the intention of introducing young scientists to piscine cranial anatomy, we have created a guide to the cranial and pectoral osteology of the common carp, *Cyprinus carpio*. This manual not only includes a guide to cranial and pectoral girdle disarticulation and reconstruction, but also sections that give detailed explanations of how to efficiently use the manual and prepare the fish skull for dissection. In addition, we include a photographic atlas of all cranial and pectoral bones, arranged by bone families. However, because ca. 32,000 species of fish have been described, this manual should be used only in an introductory capacity. Nevertheless, the student that chooses to follow this manual closely and becomes familiar with basic piscine osteology and terminology will be well-suited to begin investigating the primary literature on the subject.

0420 Poster Session I, Friday 8 July 2011

Wesley Anderson, Gad Perry

Texas Tech University, Lubbock, TX, USA

Habitat Use of the Texas Horned Lizard (*Phrynosoma cornutum*) in Central Texas

We studied habitat use of the Texas horned lizard at two sites in central Texas near the towns of Brownwood and Mason. Habitat variables were collected corresponding to locations where horned lizards had been observed during the 2007 - 2010 field seasons. We collected habitat variables at two scales - one within a 10 m radius of lizard locations and another employing 100 m transects beginning at either recorded lizard locations or at random points. At the Mason site, lizards were located in areas with higher than average forb density, whereas at the Brownwood site, lizards were found in areas with a higher than average percentage of bare ground. Lizards from both populations were encountered in areas with lower than average canopy cover. Road densities indicate that lizards at the Brownwood site are using roads more frequently than those near Mason and this conclusion was corroborated by telemetry data. This difference, along with several other differences in habitat use between populations, may be the result of differing habitat management regimes between the two sites.

0088 Invasive Species, Symphony I & II, Sunday 10 July 2011

Paul Andreadis

Denison University, Granville, OH, USA

Python Spoor in Southwest Florida: Demographic and Behavioral Insights

Extremely cold weather in January 2010 killed many Burmese Pythons (*Python molurus bivittatus*) in Florida. Nonetheless, many pythons survived. In December 2010, canal

dredging occurred on agricultural land adjacent to Collier-Seminole State Park. Long stretches of sand were exposed on a levee already known as a python "hotspot." A serendipitous absence of rain allowed spoor of large animals to accumulate. A 2.2 m python captured in January 2011 left a conspicuous trackway in this sand. Further examination of a 1.5 km stretch revealed 16 separate tracks (40 cm-36 m long) on or alongside the levee. The size, site configuration, and seasonal timing suggest the tracks were made by pythons. Some discontinuous sections could be interpreted as tracks of single individuals. I estimate the tracks represent at least 10 separate instances of python movement, deposited over an 11-21 d period. At least three track-width classes were represented. Some tracks skirted the lip of the levee, suggesting edge wandering. Several tracks crossed directly from the canal side to the park side. My interpretation is that pythons used the canal on the north side of the levee for long distance movements, then crossed the levee to seek basking sites and/or mates in the dense, invasive para grass that carpets the southern exposure. In certain settings and seasons, sand tracking may be a useful tool for monitoring python presence/activity. Python persistence cautions us that the cold weather of 2010 was just the first round of selection for cold tolerance.

0076 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

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Performance of Squamate Embryos with Respect to Phylogeny, Climate, and Adult Life History

To evaluate thermal performance of squamate embryos, we assessed how developmental rate, optimal temperature, and minimal temperature for development are related to climate, adult life history, and phylogeny. We acquired developmental and life history data from a search of the primary literature and climate data from a GIS database. We constructed a composite phylogeny from independent molecular analyses. Data were compiled for 28 species of lizard (7 families) and 12 species of snake (2 families). In general, developmental performance was largely associated with climate, and unrelated to phylogenetic relationship. Embryonic developmental rates (corrected for stage at oviposition and hatchling mass) were positively associated with an index of seasonality; rates were highest where the difference between the temperatures during the warmest and coldest part of the year was the greatest but unrelated to ambient temperature during the warmest and wettest quarters of the year. The optimal temperature for development was positively related to the mean temperature of the warmest quarter of the year but unrelated to seasonality. Minimal temperature was also positively related to the mean temperature of the warmest quarter of the year, but in addition, was positively correlated with the mean activity temperature of adults.

Developmental rate is thus matched to the length of the period suitable for incubation and upper and lower thermal tolerances are matched to environmental temperature of the breeding season.

0571 Poster Session III, Sunday 10 July 2011

Carl Anthony, Cari-Ann Hickerson

John Carroll University, University Heights, OH, USA

Mark and Recapture Data Indicate Differential Territory Use by Striped and Unstriped Color Morphs of *Plethodon cinereus*.

The Eastern Red-backed Salamander (*Plethodon cinereus*) is polymorphic for dorsal color pattern. A number of authors have suggested that there are differences in behavior and physiology between the striped and unstriped phenotypes. At our study site, male and female pairs are more likely to be of the same dorsal color morphology than expected by chance. Striped males are found paired with the largest, and presumably most fecund, females. Previous studies have shown that striped males are more aggressive and may have superior diets compared to unstriped males. We hypothesize that positive assortative mating by color in *P. cinereus* emerges through pairings that occur along a territory quality gradient where the highest quality mates gain access to each other. An untested hypothesis of this model is that, compared to unstriped salamanders, striped salamanders should exhibit evidence of increased territorial behavior in the field. We compared cover object use by striped and unstriped salamanders over a 3.5 year period. At our study site, unstriped salamanders made up 30% of the population, but this phenotype comprised only 10.1% of recaptured individuals. Unstriped salamanders had shorter residency times and were recaptured less often, relative to striped salamanders. These results suggest that unstriped salamanders may exhibit territorial behavior either differently, or at a reduced intensity, relative to the striped phenotype. This behavioral difference may play a role in the ability of both sexes of each color morph to attract quality mates.

0375 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Whitney Anthonysamy[1], Michael Dreslik[2], Marlis Douglas[2], Natalie Marioni[2], Christopher Phillips[2]

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

Mating System and Reproductive Success in Blanding's Turtles (*Emys blandingii*)

Mating systems of many reptile species are poorly understood because reproductive behavior is often cryptic and confounding strategies such as sperm storage and multiple paternity are difficult to quantify. Further, it is unknown how mating systems function when population densities are reduced by fragmentation. The Blanding's Turtle, *Emys blandingii*, is of conservation concern in Illinois because most extant populations are small and isolated within fragmented landscapes. We examined the mating system and reproductive success of two adjacent populations of *E. blandingii* in a fragmented landscape by assessing paternity using microsatellite DNA analysis. We then compared our paternity results to field observations of mating behavior between individuals during radio-telemetry surveys. From 2007-2009, we monitored 36 adult *E. blandingii* and documented 45 male-female pairings among nine males and 14 females. Tissue samples were collected from 31 clutches and all radio-equipped individuals for DNA analysis. Our populations exhibited a promiscuous mating system with both sexes having multiple partners. However, number of offspring sired among males was heavily skewed with a relatively low occurrence of multiple paternity. Using a combination of molecular genetic techniques and behavioral field observations, the results of this project provide important insights regarding turtle mating systems and aids in conservation planning for *E. blandingii*.

0377 Poster Session III, Sunday 10 July 2011

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Population Genetics of the Spotted Turtle (*Clemmys guttata*) in Illinois

The Spotted Turtle, *Clemmys guttata*, is vulnerable to extinction due to range-wide declines from habitat loss and exploitation. Although only two small, isolated populations remain extant in Illinois, their demographic structure, life history, and critical habitat requirements have been well documented over 20 years of research. Because genetic data are also essential for planning conservation strategies, we examined genetic diversity, genetic drift, inbreeding, and historical gene flow of these populations using tissue samples from 147 adult individuals collected during surveys

from 2004-2009. We amplified 15 microsatellite loci using polymerase chain reaction (PCR) with primers developed for *Emys blandingii* and *Glyptemys muhlenbergii*. We evaluated microsatellite data using standard population genetic tests (*e.g.* departure from Hardy-Weinberg equilibrium) and determined within-population diversity using standard parameters (e.g., allele frequencies, observed heterozygosity). Our results complement existing information on population structure, spatial ecology, and habitat use for these populations and will be valuable for guiding *C. guttata* recovery efforts.

0134 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Ellen Ariel, Leigh Owens

James Cook University, Queensland, Australia

Challenge Studies of Australian Native Reptiles with a Ranavirus Isolated from a Native Amphibian

The capacity of ranavirus to cross species boundaries makes the epidemiology complex with potential reservoirs in many different species in any given location. Bohle iridovirus (BIV) was originally isolated from amphibians and shown to be pathogenic to fish in challenge trials. This study aimed to clarify the potential pathogenicity of BIV in six native Australian reptile species of the common aquatic and riparian fauna of northern Queensland. Animals were challenged by IC inoculation and were observed over a period of 30 days. Mortality and specific antibody response to BIV was monitored during the trials. Histopathology, immunohistochemistry and virus isolation were performed at the end of the study. Bohle iridovirus was found to be extremely virulent in hatchling tortoises (*Elseya latisternum* and *Emydura krefftii*), resulting in lesions in multiple organs and death (100 and 40% respectively). In contrast, adult tortoises, snakes (*Boiga irregularis, Dendrelaphis punctulatus* and *Amphiesma mairii*) and yearling crocodiles (*Crocodylus johnstoni*) were not acutely affected. Virus was re-isolated from BIV-exposed tortoise hatchlings and one *B.irregularis*. Adult tortoises survived BIV-challenge and produced antigen-specific antibodies. Thus, serological surveys of adult tortoises may be useful for determining the presence and spread of BIV in northern Australia, and help to predict the potential impact to native fauna from this pathogen.

0031 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

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Successful *In Vitro* Fertilization with Hormonal Induced *Bufo fowleri* Sperm Stored at 4°C for up to 8 Days

Assisted reproductive technologies (ART) are essential for endangered amphibian colonies that are failing to reproduce in captivity. Our lab is developing ART protocols in *Bufo fowleri* that can be applied to endangered Bufonids. *B. fowleri* spermic urine retains motility when kept at 4°C but the fertilizing capacity of this sperm has never been tested. Three IVF trials were performed using a different female as an egg donor in each experiment. Spermatozoa were obtained from 17 males. IVF1 was performed with fresh, 1, 2 and 3-day old sperm. Spermic urine from these 17 males were kept at 4°C and used for IVF2 two days later (sperm was 2 to 5-days old) and IVF3 after three additional days (sperm was 5 to 8-days old). Fresh sperm samples showed a higher percentage of forward movement and quality of motility than all other samples; there were no differences in sperm parameters for any other day of IVF. Spermic urine was able to fertilize eggs through the entire experiment although fertilization rate decreased approximately 30% from fresh sperm (81% ± 13) to 8-day old sperm (48% ± 9). The age of sperm, percent motility, percent forward motility and the quality of motility were all significant predictors of the percentage of eggs that cleaved and reached neurula stage. Refrigerated sperm successfully fertilized 48% of the eggs after 8 days of storage. Short-term storage of sperm can help overcome asynchrony in gamete collection and enable sperm exchange among populations without sacrificing the donor animals.

0586 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Jairo Arroyave[1], Melanie Stiassny[1]

[1]American Museum of Natural History, Department of Ichthyology, New York, NY, USA, [2]The Graduate School and University Center, The City University of New York, New York, NY, USA

Molecular Phylogeny of the African Family Distichodontidae (Ostariophysi: Characiformes) with an Emphasis on the Economically Important Genus *Distichodus*

Fishes of the family Distichodontidae are among the very few characiform lineages exclusively found in Africa. Despite the considerable diversity and economical importance of this group of fishes, only two studies to date (morphology– and molecular–based, respectively) have dealt with the phylogenetic relationships among its

members, offering partially incongruent results. The molecular–based study, however, relied on a limited sampling of distichodontid taxa (which is explained by its focus on the higher-level relationships of the order Characiformes). Consequently, a comprehensive and robust phylogeny of the family Distichodontidae using molecular data has yet to be proposed. In this study, we present the most inclusive phylogeny of distichodontids based on DNA sequence data. Phylogenetic relationships within Distichodontidae were inferred using Maximum Parsimony (MP), Maximum Likelihood (ML) and Bayesian approaches based on a molecular dataset that included both nuclear (SH3PX3 and myh6) and mitochondrial (COI and Cyt b) markers. Inclusion of multiple representatives of all but two of the 17 recognized genera of the family allowed for testing previous hypotheses of intergeneric relationships, in addition to testing the monophyly of most of the genera. Our extensive sampling of *Distichodus* species allowed us to resolve the phylogenetic relationships within the genus in the context of the overall distichodontid phylogeny. Preliminary results corroborate the monophyly of the family and most of the genera, strongly supporting the disputed monophyly of the genus *Distichodus.* Also, our results lend further support to the notion that *Xenocharax* is the most basal distichodontid genus.

0665 Fish Morphology, Symphony I & II, Friday 8 July 2011

Helena Aryafar[1], Rachel Berquist[2], Lawrence R. Frank[2], Kathryn A. Dickson[1]

[1]California State University Fullerton, Fullerton, CA, USA, [2]University of California San Diego, La Jolla, CA, USA

Possible Sexual Dimorphism in the California Grunion, *Leuresthes tenuis* (Atheriniformes: Atherinopsidae)

The California grunion, *Leuresthes tenuis*, exhibits unusual reproductive behavior in which the adults emerge completely from the water to spawn, and externally fertilized eggs develop within the sand. Adult grunion are carried onto sandy shores with the highest spring high tides following the new and full moons in March-August. Females deposit eggs ~8-10 cm deep within the sand while males surround females at the sand surface and release sperm. Fertilized eggs incubate in the sand until a subsequent spring high tide washes them out and triggers hatching. An open question in grunion reproduction is how males fertilize eggs that have been placed deep within the sand. While extracting gametes for other experiments, we noticed a small muscular structure protruding from the genital pore of male, but not female, grunion. A subsequent investigation using magnetic resonance imaging, dissections, and histology allowed us to characterize its morphology and its location relative to surrounding structures. It appears to be a muscular genital palp that extends out of the body when the hypaxial myotomal muscles contract. The structure could not be found in female grunion, using the same imaging and histological techniques. The lack of this structure in female grunion suggests that it could be a specialized mechanism that evolved in males for directing sperm to eggs for fertilization in the sand. Therefore, we hypothesize that the

structure represents a sexually dimorphic trait in *L. tenuis*. This structure can be used to identify males even after fish have expelled their gametes.

0382 Poster Session II, Saturday 9 July 2011

Neil Aschliman

Florida State University, Tallahassee, FL, USA

The Batoid Tree of Life: Synthesizing Morphological and Molecular Phylogenies of Skates, Rays and Allies (Chondrichthyes: Batoidea)

Chondrichthyan fishes represent one of the two major extant lineages of jawed vertebrates, offering a critical outgroup perspective on the evolution of bony fishes. Skates, rays and allies (batoids) exhibit the majority of chondrichthyan species diversity and morphological disparity, but there is little consensus on the interrelationships and patterns of evolutionary change characterizing this unique group of fishes. The most taxon-rich published batoid phylogenies are based on morphological data and suggest suites of characters that appear constrained and/or convergent. However, the scarcity of shared-derived characters uniting major groups, discordance with the fossil record, and a lack of confidence in any one topology impede the resolution of critical questions posed by morphological trees. Here, I present a new framework for interpreting the evolution of batoids using morphological and molecular data. This is a synthesis of (1) an updated morphological phylogeny (Aschliman et al. 2012) incorporating new characters from the synarcual and a number of other additions and modifications to McEachran and Aschliman's (2004) matrix; and (2) a conservative molecular phylogeny recovered using independent nuclear markers and the complete protein-coding complement of the mitochondrial genome (Aschliman 2011). The morphological and molecular phylogenies are largley congruent toward the tips and in allying certain higher taxa. However, disagreements between morphology and molecules, including the placement of rajids and platyrhinids, appear to be self-consistent, robust, and irreconcilable. Conflicting hypotheses and potential sources of error are here evaluated.

0670 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Jimiane Ashe[1], Kevin Feldheim[3], Samuel Gruber[2], Demian Chapman[1]

[1]Stony Brook University, Stony Brook, NY, USA, [2]University of Miami, Bimini Biological Field Station, Miami, FL, USA, [3]Field Museum of Chicago, Chicago, IL, USA, [4]Bimini Biological Field Station, Bimini, Bahamas

Testing Predictions of the "Natal Homing Hypothesis" for Sharks, Using Lemon Sharks (*Negaprion brevirostris*) in the Western Atlantic as a Model Species

Some animals return to their birthplace to breed even though individuals from different breeding populations are mixed at most other times ("natal homing"). It has been hypothesized that natal homing by females is common in coastal sharks, which may explain why localized shark fisheries often collapse. This hypothesis predicts that juvenile sharks in their natal nursery area should be genetically distinct from other such groups, while older life-stages collected over the same range are mixed. We tested these predictions in lemon sharks (*Negaprion brevirostris*) of the Western Atlantic. The natal homing hypothesis predicts that (a) continuously distributed populations of lemon sharks are genetically structured and (b) newborn/small juveniles sampled in their natal nurseries should be more structured than subadult/adult individuals sampled from proximate locations. We sequenced 1,648 bp of the mitochondrial genome and analyzed 8 microsatellite loci in 480 specimens from 12 locations from central Florida to Brazil. Although microsatellite markers were not structured, possibly due to male-mediated dispersal, mitochondrial sequences were highly structured into at least four distinct geographic groups (global Φ_{ST}=0.35, p<0.000001). In Florida and the western Bahamas we found that nursery collections separated by as little as 300 km were genetically distinct (Φ_{ST}=0.165, p<0.0000001), whereas subadult/adult collections were more homogeneous across a similar range (Φ_{ST}=0.001, not significant). These data support the predictions of the natal homing hypothesis for lemon sharks and have implications for coastal shark conservation and fisheries management.

0480 Poster Session I, Friday 8 July 2011

Allison Asher, Edward Heist, Ryan Boley, James Garvey

Southern Illinois University, Carbondale, IL, USA

Genetic Identification of Young-of-Year Reveals Low Reproduction of Endangered Pallid Sturgeon in the Middle Mississippi River

The range of the federally endangered pallid sturgeon (*Scaphirhynchus albus*) overlaps with the shovelnose sturgeon (*S. platorynchus*) with which it hybridizes. Young-of-year (YOY) pallid and shovelnose sturgeon as well as their hybrids are morphologically indistinguishable, thus accurate species identification depends on molecular markers. To

estimate the ratio of YOY pallid to YOY shovelnose and hybrid sturgeon in the middle Mississippi River (MMR), sturgeon were trawled during April through October in 2008, 2009, and 2010 at 23 sites within the MMR. Over 2,330 sturgeon were collected from 17 of these sites. Individuals were measured to mm total length and preserved in ethanol. DNA was isolated from caudal fin tissue and amplified at 16 microsatellite loci via polymerase chain reaction. Fragments were analyzed by capillary electrophoresis using an ABI 3130xl. Species determinations were made with Newhybrids software using baselines comprised of morphologically and genetically identified adult pallid and shovelnose sturgeon. To date, 1,221 YOY sturgeon have been genotyped. Based on molecular markers, one YOY pallid and one YOY shovelnose/pallid hybrid were identified, while all other 1,119 were identified as shovelnose sturgeon. This estimate of abundance of YOY pallid sturgeon is much lower than previously reported for the MMR and indicates a low level of reproduction of pallid sturgeon in the MMR.

0576 Poster Session I, Friday 8 July 2011

Teresa Ausberger, Mark Mills

Missouri Western State University, St. Joseph, MO, USA

Using Coverboards to Examine Herpetological Biodiversity in the Loess Hills at Squaw Creek National Wildlife Refuge, Missouri

In the fall of 2009, we began a research project in the Loess Hills at Squaw Creek National Wildlife Refuge, Missouri. We placed cover boards (2x4 feet) in prairie and forested areas in order to examine the biodiversity in the Loess Hills and determine species composition and abundance for reptiles and amphibians. Sampling began in the spring of 2010 and since that time period, a total of 68 individuals of six species have been captured: 48 *Diadophis punctatus*, 8 *Thamnophis sirtalis*, 5 *Lampropeltis triangulum*,3 *Coluber constrictor*, 2 *Carphophis vermis*, , and 2 *Pseudacris triseriata*. Of these six species, *Diadophis punctatus* was the most commonly captured with males more commonly found under cover boards than females. Throughout the course of the sampling season, most (89%) were captured in prairie versus forested habitat. Our goals for this project included: (1) determine reptile and amphibian biodiversity in the Loess Hills through long-term sampling, (2) obtain measurements for captured organisms, and (3) determine habitat associations of these species.

0600 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Lyndell Bade, Susan McRae

East Carolina University, Greenville, NC, USA

Asymmetric Development of the Female Reproductive Tract in Elasmobranchs: A Comparative Analysis of Modes of Reproduction and Life History Traits.

Elasmobranchs (sharks, skates, and rays) exhibit diverse reproductive modes, including internal fertilization, and either oviparity with external development or internal development via viviparity or ovoviviparity. For example, in many batoid species, the eggs are held internally, develop in the egg sac, and then the fetuses are fed through the excretion of a uterine fluid. Asymmetric reproductive tract development in the female is exhibited across many taxa, predominantly with left-sided functionality and vestigiality of the right side of the uterine tract. This is remarkably similar to birds, where it is viewed as a flight adaptation. It is conceivable that this is an anatomical adaptation in elasmobranch species that is specific to aspects of migratory behaviors or habitat usage. A literature review will be used to identify reproductive modes and life history traits across elasmobranch diversity. Comparative analysis will be used to relate asymmetric development of the reproductive tract with reproductive mode and ecomorphology, as well as ecological traits such as migratory habit, migration distance, natal dispersal pattern, and habitat type. The study of elasmobranchs is a growing field and new species are continually being discovered, yet life histories and reproductive traits of these species are poorly understood due to difficulties with observation and capture. This study will add to our knowledge of reproductive adaptation of these fascinating but imperiled animals.

0080 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY AWARD

April Bagwill

Oklahoma State University, Stillwater, OK, USA

Effects of Land Use on Playa Wetlands and Amphibian Populations in the Southern High Plains

The Southern High Plains (SHP) contains approximately 25,000 playas. This region is substantially impacted by farming, and therefore, playas are susceptible to various ecological impacts including sedimentation, hydrological alterations, and contaminants. Throughout most of the region playas are the main source of amphibian breeding habitat. This study assessed amphibian populations in 94 playas in the SHP, over two years, located in three different land use types: cropland, native grassland, and land enrolled in USDA Conservation Reserve Program (CRP). Hydroperiod and sediment

measurements were conducted to determine land use effects on playa characteristics. Overall, cropland playas have greater sediment depths and greater water loss rates compared to native grassland or CRP. Similarly, CRP sites, which had been previously cultivated, had greater sediment depths than native grass sites. Eleven amphibian species were observed across study playas (via dip netting, call surveys, and transects) and overall, the mean total number of amphibian species did not differ among land uses (crop, 3.64 ± 0.26, CRP, 3.42 ± 0.36, grass, 3.11 ± 0.35). However, richness did increase with longer hydroperiod. We are also elucidating the potential effects of water loss and contaminants on spadefoot toad development, stress physiology, and immune function in the laboratory. Water loss treatments have resulted in altered corticosterone levels, splenocyte counts, and development rates. Investigating these effects can be useful in determining potential risks to natural amphibian populations faced with similar conditions.

0110 Poster Session III, Sunday 10 July 2011

April Bagwill

Oklahoma State University, Stillwater, OK, USA

Effects of Water Loss Rates on New Mexico Spadefoot Toad Stress Physiology, Immune Function, and Development

This study investigated the mechanistic effects of water loss rate on morphological and immunological development of New Mexico spadefoot toads (*Spea multiplicata*). Increased water loss accelerates metamorphosis and induces a spike in corticosterone, which can negatively affect the immune system. It has previously been shown that during metamorphosis this species undergoes a drastic decrease in the number of lymphocytes in the spleen when reared in wetlands with fast water loss rates. We hypothesized that with added stress of water loss, *S. multiplicata* tadpoles will have a premature spike in corticosterone, thus causing a prolonged period of immunosuppression than would naturally occur during metamorphosis. We used two water treatments (constant and loss of 0.5-1.0cm/day) to elucidate effects of rapid water loss. Pre-metamorphic and metamorphic individuals were assessed for spleen size and cellularity and corticosterone levels. Gosner stage (GS) 36 individuals subjected to rapid water loss showed an increase in spleen leukocyte numbers and corticosterone; no difference was observed for GS 45. Morphing dates were accelerated for tadpoles in the water loss treatment, but no difference was observed in weight or snout-vent length. Our results suggest that during late limb development, tadpoles are more susceptible to water loss, but do not necessarily maintain this increased susceptibility throughout metamorphosis. Understanding the interactions between physiological systems in the laboratory increases our knowledge of what can occur in natural populations affected by anthropogenic disturbances, and creates an initial framework for field studies.

0499 Poster Session III, Sunday 10 July 2011

Justin Baker[1], Brian Wagner[2], Robert Wood[1]

[1]Saint Louis University, Saint Louis, MO, USA, [2]Arkansas Game & Fish Commission, Benton, AR, USA

Conservation Genetics of *Etheostoma cragini* and *Etheostoma microperca* in Arkansas

The Arkansas Darter, *Etheostoma cragini*, is one of the rarest fishes in Arkansas and has been designated as a candidate for listing under the Endangered Species Act. The Least Darter, *Etheostoma microperca*, also has an extremely limited distribution in Arkansas, but is widely distributed outside the state and ranges from the Great Lakes region to south-central Oklahoma. Both species inhabit small spring-run habitats with sand and silt substrate, often occupying the margins where thick growths of aquatic vegetation occur. Recent surveys (2009-2011) have confirmed the persistence of these species at several historical locations, as well as identifying additional nearby locations in Benton and Washington counties. Rapid population growth and development in these counties make the need to document and conserve populations of these rare darters even more urgent. Here we present genetic analyses of specimens from all known Arkansas populations of *E. cragini* and *E. microperca*, as well as representative populations of these species range wide. Individuals were genotyped at 8 nuclear microsatellite loci and analyzed for variation at the cytochrome b gene. Genetic diversity among populations will be presented with a focus on how these results have influenced conservation and monitoring efforts.

0577 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

Jordan Balaban[1], Joseph Bizzarro[2], Adam Summers[2]

[1]University of Rhode Island, Kingston, RI, USA, [2]University of Washington, Seattle, WA, USA

Burrrowing Behavior of the Pacific Sand Lance

The pacific sand lance, *Ammodytes hexapterus,* is a schooling species of fish in the Pacific Northwest. Sand lances exhibit an unusual burrowing behavior in which they appear to swim into sandy substrates. These fish are found in intertidal and subtidal zones, but primarily over sediment with coarse grains of sand (0.36 mm to 1.0 mm). We conducted a series of behavioral experiments to determine: 1) whether sand lances preferentially burrow into certain sized sediments; 2) if they can distinguish between compacted and uncompacted sediment; and 3) if there is a difference in force required to burrow into the various sizes and compaction levels of sediment. First, we gave the fish the option of a fine sediment (0.25 mm to 0.52 mm), a small coarse sediment (0.52 mm to 1.0 mm) and a larger coarse sediment (2.0 mm to 4.0 mm). We then gave them the option between compacted and uncompacted sediment. Finally, to determine force requirements, we

used a resin model of a sand lance attached to a force gauge. We plunged this into different sediments to determine the force required to burrow. As expected, compacted sediment requires more force to burrow into than uncompacted sediment. However, it does not require less force for sand lances to burrow into the behaviorally preferred sediment size, and in some cases this sediment actually requires more force for penetration. We believe that sand lances may choose burrowing location based on vision, or perhaps the kinematic variables of burrowing change the perceived difficulty.

0705 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

Carole Baldwin[1], Ross Robertson[1]

[1]*National Museum of Natural History, Smithsonian Institution, Washington, DC, USA,* [2]*Smithsonian Tropical Research Institute, Panama City, Panama*

Exploring Deep-Reef Fishes off Curacao

Curasub, a new five-person submersible capable of descending to 1,000 ft., is being used to explore deep-reef ecosystems off Curacao in the southern Caribbean. The sub, which is available for use by both dive enthusiasts and scientists, is based at the Curacao Sea Aquarium. It is equipped with two robotic manipulator arms for collecting organisms. Because of the proximity of deep-reef areas to the Curacao coast, the sub can descend to depth from a deployment dock at the aquarium. A former NOAA ship, the R/V *Chapman,* is being renovated and ultimately will be used to carry the sub to other deep-reef sites in the Caribbean. Fish specimens collected with the sub are photographed, tissue sampled for DNA analysis, and preserved as voucher specimens. They will be compared genetically and morphologically with deep-reef fishes taken recently by trawl in the western Caribbean and with submersible collections made at other deep-reef areas in the future. This work is part of ongoing systematic and biogeographic studies of western Central Atlantic shore fishes.

0653 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

Timothy Baldwin, Yong Wang

Alabama A&M University, Huntsville, AL, USA

Survivorship and the Influence of Varying Spatial Environmental Factors on Spotted Salamander, *Ambystoma maculatum*, Egg Masses in Northern Alabama

In this study we wanted to compare spotted salamander, *Ambystoma maculatum*, egg survivorship throughout vernal pools in the Cumberland Plateau in northern Alabama. Twenty four vernal pools were surveyed biweekly between December and April from

2008 through 2011. This projected was executed over three field seasons. During this time we sampled spotted salamander egg masses using two timed visual encounter surveys. During each visual encounter survey, a gps unit was used to log each transect within the vernal pool. Each egg mass was identified down to species, tallied, and each egg counted. Biweekly surveys were executed until no Spotted Salamander embryos were noted during the surveys. At least four rounds were completed for each wetland. A round was completed if the wetland's entire basin had been sampled. In addition to spotted salamander egg data, we also took data on the wetland hydroperiod and area. The following wetland environmental measurements were also taken: soil and water temperature, water pH, dissolved oxygen concentration, and canopy cover. Landscape variables were calculated using ArcGIS 10 and ERDAS 10 at three buffer distances to represent juvenile and adult salamander migration distances. The three distances used were 75 meters, 115 meters, and 200 meters. Multiple linear regression was used to examine the relationship between the spotted salamander egg numbers and densities, pool conditions, and landscape parameters.

0072 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Margaret (Cissy) Ballen[1], Mark Wilson[2], Mo Healey[2], Michael Tobler[1], Erik Wapstra[3], Mats Olsson[1]

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Sex-specific Basking and Activity Effects on Lizard Superoxide Levels: High Superoxide Levels in Hot Females and Cool Males

Ectotherms increase their body temperature in response to ambient heat, thereby elevating their metabolic rate. An often inferred consequence of this is an overall upregulation of gene expression, energetic expenditure and a concomitant increased production of reactive oxygen species (e.g., superoxide) and, perhaps, a shortened life span. However, recent work shows that this may be a superficial interpretation; an elevated temperature may in fact trigger down-regulation of gene expression. We studied temperature and associated activity effects in males and females of the Australian painted dragon lizard (*Ctenophorus pictus*) by allowing the lizards to bask for four hours, versus 12 hours, and scoring their associated activity (inactive versus active basking or foraging). As predicted, long-basking lizards (hereafter 'hot') showed heightened activity in both sexes, with a more pronounced effect in females. We then tested for sex-specific effects of basking treatment and activity levels on the increase in net levels of superoxide. In males, short-baskers (hereafter 'cold') had significantly higher superoxide levels than hot males but with faster *decreasing* levels of superoxide per unit heightened activity. In females, hot females had higher superoxide levels but these increased faster with increasing activity in the cold as opposed to hot basking treatment, and females earlier in the ovarian cycle had lower superoxide levels. Thus, males and females differ in how their levels of reactive oxygen species change with temperature.

0180 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Ana Balseiro

SERIDA, Gijon, Asturias, Spain

Pathological Changes Observed in European Amphibians with Ranaviral Diseases

Ranaviruses have been implicated as a cause of mass amphibian deaths worldwide. Since the 1990s the number of reported ranaviral disease outbreaks has increased greatly. In Europe, ranaviruses have caused outbreaks of high mortality in the United Kingdom, Croatia, Spain, Denmark and, recently, The Netherlands. Typically, affected animals die of systemic hemorrhagic disease. The hemorrhages are noticeable in larval amphibians, but adult animals are often found dead with no external abnormalities. In addition to systemic hemorrhagic disease, there is another disease syndrome reported in Britain that is characterized by skin ulcerations, necrosis of the digits, and no obvious internal lesions. Histologically, acute necrosis occurs throughout most organ systems of infected animals showing systemic hemorrhagic disease. Lymphoid and haematopoietic necrosis can be also observed. Round, intracytoplasmic, basophilic inclusions, consistent with ranaviral inclusions are present in epithelial cells of the skin, renal tubules and gastrointestinal tract, endothelial cells of the glomeruli, hepatocytes, cells within the spleen and exocrine glandular cells of the pancreas, and are generally associated with varying degrees of necrosis. Various immunohistochemistry techniques have been performed to demonstrate the distribution of the virus. Our understanding of ranavirus pathology remains in its infancy; histological examination of infected animals will be important to understanding how the virus affects various species. Ultimately, it is important to remain vigilant and establish surveillance programs to detect new outbreaks of ranaviral disease so that we can better understand the epidemiology of this pathogen and its impact on amphibian biodiversity in Europe.

0183 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Britt Bang Jensen[1], Annette Kjær Ersbøl[2], Helga Høgåsen[3], Amanda Bayley[4], Sven Bergmann[5], Giuseppe Bovo[6], Katarina Cinkova[7], Federica Gobbo[6], Barry Hill[4], Riikka Holopainen[8], Stefanie Ohlemeyer[5], Heike Schuetze[5], Hannele Tapiovaara[8], Tomas Vesely[7], Ellen Ariel[1]

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Assessing the Risk of Introducing Exotic Ranaviruses into Europe via Imports of Infected Ornamental Fish from Asia

Introduction of exotic ranaviruses is a major concern for European aquaculture and aquatic ecosystems. Project RANA was developed to increase knowledge on susceptible hosts and improve diagnostic tools, as well as assess the risk of introducing exotic ranaviruses into Europe. The risk assessment was based on World Animal Health Organisation (OIE) guidelines and expert opinion, and the outcomes were: 1) the identification of a pathway of introduction and spread of ranaviruses into Europe via importation of live infected ornamental fish from Asia, 2) a generic model for assessing the risk of introducing an exotic pathogen via importation of ornamental fish, and 3) identification of knowledge gaps. The calculations of risk, based on our model, indicate that there is: 1) a high risk of exotic ranaviruses entering into Europe, 2) a moderate risk of ranaviruses becoming established in wild populations, and 3) a low risk of ranaviruses entering an aquaculture facility. Our model provides a preliminary tool to assess risk associated with the translocation of ranaviruses via imported fish. However, the results showed a high degree of uncertainty, due to lack of knowledge. We recommend the following future research directions: (1) Investigations on the prevalence of ranaviruses in fish and amphibian populations in both exporting and importing countries (2) Survey to estimate the likelihood of release of imported ornamental fish and amphibians and (3) In-depth research on the potential for natural transmission of ranaviruses between fish and amphibians.

0108 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Charles Bangley, Roger Rulifson

East Carolina University, Greenville, NC, USA

Variation in the Feeding Ecology of Spiny Dogfish (*Squalus acanthias*) Overwintering in North Carolina Waters Based on Size and Habitat

Spiny dogfish (*Squalus acanthias*) are highly abundant in North Carolina waters from November through March. There has been much interest in the trophic ecology of spiny dogfish due to suspected predatory and competitive interactions with species important to commercial and recreational fisheries. The stomach contents of 399 spiny dogfish were collected during trawl surveys conducted in North Carolina waters in February and March, as well as size and sex data for the sampled sharks. Data on depth, water temperature, and relative abundance of other species were also collected at each sampling station. Stomach contents were identified to the lowest possible taxa and prey species were assigned to broad prey groups by taxonomic classification. Teleost fishes made up 94% of the diet by weight in February and 61% in March. Mature sharks consumed mostly fishes while crustaceans and other invertebrate species were more important prey for smaller sharks. Immature and male sharks occupied significantly deeper and warmer habitats than adult females. The most important fish species consumed in February was Atlantic menhaden (*Brevoortia tyrannus*) while sharks sampled in March consumed a variety of species. Striped bass (*Morone saxatilis*) showed high spatial overlap with adult female dogfish and made up about 2.4% by weight of teleosts consumed in February, which may indicate competitive and predatory interactions between these two species. These results suggest that the tendency of spiny dogfish to segregate by size and sex may significantly influence their trophic interactions with other species in North Carolina waters.

0416 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Brittany Barker[1], Javier Rodriguez-Robles[2], Joseph Cook[1], Robert Waide[1]

[1]*University of New Mexico, Albuquerque, NM, USA,* [2]*University of Nevada Las Vegas, Las Vegas, NV, USA*

The Role of Sea-level Fluctuations, Topography, and Human Introductions in Generating Island Diversity: Multi-locus Phylogeography of a Widespread *Eleutherodactylus* Frog in the Puerto Rican Bank

Disentangling the influence of colonization-extinction dynamics, island topography, and historical climate change is fundamental for improving genetic divergence models of insular systems. We performed multi-locus phylogeographic analyses of the Red-eyed

Coquí, *Eleutherodacytlus antillensis*, a habitat generalist frog endemic throughout the Puerto Rican Bank (PRB), in the eastern Caribbean Sea. The PRB was a single landmass roughly twice its current size during Quaternary (2.6 Mya - current) glacial periods, and it experienced multiple episodes of flooding during interglacial periods. We evaluated two alternative hypotheses: (1) periodic land connections allowed the frequently inundated eastern region to be recolonized from populations in Puerto Rico (Dispersal Hypothesis); and (2) populations persisted in the eastern region and remained isolated from Puerto Rico, despite periods of physical connectivity (Vicariance Hypothesis). We sequenced the mtDNA control region (555 bp) of 285 individuals and four nuDNA introns (total length of 1635 bp) of a subset of 173 individuals from 58 localities across the PRB. The data revealed differentiated populations across the entire PRB, suggesting vicariant processes operating in both the flooded eastern region and in mountainous areas of Puerto Rico. We found a west to east bias in gene flow, suggesting historical immigration into the eastern region. A lack of isolation-by-distance in eastern populations signified demographic instability. Human-mediated dispersal may account for shared haplotypes between some distant Virgin Islands. These findings improve our understanding of geographic, climatic and human factors that shape population divergence and that ultimately produce regional patterns of biodiversity in a neotropical island.

0569 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Judith Barkstedt

University of Oklahoma, Norman, OK, USA

The Downstream Effects of Fish on Ecosystem Structure and Function

Freshwater fishes can regulate ecosystem structure and function by altering nutrient dynamics, algal biomass, and invertebrate communities. However, few studies have examined the spatial extent to which fishes affect these dynamics. My study's goal was to quantify the potential downstream effects of fishes on nutrient subsidies in headwater streams. In fall 2010, I assessed spatial fish effects using 12 stream mesocosm arrays with five pools each. These included six experimental replicates that contained Red shiner (*Cyprinella lutrensis*), confined to an upstream pool, and six fish-less control streams. After the addition of fish, I sampled water nutrients and benthic algae bi-weekly for six weeks. My preliminary results suggest that the presence of fish did not have a strong influence on water nutrient concentrations, potentially due to rapid nutrient uptake by algae. Algal productivity was increased in pools with fish, but the influence of fish on productivity in downstream pools was limited.

0448 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

Paul Bartelt[1], Robert Klaver[1]

[1]Waldorf College, Forest City, IA, USA, [2]U.S. Geological Survey, Sioux Falls, SD, USA

Response of Amphibians to Restored Wet Prairies on an Agricultural Landscape: Preliminary Results

How do amphibians respond to the restoration of thousands of acres of wetlands scattered across an agricultural landscape? We are measuring occupancy and movements of Northern leopard frogs (*Rana pipiens*) and American toads (*Anaxyrus americana*) among 22 wetland restoration sites in Winnebago County, Iowa. We are measuring occupancy with multiple surveys and program MARK, general dispersal patterns through mark/recapture and genetic analysis, detailed movements of individuals with radio-telemetry, and the physiological costs of different habitats with biophysical models. We used a Geographic Information System for mapping and analysis. Occupancy for both species was ~90% in 2008 and ~85% in 2009. Frogs and toads colonized restored wetlands within a year, though at some they did not breed until a year later. In 2009, five frogs and 16 toads traveled an average (+SE) distance of 219+146 m and 724+202 m, respectively, from their initial capture sites; in 2010, nine frogs and 38 toads traveled 131+29 m and 453+64 m, respectively, from their initial capture sites. Frogs did not leave wetlands or surrounding prairies, whereas some toads used croplands extensively later in the season. Toads that bred in road-side ditches surrounded by croplands traveled much farther than those that bred in restored wetlands and prairies (data currently being analyzed). Seasonal variation in physiological costs among habitats may explain some of these differences. These results will help us understand how land cover features on agricultural landscapes and spatial patterns of restored wetlands facilitate amphibian movements among wetlands.

0393 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Zachary W. Bateson, John D. Krenz, Robert E. Sorensen

Minnesota State University, Mankato, MN, USA

Multiple Paternity in Common Five-lined Skinks

Multiple mating and sperm storage can influence reproductive strategies of males and females. Male reproductive success is often limited by the ability to acquire mates; males typically seek multiple females. In contrast, the number of offspring a female produces is generally not limited by the quantity of sexual partners, thus selection for multiple matings is expected to be weaker than in males. Evidence of polyandry and sperm storage is widespread among lizards. We investigated whether female Common Five-lined Skinks (*Plestiodon fasciatus*) could store viable sperm between reproductive cycles, estimated the frequency of multiple paternity, and examined the sharing of paternity within clutches. Females were unable to store viable sperm between successive clutches. Most clutches (65%) had multiple sires but within those clutches there was unequal

sharing of paternity. Although we cannot determine the function of polyandry from our data, we suggest possible causes of polyandry in the mating system of this species.

0045 Plenary Session, Minneapolis Ballroom EFG, Thursday 7 July 2011

Aaron Bauer

Villanova University, Villanova, PA, USA

Hands, Sands, and Southern Lands: Geckos in Space and Time

Gekkotan lizards comprise approximately 25% of living lizard diversity. They include more than 1375 species in 100+ genera and occupy virtually all tropical and subtropical areas of the world, where they are among the most important groups of nocturnal insectivores. Gekkotans are the probable sister group to remaining squamates and have a fossil record extending back to the Jurassic. They have evolved a wide variety of apomorphic traits including calcareous egg shells and a fixed clutch size of 1-2 eggs, specialized vocal and visual abilities and, perhaps most significantly, a complex digital adhesive system that has allowed them to occupy a diversity of arboreal and rupicolus habitats. The recent erection of explicit phylogenetic hypotheses based on a sampling of more than 750 species in 103 genera, combined with a review of Cretaceous and Tertiary fossil gekkotans, has permitted a reinterpretation of the evolution of the gekkotan foot. The Gekkotan body plan, including the adhesive apparatus, was established early in the evolution of the group and has remained largely conservative since the Cretaceous, but pedal design has been highly labile and transitions between padded and non-padded toe types, and among different pad architectures have been common. Locomotor specialization has played a key role in the evolution of gekkotan diversity, through both adaptive radiation across diverse susbstrate types and "non-adaptive" cladogenesis in substrate-constrained lineages. These processes have yielded distinctive, species-rich and generically diverse gecko faunas in the southwest Pacific (pygopodoids), the Americas (sphaerodactylids and phyllodactylids), and Africa + tropical Asia (gekkonids).

0334 Poster Session III, Sunday 10 July 2011

Collin Beachum, Matt Michel, Jason Knouft

Saint Louis Universtiy, St. Louis, MO, USA

The Relationships Between Body shape and Water Velocity in *Pimephales notatus* (Cyprinidae) and *Etheostoma nigrum* (Percidae)

Water velocity is an important selective force acting upon aquatic organisms. It may have effects at multiple hierarchical scales by regulating assemblage structure, habitat use at the species level, and body shape at the population level. Previous work

investigating the influence of water velocity on body shape has resulted in predictions of body shapes based on the organism's position within the water column. The goal of this study was to determine whether body shape is correlated with water velocity in two widely distributed stream fishes, *Pimephales notatus* and *Etheostoma nigrum*. We photographed individuals from each population, calculated the relative warp scores (body shape), and correlated these scores with mean water velocity measured at the collection site. A mixed effects model was used to examine the relationship between variation in flow rate and body shape, where centroid size (body size) and mean water velocity were fixed effects at the individual and population level, respectively. There were no significant correlations between body shape and mean water velocity for *P. notatus*. However, for *E. nigrum*, relative warp 2 was positively correlated with mean water velocity ($p = 0.002$) and negatively correlated with centroid size ($p < 0.001$). The relationships for E. nigrum support predicted effects of water velocity on body shape for benthic taxa. Deep anterior bodies occur in relatively high velocities and shallow anterior bodies occur in relatively lower velocities. The differential responses of body shape to water velocity between species suggest that phenotypic traits related to velocity may be species specific.

0399 Poster Session I, Friday 8 July 2011

Christine Bedore, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Spectral Sensitivity and Ultraviolet Vision in Batoid Elasmobranchs

The cownose ray and yellow stingray are two members of the order Myliobatiformes that differ in morphology, habitat, and behavior. Although both species are found in spectrally rich habitats where most wavelengths (including ultraviolet) are present, their presence in different colored environments may affect wavelength (color) sensitivity. Cownose rays typically inhabit turbid, green colored, coastal waters, whereas yellow stingrays are associated with blue coral reef waters. Electrical responses of cownose ray and yellow stingray photoreceptors to ultraviolet and visible light spectra were quantified using an electroretinogram (ERG) technique in dark and light adapted conditions. Both species demonstrated three peak sensitivities in the blue, green, and ultraviolet regions, although spectral sensitivity for the yellow stingray was blue-shifted compared to the green-shifted cownose ray. This is the first report of physiological responses to multiple wavelengths in batoids, as well as the first report of ultraviolet sensitivity in any elasmobranch. The data presented here indicate that multiple cones types are present in both species and that both rays are likely utilizing a color vision system.

0068 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Mark Belk[1], Eric Billman[1], Josh Rasmussen[2], Karen Mock[3], Jerry Johnson[1]

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Demography of Southern Leatherside Chub in the Presence and Absence of an Introduced Predator

Stream fishes suffer from habitat degradation and introduction of nonnative fishes. It is important from both an evolutionary and a conservation perspective to understand the effects of introduced species and habitat degradation on stream fish demography. Southern leatherside chub (*Lepidomeda aliciae*) is a small cyprinid stream fish native to the eastern Bonneville basin in Utah. Populations have declined dramatically from historic levels in many places and they seem to be mainly affected by introduced brown trout. To understand the dynamics of southern leatherside populations we conducted a multi-year mark-recapture study and analysis of a stage-based transition matrix. Predation decreases lambda, and shifts the stable age distribution toward younger age classes. Survival of young to age 1 and transition of juveniles to adults are the most important fitness-related parameters. Introduced predators exert strong ecological effects on southern leatherside chub, and although there is no indication of an evolutionary response to introduced predators yet, there is a potential for effects.

0015 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Mauro Belleggia[2], Daniel Enrique Figueroa[3], Claudia Bremec[2], Felisa Sánchez[1], Anabela Zavatteri[1]

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Long Term Changes in the Spiny Dogfish (*Squalus acanthias*) Trophic Role in the Southwestern Atlantic

This study describes the diet of the spiny dogfish *Squalus acanthias* in the Southwestern Atlantic Ocean (35 °S - 55 °S) by examining stomach contents data collected between 1984 and 2010. Of the 3638 individuals examined, 2217 (60.77%) had prey, at different stages of digestion, in their stomachs. Generalized Linear Models were used to evaluate the support in our data for five independent variables (Sex, Predator's Total Length, Season, Region and Decade) that may explain the consumption of given prey. Our results reveal changes in the trophic level and the diet composition over the time series. The frequency of Fish, *M. hubbsi* and Benthos in the stomachs decreased over the time series, whereas the squid *Illex argentinus* and Jellyfishes exhibited positive trends. We propose that the changes in the trophic relationships, which have been affected during

the last 30 years, are probably a consequence of the increasing fishing effort. The trophic level of *S. acanthias* fell from 4.68 in 1980's to 4.1 and 4.2 in 1990's and 2000's respectively, showing evidence of substantial "*fishing down the food webs*" phenomenon. The consumption of argentine anchovy (*Engraulis anchoita*) was best explained by Region and Season as independent variables; this underexploited species was the unique prey not explained by GLMs including Decade. In agreement with the distribution and abundance of *E. anchoita*, the spiny dogfish preyed more in Northern than in Southern Region, and the consumption was also greater in Warm than in Cold Season.

0732 Poster Session III, Sunday 10 July 2011

Jordan Benjamin[1], Kate Jackson[1], Sanda Ashe[2]

[1]Whitman College, Walla Walla, WA, USA, [2]Bio-Ken Snake Farm, Watamu, Kenya

A New System for Rapid Diagnosis and Treatment of Snakebite in Kenya

The purpose of this project is the creation and distribution of a new system for rapid diagnosis and treatment of snakebite in Kenya. Traditionally, snakebite patients in Africa present doctors with a number of complications that dramatically delay time from intake to treatment, including identification of the species responsible, severity of the envenomation, development of a treatment protocol, and timely procurement of lifesaving species-specific antivenom. The system is presented in poster format with a symptom-based algorithm and flow chart for diagnosis of various envenomation syndromes, tests and methods to gauge the severity of a patient's condition with indications for antivenom administration; a database of Kenyan venomous snakes organized relative to the syndrome of their envenomations containing information on venom composition, signs/symptoms, and epidemiological potential; and a map with clinic and antivenom stock distribution across the country. The format is designed to condense pertinent information into a single visual system to provide medical professionals with the best information to facilitate appropriate and expeditious treatment, and to address the complexities of treating snakebite in sub-Saharan Africa by leveraging the combined expertise of clinicians and herpetologists.

0430 Poster Session II, Saturday 9 July 2011

Torsten Berg[2], Ralph Saporito[1]

[1]John Carroll University, University Heights, OH, USA, [2]Kalamazoo College, Kalamazoo, MI, USA

Predation in the Dendrobatid Frog *Oophaga pumilio*: Does Frog Size Matter?

The family Dendrobatidae is well known for containing brightly colored and chemically defended frogs, all of which are presumed to be aposematic. Studies of aposematism in

dendrobatids have focused largely on avian predators, which have color vision. Relatively few studies have examined the importance of predation by color-blind predators, which are not able to perceive color as an aposematic signal. Previous studies have demonstrated that alkaloids in adult dendrobatids provide adequate protection from certain colorblind arthropod predators, yet virtually nothing is known about protection in juvenile frogs, which contain lower levels of alkaloid defenses. Herein we examine differences in predation upon juveniles and adults of the dendrobatid frog *Oophaga pumilio* and the chemically undefended frog *Craugastor bransfordii* by the colorblind predatory ant *Paraponera clavata*. The results of our experiment demonstrate that frog species has a significant effect on predation, and *C. bransfordii* were attacked significantly more often than *O. pumilio* ($p \leq 0.001$). Adult and juvenile *C. bransfordii* experienced similar predation rates ($p = 0.681$), but adult *O. pumilio* were preyed on significantly less often than juveniles ($p = 0.027$). Our results provide evidence that differences in the amount of alkaloids between juvenile and adult *O. pumilio* are detected by *P. clavata*, which results in differences in predation. Our findings also suggest the possibility that alkaloid chemical cues may function as an aposematic signal to predators that do not have color vision, whereas bright coloration may largely function as an aposematic signal to predators with color vision.

0361 Poster Session III, Sunday 10 July 2011

Abigail J. M. Berkey, Christopher A. Phillips, Marlis R. Douglas

University of Illinois, Champaign, IL, USA

Cross Amplification of Microsatellite Markers Designed for the Genus *Plethodon* in the Four Toed Salamander (*Hemidactylium scutatum*)

Microsatellites are a useful tool in population genetics due to their high levels of polymorphism, but the development of novel PCR primers can be expensive. A cost-effective alternative is cross amplification, the optimization of existing primers that were developed for related species. The cross amplification of primers designed for amphibians has been less successful than that of other taxa, even between congeners. Little is known about the population genetics of the four toed salamander (*Hemidactylium scutatum*). Microsatellite loci developed for the red backed salamander (*Plethodon cinereus*) and the Del Norte salamander (*Plethodon elongatus*) were screened for cross amplification in *H. scutatum*. These markers will be used to examine the gene flow and genetic variation between and among populations of *H. scutatum*.

0403 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

Moises Bernal[1], William Ludt[1], Matthew Craig[3], Brian Bowen[2], Luiz Rocha[1]

[1]University of Texas Marine Science Institute, Port Aransas, TX, USA, [2]Hawaii Institute of Marine Biology, Honolulu, HI, USA, [3]University of Puerto Rico, Mayaguez, Puerto Rico

Phylogeography of *Halichoeres claudia* and *Halichoeres ornatissimus*: New Insights on Patterns of Population Connectivity across the Central-West Pacific.

Population connectivity across wide geographic ranges is still a matter of debate in phylogeography. As pelagic larval duration by itself does not explain high levels of connectivity, alternate hypotheses have been suggested. One of them is the species range hypothesis, which asserts the amount of connectivity between populations will be proportional to the geographical range a species occupies. In the presented work we tested the species range hypothesis with two closely related species of wrasses, *Halichoeres claudia* and *Halichoeres ornatissimus*. These species are ideal for this comparison as the first occupies a wide area across the entire Central-West Pacific, whereas the second is restricted to the Hawaiian archipelago and Johnston Atoll. For this comparison we used mitochondrial markers (cytochrome oxidase I and control region) to determine population connectivity between the different sites. For *H. claudia* we found population structure between Marquesas and the rest of the Central- West Pacific. However, there was no differentiation between the Pacific locations and the two sites in the Indian Ocean. For *H. ornatissimus* on the other hand we found no population differentiation among the Hawaiian Islands, and modest but significant levels of structure between these islands and Johnston Atoll. As both species show significant structure in parts of their ranges regardless of range size, we urge caution in using species range as a proxy for genetic structure.

0245 Poster Session II, Saturday 9 July 2011

Virgínia Bernardes, Camila Ferrara, Richard Vogt

Instituto Nacional de Pesquisas da Amazônia - INPA, Manaus, Amazonas, Brazil

Population Structure of *Podocnemis erythrocephala* in the Unini River, Amazonas, Brazil

We studied the population structure, sex ratio and abundance of the red headed river turtle *Podocnemis erythrocephala*, on the Unini River a tributary of the Negro River in Brazil. Turtles were marked and recaptured throughout the year in both rainy and dry seasons. We used trammel nets with three different sizes of mesh to capture turtles in the lakes. The nets were checked every three hours and during their 12 hours per day in the water. During the study, 352 individuals were marked, 162 males, 150 females and 40 immatures. The males captured had a straight line carapace length mean of 210 ±

14,02 mm (163-262) and females mean of 251 ± 17, 75 mm (221-303). The population structure showed that most of individuals belong of the intermediate size classes: males (200-210 mm) and females and (230-270 mm). All the sizes (carapace length, carapace width, plastron length and plastron width) and weight were significantly larger in females than in males (ANOVA, $p < 0,05$). The sex ratio of adults was 1,05 males per female, not significantly different from 1:1. The turtles were recaptured just one time, five males, five females and two immatures. The population showed recruitment and the adults are in equilibrium, but few belong to the smaller or larger size classes.

0455 Poster Session III, Sunday 10 July 2011

Rafael Bernhard, Richard Carl Vogt

Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil

Growth and Sexual Maturity of *Podocnemis erythrocephala* of the Middle Rio Negro, Amazonas, Brazil

We tested the accuracy of using growth rings on the epidermal scutes of the carapace of *Podocnemis erythrocephala* to determine age, age at sexual maturity, and growth rates. The study was conducted from November 2003 through February 2008 in the Ayuanã River, a tributary of the middle Rio Negro. Photos of the first left costal scute were compared for number and size of growth rings between first capture and all recaptures to determine the number of growth rings formed per year. Sexual maturity in females was determined by the presence of shelled eggs and/or gonadal analysis. Sexual maturity in males was determined by ontogenetic changes in the pre-cloacal tail length and gonadal analysis. Growth rates were obtained from the variation in the size of the carapace between recaptures. A nonlinear growth model was used to estimate growth rates: von Bertalanffy as modified by Fabens. Males reached sexual maturity at a mean of 161 mm in straight line maximum carapace length, females at a mean of 222 mm. Sexual maturity in both males and females was estimated to be nine years.The growth rings formed between recaptures did not correspond to a specific period of time nor to the number of periods of high and low water levels between captures. Immature turtles have a faster growth rate than adults; the growth was linear with the increase in carapace length.

0150 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

James Berry

Elmhurst College, Elmhurst, IL, USA

Why are There So Many Species of *Kinosternon* in Mexico?

Approximately 12 of the 20 or so species of mud turtles of the genus *Kinosternon* have distributions that include parts of Mexico, far more than occur in any other country.

Previous studies have attributed this pattern generally to endemism, environmental diversity, and competitive relationships. This study uses a multiple regression analysis to examine geographical and ecological factors, and unconventional factors such as herpetological exuberance, to determine the most likely factors explaining the pattern. The results suggest a complex interrelationship of factors.

0770 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Kebede Beshera, Phillip Harris

The University of Alabama, Tuscaloosa, AL, USA

Evolutionary Relationships and Population Genetic Structure of *Labeobarbus* (Cyprinidae) Species Flock of Lake Tana, Ethiopia

Lake Tana, Ethiopia's largest lake, is known to harbor highly diverse *Labeobarbus* (Cyprinidae) whose organization has been recently qualified as a 'species flock'. This diversity was noticed as early as 1836, but there is still a great deal of speculation regarding its taxonomy and origin. The latest revisions described 15 species of *Labeobarbus* in Lake Tana based on morphological characters. However, genetic isolation among the species has not yet been demonstrated. Population genetic structure and phylogenetic relationships of L. Tana's *Labeobarbus* were assessed based on microsatellite markers and mitochondrial cytochrome *b* and cytochrome oxidase I gene sequences to test if 15 recently recognized *Labeobarbus* species of L. Tana are genetically distinct to warrant species recognition. 174 specimens representing L. Tana's *Labeobarbus* species, *Labeobarbus intermedius Varicorhinus besso* and *Labeobarbus gananensis* were examined. RAxML analysis based on cytochrome b and cytochrome oxydase I gene sequences seemed to refute monophyly of L. Tana *Labeobarbus* species. Cross species amplification of microsatellite loci showed that 20% of the 50 successfully amplified microsatellite loci were polymorphic. The lack of phylogenetic resolution and the existence of very few polymorphic microsatellite loci suggest that the diversity within Lake Tana's *Labeobarbus* is probably a result of extremely recent radiation and speciation processes. Currently, genotyping using 10 microsatellite loci is underway and preliminary results seem to indicate that these microsatellite loci could be useful in revealing population genetic structure within this unique species flock.

0628 Poster Session II, Saturday 9 July 2011

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Population Genetic Structure in the Genus *Cycleptus*

The genus *Cycleptus* is a highly migratory group of large riverine fishes that occupies a vast portion of North America. Although widespread, they are of prominent conservation concern throughout; thus, timely knowledge of intrageneric diversity is important for management decisions. In this study, we examined intrageneric population structure with two highly variable molecular data sets. Analysis of mtDNA sequences revealed a pattern of allophyly in the two described species, *Cycleptus elongatus* and *C. meridionalis*, while the Rio Grande population is reciprocally monophyletic and clearly divergent from the others. Bayesian analyses of microsatellite data from throughout the range indicates long-term reproductive isolation of the two described species and lends further support for the designation of the Rio Grande clade as a distinct taxonomic unit.

0531 AES Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Dana Bethea, Kelcee Smith, John Carlson

NOAA Fisheries, Panama City, FL, USA

Environmental Effects on the Recruitment of Smalltooth Sawfish, *Prisits pectinata*, in Southwest Florida, USA

The completion of the Smalltooth Sawfish Recovery Plan initiated a new phase of conservation objectives for the US population of smalltooth sawfish, *Prisits pectinata*. Research and monitoring priorities identified in the Recovery Plan include monitoring recruitment and juvenile abundance in designated critical habitat and identifying affecting factors. Over the last 3 years, major environmental differences existed during peak times of hypothesized recruitment of neonates. Early 2010 posted unusually cold air temperatures for southwest Florida, resulting in the mortality of over 200 Florida manatee and several species of teleosts fish. Average backwater temperature in February 2010 was 17 ^{o}C; whereas, temperatures in other years are generally above 23 ^{o}C. Additionally, southwest Florida experienced unusually high rainfall during the "dry season" (December – May) and usually low rainfall during the "wet season" (June – November) in 2010, causing average backwater salinity to drop below 10 at certain times. In 2010, we experienced a significant decline in juvenile smalltooth sawfish recruitment over previous years with annual catch-per-effort dropping from 0.12 animals per net hour to 0.06 animals per net hour. In addition, juvenile smalltooth sawfish were not captured in 2010 until June when they are historically first encountered

in late-March. We believe the unusually colder temperatures and lower salinity levels are the cause of the lower catch rates in 2010 and may be indicative of a recruitment failure.

0636 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Lily Bieber-Ham, Scott Boback

Dickinson College, Carlisle, PA, USA

Using Camera Traps to Detect Hatchling Turtle Predators in Pennsylvania

Female Painted turtles (*Chrysemys picta*) often lay clutches of eggs in the late spring and early summer, with hatchlings pipping from these eggs in the late summer and early fall. However, hatchlings often remain underground, overwintering in the nest, and emerging the following spring. Prior research has suggested that one of the possible benefits of emerging in the spring is the decreased risk of predation. This study aimed to quantify predation intensity on hatchling Painted turtles in Pennsylvania both in the fall and spring. Motion-sensitive cameras were used to monitor hatchling replicas at documented nesting sites. In an attempt to differentiate between visual and olfactory predators, replicas were either unscented or scented with water from an aquarium housing a hatchling turtle. We present preliminary data obtained from 1,965 animal images during 2,016 camera hours in the fall of 2010. These data document minimal predation pressure on hatchling Painted turtles in the fall. Data obtained from spring trials will be analyzed and compared to those obtained in the fall to detect whether differences in predation exist during these times. Our results demonstrate the utility of game cameras and hatchling replicas in detecting Painted turtle predators.

0707 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

Phil Bishop[1], Jaime Garcia-Moreno[2], Simon Stuart[3], George Rabb[4], Jonathan Baillie[2]

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The Amphibian Survival Alliance (ASA) Jumps into Action.

The 2004 Global Amphibian Assessment published by IUCN revealed that amphibians are the most imperiled class of vertebrates, with at least 1 in 3 species currently facing extinction and as many as 159 species already recently extinct. Although the 2005 Amphibian Conservation Summit generated an Amphibian Conservation Action Plan (ACAP) outlining steps to understand, halt, and reverse the crisis, progress has been uneven, disjunct, and generally deficient due to a lack of coordination and funding. At a

mini-summit in 2010, participants agreed to form an Amphibian Survival Alliance (ASA) of organizations and institutions to oversee implementation of the ACAP, focusing initially on the urgent threats of habitat destruction and change and of chytridiomycosis. The IUCN has recently appointed two people to undertake the formation and coordination of the Amphibian Survival Alliance to implement the Amphibian Conservation Action Plan in cooperation with scientists and members of the ASG of SSC/IUCN. The ASA's plans and the necessary action steps will be discussed in this presentation.

0620 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Devin Bloom

University of Toronto, Toronto, ON, Canada

Does Habitat Control Lineage Diversification Rates? A Test Using Molecular Phylogeny and Biogeography of Silversides (Atherinopsidae)

Freshwater habitats make up only ~0.01% of available habitat and yet harbor 40% of all fish species, while marine habitats comprise 99% of available habitat and yield only 60% of fish diversity. Yet, no study has offered a sufficient explanation for the underlying processes that generated this discrepancy in aquatic biodiversity. One possible explanation is that net diversification rates (speciation-extinction) are higher in freshwater habitats than in marine habitats. I used New World Silverside fishes in the subfamily Menidiinae (Family: Atherinopsidae) as a model system for investigating species richness across marine and freshwater clades. Menidiinae includes 74 species distributed across western Atlantic and eastern Pacific marine habitats, as well as continental freshwater habitats in North and Central America. I used a multi-gene (>4kb) time-calibrated phylogeny and ancestral character reconstruction to determine the frequency and timing of habitat transitions in Menidiinae. I then used a state dependent speciation-extinction approach to test for differences in net diversification rate between marine and freshwater lineages. My results show that Menidiinae is an ancestrally marine lineage that independently colonized freshwater habitats three times followed by two reversals to the marine environment. I found that net diversification rates are not always higher in freshwater lineages, but rather that particular geographic regions may act as "hotspots" that generate a disproportionate amount of freshwater diversity.

0573 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Flávio Bockmann[1], Roberto Reis[2]

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Two New, Beautifully-Colored Species of the Neotropical Catfish *Cetopsorhamdia* Eigenmann and Fisher, 1916 (Siluriformes, Heptapteridae) from Western Brazil, with a Cladistic Analysis of the Genus

The heptapterid genus *Cetopsorhamdia* encompasses catfishes which inhabit fast-flowing rivers in South America. In this work, we present two new, distinctly colored species of this genus caught in nearby localities of central Brazil during the Transcontinental Catfish Expedition (All Catfish Species Inventory Project/NSF). *Cetopsorhamdia* new species 1 is from the upper Rio Madeira basin, in State of Rondônia, while *Cetopsorhamdia* new species 2 is from the upper Rio Tapajós drainage, in State of Mato Grosso. These species are markedly diagnosed by their autapomorphic color patterns of the trunk: the new species 1 has well-defined quadrangular marks while the new species 2 bears irregular, vertical bars. The first cladistic diagnosis for *Cetopsorhamdia* is provided on the basis of synapomorphies of skull, suspensory, fins, and body coloration. Besides the two species herein presented, five species are recognized as valid members of *Cetopsorhamdia*: *C. boquillae*, *C. iheringi*, *C. insidiosa*, *C. nasus* (its type species), and *C. picklei*. The nine other species assigned to *Cetopsorhamdia* are transferred to distinct heptapterid genera (some of them new). *Cetopsorhamdia boquillae* is unequivocally recognized as the most basal species of *Cetopsorhamdia*, whereas the two undescribed species form a monophyletic group which is the sister to the clade composed of all other species of the genus exclusive of *C. boquillae*. *Cetopsorhamdia* is hypothesized to be closely related to the clade formed by *Chasmocranus*, *Pariolius*, *Phenacorhamdia*, and related forms, since they share exclusive attributes of the head laterosensory system and optic and facial enervation. Financial support by CNPq and FAPESP.

0387 Poster Session II, Saturday 9 July 2011

Benjamen Bond[1], Susan Lyons[1], Peter Braun[2], Angela Horner[2], Molly Morris[1]

[1]Ohio University, Athens, OH, USA, [2]Brown University, Providence, RI, USA

Alternative Growth Strategies and the Tradeoffs Between Growth, Development and Swimming to Survive

There is extensive evidence that most organisms are capable of growth rates that are far greater than those exhibited in nature, suggesting tradeoffs between growth rate and other life history traits, such as developmental differentiation (growth-differentiation hypothesis). Here we examine how variation in diet quality influenced the morphology,

growth and swimming performance of males in the swordtail fish *Xiphophorus multilineatus*. It has been hypothesized that increased growth could reduce relative allocation of resources to muscle development, which could negatively impact swimming performance. We expect this tradeoff to be stronger with individuals raised on a low as compared to high protein diet. We describe the relationship between juvenile growth rate, and several morphological traits and then test the prediction that individuals growing faster than predicted for their size are less proficient at aspects of the fast start escape response.

0572 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Michelle Boone[1], Caren Helbing[2], Nik Veldhoen[2], Melissa Youngquist[1]

[1]*Miami University, Oxford, OH, USA,* [2]*University of Victoria, Victoria, BC, Canada*

Effects of Insecticide Exposure at Different Times in Larval Development on Green Frog Thyroid Hormone Action and Metamorphosis

The orchestration of metamorphosis is initiated and integrated by thyroid hormones. Pesticides can affect thyroid production, breakdown, or function; because abundance of thyroid hormones changes during larval development, the impact of pesticides may vary depending on developmental stage of the amphibian. Previous studies have found that green frogs reach metamorphosis earlier or are more developed when exposure to the insecticide carbaryl occurs later in development, suggesting that carbaryl could affect the thyroid hormone axis. We examined the effects of carbaryl exposure on green frog (*Rana clamitans*) tadpoles exposed or not to 1 mg/L of carbaryl at 2, 4, 8, or 16 weeks after hatching in the laboratory; exposure lasted 72 hours. We examined effects on survival, metamorphosis, and thryoid response genes in the brain. We found that carbaryl did not impact survival at metamorphosis, or mass at or time to metamorphosis, but it did significantly increase the abundance of some thyroid responsive genes (TR-alpha) in brain tissue. These results suggest that this insecticide can have endocrine disrupting effects that vary with time of development.

0266 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Cal Borden[1], Terry Grande[1], Wm. Leo Smith[2]

[1]Loyola University Chicago, Chicago, IL, USA, [2]Field Museum of Natural History, Chicago, IL, USA

Paracanthopterygii Revisited: An Assessment Based on Molecular and Morphological Data

Paracanthopterygii was introduced as an assortment of diverse fishes that essentially were neither actinopterygians nor protacanthopterygians. Characters justifying their monophyly included similar jaw mechanics and musculature, a caudal fin skeleton with the upper hypurals fused to ural centrum 2, a complete spine on preural centrum 2, and a reduction of epurals (£ 2). Fishes placed within Paracanthopterygii included Percopsiformes, Gadiformes, Lophiiformes, Gobiesociformes, and Batrachoidiformes to name a few. Since 1966, various groups have been removed leaving the Gadiformes as the only consistent member of paracanthopterygians. This study reexamines the taxonomic composition and phylogenetic relationships among putative paracanthopterygians in the light of recent studies, which suggest gadiforms and zeiforms as sister clades and *Stylephorus* (a putative lampriform) as the basal gadiform. Our approach used eight gene fragments (12S, tRNA-Val, 16S, 28S, histone H3, ENC1, RAG1) analyzed under the criteria of maximum parsimony and Bayesian inference to reconstruct phylogenetic relationships. As in other molecular analyses, *Stylephorus* was sister to all gadiforms, and together, they were sister to zeiforms. Percopsiformes [percopsids (aphredoderids amblyopsids)] and polymixiids were each monophyletic and sequential clades to gadiforms-zeiforms. If the term "Paracanthopterygii " is to be retained and defined as the sister clade to "Acanthopterygii", paracanthopterygians would include polymixiiforms, percopsiforms, zeiforms, gadiforms (including *Stylephorus*). Historically important osteological and myological characters were then reassessed based on this new phylogenetic hypothesis, including the taxonomic distribution and homology of "extra" (X and Y bones) caudal fin elements. Congruence between morphology and molecular data is discussed. Future plans are outlined.

0402 Poster Session II, Saturday 9 July 2011

Cal Borden[1], Guillermo Ortí[1]

[1]University of Nebraska-Lincoln, Lincoln, NE, USA, [2]George Washington University, Washington, D.C., USA

Molecular Systematics and Biogeography of *Semaprochilodus* Characiforms

The Neotropical ichthyofauna of South America is one of the most diverse assemblages of fishes, and numerous models have been invoked to effectively account for this

diversity. We reconstructed species-level relationships in a small clade of flannel-mouth characiforms (*Semaprochilodus*, Prochilodontidae) distributed east of the Andes. We evaluated geographical and ecological-based hypotheses of speciation with respect to geological history, basin hydrology, and water-type. A mitochondrial gene tree of 54 individuals was constructed to assess the limits of the nominal morphospecies and to identify potential field misidentifications. Phased sequences of one mitochondrial and five nuclear loci from five individuals per lineage were then analyzed using Bayesian and parsimony criteria. *Semaprochilodus* is sister to *Prochilodus*, and both form the sister clade of *Ichthyoelephas*. *Semaprochilodus* is comprised of two clades, each of three species. One clade [(*varii* (*laticeps*, *brama*))] is distributed outside the mainstem Solimões-Amazonas, while the second clade [(*taeniurus* (*insignis*, *kneri*))] is restricted to the mainstem Solimões-Amazonas and the Orinoco basins. Their distributions suggest divergence of peripheral populations following reduced gene flow. Interestingly, sympatric species in the Solimões-Amazonas displayed more morphological apomorphies. Whether these changes in the upper jaw, branchial gills, and gill cover result in niche differentiation is unknown. One sympatric species in the Solimões-Amazonas (*insignis*) has recently dispersed into the Orinoco basin and differentiated (*kneri*). Such long distance dispersal is consistent with the sister group relationship of *kneri* and *insignis*, the paraphyly of *insignis* mitochondrial haplotypes, and the inability of meristic and morphometric measurements to unequivocally differentiate them.

0339 Poster Session III, Sunday 10 July 2011

Paul Borsuk, Randolph Krohmer

Saint Xavier University, Chicago, IL, USA

Colocalization of Aromatase and Nitric Oxide Immunoreactive Neurons in the Forebrain of the Male Red-Sided Garter Snake

Nitric oxide (NO) first identified as an endogenous regulator of blood vessel tone, may also serve as a neurotransmitter. With a half-life of less than five seconds, NO has been examined by assessing the presence enzymes responsible for the formation of NO. The NO producing enzyme, reduced nicotinamide dinucleotide phosphate-diaphorase (NADPH-d) is broadly distributed in the mammalian and avian brain, particularly in steroid-sensitive areas implicated in the control of reproductive behavior. In addition, distribution of NADPH-d corresponds to areas with dense populations of cells containing the aromatase enzyme (ARO). Previously, we found aromatase immunoreactive (ARO-ir) cells to occur at all levels of the male red-sided garter snake (RSGS) brain. However, cells containing the highest concentration of ARO-ir were concentrated in regions classically associated with the control of courtship behavior and mating. In the current study, we examine the anatomical relationship between ARO and NO by labelling ARO-ir and NADPH-d (NO-ir) cells. The distribution of ARO-ir cells was similar to that reported by Krohmer et al (2002) with NO-ir cells significantly overlapping the ARO-ir cells in regions critical for the control of courtship behavior,

such as the preoptic area, bed nucleus of the stria terminalis, nucleus sphericus, hypothalamus, and septum. Tissues double labelled for ARO and NADPH-d revealed a possible co-localization of these enzymes within the same cell subset. Based on these data, the close association of ARO-ir and NO-ir cells suggest input from NO-positive neurons may modulate the expression or activity of ARO in the male red-sided garter snake brain.

0154 Fish Conservation, Symphony III, Saturday 9 July 2011

Stephen A. Bortone, Karen M. Burns, John T. Froeschke, Carrie M. Simmons, Steven M. Atran, Ryan Rindone

Gulf of Mexico Fishery Management Council, Tampa, FL, USA

Research Status Following the BP Deepwater Horizon Oil Spill

The Gulf of Mexico Fishery Management Council, authorized under the Magnuson – Stevens Act, is responsible for the management of fishes and invertebrates in Gulf of Mexico federal waters. Measures to end overfishing and rebuild stocks toward creating sustainable fisheries depend upon a healthy ecosystem. The Deepwater Horizon oil spill and natural occurrences of other extreme environmental impacts, including red tides and hurricanes, can profoundly influence the Gulf Council's ability to achieve sustainability of our fishery resources, especially as these events may curtail normal ecological services available to these resources. Specific concerns are loss of current and future year classes and eggs and larvae advected into proximate locations by currents. Because it can take three to five years for individuals of many fish stocks to recruit to the fishery, impacts on fishery resources may not be immediately apparent. Additional effects are: ocean acidification; increased toxins in phytoplankton and zooplankton and the subsequent bioaccumulation of these toxins through food webs; loss or alteration of essential spawning and nursery habitats; new or increased areas of hypoxia; and effects of oil and dispersants on coral, seagrasses, mangroves, and macroalgae that provide habitat for managed species. Impacts on forage species could affect predator-prey relationships, growth rates, natural mortality and stock distribution. The Gulf Council is identifying databases (existing and forthcoming) and appropriate analytical methods necessary to make meaningful assessments and evaluate future management actions allowing Gulf fisheries to remain sustainable (or become sustainable) in light of short- and long-term, extreme environmental perturbations.

0686 Poster Session III, Sunday 10 July 2011

Noelle Bowlin

Scripps Institution of Oceanography, La Jolla, CA, USA

Mesopelagic Fish Diversity in the Santa Barbara Basin

Life in the mesopelagic zone requires a variety of adaptations to cope with the physical constraints of this region. Food availability in this zone is limited, thus, many mesopelagic fishes migrate vertically to the surface at night to feed in the nutrient rich epipelagic zone, returning to depth at dawn. Mesopelagic fishes in the Santa Barbara Basin of the southern California Bight cope with the added constraint of an oxygen minimum layer. Isaacs-Kidd Midwater Trawls were towed at night in the Santa Barbara Basin on a nine day cruise in September 2010 to assess the mesopelagic fish diversity in this oxygen-poor region. Results will be compared to a similar study done in the neighboring San Pedro Basin.

0404 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Krista A. Boysen[1], Casey B. Dillman[2], Robert M. Wood[1]

[1]Saint Louis University, St. Louis, MO, USA, [2]Virginia Institute of Marine Science, Gloucester Point, VA, USA

Sequence Validation of Known Microsatellites of *Scaphirhynchus* Sturgeon Species from the Lower Mississippi River Basin

To date there have been many molecular studies on species of *Scaphirhynchus*. These studies have utilized allozymes, as well as nuclear and mitochondrial DNA in an attempt to identify species, populations, and quantify effects of hybridization. Further complicating the issue is the hypothesized slow rate of molecular evolution in sturgeon, which is supported by the fact that none of these data types has proven to be of utility in the diagnoses of *Scaphirhynchus* species. The imperiled status of these species and lack of robust diagnostic markers necessitates a continued effort. Many microsatellite loci have been developed for *Scaphirhynchus* and have been used with great success to genotype individuals. Recent research however has questioned the validity of microsatellite data due to various mutational mechanisms. These mutations can lead to genotyping errors as observed allelic polymorphism could be mistaken for species or population-level variation. Thus alleles that are considered homologous may in fact be homoplastic. In this study, we sequenced alleles for microsatellites from 10 individuals of both *S. albus* and *S. platorynchus* as well as six individuals of *S. suttkusi*, which served as the outgroup. The sequence data were examined for microsatellite verification as well as for potential species specific nucleotide characters. Sequences from each locus were independently explored and a concatenated matrix of aligned data was also investigated. Validation of previously published microsatellite motifs and number of repeats will be reported.

Genotyping errors will be calculated for implementation in future genotyping of new individuals of *Scaphirhynchus* for these loci.

0400 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Dennis Bramble

University of Utah, Salt Lake City, UT, USA

Earthquakes and Ears: Interpreting the History of the North American Gopher Tortoises

Gopher tortoises are a North American clade of fossorial testudinids with a rich fossil record extending back to at least the late Eocene. The modern species represent two distinct genera, *Gopherus* and *Xerobates,* which have been separate since the Middle Miocene (~18 mya). Among the most striking morphological features that distinguish the groups is the structure of the inner ear. The distinctly wider skull of *Gopherus* reflects a dramatically inflated inner ear chamber containing a saccular otolith of remarkable dimensions. The relative size of the otolith in modern *G. polyphemus* and *G. flavomarginatus* likely exceeds that of any known tetrapod. The inner ear in *Xerobates* does not differ greatly from that of other testudinids and harbors only a small otolithic mass. The detailed anatomy of the highly specialized inner ear of *Gopherus* points to an enhanced capacity for detecting and interpreting weak substrate vibrations. It is suggested that, historically, this amplified sensory capability functioned to reduce the risk of these turtles emerging from their protective burrows at times when surface conditions heightened the chance of injury or death. The effective use of the inner ears as "seismometers" may likewise help to explain the distinctive geometry of the burrows constructed and maintained by *Gopherus* (but not *Xerobates*). Finally, the historic and current distributions of *Gopherus* and *Xerobates* strongly suggest that their evolutionary divergence is correlated with regional patterns of seismicity within North America, raising the possibility that earthquake activity may been influential in shaping the history of these tortoises.

0206 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Camrin Braun[1], Gregory Skomal[2], Michael Berumen[3], Simon Thorrold[2]

[1]The College of Idaho, Caldwell, ID, USA, [2]Woods Hole Oceanographic Institution, Woods Hole, MA, USA, [3]King Abdullah University of Science and Technology, Thuwal, Saudi Arabia

Movements of Juvenile Whale Sharks (*Rhincodon typus*) in the Red Sea

The whale shark (*Rhincodon typus*) is widely distributed in tropical and warm temperate waters worldwide. Although trade has been banned in many countries, unregulated

whale shark fisheries are still common in some areas. Potential fisheries mortality and the lack of population information led the IUCN to list them as "vulnerable." The biology of the whale shark is poorly understood; however, the species is known to form seasonal aggregations near reefs. We recently discovered a globally significant group of juvenile whale sharks on the northern end of the Farasan Banks in the eastern Red Sea. Our study describes short- and long-term movements of whale sharks from this site. In 2010, forty-seven juvenile sharks were fitted with combinations of satellite and acoustic transmitters for tracking shark location and depth. A hydrophone array was constructed near the tagging locations to monitor acoustic tag signals. Much of the shark traffic in this area was concentrated in a small portion of the reef. Large-scale movements were determined from 10 SPOT5 satellite tag deployments. One individual moved to the northern end of the Red Sea before returning to the coast north of the tagging site after travelling 2,000 km in 115 days. Five whale sharks showed similar southerly movements toward Bab el Mandeb Strait before tag detachment. A single whale shark was confirmed off the southern coast of Oman after traveling 3,000 km over a 104-day period. Our results suggest the southern Red Sea may serve as an important nursery for juvenile whale sharks.

0433 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Camrin Braun, Christoph Walser

The College of Idaho, Caldwell, ID, USA

Distribution and Diet of Largemouth Bass (*Micropterus salmoides*) in the Lower Boise River, Idaho

Where introduced, largemouth bass *(Micropterus salmoides)* are known to have negative effects on aquatic ecosystems. In this study, we used historical museum collection records (1942-2006) and contemporary (2009) collections to assess changes in the distribution of largemouth bass in the Boise River (southwestern Idaho). We also examined the stomach contents of largemouth bass collected during the contemporary survey to determine diet. Seventy-four largemouth bass (45-137mm TL) were represented in 13 historical collections from five Boise River locations. During autumn 2009, we sampled eight sites in the lower Boise River for largemouth bass. Sixty-one largemouth bass (range 55-156mm TL; mean=84mm) were captured from five sites downstream of a 4-m high diversion dam. Largemouth bass were absent from all sites upstream of the dam. Our contemporary collection data extends the known distribution of largemouth bass 7.2 river km upstream. The long-term persistence (without recent stocking) of largemouth bass in the Boise River indicates the fish may be spawning in the river and/or entering the system from external sources. Eighty percent of the largemouth bass collected in 2009 were less than 100mm TL. Analysis of largemouth bass stomach contents revealed aquatic insects (40%), crayfish (37%), and small–bodied fishes (11%) comprised much of the diet. Our study confirms that the largemouth bass is successfully established in the Boise River, and the species is piscivorous at small sizes

(less than 100mm TL). These findings suggest that largemouth bass could have a negative impact on native Boise River fishes.

0326 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Ralf Britz[1], Kevin Conway[2], Lukas Ruber[1]

[1]The Natural History Museum, London, UK, [2]Texas A&M University, College Station, TX, USA

Paedocypris, not a Cypriniform?! An Evaluation of the Evidence. Part 1 Morphology

One of the most unusual discoveries in systematic ichthyology of the last decade is the cyprinid genus *Paedocypris*. Its three described species include some of the smallest vertebrates with individuals maturing at less than 8 mm standard length. *Paedocypris* has the appearance of a larval fish and its skeleton is highly reduced with more than 40 of the bones typically present in cypriniforms and other ostariophysans missing. The phylogenetic position of *Paedocypris* among cypriniforms was hypothesized to lie with the danionine cyprinids, specifically the genera *Sundadanio* and *Danionella*. A recent molecular analysis has challenged this hypothesis and has argued that *Paedocypris* is "neither a cyprinid nor a cypriniform". This study also concluded that the newly recovered position of *Paedocypris* "as the sister-group to all Cypriniformes" is "supported by a reevaluation of the anatomical characters presented." Part one of our two part presentation (for part 2, see Rüber, Conway & Britz) looks at the morphological evidence for placing *Paedocypris* among Ostariophysi and discusses previous hypotheses.

0767 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

Christopher Brochu

University of Iowa, Iowa City, IA, USA

The Giant Horned Crocodiles that Ate Our Ancestors and Their Phylogenetic and Biogeographic Implications

Crocodiles are common in most East African deposits of Miocene through Quaternary age preserving human ancestors, but have received somewhat less attention. One, *Crocodylus anthropophagus* from the Pleistocene of Olduvai Gorge, Tanzania, had a prominent "horn" on each squamosal and was found in association with hominid bones preserving crocodile bite marks. A new horned crocodile closely related to *C. anthropophagus* has been identified from the Mio-Pliocene of the Lake Turkana Basin of Kenya. This is the largest known crocodile, with some individuals reaching a total

length of 7.0 to 7.5 m; and depending on how relationships are resolved, the lineage including the Nile crocodile *C. niloticus* (one of the largest living crocodylians) may actually reflect a reduction in body size over time. These fossils constrain the timing of divergence (but not necessarily of dispersal) between *C. niloticus* and living Neotropical crocodiles minimally to 7 million years, consistent with molecular evidence and reinforced by reanalysis of *Crocodylus checchiai* from the Late Miocene of Kenya and Libya, which had a large midrostral boss similar to those found in Neotropical *Crocodylus*. Ongoing phylogenetic analyses of other Neogene crocodiles (including some truly bizarre forms) suggest a complex biogeographic history in Africa and the western Indian Ocean, with multiple dispersal events to and from the region impacting what may have been a morphologically diverse endemic radiation represented today only by the dwarf crocodiles (*Osteolaemus*). These are part of a global pattern of repeated replacement of endemic crocodyliform radiations over the past 20 million years.

0556 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011, NIA BEST STUDENT PAPER AWARD

Kristen Brochu[1], William G. R. Crampton[2], Javier A. Maldonado Ocampo[3], Nathan R. Lovejoy[1]

[1]University of Toronto, Toronto, ON, Canada, [2]University of Central Florida, Orlando, FL, USA, [3]Universidad Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brazil

Molecular Phylogenetics of the Neotropical Electric Knifefish Genus *Gymnotus* (Gymnotidae, Teleostei): Biogeography and Signal Evolution of the Trans-Andean Species

Gymnotus, the banded electric knifefish, is a diverse genus with a range that extends from Argentina to southern Mexico. It includes species distributed both east (cis-Andean) and west (trans-Andean) of the Andes. Seven species of *Gymnotus* exhibit exclusively trans-Andean distributions; however, only one has been included in molecular studies (*G. cylindricus*). Each *Gymnotus* species exhibits a distinctive electric organ discharge (EOD), used for communication and navigation. The two trans-Andean species with a known EOD, *Gymnotus cylindricus* and *Gymnotus maculosus*, have monophasic (i.e. composed of a single phase) EODs. In contrast, adults of all but one of the 22 species of cis-Andean *Gymnotus* with known EODs, exhibit triphasic or tetraphasic EODs. We collected five trans-Andean *Gymnotus* species in Panama, Costa Rica, and Colombia and recorded their EODs. We sequenced multiple nuclear and mitochondrial genes to incorporate these new taxa into a molecular phylogenetic hypothesis for *Gymnotus*. Our results suggest that the trans-Andean species are distributed in three separate clades, each with a cis-Andean sister group. We considered the evolution of EOD phase number in a phylogenetic context. Each trans-Andean clade exhibits reduced phase number relative to its cis-Andean sister group, with three trans-Andean species possessing monophasic signals. We provide hypotheses to account for

the unusually high proportion of trans-Andean taxa with reductions in EOD phase number.

0064 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

Bob Brodman

Saint Joseph's College, Rensselaer, IN, USA

Do Local Amphibians Believe in Climate Change?

I examined 17 years of frog call and salamander count data from an annual county survey in northwest Indiana to test the hypothesis that amphibians are responding to climate change by breeding earlier in the season. Mean temperatures (Jan-June) in the study area were 0.3 C warmer than normal from 1994-1997, and 1.5 C warmer than normal from 1998-2010. All nine frog species are calling significantly earlier (mean = 16.6 days) and all three salamander species are active significantly earlier (mean 14.0 days) since 2000-2002 compared to the 1990's.

0574 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Ronald Brooks

University of Guelph, Guelph, ON, Canada

The "Common" Snapping Turtle: What does Abundance Tell Us about Extinction and Conservation Priorities?

From Assessment to Recovery, the focus of species at risk activities is on species that are uncommon, have restricted distributions and are declining. The listing of the Snapping Turtle as a species at risk in Canada was disturbing to some, because the species is not rare and is still widespread, and although snappers are declining, the decline is not quantified and is rarely acknowledged. In these attributes, snapping turtles are similar to many listed marine fishes, trees and birds. Unlike these other species, the snapper is neither valued nor charismatic and lacks quantitative data on abundance. In essence, the facts pointing to snappers being at risk are overwhelming, but the perception of imperturbable abundance is emotionally powerful. I argue that one needs to market a good story for the former to overpower the latter. I address two key questions. First, how does one deal with the conflict between at risk deniers and the scientific data, especially when many deniers are stakeholders? Second, are there facts showing that protection of widespread, common species is at least as important as saving rare, ecologically restricted species? The common philosophy is to wait until a species is decimated before paying attention to declines which are often missed because no one is

tracking abundance. We also overlook the potential greater importance of common species to ecosystem stability and function.

0074 Poster Session III, Sunday 10 July 2011

Mary Brown[1], Susan Walls[2]

[1]Jacobs Technology, Gainesville, FL, USA, [2]United States Geological Survey, Gainesville, FL, USA

Effects of Acute Salinity on Larval Amphibians

Amphibians in freshwater coastal wetlands bordering the Gulf of Mexico periodically experience acute exposure to salinity from hurricane-related overwash events, as well as chronic exposure associated with rising sea levels. We conducted a laboratory study to test the hypothesis that native amphibians vary in their tolerance to changes in salinity. We exposed larval *Hyla cinerea* (Green Treefrog) and *Rana sphenocephala* (Southern Leopard Frog) from an inland population to acute salinity for 3 days. In replicated trials, we exposed tadpoles to 0.2 (control), 5, 10, 12, 14, and 16ppt salinity treatments. *Hyla cinerea* survived significantly longer at higher salinity concentrations of 12, 14, and 16ppt than did *Rana sphenocephala* of similar mass. There was no significant difference in survivorship among the control, 5, and 10ppt treatments for both species. *Hyla cinerea* exhibited 96.7% survival in the control, 100% in 5ppt, 56.7% in 10ppt, 3.3% in 12ppt, and 0 survival in the 14ppt and 16ppt. *Rana sphenocephala* survival was 96.7% in the control, 100% in 5ppt, 46.7% in 10ppt, and 0 in 12ppt, 14ppt, and 16ppt treatments. Our results demonstrated that species commonly associated with coastal freshwater wetlands may differ in their salinity tolerances, suggesting that salt water intrusion due to storm surges and sea level rise may affect the species composition of these ecosystems.

0733 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011

Rafe Brown

University of Kansas, Lawrence, KS, USA

Phylogenetic Analysis of Community Structure in Melanesian Forest Frogs

How do complex anuran communities form in Pacific island archipelagos? For a given island, island bank, archipelago, or region, have today's complex communities evolved in situ or assembled via ecological processes? At the low end of the spectrum of relative dispersal abilities, frogs are arguably the vertebrate group least capable of dispersal in the islands of the Philippines, Indonesia, New Guinea, the Solomon-Bismarck archipelagos and Fiji. Because frogs are relatively sedentary, susceptible to desiccation, and less tolerant of exposure to salt water, we might expect the diverse frog communities of the Pacific to be derived disproportionately from *in situ* diversification. In this study I used a phylogenetic approach to the study of community assembly to test

this prediction in Melanesian forest frogs. I find evidence for a diffuse combination of processes, with some complex communities arising exclusively as a result of ecological assembly (phylogenetic overdispersion) and others derived largely from speciation within islands and archipelagos (phylogenetically clustering). These results provide new insights into patterns of diversification for terrestrial vertebrate communities of the Pacific. Many island assemblages are the result of a combination of processes that interact in novel ways dictated by history of the lineages involved, the idiosyncrasies of individual taxa, and the geographical template of the landmasses themselves. The end result, my data suggest, is high levels of equivalent species diversity on many island banks, but complex communities are derived from different processes in the various archipelagos of the Pacific.

0541 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

William S. Brown

Skidmore College, Saratoga Springs, NY, USA

Work on *Terrapene coahuila* after the *T. ornata* Model of John M. Legler (1960) and Evidence of Habitat Loss over a 37-year Period (1965-2002)

In 1965, the author conducted a field study of the aquatic Coahuilan box turtle, *Terrapene coahuila*, work that was modeled after the pioneering monographic study of the ornate box turtle, *T. ornata*, by John M. Legler. The field work in Mexico was conducted while at Arizona State University under W.L. Minckley who had been a graduate colleague of Legler's at Kansas. On a graduate-student field trip to the Cuatro Cienegas basin with Minckley in December 1964, a study site was selected. Returning in the summer of 1965, *T. coahuila* were captured and marked in a series of shallow marshes within surrounding Chihuahuan shrub-grassland communities. In 2002, after a 37-year hiatus that included a valuable year as Legler's graduate student at the University of Utah before the author abandoned the anapsids in favor of limbless diapsids, the Mexican field site was revisited under the auspices of Dean Hendrickson and his doctoral student, Jennifer Howeth, of the University of Texas. Using the author's old survey maps and photographs, our field team located the sites of the original marshes. We found that there were no wetland habitats remaining, all marshes having been replaced by dense stands of grasses. With the evident disappearance of the original wetland habitats throughout the study area, the turtles had also disappeared. Our observations make imperative all available steps to protect the remaining wetland habitats of *T. coahuila* in the Cuatro Cienegas basin.

0078 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Jesse Brunner

Washington State University, Pullman, WA, USA

Amphibian Ranavirus Transmission and Persistence

While amphibian ranaviruses are transmissible via several routes—contaminated water, fomites, casual contact, and ingestion via cannibalism and necrophagy—most transmission seems to require close contact. This suggests that transmission is density-dependent. This is true at low densities, according to mesocosm experiments, but at ecologically relevant densities, transmission is essentially a frequency-dependent process. This, in concert with the potential for continued transmission from dead animals, suggests that ranavirus epidemics can extirpate their host populations. How, then, does ranavirus persist to cause recurrent epidemics in the larval segment of amphibians populations? Evidence of ranavirus being able to persist in the environment is mixed, but it is clear that many environments are inhospitable. Similarly, while ranaviruses have a wide host range, there are no demonstrated instances of long-term persistence in a reservoir host species, although this likely reflects a lack of research. In at least some environments there are no alternate hosts. In these places it appears that ranavirus persists in the form of occasional chronic, transmissible infections of their primary host. Just how common this phenomenon is is not known. There is a clear need for more research on 1) the relative importance of transmission from environmental sources, infected carcasses, and live hosts, and 2) transmission between the various members of a pond community. There is also a need to quantify ranavirus persistence in the environment and on fomites, which will help elucidate the risks of repeated epidemics and the translocation of these virulent pathogens.

0415 Poster Session III, Sunday 10 July 2011

Gary Bucciarelli[1], Lee Kats[2], David Schlais[2], Barbara Han[3], Andrew Blaustein[4]

[1]University of California, Los Angeles, CA, USA, [2]Pepperdine University, Malibu, CA, USA, [3]University of Georgia, Athens, GA, USA, [4]Oregon State University, Corvallis, OR, USA

Ultraviolet Radiation as a Factor in Perch Selection by a Neotropical Poison-dart Frog, *Oophaga pumilio*

Ultraviolet-B radiation (UV-B) can harm amphibian eggs, larvae, and adults. However, some amphibians avoid UV-B radiation when given the opportunity. The strawberry poison dart frog, *Oophaga pumilio*, is diurnal and males vocalize throughout the day in light gaps under forest canopies that expose them to solar radiation. Previous studies have demonstrated that males calling from high perches are more successful at mating than those at lower perches. We investigated whether frogs at higher perches receive more UV-B than those calling from lower perches. We also investigated whether frogs

on perches receiving relatively low UV-B levels maintained their positions for longer compared to individuals calling from perches receiving higher levels of UV-B. Finally, we artificially elevated UV-B levels to examine whether males exposed to artificially elevated UV-B abandoned their perches sooner compared to males exposed to visible light. We found that frogs called from perches receiving low UV-B regardless of perch height, and that frogs maintain their positions longer on perches receiving low UV-B compared to perches receiving even slightly higher UV-B levels. Exposing the frogs to artificially elevated levels of UV-B radiation caused males to move off of their perches faster than when they were exposed to a control light source. These experiments suggest that UV-B radiation plays an important role in frog behavior related to perch selection, even in rainforests where much of the solar radiation is shielded by the forest canopy.

0218 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Paulo A. Buckup

Museu Nacional / UFRJ, Rio de Janeiro, Brazil

Areas of Fish Endemism in the Southern Tributaries of the Amazon River

Southern tributaries of the Amazon river that drain the northern slope of the Central Brazilian Shield are characterized by clear and fast flowing waters that differ considerably from meandering muddy systems along the main Amazon. In order to investigate fine scale endemism associated with these rivers, an intensive sampling campaign was conducted in 111 locations of the middle Xingu (48) and Tapajós (52) basins, as well as in the upper Curuá-Una (9) drainages. The data covered 28 small-scale drainage units in the states of Pará and Mato Grosso. Undescribed and unidentifiable taxa with similar morphology were compared among sites to ensure conspecificy across localities. The data set included 455 species, but only 50 are shared among the three basins. Among the 288 species found in the Xingu river basin, 128 (44,4%) were collected exclusively in that basin; and among 305 species from the Tapajós bacin, 141 (46,2 %) are exclusive. Only 81 species were collected in the Curuá Una basin, which is much smaller than the other two drainages. Areas of endemism detected by parsimony analysis of endemism do not coincide with main basin limits. Although the Curuá-Una basin is recognized as a separate area of endemism, some subunits of the Tapajós are more closely related to the Curuá-Una than to other subunits in the same basin. The hilly terrain of the Serra do Cachimbo show very high diversity and endemism, wich is shared among headwaters of the Iriri river (Xingu basin) and the rio do Braço drainage (Tapajós basin). (Financial support: CNPq)

0219 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Jim Bull

University of Texas, Austin, TX, USA

Recollections of a Failed Turtle Biologist

The Legler lab in the 1970s was dynamic, with a focus on issues including but going well beyond turtle biology. My talk will offer a perspective on John's philosophy, his wisdom for the ages, and the impact he had on my career.

0583 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

George H. Burgess[1], Galal Nasser[1]

[1]Florida Program for Shark Research, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA, [2]Environment Department, Chamber of Diving and Watersports, Egyptian Environment Affairs Agency, South Sinai, Egypt

Sequential and Serial Shark Attacks on Humans Over an Abbreviated Period of Time and Space in Sharm el-Sheikh, Egypt: 6 Days, 5 Attacks, 2 Species - 2 Sharks?

In 2010, the tourist community of Sharm El Sheik, Egypt was shaken by the unprecedented occurrence of five severe shark attacks (one a fatality) over a six day period. All incidents took place within a stone's throw from shore and within a nine km stretch of coastline. A pair of attacks separated by 20 min and several hundred m occurred on 30 November and on the following day another pair occurred 6 km away and less than five minutes and 20-30 m apart. The testimony of abundant credible witnesses, fortuitous photographic evidence, and examination of wound characteristics allowed identification of the attacking species as shortfin mako (*Isurus oxyrinchus*) and oceanic whitetip (*Carcharhinus longimanus*) sharks, two pelagics not normally implicated in nearshore attacks. Evidence confirms that single individuals of each species were the attackers in two pairs of incidents. Although identification of the attacker in the fifth incident couldn't be confirmed, the wounds produced indicate the perpetrator was a carcharhinid of the same size as the twice-implicated attacking whitetip. When considered within the temporal-locational sequence, this suggests that a single whitetip could have been a partner to three attacks and that two sharks were responsible for all five. Furthermore, underwater photographers documented the movements and aggressive behavior of the attacking whitetip in the days immediately following the final attack. Biotic and abiotic factors contributing to this unique event are discussed with particular reference to elevated water temperatures, dumping of refuse by ocean-going vessels, overfishing, and attraction of marine life by feeding.

0447 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

Gordon Burghardt[1], Masahiro Shibasaki[2], Nobuyuki Kawai[4], Akira Mori[3], Nobuo Masataka[1]

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Snakes and Conservation: Do Monkeys Provide Lessons?

Conserving snakes is made much more difficult by the entrenched ophiophobia found in many cultures. As some snakes are dangerously venomous or large constrictors, evolved predispositions to avoid and fear snakes seem reasonable hypotheses. Recently, the consensus view has been that fear of snakes in human and nonhuman primates is not innate, but is easily acquired through observational learning. The studies on which this conclusion is based largely involve comparing responses of captive and wild-caught rhesus macaques. Such studies rarely use native snakes and often use model or toy snakes and often contain a number of other design flaws. We tested 8 adult Japanese monkeys, the closest relative to rhesus monkeys, who had been raised in captivity without encountering any snakes, or for that matter, virtually no other vertebrates besides their human caretakers. Using a standard WGTA primate test apparatus in which monkeys were trained to reach for a preferred food placed in front of a cage with a small native snake or a control stimulus, we found that several monkeys developed a strong reluctance to take the food and exhibited numerous stress-induced abnormal behaviors. Most monkeys also discriminated between a harmless and venomous species. In fact, for some monkeys, familiarity and repeated testing led to far stronger avoidant behavior than was seen initially. These results, along with data on humans, suggest that environmental education, rational appeals, and familiarity with snakes are not sufficient conservation strategies and underline the need for a continuing search for effective means to counter ophiophobia.

0181 Poster Session I, Friday 8 July 2011

Chaz Burke, Richard Durtsche, Hazel Barton

Northern Kentucky University, Highland Heights, KY, USA

Tadpole Developmental Impact of a Natural Anti-Fungal Solution to the Bat White-nose Syndrome as Determined by FETAX

White-Nose Syndrome has been an emerging bat epidemic that, with its current spread, is rapidly turning into a wildlife crisis. Outside of limiting cave access, wildlife managers have limited methods for controling this fungal infection. Our study investigates the environmental impact of a naturally occurring, plant produced, volatile organic compound that is currently undergoing testing as an antifungal agent to treat White-Nose Syndrome in bats. The anti-fungal agent (Carvone), undergoing testing to

determine toxicity and endocrine disruption in bats, is a derivative of spearmint oil. This investigation focuses on the potential toxicity of this anti-fungal agent on other cave aquatic organisms, namely amphibians. In testing the anti-fungal agent, we are conducting Frog Embryo Teratogenesis Assays with tadpoles of the frog *Xenopus laevis* (FETAX). The FETAX protocol provides a standardized method for evaluating potentially hazardous materials on the development of vertebrates. Hormone injection induced amplexus in three pair of *X. laevis* provided embryos for replicate testing of serial concentrations of the Carvone. Mortality and developmental abnormalities were recorded in these replicates through the 96 hour stage of development followng the FETAX protocols. Monitored embryo development followed the Nieuwkoop and Faber staging system for *Xenopus*, and experiments were initiated when each embryo was between stages 8 and 11 with the gelatinous coating of each embryo stripped off. These carvone tests were also conducted in several native anuran species of the genus *Lithobates*. By determining compounds with limited impact on sentinel species, we can continue tests in more sensitive cave species.

0116 Poster Session III, Sunday 10 July 2011

Michael D. Burns, Kathleen S. Cole

University of Hawaii at Manoa, Honolulu, HI, USA

Gonad Morphology of the Gobiid Genus *Fusigobius* and the Implications for the Evolutionary Relationships of the Genus

Gobiid fishes (Family Gobiidae, Order Gobioformes) consist of approximately 214 genera and 1,400 species, comprising the largest marine vertebrate family. The reproductive anatomy of gobiids is morphologically diverse among both gonochoric (i.e., non-sex changing) and hermaphroditic species. Although reproductive morphology varies considerably among hermaphroditic gobiid taxa, both morphology and development appear to be highly conserved within different hermaphroditic clades. Gonad morphology has been described for two *Fusigobius* species. Both show reproductive morphology similar to that of several hermaphroditic genera which are all closely related to one another (i.e., the Coryphopterus group). However, a recent phylogeny placed one of these two *Fusigobius* species in close association with the Coryphopterus group, and the other well-distanced, placing this genus in polytomy. A histological study was carried out to examine the gonad morphology of six additional *Fusigobius* species to determine whether reproductive morphology typical of the Coryphopterus group is widespread across the genus. This was found to be the case. All species examined showed distinctive tissue masses associated with the ovariform gonad that appear very similar to precursive accessory gonadal structures (pAGS) of many hermaphroditic goby species, including those of the Coryphopterus group, while testes showed no ovarian features. If *Fusigobius* is a hermaphroditic genus as the presence of pAGS suggests, then it shows the same interim ovotestis developmental pattern as that found only within the Coryphopterus group, thereby supporting monophyly for the genus *Fusigobius*.

0425 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Thaddaeus Buser, J. Andres Lopez

University of Alaska Fairbanks, Fairbanks, AK, USA

Molecular Systematics of Agonidae

The poachers (Scorpaeniformes; Agonidae) are benthic, marine fishes found in artic, subarctic, and temperate regions of the Pacific and Atlantic oceans. Agonids are traditionally united by three autapomorphous conditions; the rectus ventralis II, three supraorbitals, and, most obviously, a covering of bony plates over the body. However, recent phylogenetic analyses have cast doubt on the monophyly of this clade as well as the relationship of agonids to closely related taxa within Cottoidae. The objectives of this study were to: (a) test the monophyly of the family, (b) develop a phylogenetic hypothesis among the genera of Agonidae and (c) infer the relationships of Agonidae to other groups within Cottoidae. Five protein-coding single-copy nuclear genes (baz1b, 900bp; VCPIP1, 850bp; SVEP1, 950bp; ptchd1, 770bp; and TBR1, 750bp) were amplified and sequenced from a broad, representative sample of genera within Agonidae, Hemilepidotidae, and Hemitripteridae. Additionally, outgroup taxa were sampled from cottoid and other, more distant, percomorph groups. Phylogeny was then inferred using maximum likelihood and Bayesian analysis. The results of this study will help elucidate the phylogenetic relationships of members of Agonidae with one another and within Cottoidae and add to our growing understanding of broader phylogenetic relationships as part of the Euteleost Tree of Life Project (www.FishTree.org).

0471 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Kenneth Cabarle[2], Christopher Beachy[1], Robert Page[3], Randal Voss[3]

[1]Minot State University, Minot, ND, USA, [2]University of North Dakota, Grand Forks, ND, USA, [3]University of Kentucky, Lexington, KY, USA

Cadmium Induction of Gene Expression in Salamander and Biomonitoring in an Agricultural Landscape

Cd^{2+} is an important causative agent in several cancers. This metal can be found in nature in soils and wetlands, and can also be found in high concentrations in agricultural regions. Salamanders are ubiquitous throughout the Northern Plains and represent the most important vertebrate in ecosystems in terms of energy flow. Salamanders are also excellent model organisms for examining the relation of metal-induction of gene expression. We harvested tissue from salamanders in two settings: in natural areas associated with farmland and from salamanders grown in the lab at a range of Cd^{2+} dosages. We examined liver and tail cadmium content and correlated this

with patterns of cadmium-induced gene expression using microarray analysis. We identified approximately 100 genes that were statistically and two-fold differentially expressed between control and cadmium treatments. These expression levels appear to be dosage-dependent. In addition, cadmium content increases during aging in wild salamanders, suggesting that this metal is bioaccumulated. Salamanders represent excellent biomonitors. Cadmium uptake is significant even at low dosage levels so long as environmental stressors are present (e.g., competition, predation).

0131 Poster Session III, Sunday 10 July 2011

Natalie Calatayud[1], Cecilia Langhorne[1], Tricia Rowlinson[1], Kevin Thompson[3], Carrie Vance[2], Jennifer Germano[2], Scott Willard[1], Andrew Kouba[2]

[1]Mississippi State University, Starkville, MS, USA, [2]Memphis Zoo, Memphis, TN, USA, [3]Colorado Division of Wildlife - Native Aquatic Species Restoration Facility, Alamosa, CO, USA

Induced Ovulation and Hormone Profiling of the Boreal Toad, *Bufo boreas boreas*

The Southern Rocky Mountain population of boreal toads, *Bufo boreas boreas*, range from south-central Wyoming and the mountain regions of Colorado to north-central New Mexico. Recently, population declines have prompted the implementation of recovery strategies for the preservation of isolated populations and genetic diversity. The use of assisted reproduction is one of the latest strategies for preserving genetic diversity in captive colonies and increasing the number of animals for release into the wild. The development of exogenous hormone protocols to induce and maximize egg recovery for use in in vitro fertilization (IVF), as well as long term storage, has not yet been explored in detail in this species. Therefore, the aims of this study were to: 1) test the effects of three different concentrations of human chorionic gonadotropin (hCG) (250, 500, and 750 IU/average weight) and luteinizing hormone releasing hormone (LHRH) (2.5 µg/g body weight) on ovulation; 2) evaluate the collection of eggs for use in IVF experiments and determine fertilization curves; and 3) determine the optimal stage at which to cryopreserve embryos using a novel cryoprotectant, anti-freeze protein I (AFP-I). The results of these experiments may lead to the development of effective protocols for the induction of ovulation, provide important information about fertilization rates and embryonic development, help secure genetic diversity, and facilitate reintroductions back into the wild for this endangered species.

0272 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Hannah Calich, Richard, J. Wassersug

Dalhousie University, Halifax, NS, Canada

The Architecture of the Aquatic Environment and its Influence on the Growth and Development of Tadpoles (*Xenopus laevis*)

We investigated how the size of the air-water interface (surface area), water depth, and partitioning the aquatic space independently affected the growth and development of *Xenopus laevis* tadpole. To do this, we used a series of pyramidal frustra and partitioned aquaria. In our experimental containers, as the surface area decreased the dissolved oxygen concentration decreased and the tadpole air-breathing rates increased. As the depth of the water increased, the dissolved oxygen concentration also decreased; however, the tadpoles' air-breathing rates decreased. When the aquatic space was vertically partitioned to form either 2cm or 4cm wide corridors, tadpoles avoided the narrower spaces. Neither varying the surface area, nor vertically partitioning the aquatic space, significantly affected tadpole growth or development. However, tadpoles raised in shallow containers grew significantly slower than tadpoles in the deeper containers. Shallow water appeared to prevent the tadpoles from ascending normally to break the surface tension of the water and properly air-breathe. Instead, the tadpoles in the shallow containers often floated at the surface, rather than in their normal position in the water column. The results of our study have implications to designing containers that maximize tadpole growth. Additionally, our results suggests that if climate change leads to lower water levels this may detrimentally impact wild populations of air-breathing tadpoles, since shallow water appears to impede the animals' ability to respire normally.

0208 Poster Session II, Saturday 9 July 2011

Neftali Camacho

Natural History Museum of Los Angeles Co., Los Angeles, CA, USA

Digitization of Photographic Slide Vouchers of the Herpetology Section, Natural History Museum of Los Angeles County

The Herpetology section at the Natural History Museum of Los Angeles County, in addition to its extensive holdings of preserved specimens and skeletons, holds approximately 7,922 35mm color photographic slides. These images represent animals ranging from salamanders to frogs to turtles to snakes and lizards, from various localities throughout the world mostly from the western United States, Mexico, Costa Rica, Zimbabwe and includes scenes of locality habitat. Most of the images are of posed specimens on a background with a few taken in situ. Herpetology holds catalogued voucher specimens for most of the images. To make these images more accessible to the herpetology community, they were scanned by a commercial service (Larsen Digital

Services). The resulting TIFF files are saved on the computers in Herpetology. Each image is labeled with a LACM Photographic Collection (PC#) and usually linked to a catalogued LACM specimen. The slides represent an irreplaceable photographic record of collections over the past 50 years. In the future we plan to link each digital image to the cataloged specimen page in the Herpetology database and add a sampling of the best images on to our webpage. In the meantime, for research purposes, images may be sent electronically as attachments, by request.

0163 Poster Session II, Saturday 9 July 2011

David Camak, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

In the Line of Fire: A Phylogeographic Assessment of Diversity in the Firemouth Cichlid (*Thorichthys meeki*)

The Firemouth Cichlid, *Thorichthys meeki*, is a Middle American cichlid in the Tribe Heroini (Teleostei: Cichlidae) distributed on the Atlantic slope from southern Mexico into northern Belize and Guatemala. Like many New World cichlids, the taxonomy of *T. meeki* is uncertain, and a better understanding of phylogeographic variation is warranted. Previous work suggested that Firemouth Cichlids in Laguna Bacalar (Quintana Roo, Mexico) (*Thorichthys* aff. *meeki*), possesses a unique color pattern and may represent a distinct taxon. Variation across the range of *T. meeki* has not been conducted. Therefore, to gain a better understanding of variation within this species, we conducted a phylogeographic study of *T. meeki* using mtDNA. In particular, we focused on examining the status of the Laguna Bacalar population relative to other populations in and around the Yucatan peninsula. Furthermore, we included sequences from all other species of *Thorichthys* to examine the phylogenetic placement of *T. meeki* relative to other species of *Thorichthys*. Results suggest minimal levels of genetic variation (<1%) across the Yucatan portion of the range of *T. meeki*, including the Laguna Bacalar population. However, comparisons of Yucatan/Laguna Bacalar and Rio Usumacinta populations indicated a large degree of genetic divergence (>8%). This is interesting considering that there is more intraspecific variation for *T. meeki* than interspecific variation (i.e. *T. meeki* vs. *T. pasionis*). The high level of divergence within *T. meeki* is not unexpected considering the geologic history of the region and long period of isolation among Yucatan and Rio Usumacinta basins.

0559 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Gerardo Carfagno[1], Patrick Weatherhead[2]

[1]Gettysburg College, Gettysburg, PA, USA, [2]University of Illinois, Urbana-Champaign, IL, USA

Snakes in the Fast Lane: Thermal Strategies of Racers (*Coluber constrictor*)

We use a standard field methodology to examine the thermoregulatory behavior of racers, *Coluber constrictor*, in Illinois. Racers face a challenging thermal environment because of the species' relatively warm preferred temperatures. Racers adopt a flexible strategy: thermoregulating most effectively during the day and during the more challenging times of year. This strategy provides the benefits of accurate temperature regulation when needed, but may allow snakes to become metabolically conservative when inactive. Our results, and those of previous authors, allow us to draw some general conclusions about how the relative costs and benefits associated with thermoregulation should vary with species and variable environments. It is clear that ecological differences such as behavior and habitat use between species influence how thermoregulatory strategies vary among populations. Active racers clearly experienced greater benefits relative to the costs associated with behavioral temperature regulation compared to ratsnakes at the same study site. Intraspecifically, shifts in thermoregulatory behavior by gravid females may be important only for species facing challenging thermal conditions, and for those that are normally active at relatively cooler body temperatures. Further studies with racers in different environments, and with ecologically different species, will continue to improve our ability to predict and explain patterns of temperature regulation in reptiles.

0043 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Aaron Carlisle[1], Daniel Madigan[1], Kenneth Goldman[2], Thomas Kline[3], Barbara Block[1]

[1]Hopkins Marine Station of Stanford University, Pacific Grove, CA, USA, [2]Alaska Department of Fish and Game, Division of Commercial Fisheries, Homer, AK, USA, [3]Prince William Sound Science Center, Cordova, AK, USA

Reconstructing the Life of a Pelagic Shark: Investigating Ontogenetic Changes in Trophic Ecology and Habitat Use in Salmon Sharks (*Lamna ditropis*) Using Stable Isotope Analysis

Salmon sharks (*Lamna ditropis*) are wide-ranging apex predators in the North Pacific. As endothermic upper trophic level predators they likely play an important role in North Pacific marine ecosystems, yet virtually nothing is known about trophic ecology and habitat use of young salmon sharks or of possible ontogenetic shifts in diet and habitat use. We used stable isotope analysis (SIA) of salmon shark vertebrae to elucidate

ontogenetic changes in habitat use and trophic ecology. The stable isotope composition of an organism is directly related to that of its prey, and isotope signatures of different food webs, which vary spatially due to differences in biogeochemical processes. Consequently, SIA data can be used to provide information on salmon shark diets and habitat use. The tissue in each annulus of a salmon shark's vertebrae provides an isotopic record that reflects movements and foraging integrated over a year of a shark's life. As a result, by serially sampling vertebral annuli for stable isotope ratios of carbon ($^{13}C/^{12}C$) and nitrogen ($^{15}N/^{14}N$) we were able to reconstruct the general dietary and migratory history of individual sharks. We used a basic isoscape of the major ecoregions of the eastern North Pacific to estimate use of different regions. Electronic tagging data was used to inform SIA results by characterizing annual patterns of ecoregion residence. Integrating electronic tag and stable isotope data provides a unique and powerful way to study the ecology and life history of these important and difficult to study predators.

0538 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Amy E. Carlson, James A. Sulikowski

University of New England, Biddeford, ME, USA

Vertical and Horizontal Movement Patterns of Archival Satellite Tagged Spiny Dogfish in the Northwestern Atlantic

The spiny dogfish (*Squalus acanthias*) stock abundance in the Northwest Atlantic Ocean has been of concern due to conflicting population trends over the last several years. To obtain a better understanding of the movement dynamics of this species, Microwave Telemetry Pop-Up Archival X-Tags have been attached to 10 adult male and 13 adult female dogfish off the coast of Portland, Maine. Eighteen of the tags have released and transmitted data. Of these 18 tags, three have been physically recovered, and 11 have been filtered and modeled. Approximate geolocations and vertical movements within the water column were derived from archival light level, pressure, and temperature records and has been filtered and fitted with bathymetric and sea surface temperature data using derivations of kftrack and ukfsst modeling packages in R and Matlab. Reconstructed tracks ranging in lengths from 2 to 12 months are helping to elucidate the seasonal migration patterns, which appear to be more regional (between the Gulf of Maine and New Jersey) and local (between the Gulf of Maine and Cape Cod) in nature. In addition, vertical movements show distinct diel patterns with recorded depths ranging from 70 to over 600 meters. Based on this preliminary data, it appears that the movement patterns of dogfish may prevent this species from being effectively captured by NEFSC otter trawl surveys.

0191 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011

Mollie Cashner, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Muddy Waters: Investigation of the Morphological and Genetic Variation Among Populations of *Notropis lutipinnis* and *N. chlorocephalus* (Subgenus *Hydrophlox*)

Notropis lutipinnis and *N. chlorocephalus* are found in small to medium sized streams in Georgia, South Carolina, and North Carolina. It has long been acknowledged that considerable variation exists among populations within the range of *N. lutipinnis*. Allozyme data supported the existence of at least one undescribed form in the Congaree River and Lynches River systems of the Carolinas, sister to *N. chlorocephalus*; however, species and range delineations remain problematic. Morphological variation, such as nuptial fin coloration, pharyngeal tooth count, and lateral line position, has added to the confusion surrounding this clade. Using intense population sampling and both mtDNA and nDNA, we have found strong support for three distinct species within this monophyletic group: *N. chlorocephalus* from the Catawba River system in North Carolina, *N. cf. chlorocephalus* from the Broad River system of the Congaree Drainage, and *N. lutipinnis* from the Chattahoochee, Altamaha, Savannah, and Edisto River systems. Additional morphological and meristic data support these delineations. However, the molecular and morphological data also reveal ambiguities which explain some of the confusion surrounding these species. Populations in the Lynches River, Saluda River, and portions of the Catawba River systems are problematic for a variety of reasons, and phylogenetic analyses suggest that *N. lutipinnis* from the Altamaha system may be distinct from populations in the Savannah and Edisto. Bait bucket transfer, hybridization, ancient stream capture events, and polymorphic nuptial characteristics may all play a role in perpetuating the confusion surrounding these species.

0042 Fish Morphology, Symphony I & II, Friday 8 July 2011; ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY AWARD

Amanda Cass

Cornell University, Ithaca, NY, USA

Swimbladders and Lungs: Molecular Development of the Air-filled Organs of Vertebrates

The presence of an air-filled organ, either lungs or a swimbladder, is a synapomorphy of the Osteichthyes (including tetrapods). Despite the functional and structural diversity of air-filled organs, little was previously known about AO development except in relation to tetrapod lungs. Using reverse-transcriptase PCR and whole-mount in situ hybridization, this study demonstrates that a suite of genes (Nkx2.1, FoxA2, Wnt7b, GATA6), previously reported to be co-expressed only in the tetrapod lung, is also co-

expressed in the adult and developing zebrafish swimbladder and in the adult swimbladders of several basal ray-fin fishes. Co-expression of this suite of genes in both tetrapod lungs and swimbladders of ray-fin fishes is more likely due to common ancestry than independent co-option, because these genes are not known to be co-expressed anywhere except in the air-filled organs of Osteichthyes. This assertion can be further tested by examining the network relationships of these gene products in zebrafish (creating a complex conserved character) and by looking for co-expression of these genes in non-osteichthian fishes (to determine if they are co-expressed in other groups). If the network relationships are conserved and these genes are not co-expressed outside of the Osteichthyes, then this network constitutes a molecular synapomorphy of the bony fishes and examination of changing expression patterns downstream gene products may characterize sub-groups within the clade.

0602 Poster Session II, Saturday 9 July 2011

Abel J. Castaneda[1], Robert B. Gillespie[1], Peter C. Smiley[2], Mark A. Jordan[1]

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Contribution of Water and Habitat Quality to the Structure of Amphibian Assemblages in Agricultural Ditches of Two Midwest Watersheds

Agricultural ditches represent the headwaters of most watersheds in the Midwest. Constructed to improve agricultural productivity, there has been less attention given to their role in providing habitat to freshwater biota. The purpose of our study was to examine the relationship between the composition of amphibian assemblages that use ditch systems, and water and habitat quality in a portion of the St. Joseph River watershed in northeastern Indiana and the Upper Big Walnut Creek Watershed in Ohio. Instream habitat, water chemistry, and amphibian assemblages were characterized at 14 sites sampled three times per year for two years. Principle components analysis was used to identify variables that contributed most to variation within habitat and water quality categories. Axes identified were then regressed against measures of abundance, diversity, and assemblage composition. Overall, assemblages were most correlated with instream habitat. Streams with high velocity and discharge had lower amphibian abundance and diversity. Although there was identifiable variation among sites in water chemistry, axes were not associated with any measure of assemblage structure. Parallel results from fish assemblages in the same systems suggest that management for enhanced habitat quality should be prioritized when applying conservation practices.

0374 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Renee Catullo, J. Scott Keogh

The Australian National University, Canberra, ACT, Australia

Using Phylogenetics and Ecological Niche Modeling to Investigate Speciation Patterns in Australian Burrowing Frogs (*Uperoleia*: Myobatrachidae)

The Australian Monsoonal Tropics (AMT) has been subject to a number of studies focusing on historical biogeography of sub-regional divisions, but inadequate sampling has made it difficult to test hypotheses concerning the influence of environmental variables on the speciation process in this important region. Here we present the first results of a well-sampled, AMT-wide species complex of frogs, *Uperoleia lithomoda* and *U. trachyderma*. Using a multi-gene phylogeny (2 mtDNA, 6 nDNA exons) and molecular dating methodology we have produced a well sampled phylogeny spanning the entire monsoonal tropics region of Australia. Genetic, morphological and call data support the presence of two previously undescribed cryptic species of *Uperoleia*. By combining phylogenetic data with Ecological Niche Modeling (ENM), we explore the role of habitat and climate in current species distributional limits, and in the process of speciation. This study provides a region-wide testable biogeographic framework for further studies of the Australian Monsoonal Tropics.

0442 Poster Session III, Sunday 10 July 2011

Taryn Cazzolli, Aaron Bauer

Villanova University, Villanova, PA, USA

The Morphology of the Gekkotan Nasal Region

Within the Squamata, there is a continuum between visual predators and chemosensory predators. Most chemosensory predators rely chiefly on vomerolfaction facilitated by tongue-flicking behavior, but geckos have been described as olfactory specialists. Support for this interpretation has come chiefly from behavioral data. Morphological and physiological investigation of the olfactory apparatus of geckos has thus far been limited to a few exemplars representing only two of the seven gekkotan families and less than 0.5% of species. We reinterpret the functional implications of gecko nasal morphology in light of recently revised phylogenetic hypotheses for Squamata and Gekkota. We use histological methods and light microscopy, as well as x-ray CT scanning to investigate the morphology of the nasal region across all major gekkotan lineages. Parameters of nasal architecture, including the relative size of the nasal conchae, thickness and surface area of olfactory epithelium, and density of olfactory sensory cells have been measured. Qualitative and quantitative approaches to these data have been used to evaluate the generalization that gekkotans are olfactory specialists. Although geckos do possess a well-developed olfactory system, there is significant

variation in morphology across taxa. Geckos are unique among squamates not so much in features of the olfactory system, but in the degree to which different sensory modalities are integrated. This integration is reflected in the foraging mode of gekkotans, which has elements of both active foraging and ambush predation.

0388 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Ryan Chabarria, Frank Pezold

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

Population Genetics of *Sicydium salvini*

Sicydium salvini is an abundant sicydiine goby found along the continental drainages of the Pacific slope of middle and Central America. The amphidromous life history of sicydiine gobies can potentially add connectivity between river systems that is not typically found in freshwater fishes. Some authors suggest that because ocean currents could control marine larval movement, a source-sink dynamic may exist among river populations. The goal of this project was to investigate the genetic structure and population demographics of *Sicydium salvini*. In addition, identification of potential source-sink dynamics between river systems will also be investigated. For this study we sampled multiple populations along the Pacific slope of Costa Rica. For the population genetic analysis, the mtDNA gene *cyt b* was sequenced for 160 individuals. Preliminary data show *S. salvini* populations have high haplotype diversity and analyses indicate a recent population expansion.

0271 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Chris L. Chabot

The University of California, Los Angeles, Los Angeles, CA, USA

The Resurrection of *Galeorhinus zyopterus* in the Northeastern Pacific and its Global Congenerics Based on Genetic, Life-history, and Morphological Evidence

The soupfin shark, *Galeorhinus galeus,* is a commercially important member of the Triakidae that has suffered a long history of global exploitation resulting in historic population collapses. In order to effectively manage and conserve populations of *G. galeus*, it is important to determine the levels of connectivity among globally distributed populations and assess the taxonomic status of the species. Thirteen polymorphic microsatellite loci were used to determine the population connectivity of geographically isolated populations of *G. galeus* from Africa, Australia, North America, South America, and the United Kingdom. Genetic analyses revealed significant structure among all

populations indicating a lack of gene flow and evidence of a genetic bottleneck in the northeastern Pacific. These findings indicate that globally distributed populations of *G. galeus* are isolated and should be managed as distinct, independent stocks. Furthermore, the observation of private microsatellite alleles, unique region-specific mitochondrial haplotypes, and regional differences in morphology and life-history suggest that a resurrection of *Galeorhinus zyopterus* in the northeastern Pacific as well as the resurrection of its global congenerics may be warranted.

0270 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Chris L. Chabot, Sergio Nigenda

The University of California, Los Angeles, Los Angeles, CA, USA

The Use of Next-generation Sequencing to Discover Microsatellite Loci for Northeastern Pacific Triakid Sharks

Using population genetic methods to estimate population connectivity is important for the conservation of exploited elasmobranch species. One such elasmobranch, the soupfin shark, *Galeorhinus galeus* (Triakidae), has been exploited for >80 years and has suffered population declines historically. Here we describe the discovery of microsatellite loci for *G. galeus* by next-generation sequencing (Roche 454 pyrosequencing) and their utility for eastern Pacific smooth-hound sharks (*Mustelus*). Next-generation sequencing generated ~40,000 sequences, of which, 256 putative microsatellite loci were identified consisting of di, tri, tetra, and pentanucleotide repeats. Similar to other species of shark, dinucleotide repeats were the most commonly observed motif in *G. galeus.* Thirty-two loci were screened for *G. galeus* resulting in a total of 13 polymorphic loci (3-12 alleles) with observed heterozygosities between 0.11 and 0.86 and expected heterozygosities between 0.24 and 0.87. All loci were in Hardy-Weinberg equilibrium with the exception of two loci and all were in linkage equilibrium. Of the 13 loci, seven positively amplified for *Mustelus californicus and M. henlei* from the northeastern Pacific.

0070 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

Prosanta Chakrabarty[1], Larry Page[2]

[1]*Museum of Natural Science, Louisiana State University, Baton Rouge, LA, USA,* [2]*Florida Museum of Natural History, Gainesville, FL, USA*

Genetypes: A Concept to Help Integrate Molecular Systematics and Traditional Taxonomy

In order to better integrate molecular phylogenetics and taxonomy, genetic sequences from type materials should be explicitly identified in publications using a consistent nomenclature. Because of the lack of an explicit nomenclature tied to taxonomy, the existence of genetic "type sequences" is obscured. To remedy this problem and bring awareness to the situation, we propose the use of the term "genetype" as a label for any sequence data from types (including from holotypes, topotypes, etc.). For nomenclatural purposes, genetic sequences from a holotype should be referred to as a "hologenetype" (from: **holo**type and **genetype**), sequences from a topotype will be a "topogenetype," and so forth. By making gene sequences from type materials readily available, researchers will be able to rapidly compare what they suspect to be undescribed species, new populations, or species in synonymy. This nomenclatural system will also create "gold standard" sequences on GenBank that due to their direct link to type specimens will be more reliable and credible than standard sequences whose identification may be problematic. Type materials remain essential for taxonomic comparisons, but sequence data have not been fully incorporated into these comparisons, or into the tradition of taxonomy. Ultimately, the genetypes approach will promote all forms of taxonomic research as molecular phylogenetics becomes integrated with taxonomy and as technology improves in molecular biology.

0482 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Jeremy Chamberlain, Neil Ford

University of Texas at Tyler, Tyler, TX, USA

Stochastic Variation in Life-history Traits in a Population of *Thamnophis proximus* in East Texas

Yearly variation in life-history traits can be an important adaptive feature that helps populations stabilize in stochastic environments. The ability to change reproductive effort according to environmental conditions can ensure survival of offspring or optimal reproduction. Several life-history characteristics of the western ribbon snake (*Thamnophis proximus*) were measured from a population occurring at the Old Sabine Bottoms Wildlife Management Area, Smith County, Texas. Data was collected over a 10 year period from 2001-2010. Gravid females were collected and brought into lab and fed on consistent diet of tadpoles and fish. This population is found

in the floodplain of the Sabine River, where the habitat is highly stochastic. Food and habitat availability can drastically change from year to year for ribbon snakes occurring there. In addition, unexpected flooding may cause elevated mortality in this population. It is speculated that these kinds of factors should have a strong influence in varying life-history traits of these snakes. Characteristics of each clutch were compared from year to year. Also, the amount of within clutch variation was compared from year to year. Female length and weight was also considered. Yearly variation was compared with yearly flood patterns measured by the USGS. The results from this study were compared to other populations in the United States.

0500 Poster Session I, Friday 8 July 2011

Guangchun Chen[1], Brian Ward[1], Gregory Chinchar[2], Jacques Robert[1]

[1]University of Rochester Medical Center, Rochester, NY, USA, [2]University of Mississippi Medical Center, Jackson, MS, USA

Knockout Methodology to Investigate Ranavirus-mediated Pathogenesis and Immune Evasion in *Xenopus*

To better assess the roles of Frog virus 3 (FV3, genus *Ranavirus*, family Iridoviridae) genes in virulence and immune evasion, we have developed a method to systematically knockout (KO) putative virulence genes by site-specific integration into the FV3 genome of a double selectable marker that consists of a puromycin-resistance gene fused with the eGFP reporter (Puro-eGFP cassette) under control of the FV3 immediate early gene 18K promoter. By selecting for both GFP expression and puromycin resistance, we have successfully constructed three recombinant viruses: (1) FV3-BW-KO (the Puro-eGFP cassette was inserted into a non-coding region); (2) FV3-eIF-KO (replacement of the truncated eIF-2α gene); and (3) FV3-18K-KO (replacement of the 18K gene). Each recombinant was purified by sucessive rounds of puromycin and GFP+ plaque selection. The specificity of recombination and the clonality of the resulting virus were confirmed by diagnostic PCR and sequencing. Viral replication of each recombinant was similar to parental FV3 *in vitro* as determined by growth on BHK-21 cells. However, FV3-18K-KO growth in both tadpole and adult *Xenopus* was markedly impaired compared to FV3-eIF-KO and wild type FV3. Currently, we are further evaluating in the *Xenopus* model the impact of KOs on host survival and immune responsiveness. Our results suggest that 18K, a gene conserved in all RVs, is critically involved in FV3 infectivity. In addition, our study lays the foundation for the discovery of potentially new viral genes involved in virulence and immune escape.

0581 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Megan Chesser[1], John Kim[2], Kevin McGarigal[3]

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Analysis of Human Error Rates Related to Photographic Identification in Ecological Databases: Implications for the Possibility of Incorporating Citizen

Photographic identification offers many advantages as a non-invasive method of capture-mark-recapture (CMR). However, because computer vision for wildlife applications has not yet reached the point of fully-automated matching, all forms of photo-id remain constrained by the potential for human errors. Error type and frequency greatly impact the structure of image databases, as well as the accuracy and precision of analyses or population estimates. Ten years of photographic CMR work consisting of more than 12,000 images of the Massachusetts state-threatened marbled salamander (*Ambystoma opacum*) provides an exceptional platform for interdisciplinary collaboration and exploration of human error rates through a blind, trial-based collection of matching information. Sixty students each completed a series of 15 online trials (varying in database size and number of matching images) - each viewing a total of 2,625 pairs of images. Covariates such as experience, time, and trial order were documented. False negatives (missed matches) accounted for almost all errors. Consequently, trials containing more matches generated more errors, regardless of database size. Observer fatigue had a smaller impact than photographic quality on the frequency of errors. These results form a springboard for the larger question of the feasibility of collecting high quality data from either large numbers of citizen-scientists or computer-assisted approaches. We hope that a simple emphasis on visual-based, binary questions (match or non-match) can bridge differences in age, gender, education levels, and technological proficiencies that might normally separate a community of learners, enabling photo-id to become a vector for reciprocal learning between scientists and the public.

0128 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

V. Gregory Chinchar[1], Dexter S. Whitley[1], Elizabeth Kwang Yu[1], Jacques Robert[2]

[1]U. Mississippi Medical Ctr., Jackson, MS, USA, [2]U. Rochester School of Medicine, Rochester, NY, USA

Elucidating Ranavirus Gene Function Using Anti-sense Approaches

Currently, functions have been attributed to one-third of the 100 gene products encoded by frog virus 3 (FV3, family Iridoviridae, genus *Ranavirus*), and this by inferred homology with proteins of known function in other eukaryotic organisms. To better understand the role of FV3 proteins in virus replication, we began to systematically knock down (KD) the expression of putative replicative and immune evasion genes using either anti-sense morpholino oligonucleotides (asMOs) or small, interfering RNAs (siRNAs) and to ascertain gene function by changes in phenotype. Using asMOs, we successfully KD the expression of six viral proteins and showed that five of them (i.e., the major capsid protein, the largest subunit of the virus-encoded homolog of RNA polymerase II, a 50 kDa myristoylated membrane protein, and two immediate-early proteins of unknown function) were essential for replication *in vitro*. Currently we are focusing on nine additional putative replicative and immune evasion proteins. Complementary experiments using siRNAs to KD viral gene expression have confirmed asMO findings and demonstrated that the viral DMTase is required for replication *in vitro*. However, in contrast to asMO-mediated KD, the efficiency of siRNA-mediated KD is inversely related in the multiplicity of infection. These studies, along with those using homologous recombination to knock out targeted viral genes, will provide a better understanding of the function of key ranavirus replicative and immune evasion genes both *in vivo* and *in vitro*, and perhaps suggest effective and practical ways to combat ranavirus-mediated disease.

0186 Poster Session I, Friday 8 July 2011

James Christiansen[1], Neil Bernstein[2], Christopher Phillips[4], Jeffrey Briggler[3], Don Kangas[5]

[1]Drake University, Des Moines, IA, USA, [2]Mount Mercy University, Cedar Rapids, IA, USA, [3]Missouri Department of Conservation, Jefferson City, MO, USA, [4]Illinois Natural History Survey, Champaign, IL, USA, [5]Truman State University, Kirksville, MO, USA

An Update on Declining Yellow Mud Turtles *(Kinosternon flavescens)* in Iowa, Illinois, and Missouri

The yellow mud turtle, *Kinosternon flavescens* is thought to have invaded Iowa, Illinois, and northeastern Missouri from southwestern North America during the hypsithermal interval. With the cooler and moister conditions that developed since then, the range of this xeric-adapted species has contracted to a few localities in these states. Studies in the

late 1970s and 1980s documented eight locality clusters in nine counties in Illinois, five in four counties in Iowa, and five from two counties in Missouri. Sampling since 1995 demonstrated the continued existence of the species at only two localities in Illinois, two in Iowa and one in Missouri. Furthermore, severe declines have been observed in the largest population in each of the three states. In all three states, severely lowered water levels, usually due to water withdrawal from the aquifer have contributed at least partly to some of the declines. Water has disappeared from some ponds for multiple years. Other contributors are woody encroachment on nesting habitat or between nesting areas and aquatic feeding areas, often associated with heavy predation of turtles and nests by mesopredators. We review new information on populations as well as mitigation efforts underway in Iowa Illinois, and Missouri.

0079 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

James Christiansen, Travis LaDuc

University of Texas, Austin, TX, USA

Kinosternon flavescens in the Upper Mississippi Valley and Arid West Texas, a Comparison

Mark-recapture methods were used to study Yellow Mud Turtles, *Kinosternon flavescens,* in pools adjacent to the Mississippi River in Muscatine and Louisa counties, eastern Iowa from 1971 through 2005 by JLC and in Presidio and Jeff Davis counties in western Texas from 2006 through 2010 by JLC and TJL. Results from the studies of the turtle in these two areas suggest an amazing level of adaptivity for this widespread species. As examples, the first turtles enter aquatic feeding areas almost a month earlier Iowa than in warmer west Texas even with rain in both areas. In Iowa, aquatic feeding ends by mid July but in west Texas, it continues for many turtles into September. Brumation occurs in loose sand dunes in Iowa but seemingly exclusively in kangaroo rat burrows in west Texas, sometimes a half kilometer from the aquatic feeding area. Radio telemetry revealed that several west Texas turtles navigated rough terrain to the same kangaroo rat burrow complex in successive years. Our observations suggest that many west Texas mud turtles do not find permanent aquatic feeding areas (cattle tanks) and may subsist for years at a time probably by hydrating in very short lived desert pools, spending nearly all their time underground. Additionally, habitat and rainfall differences between three west Texas cattle tanks may account for observed differences in growth rates and other behavioral features despite the approximate 8 km distance between the two most distant tanks.

0453 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

James Church, Dean Adams

Iowa State University, Ames, IA, USA

Putting the Niche into Macroecology: The n-dimensional Hypervolume, Limiting Similarity and Population Ecology in *Plethodon* Salamander Communities

The mechanisms that regulate species distributions have long been of interest to biogeographers. Recently, considerable research has investigated how processes occurring at small spatial scales generate patterns at larger, geographic, patterns. It is well known that several factors influence species abundance and range distributions. Among these factors are climate, habitat, dispersal barriers, and interspecific competition. In this study, we developed models of species responses to broad-scale environmental gradients as well as population models across these gradients, and with the influences of interspecific competition for several species of Plethodon salamanders in the southern Appalachian Mountains. Our results suggest that the effects of competition are mediated by local environmental conditions, and that it is the interplay between regional environmental conditions and interspecific relationships that regulate local species assemblages and geographic distributions. Further, we demonstrate that using this pluralistic approach allows for the formulation of hypotheses regarding the relative influences of several factors in determining local community structure and broad-scale species distributions.

0319 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Angela Cicia[1], Lela Schlenker[2], James Sulikowski[3], John Mandelman[1]

[1]University of New England, Biddeford, ME, USA, [2]Dauphin Island Sea Lab, Dauphin Island, AL, USA, [3]New England Aquarium, Boston, MA, USA

The Seasonal Blood Biochemical Status of the Little Skate, *Leucoraja erinacea*, Exposed to Graded Bouts of Aerial Exposure

Sustained bouts of air exposure occur during capture/handling processes, functionally inhibiting ventilation in obligate water-breathing fishes. However, few studies have investigated the direct physiological alterations it causes, particularly in elasmobranchs. In the laboratory, blood samples were obtain from little skates (*Leucoraja erinacea*) subjected to three air exposure durations (0, 15, 50 min) during two distinct temperature (winter and summer) regimes. Additional blood samples were collected 5 day after initial experiments to assess recovery. Results indicate acid-base status (pH, pCO_2), whole-blood lactate, and K^+ became progressively more disturbed the longer skates were exposed to air in both the winter and summer studies. In addition, glucose, Na^+, Cl^-, Ca^{2+} and Mg^{2+} were only affected by aerial exposure in the summer study. Lastly,

disturbances in blood chemistry were resolved in all surviving skates after the five-day recovery periods in both temperature studies. However, mortality was also exaggerated during the summer study (winter: 18% and 37% for the 15 and 50 min group; summer: 87% and 100% for the 15 and 50 min group). Thus, a qualitative comparison revealed that the magnitude of physiological alterations and rates of mortality were more pronounced during the summer study. This infers acute thermal shock associate with rapid transfer from the seafloor to the vessel deck during commercial capture, may exacerbate the physiological impairment and mortality rate in the little skates subjected to aerial exposure.

0441 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Todd Clardy

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

Using Fractals to Describe Morphology and Ontogeny of the Trunk Lateral Line Canals of the Prickleback Genus *Xiphister* (Cottiformes: Zoarcoidei: Stichaeidae), with Comparisons to Other Stichaeids

Fishes of the family Stichaeidae, commonly known as pricklebacks, are a diverse group of about 37 genera and 76 species distributed in intertidal and continental slope waters of the North Pacific, Arctic and North Atlantic Oceans. A peculiar characteristic of some stichaeid genera is the presence of multiple, complexly branching trunk lateral line canals. This condition is rare among teleostean fishes and is found in members of only twelve other families. In this presentation, I describe the morphology of the trunk lateral line system of the two species of *Xiphister* using a fractal approach. Both species each have seven trunk lateral line canals, which are supported by dermal, ring-like ossifications. Lateral line systems in *Xiphister* were traced from cleared and stained specimens (32.4-170.1 mm SL) and their fractal dimensions were measured using the box/count method. This method calculates the complexity of a 2-dimensional object and yields values ranging from one (simple) to two (complex). At small sizes, trunk lateral lines in *Xiphister* are poorly developed resulting in low fractal dimensions (1.2-1.3). As *Xiphister* increase in size, branching of trunk lateral lines increases resulting in greater complexity and higher fractal dimensions (1.5-1.7). The implications of increasing fractal dimension of lateral line systems in *Xiphister* will be discussed, and comparisons to other stichaeids with multiple trunk lateral lines will be made.

0594 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

Eugenie Clark[1], Diane Nelson[2]

[1]Mote Marine Laboratory, Sarasota, FL, USA, [2]East Tennessee State University, Johnson City, TN, USA

Group Nesting Sites of the Ocean Triggerfish, *Canthidermis maculatus*, in the Solomon Islands and Thailand.

We studied the nests, eggs, and larvae of the ocean triggerfish, *Canthidermis maculatus*, off the island of Kicha, Solomon Islands, April 1996 in three locations and off the southern end of the island of Ko Tachai, Thailand, April 2000. In the Solomon Islands, we observed ten ocean triggerfish nests on a ledge of sand rubble at 10 - 12 m depth, between a cluster of large coral boulders. During the day, a large group (35+ individuals) of ocean triggerfish cruised nearby along the steep drop-off. In Thailand, we observed nine ocean triggerfish nests inside a ring of boulders at 18 - 20 m depth. Usually there was only one fish (male?) near a nest. The guarding fish fought off other fish species, including three other species of triggerfish, snappers, and the goatfish, *Mulloides vanicolensi*, but allowed several species of herbivorous surgeonfish to feed at the rims of their nests. While the fish defended the nest, its color pattern changed from a pale bluish-gray all over head and body to having a solid dark black line by each eye and a dark spot by the tail. Actual mating was not witnessed, but egg-laying was observed shortly after noon. Several hundred eggs were collected per nest and placed into jars, which were brought onto our boat. The eggs, 0.7mm diameter, began hatching approximately 15 h later at 3:50am in slightly warmer water and the larvae, 3.2mm TL, swam upward.

0706 Herp Behavior, Symphony I & II, Monday 11 July 2011

Rulon Clark, Matthew Barbour

San Diego State University, San Diego, CA, USA

Predator-Prey Communication Between Northern Pacific Rattlesnakes (*Crotalus oreganus*) and California Ground Squirrels (*Spermophilus beecheyi*): The Response of Predators During Natural Signaling Interactions

When encountering predators, prey often exhibit conspicuous antipredator displays that communicate their awareness of the predator and/or their ability to escape. Predators are thought to alter their hunting behavior in response to these signals; however, there is little empirical evidence on predator behavior in most predator-prey communication systems. This is likely due to the difficulty of documenting signaling interactions and predator behavior under natural conditions. Rattlesnakes are an ideal predator for studying naturally occurring predator-prey interactions due to their sedentary ambush hunting style. We used a combination of radio telemetry and fixed videography to evaluate the responses of Northern Pacific Rattlesnakes (*Crotalus oreganus*) to tail-

flagging displays from California ground squirrels under natural conditions. Preliminary results from natural observations suggest that rattlesnakes rarely exhibit overt responses during the displays, but are more likely to abandon their ambush position after receiving intense, prolonged displays. However, after leaving their ambush position, snakes often remained in the vicinity of interaction locales and continue to hunt squirrels. These field observations comprise one of the most comprehensive assessments of predator responses to antipredator displays from prey, and will potentially contribute much needed empirical insight to predator-prey communication theory.

0696 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Nat Clarke[1], Richard Tinder[2], Kate Jackson[1]

[1]Whitman College, WA, USA, [2]Washington State University, WA, USA

The Physics Behind the Shape of Venom-Conducting Fangs in Snakes

Some snakes have highly-specialized, tubular fangs for conducting venom. These evolved from laterally-grooved fangs through a gradual deepening of the groove into an enclosed channel, and a simultaneous rotation so that the channel is on the anterior face of the fang. Much is known about the evolution of fangs, but the purpose of this rotation in tubular fangs remains unclear. We developed a mathematical model quantifying the forces acting on fangs of differing shapes and subsequently examined fangs representative of both the tubular and grooved types using electron microscopy and histology to test the hypothesis that basic physical principles inherent in the shape of fangs necessitate the rotation of the fang.

0777 Poster Session III, Sunday 10 July 2011

Emma Clarkson, Kevin Young, George Guillen

University of Houston, Environmental Institute of Houston, Houston TX, USA

Small-Scale Habitat Selection and Activity Trends of the Diamondback Terrapin in West Galveston Bay, Texas As Determined by Acoustic Telemetry

The Diamondback terrapin (*Malaclemys terrapin*) is the only Chelonian species that resides exclusively in brackish water. There is considerable interest in the conservation and protection of this species due to its overharvest in the early 1900's, extreme susceptibility to other forms of human-induced mortality, and consequent local population declines. It is considered an important component of the salt marsh ecosystem and may function as a keystone species. Several studies have been conducted on large-scale movement patterns, range, and migration of terrapin. However, few comprehensive studies have been conducted on short-term and/or diel movements and

habitat use. To evaluate short-term and diel movement and habitat utilization we used an acoustic telemetry receiver array to document tagged terrapin movement once every three minutes over a three year (May 2009-May 2011) period. This effort was coordinated with active terrestrial hand capturing efforts and passive trapping using modified crab traps deployed around South Deer Island in West Galveston Bay, Texas. These efforts provided us with useful data on habitat selection and movement trends of terrapin over small-scale (24 hour) and large-scale (annual) periods. We found instances of nocturnal activity in the open bay, and prolonged periods (>48 hrs) of open bay and tidal creek activity. No swimming activity was observed during January. Our findings highlight the need 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.

0084 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

John Clulow[1], Helen Robertson[3], Stephen Donnellan[2], Michael Mahony[1]

[1]University of Newcastle, Newcastle, NSW, Australia, [2]South Australian Museum, Adelaide, South Australia, Australia, [3]Perth Zoo, Perth, Western Australia, Australia

Genome Banking Australian Frogs - The Way Forward

The frog fauna of Australia is highly endemic and diverse. However, evolution in isolation has not prevented extensive species' declines and extinctions. Four Australian species are listed nationally as extinct since 1980; many more are endangered. Complicating responses to amphibian declines (with implications for biobanking sampling strategies), the taxonomy of the amphibian fauna is not fully resolved with new species described regularly. Genome banking has not been actively implemented as a biodiversity management tool in Australia to manage the genetics of small populations and insure against extinction, and the concept has not gained a prominent role in recovery and management plans. What could be done to change this situation? One approach is to present a mechanism to establish genome resource banks that is feasible, affordable and practical. A small, but active, research base in Australia could supply the capacity to develop procedures and protocols. The essential infrastructure is in place for an amphibian genome resource banking network. In Australia, the major museums hold extensive collections of frozen material. One example, the South Australian Museum, holds over 9000 frozen amphibian specimens, including highly threatened and extinct species (raising the possibility of species recovery through nuclear transfer). This infrastructure is capable of retrievably storing live cell lines, reproductive cells and tissues to regenerate live organisms. Advocacy and a paradigm shift is needed to convince institutions holding frozen collections of the benefits of accepting a biobanking role, and conservation agencies that biobanking is affordable and has substantial immediate and future benefits.

0697 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Philip Cochran

Saint Mary's University of Minnesota, Winona, MN, USA

Field and Laboratory Observations on the Ecology and Behavior of the Chestnut Lamprey (*Ichthyomyzon castaneus*)

Relatively little information on the ecology and behavior of the chestnut lamprey is available in the primary literature. I synthesize findings from several field and laboratory studies, with an emphasis on lampreys from the Saint Croix River drainage in Wisconsin and Minnesota. Spawning occurs in late May or early June, with substantial year-to-year variability in the onset of spawning associated with differences in water temperature. After metamorphosis from the larval phase, some parasitic phase lampreys move downstream, but others may feed parasitically in the same location where spawning and larval rearing occur. Parasitic attachments tend to occur relatively more often at night. Captive lampreys were able to attack successfully in complete darkness, but during the daytime they did not respond to visual cues when separated from hosts by a glass barrier. Like other parasitic species, chestnut lampreys tend to be size selective. Attachments tended to occur dorsally on hosts both in the laboratory and in the field. Reported host species in the Saint Croix system include redhorse, northern pike, and brown trout.

0397 Poster Session II, Saturday 9 July 2011

Kathleen Cole

University of Hawaii at Manoa, Honolulu, HI, USA

Looking for Character Traits in the Reproductive Morphology of Gobioid Fishes

Gonad developmental patterns are so far consistent within closely related gobiid taxa, but vary considerably among more distantly related clades. This is particularly evident in hermaphroditic taxa. The question is whether morphological traits associated with the reproductive system may be phylogenetically informative across a wider spectrum of gobioids. An investigation into comparative gonad morphology within the order Gobiiformes is in the early stages, but preliminary results are encouraging, and will be presented here.

0235 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

Bruce Collette, Kent Carpenter

National Marine Fisheries Service, Washington, DC, USA

Red Listing Tunas and Billfishes

Four IUCN Red List workshops focused on 64 species in four families of epipelagic marine fishes: Scombridae (tunas and mackerels), Istiophoridae (billfishes), Xiphiidae (swordfish), and Coryphaenidae (dolphinfishes). Previous Red List workshops on marine species concluded that all species of sea turtles and a large proportion of marine mammals, sharks and rays, and groupers fall into one of the threatened categories. However, 2/3 of the highly valuable and heavily fished tunas and billfishes fall into the category of Least Concern and only 17% are in one of the three threatened categories: Critically Endangered (2%), Endangered (2%), and Vulnerable (5%) or the next lower threat category, Near Threatened (8%). Evaluating the threat status of commercial species has revealed several problems in using IUCN Red List criteria. It is considered "normal" by many fishery biologists for a virgin stock to be fished down to 50% of its original spawning stock biomass in the first few years of a new fishery. If measured relatively soon after a fishery begins (within 3 generation lengths), this 'ski jump' picture would lead to an evaluation of Critically Endangered under Red List criteria. Populations of many species level off after the initial reduction so they may be able to be managed sustainably, although at a much lower level than in the original situation. However, in the cases of species like the Atlantic (*Thunnus thynnus*) and Southern (*T. maccoyii*) bluefin tunas, population reduction by overfishing has been so severe that these populations may not be able to recover.

0184 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

Patrick Colombo[1], Taran Grant[1], Laura Verrastro[2], Ralph Saporito[3]

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Geographic and Individual Variation in Alkaloid-Based Chemical Defenses of the Red Bellied Toad *Melanophryniscus simplex* (Caramaschi and Cruz, 2002) (Anura, Bufonidae)

Red bellied toads of the genus *Melanophryniscus* occur in southern South America and represent one of several lineages of anurans collectively referred to as poison frogs based on their shared presence of defensive alkaloids. Alkaloids in poison frogs are sequestered from a diet of alkaloid-containing arthropods, including ants, mites, beetles and millipedes, and are presumably used as a chemical defense against predators, parasites and pathogens. The composition of alkaloids present in poison frogs may vary

geographically among populations as well as among individuals of the same population. This variation appears to be associated with differences in the availability of alkaloid-containing arthropods at different locations. Characterizing patterns of variation in alkaloid composition in poison frogs is fundamental to understanding predator-prey interactions and the use of food resources by these frogs. Geographic and individual variation in alkaloid composition has been well documented in dendrobatid and mantellid poison frogs, but less so in *Melanophryniscus*. Herein we report on differences in alkaloid composition among and within populations of *M. simplex* from Atlantic Forest in southern Brazil. We analyzed alkaloid profiles of multiple individuals from eight populations of *M. simplex*. Our results show marked differences in alkaloid composition among populations and among individuals of the same population. Some of the alkaloids identified in *M. simplex* are likely obtained from dietary mites and ants, although specific dietary sources have not yet been identified.

0020 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

Robert Colombo[1], John West[1], Trent Thomas[2]

[1]*Eastern Illinois University, Charelston, IL, USA,* [2]*Illinois Department of Natural Resources, Gibson City, IL, USA*

Effects of Habitat Restoration on Stream Fish Assemblages in a Midwestern Stream

During 2001, a massive fish kill occurred in Kickapoo Creek near Charleston, Illinois due to a spill of 8000 gallons of the chemical furfural. The company responsible for the spill was required to finance a restoration project. The Illinois Department of Natural Resources identified a 0.5 km stretch of stream as needing restoration. Restoration completed during September 2010 included both bank stabilization and the creation of artificial riffles. We are attempting to assess the effect of instream restoration on the fish community assemblage. To have a representation of pre-restoration community assemblage, we sampled four stream reaches of Kickapoo Creek: two control reaches (upstream and downstream) and two treatment reaches within the 0.5 km restoration stretch (upper and lower). During fall 2009 and spring 2010, a six person crew sampled all four sites using an electric seine. We collected 8530 individuals from 32 different species. Relative density as estimated by CPUE was higher in the fall (6.53 fish/m) compared to the spring (3.05 fish/m). Additionally, Shannon-Weiner diversity was higher in the fall (2.24) compared to the spring (1.95). These large differences in density and diversity point to the need for standardization of stream sampling protocols. Post restoration sampling will continue through spring 2012 to assess the impacts of restoration on the fish community assemblage.

0487 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Justin Congdon[1], Whitfield Gibbons[1], Ronald Brooks[1], Njal Rollinson[1], Ria Tsaliagos[1]

[1]Savannah River Ecology Lab, Aiken, SC, USA, [2]Savannah River Ecology Lab, Aiken, SC, USA, [3]University of Geulph, Guelph, Ontario, Canada, [4]Dalhousie University, Halifax, Nova Scotia, Canada, [5]Savannah River Ecology Lab, Aiken, SC, USA

Perceptions of Indeterminate Growth and its Importance in the Evolution of Turtle Life Histories and Longevity.

Although evidence for or against the assumption (and assertion) that reptiles exhibit indeterminate growth has been weak and equivocal, the general concept is widely accepted. We examined patterns of variation in adult growth using long-term mark-recapture data on 13 populations of 9 species of freshwater turtles located in South Carolina, Michigan, and Arizona in the USA and in Ontario, Canada. Adult growth rates among 13 populations averaged 1.5 mm/yr and sources of variation in growth rates included species, population, sex, and age. Some adults of both sexes (recapture intervals > 4 years) grew, but among all populations an average of 19.2% did not grow. For both sexes of known-age turtles of three species, the highest growth rates occurred from 1–9 years following sexual maturity, and the proportions of individuals that did not grow increased with age. Compared to juvenile growth rates, adult growth was reduced by approximately 93%. At average juvenile and adult growth rates, it would take 0.7 (0.2 – 1.2) years and 8.6 (2.3-18.5) years, respectively, to increase clutch size by one egg (a benefit discounted by mortality rates). The major determinant of within population variation in adult body size appears to be a combination of differences in juvenile growth rates and ages at maturity, rather than indeterminate growth. Our study indicates that although all of the turtle populations studied exhibited indeterminate growth in the general sense, adult growth does not appear to be a trait that is strongly involved in the evolution or maintenance of longevity.

0718 Poster Session III, Sunday 10 July 2011

Martin Connaughton, Joseph Yates

Washington College, Chestertown, MD, USA

Effects of Exogenous Steroids on Seasonally Dimorphic Changes in the Sonic Muscle of the Atlantic Croaker, *Micropogonias undulatus*.

Male and female Atlantic croaker possess specialized sound producing muscles lateral to the swimbladder. Sounds are used for startle response by both genders but for courtship exclusively by the males. During the mating season these sonic muscles hypertrophy in males and atrophy slightly in females. A steroid implant experiment including four groups (time zero, sham [coconut oil vehicle only], testosterone [T], and estradiol [E2]) was carried out to determine if these seasonal changes are driven by

steroids rather than by altered use patterns. ELISA analysis of end-of-experiment plasma steroid titers indicated significant (three orders of magnitude) increases in T and E2 implanted fish. Gonadosomatic index (GSI) increased significantly in males and females from time zero in the sham group indicating that the fish were still maturing. Females exhibited no further significant changes in GSI, while those of males decreased significantly in both the T and E2 groups. Male sonic muscle -somatic index (SMSI) increased (not significant) in the T group and decreased significantly in the E2 group compared to the time zero and sham groups. Female SMSI did not vary greatly and did not decrease in response to E2 treatment. Sonic muscle tissues of all groups are being histologically examined for differences in myofibrillar, sarcoplasmic and total fiber cross-sectional area. Results support a potential role for testosterone but not estrogen in the seasonal hypertrophy of male and atrophy of female sonic muscles and suggest that differential use of the muscles might also play a role in these spawning-season changes.

0373 Poster Session II, Saturday 9 July 2011

Kevin W. Conway[1], Lukas Rüber[2], Héctor Espinosa Pérez[3], Phil Hastings[4]

[1]Texas A&M University, College Station, TX, USA, [2]Natural History Museum, London, UK, [3]Instituto de Biología, UNAM, Mexico, [4]Scripps Institution of Oceanography, La Jolla, CA, USA

Phylogenetic Relationships of the Skilletfishes (Genus *Gobiesox*): Preliminary Insights from Mitochondrial DNA

With 29 valid species, the genus *Gobiesox* is the largest generic grouping of clingfishes (family Gobiesocidae). It also exhibits the widest distribution of any of the clingfish genera, found along the Pacific coast from Alaska to Chile and the Atlantic coast, including the Caribbean, from at least Virginia to Brazil. *Gobiesox* is also particularly noteworthy because it includes the only freshwater members of the family (eight species of *Gobiesox* inhabit swift streams in Central America, northern South America and adjacent Caribbean Islands). Generic-level taxa that include both marine and freshwater species are relatively rare and provide a unique opportunity to investigate the evolution of morphological and physiological specializations associated with the transition from marine to freshwater habitats in a phylogenetic context. Unfortunately, the phylogenetic relationships of skilletfishes are presently unknown and the relationships of its freshwater members are unclear. We present preliminary hypotheses on the relationships of nine species of *Gobiesox* and 17 outgroup taxa based on phylogenetic analyses of CO1 and 12s nucleotide sequence data. All analyses recovered a monophyletic freshwater *Gobiesox* clade, that was sister group to all remaining (marine) *Gobiesox*. Though tentative, our results support a single origin for freshwater clingfishes congruent with previous (non-phylogenetic) hypotheses about their relationships.

0172 Poster Session III, Sunday 10 July 2011

Gerardo Antonio Cordero, Christan Halverson, Fredric Janzen

Iowa State University, Ames, IA, USA

Reevaluating Patterns of Embryological Development in the Painted Turtle, *Chrysemys picta*

The Painted Turtle (*Chrysemys picta*) is a model for the study of key questions ranging from the evolution of sex determining mechanisms to physiological adaptation in turtles. Moreover, the phylogenetic position of turtles makes it an important taxon for comparative analyses of developmental traits in amniotic vertebrates. Though a sequenced *C. picta* genome and associated resources will soon be available to researchers, there is a paucity of information on the development of this species. To remedy this, we reevaluated the embryological development of *C. picta*. We collected and incubated 132 *C. picta* eggs. These were sampled beginning with day 7 and ending in day 38 after oviposition. Embryos were preserved and photographed to describe key developmental features using the Standard Event System for Vertebrate Embryology. We compared our findings to Mahmoud et al.'s (1973) staging criteria for *C. picta*. Then we contrasted developmental events to those described in the published criteria for sister species *Trachemys scripta*. Lastly, we assessed whether the widely used Yntema (1968) criteria for *Chelydra serpentina* could be generalized to *C. picta*. Our results confirm that Mahmoud et al.'s (1973) criteria should be preferentially used when describing the development of this species. We recommend for studies of turtle developmental biology to be guided by species-specific accounts as to reduce biases that may arise due to phylogenetic distance.

0255 AES Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Aurélie Cosandey-Godin[1], John K. Carlson[2], Valérie Burgener

Department of Biology, Dalhousie University, Halifax, Nova Scotia, Canada, [2]National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, Florida, USA

Little effect of circle hooks on elasmobranch catch and at-vessel mortality in pelagic longline fisheries

Fisheries bycatch is a main cause of population declines in several species of sharks and skates around the world. Circle hooks have gained attention as a cost-effective bycatch mitigation tool in pelagic longline fisheries, particularly for marine turtles. Over the last few years, a growing number of studies have investigated the use of circle hooks and their effects on other species, including elasmobranchs. To elucidate the value of circle

hook as a conservation tool for shark management in pelagic longline fisheries, we conducted a quantitative review of all studies to date, including recent data presented at the Circle Hook Symposium, Miami, Florida (May 2011). The effects of circle hooks on catchability and at vessel mortality rates were analyzed with random effects meta-analysis using an odds ratio test and analysis of covariance. Based on our review and meta-analysis, the use of circle hooks (1) does not affect total catch of all shark species combined; (2) may slightly increase catch rates of mackerel sharks; (3) reduce catch rates of pelagic stingrays; and (4) does not significantly reduce at-vessel mortality of shark species. In light of these largely trivial results we urged managers and scientists to explore other bycatch mitigation to reduce bycatch mortality of sharks.

0439 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Matthew Craig

University of Puerto Rico Mayaguez, PR, USA

Phylogenetic Relationships of the Cowfish Genus *Acanthostracion* Bleeker

The genus *Acanthostracion* comprises four species distributed in the Atlantic Ocean basin. Hypotheses of relationships among these four species are largely absent from the literature, primarily due to historical confusion surrounding their generic placement, but also due to a lack of comparative morphological features common to the group. In the current study, genetic data from mitochondrial and nuclear DNA were used to create a phylogenetic hypothesis for all species of *Acanthostracion*. These results are interpreted along with previous morphological characters hypothesized to be informative, and a biogeographic scenario for the evolution of the genus is presented.

0506 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Todd Crail, Jonathan Bossenbroek

University of Toledo, Toledo, OH, USA

Different Riffles, Same Species Space: Habitat Utilization and Partitioning in Darter Communities of the Ohio River Basin

To better understand assemblages of sympatric populations of *Etheostoma* darters, we examined the distribution of eight species in the Ohio River basin. Our hypothesis was more specialized species would utilize distinctive environmental space and cause shifts in habitat usage of more broadly distributed species where they co-occurred. Over 700 samples were taken by seine at 14 riffles in ten streams in the Ohio River drainage to test our hypothesis. First, we used CCA to visualize the relationships between species and

flow, depth, and substrate composition. Common species such as *E. blennioides* and *E. zonale* were associated with sand, gravel and low flow while rarer species such as *E. camurum* and *E. maculatum* were associated with cobble, higher flow and deeper segments. Using a univariate density estimator, we were able to determine significantly different habitat usage for most species across multiple axes. We also found that habitat usage frequently shifted with and without the presence of an associated species. We found significant shifts in habitat usage for most species, and supported our hypothesis that specialized species would cause shifts in habitat usage of more common species. For example, the greatest number of significant shifts occurred in the presence of *E. flabellare*, *E. maculatum* and *E. variatum*, while these species exhibited the least number of shifts in the presence of their associates. Our research suggests that local environmental variables and interspecific interactions should be considered for management of declining species and when investigating species reintroductions.

0348 Poster Session III, Sunday 10 July 2011

Adam Crane, Alicia Mathis

Missouri State University, Springfield, MO, USA

Predator-recognition Training: A Conservation Strategy to Increase Post-release Survival of Hellbenders in Head-starting Programs

For species with declining populations, captive-rearing with subsequent release into natural habitats ("head-starting") is often used as part of a conservation strategy. One challenge to head-starting programs is that head-started individuals can suffer high rates of post-release predation. Head-starting programs are currently being established for hellbenders (*Cryptobrancus alleganeinsis*), large aquatic salamanders that are experiencing population declines throughout much of the species' range. Although hellbenders have innate recognition of many predators, inexperienced juveniles show only weak recognition of introduced trout. We used a classical conditioning protocol to train captive-reared hellbender larvae to show fright responses to the scent of trout. We exposed hellbender larvae to trout-scented water plus a hellbender distress secretion during training trials. In a subsequent test, these larvae responded to trout cues alone with a fright response; control larvae that were trained with the trout scent plus a blank control did not show a fright response to the trout cues. Learning was specific to trout because trained larvae did not respond to water that had been scented by a suckermouth catfish. Although a number of details remain to be addressed concerning standardized procedures, we recommend that head-starting programs for hellbenders include trout-recognition training.

0290 Herp Behavior, Symphony I & II, Monday 11 July 2011

Adam Crane, Carly McGrane, Alicia Mathis

Missouri State University, Springfield, MO, USA

Socially-facilitated Antipredator Behavior by Ringed Salamanders (*Ambystoma annulatum*)

Many aspects of animal behavior can be socially facilitated, including foraging behavior, exploration behavior, and antipredator behavior. Larvae of the ringed salamander (*Ambystoma annulatum*) hatch from eggs in ponds where they can live in high density and face intense predation pressure. In a predator-recognition experiment, we found that these salamanders responded to chemical cues from dragonfly naiads (Family: Libellulidae) with appropriate antipredator behavior (reduced activity), and this response was absent when salamanders were exposed to chemical cues from nonpredatory mayfly naiads (Family: Heptageniidae). In a second experiment, we tested whether antipredator behavior in response to dragonfly naiads could be socially facilitated among larval ringed salamanders. We placed an 'observer' salamander into a central arena, with four 'demonstrator' salamanders behind clear barriers around the arena. The barriers ensured that chemical cues would not be detected by the observer. When demonstrators were exposed to chemical cues from dragonfly naiads, both demonstrators and observers reduced activity relative to a blank control. Our results provide evidence that social facilitation can occur in larval ringed salamanders.

0737 Poster Session III, Sunday 10 July 2011

Brian Crnobrna

Asociacion Fauna Forever, Puerto Maldonado, Madre de Dios, Peru

Comparison of 20 m Quadrats to Smaller Quadrat Methods in Studies of Amazonian Reptile and Amphibian Populations

One common method for studying reptile and amphibian populations in rainforest environments is the intensive quadrat search. Designed to find all animals present within a restricted area, multiple observers focus all their effort inside the quadrat in a coordinated fashion. This usually involves using the corners of a square plot as strategic start and end points, which observers make their way to or from either together or separately. Commonly, quadrats are eight or ten meter squares, with observers starting at all four corners and moving inside. Over ten years of study, this methodology has proven to be capable of finding reptiles and amphibians in the lowland Amazon rainforests of Southeast Peru, but averages less than two individuals per quadrat. Since being introduced last year, 20 m quadrats have revealed more species and a greater density of reptiles and amphibians over a smaller number of samples (n=70), when compared to an equal area represented by 10 m quadrats from similar areas of the forest. These larger quadrats may well be recognized as a hybrid protocol, with separate

surveys running "corner-in" followed immediately by a "center-out" approach. More recent data have found that the initial "circular walk" method actually yields fewer animals compared to follow-up searching within the quadrat area. These findings call into question the traditional 10 m quadrat as a complete survey method.

0736 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

Brian Crnobrna, Chris Kirkby, Madison Wise

Asociacion Fauna Forever, Puerto Maldonado, Madre de Dios, Peru

Tracking and Comparing Reptile and Amphibian Species Accumulation Over Year Long and Ten-year-long Surveys in a Diverse Amazonian Protected Area (Tambopata National Reserve, Madre De Dios, Peru)

Developing species accumulation curves generated through rarefaction analysis is a fast track to determining effectiveness of surveys, in cases when they express a reduction in species discovery rate. Over the course of multiple visual encounter survey (VES) transects repeated in a small (1 ha) area over the period of one year, these curves usually indicate that a complete survey has been done e.g. all species present have been detected. This was the case for two out of four sites in the Tambopata region in the lowland Amazon of Peru, while others reflected a more stochastic rate of species accumulation. In contrast to this finding, the differences between these curves, built from 100m VES transects, and the comparatively more stable ten-year-long curves made from complete one year studies of larger rainforest sites, suggest a wider relationship over time between the species detected on restricted plots and the biodiversity of areas up to the size of watersheds.

0649 Poster Session II, Saturday 9 July 2011

Stephanie Crofts

University of Washington, Seattle, WA, USA

Finite Element Analysis of Simplified Crushing Teeth

A number of lineages of non-mammalian organisms include durophagous members; animals that have modified their jaws and teeth to allow them to eat hard prey. It has been proposed that the generalized molariform tooth shape is an adaptation to either increased crushing efficiency, or increased resistance to breakage. In this study, we test the second of these hypotheses, and explore the effects of forces on the teeth using finite element analysis (FEA). We constructed simplified, canonical models of teeth and loaded them with point and distributed loads to simulate different prey morphologies. Three series of tooth models were constructed that graded from one morphological extreme to another. These included degree of convexity/concavity of the occlusal

surface, height of a small conical stress concentrator, and radius of a centrally located stress concentrator. We used maximum principal stress as an indicator of where on the tooth failure was most likely to occur. We found that shallowly domed and cupped teeth are probably most effective at resisting breakage, and that there are functional limits to the shape of a central force concentrator. Our results demonstrated that effective tooth shape depends, in part, upon the size and shape of the prey item.

0423 Poster Session III, Sunday 10 July 2011

Paul Cupp

Eastern Kentucky University, Richmond, KY, USA

Responses of Ground Skinks, *Scincella lateralis*, and Green Anoles, *Anolis carolinensis*, to chemical deposits of eastern milk snakes, *Lampropeltis triangulum*

This study compared the ability of ground skinks, *Scincella lateralis*, and green anoles, *Anolis carolinensis*, to detect chemical deposits of eastern milk snakes, *Lampropeltis triangulum*. In feeding trials, both species of lizards were eaten by *L. triangulum*. Tests were conducted in plastic containers in which each lizard had a choice of two substrates. In the experiment, one substrate consisted of a moist paper towel exposed to *L. triangulum* for 24 hours and the other consisted of a moist paper towel without snake odor. Lizards were released at the center of the containers and their positions monitored for two 40-min periods. The results indicated that *S. lateralis* preferred the substrate with no odor over that with *L. triangulum* odor. However, *A. carolinensis* showed no significant preference for either substrate. The avoidance of predatory snake odors by *S. lateralis* may be related to their burrowing habits in leaf litter where milk snakes may be encountered. In this habitat, they rely more on chemical senses to detect and avoid predators. But, *A. carolinensis*, being highly arboreal, are less likely to encounter milk snakes and do not avoid their odors.

0661 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Jonathan Dale, Kim Holland

University of Hawaii at Manoa, Honolulu, HI, USA

Metabolic Rates and Bioenergetics of Juvenile Brown Stingrays, *Dasyatis lata*, in Kāne'ohe Bay, Oahu, HI

Many species of elasmobranchs use coastal bays and estuaries as nursery habitats. Yet the ecological impacts of juveniles within these nursery habitats have received relatively little attention. Static respirometry was used to determine standard metabolic rates

(MO2) for 20 juvenile brown stingrays ranging in size from 1.03 to 9.85 kg. Experiments were conducted on seasonally acclimatized rays at temperatures from 22.5 to 27.3 °C. Estimates of mass-specific MO2 ranged from 53.06 mg O2 kg-1 h-1 for a 9.85 kg individual at 23 °C to 115.99 mg O2 kg-1 h-1 for a 1.16 kg animal at 27 °C. A general linear model was used to test the effects of mass (M) and temperature on whole-animal MO2. Both mass and temperature had significant effects on MO2 ($P < 0.001$) and explained 98% of the variance in MO2 values. Standard metabolic rates increased with temperature at a Q10 (22-27 °C) of 1.82 and increased with mass following the allometric equation: MO2 (mg O2 h-1) = 107 x M0.78. A bioenergetics model was used to estimate daily ration for brown stingrays and to evaluate the impacts of brown stingrays on their primary prey items in Kāneʻohe Bay.

0264 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Tanya Darden

SC Dept. Natural Resources, Charleston, SC, USA

Dispersal and Colonization of Fish Communities within Palustrine Wetland Complexes

Due to high rates of wetland habitat destruction and subsequent re-creation efforts, it is crucial to understand the biological processes of these natural systems. Current functional knowledge revolves primarily around wetland hydrology and physical vegetative structure, without regard to the rest of the biological community. Using a model group of sunfishes, previous research evaluating dispersal processes in palustrine wetlands throughout the Atlantic coastal plain suggested that the current regulatory assumption of natural recruitment in these systems is not a valid management strategy. My current project expands upon this work by addressing these processes in entire fish assemblages and at smaller spatial scales. Specifically, I'm using molecular genetic techniques to reconstruct the evolutionary histories among communities within wetland complexes of the Francis Marion National Forest and addresses whether fish communities of these systems are functioning as metapopulations. These complexes occur at varying spatial scales within the forest which will allow for the determination of critical distances to gene flow, if they exist, for these wetland-dependent fish communities. An increased mechanistic understanding of these processes will allow for the development of more effective management and conservation practices for these critical wetland resources and their biological communities.

0776 Poster Session I, Friday 8 July 2011

Jonathan Davis

Leigh Marine Laboratory,University of Auckland, Ocean City, MD, USA

Movement and Behaviour of the New Zealand Eagle Ray, *Myliobatis tenuicaudatus*

The ability of intertidal species to navigate through the shallow waters of estuaries and orient themselves in such a featureless environment is a continuing area of interest for many researchers. The New Zealand Eagle Ray, *Myliobatis tenuicaudatus*, is one of these intertidal species that has developed the ability to utilize these highly productive intertidal habitats and stay safe from stranding. It has been suggested that the use of tidal information and particularly orientation to water currents may be one cue that is used to avoid stranding on an outgoing tide. The movements of *M. tenuicaudatus* in relation to the tides they were tracked and analyzed using GPS data-loggers, telemetry transmitter/receivers, and software for behavioural modelling. The modelling broke down movements into Transiting or Area-Restricted Behaviour (ARB) according to breaks in movement trajectories determined by changes in speed or heading angle. With respect to heading angle, transiting movement was centred around 0° while ARB was recognised when the track turned back on itself. The models show a definitive use of the tides for transiting movement in and out of the estuary during rising and falling tides, while also showing their resting/feeding behaviour in the channels in the lower part of the estuary at low tide, and across the mudflats in different areas at times of high tide. In addition to the fieldwork, two tanks were set up with spray-bars attached to solenoids and timers that would simulate the tidal cycle ever six hours and ~12-15 minutes. Two rays were put in these tanks and behaviour was recorded for 13 days. They exhibited positive rheotaxis ~100% of the time they were resting and every time the flow changed they reacted within 90 seconds by turning and facing the new current direction. This is consistent with the orientation seen in the field by fresh pits and resting/feeding rays.

0519 Poster Session II, Saturday 9 July 2011

Julian Davis, Steve Poe

University of New Mexico, Albuquerque, NM, USA

A Phylogenetic Analysis of the *Anolis pentaprion* Species Group

The lizard genus *Anolis* is the largest and most diverse amniote genus with over 369 species spanning North America, Central America, South America, and the Greater and Lesser Antilles. *Anolis* are easily recognized by their dewlaps, a throat fan used for inter- and intra-specific signaling, and their expanded toepads with modified scales used for climbing. The phylogeny of *Anolis* has been difficult to elucidate because of the great size of the genus and the apparent morphological conservation among species.

The relationships of mainland forms are especially poorly known. I am working on the relationship of the *A. pentaprion* species group from Central America. This group includes seven species distributed from Southern Mexico to Northern Colombia. I have gathered morphological and molecular data to conduct a phylogenetic analysis in PAUP*4 and MrBayes. I will test biogeographic hypotheses for the evolution of this clade.

0407 Snake Morphology, Symphony I & II, Saturday 9 July 2011

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

[1]Illinois Natural History Survey, Unviersity of Illinois, Champaign, IL, USA, [2]Stephen F. Austin State University, Nacogdoches, TX, USA, [3]University of Arkansas, Fayetteville, AR, USA

Head Shape and its Contribution to the Phylogenetic Resolution of the Western Rattlesnake Complex (*Crotalus viridis* and *C. oreganus*)

Molecular genetic approaches have broadened and extended Klauber's early 20th century approaches to the phylogenetic relationships within the Western Rattlesnake Complex. Yet additional research is needed. Here we augment previously-established molecular phylogenetic hypotheses with a modern morphological perspective. Our objective is to determine how informative head shape is in clarifying phylogenetic relationships within the complex. Geometric morphometric analyses were conducted on >3,000 snakes comprising 9 putative subspecies of *Crotalus viridis*/*C. oreganus*, representing both sexes, all stages of development distributed across their geographic ranges. First, we compared a shape-based phylogenetic hypothesis against one derived from molecular genetic data to assess overall congruence. Discriminant function analysis of shape variables was then employed to assign individuals to well supported molecular clades. Finally, we quantified the importance of gender, ontogeny, ecology, and phylogeny in the evolution of head shape by contrasting these models using phylogenetic generalized least squares (PGLS) estimation. Results depicted both synergistic and antagonistic components of trophic morphology, and identified historical contingency (phylogenetic constraint) vs independent (ecologically-driven) morphological evolution. Additionally, the utility of geometric morphometric shape variables in yielding a reliable phylogenetic signal is discussed. Ultimately, these data will contribute (with DNA data) towards phylogenetic resolution of this group, and promote newer hypotheses regarding the evolution of head morphology within the complex and among pit-vipers in general.

0098 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Matthew Davis[1], Prosanta Chakrabarty[1], Wm. Leo Smith[2], Zach Baldwin[3], John Sparks[3]

[1]Louisiana State University, Baton Rouge, LA, USA, [2]The Field Museum, Chicago, IL, USA, [3]American Museum of Natural History, New York, NY, USA

Is Sexual Selection Driving Diversification of the Bioluminescent Ponyfishes (Teleostei: Leiognathidae)?

Sexual selection is a mechanism of speciation that theoretically could provide genetic isolation among populations and lead to an increase in diversification rates. In this study, we investigate the impact of potential sexual selection on the diversification of ponyfish evolution. Ponyfishes (Leiognathidae) are bioluminescent marine fishes that exhibit sexually-dimorphic features of their unique light-organ system (LOS), and sexual selection has previously been hypothesized to be a driving force behind ponyfish speciation. Given that some leiognathid species have a sexually dimorphic LOS, whereas others do not, this family provides an excellent system within which to study the potential role of sexual selection in diversification and morphological differentiation. In this study we estimate the phylogenetic relationships and divergence times of Leiognathidae and investigate ponyfish diversification. Our studies of ponyfish diversification identify that there is no conclusive evidence that sexually-dimorphic taxa are significantly more species rich than non-sexually dimorphic lineages given time, and there is no evidence to support any significant diversification rate increases within ponyfishes. Further, we detected a lineage through time signal that indicates that ponyfishes have continuously diversified through time, which is in contrast to many recent diversification studies that identify lineage through time patterns that support mechanisms of density-dependent speciation.

0288 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Mike Davis

Minnesota Department of Natural Resources, Lake City, MN, USA

Urban River Redemption - A Mississippi Mussel Story

Historically the Mississippi River below St Anthony Falls supported over 40 species of native mussels. Mussels have been integral players in river ecology for millions of years, filtering organic matter from the water and providing food and habitat for aquatic life ranging from algae and snails to turtles and walleye. They are unique among mollusks in having a parasitic larval stage requiring a host. Larvae are delivered to hosts by mimicking prey. Once so abundant that the river was paved with mussels, degraded water quality had eliminated them by 1900 in the Twin Cities. These Dead-Zone conditions continued for decades. Water quality improved as Clean Water Act

provisions were implemented from 1980-2000. Today, both native fish and mussels are again thriving in this reach of the river. However, 20 species of native mussels have yet to recolonize. In order for this to occur, hosts carrying mussel larvae must travel from a part of the river still supporting these species to the reach above Lake Pepin - travel that is greatly impeded by dams. Improved conditions present an opportunity to reintroduce missing native species. Efforts to date include a Federally Endangered mussel, *Lampsilis higginsii*, and several state listed species. More reintroductions are planned. Ironically, this former dead-zone of the Mississippi may now become a mussel refuge.

0456 Poster Session II, Saturday 9 July 2011

Juan D. Daza, Aaron M. Bauer

Villanova University, Villanova, PA, USA

An Amber-embedded Sphaerodactyl and the Morphological Evolution of Sphaerodactylidae

Fossil amber from Hispaniola (Dominican Republic) is an important source of herpetological specimens from the late Early Miocene through early Middle Miocene (15 to 20 million years ago). Two specimens found in this amber have been referred to the extant genus *Sphaerodactylus*. To date identification of this material has relied on just a few integumentary characters. This has resulted in some taxonomic confusion and in one case even the familial allocation of the specimen has been called into question. We present data on a new specimen of Miocene sphaerodactyl for which both skeletal and integumentary data are available. This specimen was included in a phylogenetic analysis using 674 morphological characters and 15 gekkotan species, including representatives of all the sphaerodatylid genera. It was possible to score 240 characters (34.5%) for the amber gecko. The most parsimonious trees place the amber gecko with the genus *Sphaerodactylus*. We present this morphologically-based hypothesis of relationships for the family Sphaerodatylidae and provide diagnostic features for its major suclades.

0615 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Mario de Pinna

Museu de Zoologia da Universidade de Sao Paulo, Sao Paulo-SP, Brazil

Structure and Relationships of Primitive Loricarioid Catfishes (Siluriformes, Trichomycteridae and Nematogenyidae): Effects of Long-branches and Taxonomic Density in Lower Loricarioid Phylogeny

Although there has been no question about loricarioid monophyly, relationships among its basal components remain controversial. It has been noticed that resolution of the question hinges heavily on character states displayed by primitive members of the Trichomycteridae (Trichogeninae and Copionodontinae) but modified beyond meaningful comparison in more distal members of the family. This phenomenon is a reflexion of the effect of taxonomic density in the accuracy of phylogenetic hypotheses, often discussed in context of fossil taxa but equally applicable to studies involving living taxa only. Despite their interest in understanding higher-level relationships among loricarioid families, the anatomy of primitive trichomycterids and of the Nematogenyidae remains known only in its general features. In this paper, a detailed analysis is presented of the anatomy of primitive trichomycterids, with emphasis on comparisons with nematogenyids. These and other comparisons disclose new evidence which strongly supports a sister-group relationship between Trichomycteridae and Nematogenyidae. Again, conditions in Copionodontinae and Trichogeninae remain key to a correct parsimonious resolution of several morphological characters. The phenomena herein observed in morphology are analogous to the effects of long branches in analyses of molecular sequences. Likewise, the impact of taxonomic density on phylogenetic accuracy are equally visible in lower loricarioid phylogeny. Reasons for the lack of support from molecular sequences for a Trichomycteridae/Nematogenyidae clade are also discussed. [funded by CNPq proc. 307207/2009-9]

0645 Poster Session I, Friday 8 July 2011

Mason Dean[1], Justin Schaefer[2], Dominique Adriaens[3], Adam Summers[4]

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Morphological Bases of Force Transmission in the Cartilaginous Skeletons of Sharks and Rays

Cartilaginous skeletons and cartilage-cartilage joints are the norm in the low impact environment of vertebrate embryos. In cartilaginous fishes, however, cartilage-cartilage joints clearly function as high performance surfaces, bearing similar loads as in adult bony skeletons. The cartilaginous fish skeleton is also clearly capable of tolerating and functioning under large applied muscular forces, but it is unclear how tendons actually

attach and transmit loads to the skeleton, given that the pullout strength of skeletal cartilage is significantly lower than that of bone. We investigate the tissue and structural morphologies involved in the application and management of forces in the elasmobranch skeleton, by examining tendinous insertions and joints associated with the cartilaginous fin radials of two stingray species using histology, high-resolution tomography (μCT, SR-μCT) and back-scattered electron imaging. The tendon-to-cartilage insertions are structurally complex and exhibit interesting morphological anchor designs for resisting avulsion: shallow fiber insertion angles; bulbous 'fiber plugs'; and analogs to mammalian Sharpey's fibers. Inter-radial joints are encapsulated in a layered series of concentric tissue wrappings, grading from fibrous perichondrial tissue peripherally, through an intermediate, more cellular layer, to the highly cellular joint center, which lacks any intervening uncalcified cartilage as a bearing surface. The calcified portions of the articulating ends of two radials form reinforcing struts, with the fibers of the joint capsule merging into the surrounding mineralized tissue. These features indicate that forces impinging on the elasmobranch skeleton are managed through characteristic local variations in the proportion and arrangement of mineralized cartilage and fibrous tissue.

0248 Fish Morphology, Symphony I & II, Friday 8 July 2011

Alison Deary, Eric Hilton

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

Comparative Ontogeny of the Oral Jaws in the Drums (Sciaenidae) of the Chesapeake Bay with Comparisons to the Freshwater Drum, *Aplodinotus grunniens*

Starvation is one of the main causes of larval mortality in fishes. By studying the ontogeny of structures that are used for feeding, such as the oral jaws, better predictions regarding larval survival may be devised. Adult drums occupy a diversity of freshwater and marine habitats worldwide, and it has been demonstrated that the morphology of the feeding apparatus can influence the selection and exploitation of essential fish habitat and the foraging strategy utilized. Adults of closely related species show segregation in feeding niches matched by differences in mouth position, dentition, and structure of the oral jaws. As adults, benthic feeding species have an inferior mouth position, relatively shorter premaxillae, and enlarged ascending processes of the premaxillae than pelagic feeding species. Little research has investigated the ontogeny of the oral jaws in larval sciaenids. This presentation focuses on the anatomy and ontogeny of the oral jaws in six genera of Sciaenidae from Chesapeake Bay and the freshwater drum *Aplodinotus.* Clearing and staining techniques were used to examine the structure of the oral jaws in larval and post-larval (juvenile and adult) specimens. Species that forage in the water column as adults had a significantly longer lower jaw (5.54 mm, $p=5.29 \times 10^{-9}$) and a smaller ascending process of the premaxilla ($p=2.70 \times 10^{-7}$) compared to species that are benthic foragers as adults (1.33 mm; 2.26 mm). These findings suggest

that by 20.0 mm, species have developed characters in the oral jaws that enable them to partition their feeding niches.

0314 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

Jennifer Deitloff, Craig Guyer

Auburn University, Auburn, AL, USA

Hemipenes vs. Dewlaps: Which Morphological Characters Can be Used to Delineate Species in Anoles?

Previous research has suggested that *Norops humilis* should be divided into several species within its range in Costa Rica due to differences in hemipenis morphology, dewlap coloration, and/or additional morphological characteristics. However, different research groups disagree on these species delineations and on which characteristics are more important in describing new species. Combining several of these species hypotheses, *N. humilis* remains the species delineation for individuals with a long-lobed hemipenis and red-with-yellow-border dewlap; *N. quaggulus* is designated for populations with a short-lobed hemipenis and red-with-yellow-border dewlap; and *N. marsupialis* has been proposed for populations with a red-purple dewlap lacking the yellow border. Using a preliminary molecular phylogeny to separate groups by genetic relatedness, we tested whether hemipenis morphology and/or dewlap color can indeed be used to determine genetic relatedness and, thus, to delineate new species. Our results suggest that dewlap color corresponds closely with the molecular phylogeny, but that hemipenis morphology does not. We conclude that different hemipenis morphologies may exist within one species, possibly correlating with differences in male reproductive strategies, or that different species possess very similar hemipene morphologies and species diversity is likely much greater than currently proposed. Further sampling as well as behavioral comparisons will help in determining which characteristics are essential for maintaining reproductive isolation between species of anoles.

0055 AES Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Andrea Dell'Apa[1], Simona Clò[1]

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Comparative Analysis of Elasmobranch Vs Fish Landings in Italy Within the Frame of the Law 41/82: Consequences for Elasmobranch Fishery Management

Elasmobranchs are extremely vulnerable to overexploitation, owing to their specific biology and life history characteristics. European shark fisheries are virtually

unregulated or unmanaged at both national and regional levels. We analyzed and compared national (ISTAT) historical data of elasmobranch and fish landings between 1959-2004, to investigate on changes in fishery exploitation toward elasmobranchs over time. Rays (*Raja spp*.) and smooth-hounds (*Mustelus spp*.) are the only elasmobranch categories present in the data, but other similar species could have been mistakenly annexed within these groups. Qualitative comparisons are useful since species description is often ambiguous and hard to be interpreted from landing data. Elasmobranch landings were steady until the beginning of the 1970's, peaked in the 1990's, then sharply declined. Mean annual landing for elasmobranchs in recent years (1997-2004) decreased 77% compared with previous years (1959-1982). This remarkable decrease may be attributed to elasmobranch overharvest occurred during the 1980's and the 1990's. That was likely an unreported effect of the 41/82 law issuing, known as "Plan for the rationalization and the development of commercial fishery", and contributed to a serious decline in landings of sharks and rays. In order to foster elasmobranchs management and conservation, there is an urgent need to improve actual species stock assessment programs, to advance knowledge on catches, landings and production of sharks and rays species caught by Italian commercial fisheries. Also, elasmobranch management regulations should be tuned to their specific biology and life history characteristic, which significantly differ from those of teleost fishes.

0023 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Gina Della Togna[2], Pierre Comizzoli[1], Brian Gratwicke[1]

[1]*Smithsonian Conservation Biology Institute, Washington, DC, USA,* [2]*University of Maryland, College Park, MD, USA*

Establishing a Genome Resource Bank for the Panamanian Golden Frog (*Atelopus zeteki*)

The Panamanian Golden Frog (*Atelopus zeteki*) is an iconic amphibian extinct from the wild that only exists in captive breeding facilities. To preserve the genetic integrity over the long term, the genetic diversity of captive populations needs to be maintained. Assurance colonies of golden frogs therefore could benefit from assisted reproduction in association with Genome Resource Banking. This approach will allow us to conserve genetic material from founding populations that could be lost due to diseases or genetic drift. However, there is a lack of knowledge in golden frog's gonad and gamete physiology which prevents us from developing appropriate techniques for gamete preservation and assisted reproduction. Our first objectives therefore are to (1) better understand the gametogenesis (2) develop safe stimulation methods to induce spermiation and ovulation to recover viable gametes (3) and study the mechanisms of sperm motility activation and fertilization. Specifically, structural and functional properties of sperm cells (focusing on the role of the mitochondrial vesicle) will be investigated using flow cytometry and near infra-red spectroscopy. These techniques will allow us to characterize cellular and molecular mechanisms related to motility

activation and fertilization. Results of these fundamental studies will be used to explore optimal long-term preservation methods for viable gametes and gonadal tissues. We hope to use these insights to assist with the genetic management and reproduction of other threatened *Atelopus* species, including newly established captive assurance colonies of 3 closely related *Atelopus* species collected as part of the Panama Amphibian Rescue and Conservation Project.

0715 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Naomi Delventhal[1], Ainhoa Agorreta[2], Lukas Ruber[2]

[1]University of Manitoba, Winnipeg, MB, Canada, [2]The Natural History Museum, London, UK

Molecular Phylogeny of *Callogobius* (Gobiidae)

Callogobius comprises more than 40 nominal species, with perhaps 20 or more undescribed species, making it one of the largest gobioid genera. They are widespread in Indo-Pacific shallow marine and brackish environments, including coral reefs, tidepools and mangrove streams. Because of cryptic coloration, habitat specialization, and poor condition of most specimens (many species have fragile skin and deciduous scales), the taxonomy is poorly known. In the present study, we use DNA sequences from six mitochondrial and nuclear regions to explore the following questions: 1) Is *Callogobius* monophyletic? 2) Where does *Callogobius* fit in relation to other gobiines? 3) What are the inter- and intra-relationships among the different species groups within *Callogobius*? 4) How do the molecular findings compare with morphological and biogeographic findings?

0153 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Robert Denton, Stephen Richter

Eastern Kentucky University, Richmond, KY, USA

A Comparison of Amphibian Communities Between Natural Ponds and Constructed Ponds of Multiple Ages and Construction Types

Among the many causes for amphibian declines, habitat loss and alteration remains one of the most significant. A lack of federal protection for isolated wetlands that provide habitat for unique species has resulted in the loss of breeding habitat. Ponds built for mitigation purposes often do not replicate removed ponds in structure or ecological processes. In the Daniel Boone National Forest (DBNF), Kentucky, ridge-top ponds have been constructed for habitat enhancement consistently for the last 23 years. We

compared amphibian communities of multiple types and ages of these constructed ponds and natural, reference ponds using canonical correspondence analysis (CCA) and analysis of similarity (ANOSIM) procedures. In addition, individual amphibian species' abundance was predicted via linear stepwise regressions using a suite of habitat variables. Amphibian communities differed significantly between ponds types (Natural, New Construction Method, Old Construction Method). Wood frogs (*Rana sylvatica*) and marbled salamanders (*Ambystoma opacum*) were almost exclusively found in natural, ephemeral ponds, whereas large Ranid frogs (*Rana clamitans*, *Rana catesbeiana*, *Rana palustris*) were found to only be breeding in permanent, constructed ponds. Habitat predictors for some species showed differing preferences within habitat gradients. New construction methods were intermediate between old construction method and natural ponds in terms of habitat variables and amphibian community composition. Discussion will include how the results of this research directly address the monitoring needs of amphibian communities in ridge-top ponds of the DBNF and how this research has helped to refine management practices and construction protocols.

0512 Poster Session II, Saturday 9 July 2011; STORER ICHTHYOLOGY AWARD

Lesley deSouza

Auburn University, Auburn, AL, USA

The Significance of a Hydrological Link Between the Amazon River Basin and the Eastern Guiana Shield on the Neotropical Ichthyofauna

The seasonal inundation of the Rupununi savannas in south central Guyana allows for potential faunal exchange between the Takutu and Rupununi Rivers and ultimately between the Essequibo and Amazon Rivers. This hydrological connection unites two distinct regions in South America, the Amazon River basin to the drainages of the eastern Guiana Shield. Significant fish community differences on either side of the Rupununi portal suggest the importance of this feature on fish distributions. Therefore, in order to further investigate the influence of the Rupununi portal on fish distributions, I evaluated gene flow of five species found across the portal. This study incorporated three molecular markers: two mitochondrial genes and one nuclear gene. Population genetics of the five species varied, suggesting that the Rupununi portal is acting as a barrier to dispersal for some and a conduit for others. These patterns were based primarily on their ecology. In addition to population genetics of species across the portal, assuming a molecular clock I was able to estimate the timing of the final breakup of the proto-Berbice, thus forming the Rupununi portal. This study highlights the significance of the Rupununi portal in uniting the most species rich river in the world to a region of historical geological complexity and its role in shaping fish distributions of the Neotropical ichthyofauna.

0517 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Lesley deSouza[1], Geoffrey Sorrell[2], Michael Gangloff[3], Craig Guyer[1]

[1]Auburn University, Auburn, AL, USA, [2]The Nature Conservancy, Ft. Benning, GA, USA, [3]Appalachian State University, Boone, NC, USA

Biogeographic Patterns of Aquatic Fauna in Coastal Plains Drainages of the Eastern United States

The detection of biogeographic patterns is aided by large datasets that span a range of unrelated taxa. Our dataset includes distribution information for six groups of aquatic and semi-aquatic organisms including anurans, caudates, snakes, turtles, fish, and freshwater mussels. We compiled our data from published distribution maps and built a matrix based on presence or absence of each taxon in the major drainages of the Atlantic Seaboard, Peninsular Florida, and the Gulf Coast. A total of 61 rivers spanning from the Mullica River to the Rio Grande were included. A Parsimony Analysis of Endemism including all taxa identified the Gulf Coast drainages as the area containing the highest degree of endemicity. The drainages along the Atlantic Coast contain a fauna that is distinct as well. The Florida peninsula is less species rich and appears to be comprised of species from both the Gulf and Atlantic coasts, thus lacking a unique fauna. An area cladogram based on several genera, indicate the Gulf coast drainages share a history of vicariance. The congruence of these results highlights the uniqueness of the Gulf coast fauna.

0159 Poster Session I, Friday 8 July 2011

Charles Determan, Erik Wild, Logan Huse

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

Comparative Antibacterial Properties of Crocodilian Immunology and Select Wisconsin Snake Species.

Previous studies have demonstrated the broad spectrum antibacterial properties of crocodilian immune systems in the wild. Despite developing interest in reptilian immunology, little data has been reported regarding the antibacterial properties of entirely captive raised crocodilians. Secondarily, despite the broad resistance representative in crocodilians, essentially nothing has been reported pertaining to the antibacterial resistance among other reptiles. Herein we report the results of immunological assays of blood serum from a captive American alligator and compare these to known values for wild alligators. Serum was separated from whole blood by differential sedimentation and subsequently tested against a wide range of bacteria following established methods. Immunological assays of select native Wisconsin species of snakes will be reported as well. The potential significance of such findings and further research directions will be discussed.

0527 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Anna Deyle, Henry Mushinsky, Earl McCoy

University of South Florida, Tampa, FL, USA

Trapping Two Species of Aquatic Salamanders in Central Florida for Genetic Analysis of Dispersal

We are using mitochondrial DNA sequencing to examine among-population genetic differentiation within two species of fully-aquatic salamanders, *Amphiuma means* and *Siren lacertina*. The study is being conducted in naturally fragmented permanent and seasonal wetlands in central Florida. Both salamander species have limited dry land dispersal capabilities; thus, periodic flooding should be the typical way that individuals move among wetlands. Such movements should be confined to drainage basins; and, therefore, genetic similarity is expected to be related more closely to water flow patterns than to distance. Individuals were captured with two types of commercially-available traps: crayfish traps and minnow traps. Traps were haphazardly dispersed in the field and 20 different wetlands were sampled from June 2009 to June 2010. The trapping period was not the same at each wetland, as the main goal of the study was to capture as many salamanders as possible for genetic analysis. A total of 28 individuals of *A. means* and 27 individuals of *S. lacertina* was captured during the study. We present information on differences in catch per unit effort between both trap types and wetland types, and differences in the size profiles of individuals captured by the trap types. We also present preliminary data on the genetic analysis of possible movement patterns of the two salamander species.

0246 Poster Session I, Friday 8 July 2011

Valentina Di Santo[1], Bruce Cooper[2], Wayne Bennett[2]

[1]Boston University, Boston, MA, USA, [2]University of West Florida, Pensacola, FL, USA

Thermal Tolerance of the Red-bellied Pacu in Relation to its Survival in the United States

Red-bellied pacu (*Piaractus brachypomus*) populations are in decline because overfished across their range in central and South America. Once ignored by aquaculturists because considered to be of low economic value, renewed efforts to culture pacu have been aimed at relieving overfishing pressures on natural populations. However, major concerns over pacu aquaculture in the southern United States are related to the potential of the fish to become established outside captivity if surviving winter temperatures. In the present study, pacu's thermal tolerance niche was quantified by constructing an ecological thermal tolerance polygon. The total area of the thermal polygon was approximately 680 °C^2 which would indicate stenothermic strategy. Most aquaculture

facilities are located in temperature zones amenable to fast growth and reproduction of pacu, but this may allow exotic introduction and establishment of populations. An approach whereby culture potential is closely integrated with environmental constraints may reduce or eliminate threats of introduction.

0303 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

Joseph DiBattista[1], Matthew Craig[2], Luiz Rocha[3], Kevin Feldheim[4], Brian Bowen[1]

[1]Hawaii Institute of Marine Biology, Honolulu, HI, USA, [2]University of Puerto Rico, Mayagüez, Puerto Rico, [3]University of Texas at Austin, Port Aransas, TX, USA, [4]Field Museum, Chicago, IL, USA

Phylogeographic Patterns in Two Related Indo-Pacific Butterflyfish, *Chaetodon meyeri* and *Chaetodon ornatissimus*, Reveal Insights into Evolutionary History

Speciation is a particularly relevant topic for the study of coral reef fishes given their high biodiversity and the abundance of closely-related taxa with sympatric distributions. We focus our research on two Indo-Pacific reef fish species, the ornate butterflyfish (*Chaetodon ornatissimus*) and the scrawled butterflyfish (*Chaetodon meyeri*), which are sister taxa that have similar morphology, life-history characteristics, dispersal potential, habitat preferences, and are known to hybridize at specific sites of overlap in the eastern Indian Ocean. To investigate the influence of shared history and biogeographic barriers on these two species, mtDNA cytochrome *b* sequences and 10 microsatellite loci were surveyed from locations across the Indo-Pacific region; $N = 296$ and $N = 134$ for *C. ornatissimus* and *C. meyeri*, respectively. Analysis of molecular variance based on both sets of molecular markers revealed little or no genetic structure for *C. meyeri*, but moderate structuring for *C. ornatissimus*. Statistical parsimony haplotype networks and Bayesian clustering analyses were also consistent with a scenario of minimal genetic differentiation among sampling sites for *C. meyeri*, but highlighted discrete groups (with some admixture) for *C. ornatissimus*: 1) Indian Ocean and western Pacific sites, 2) Central Pacific sites, and 3) all Hawaiian sites. Moreover, coalescence time estimates indicate much older population expansion events in *C. ornatissimus* versus *C. meyeri*. Thus, despite similarities in ecology, morphology, life history, and distribution, these closely related species have divergent patterns of dispersal and corresponding evolutionary history.

0356 Poster Session II, Saturday 9 July 2011

Casey Dillman, Katie May Laumann, Eric Hilton

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

A Novel Molecular Approach to the Systematics of Acipenseriformes

The use of molecular data to elucidate phylogenetic relationships among the Acipenseriformes presents a special challenge in molecular systematics. Hypotheses of relationships based on various mtDNA loci (both combined and separate) tend to indicate somewhat stable recoveries, although topologies are often in conflict between studies using different markers. Interrelationships among extant members have not been investigated with molecular sequence data from multiple nuclear loci. Compounding some of the challenges with working with sturgeons from a molecular perspective (e.g., rarity of certain taxa and natural hybridization) is that sturgeons exhibit various ploidy levels. As part of our ongoing studies into the systematics and evolution of sturgeons, multiple nuclear loci, e.g. RAG1, Rhodopsin and others have been investigated to gauge levels of phylogenetic information of characters in the nuclear genome. Results from these preliminary investigations will be compared to hypotheses based on mtDNA and morphology, and their implications for phylogeny reconstruction of sturgeons will be discussed.

0362 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Casey Dillman, Katie May Laumann, Eric Hilton

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

Developmental Ossification of the Dermal Skeleton in Sturgeons (Acipenseridae) and its Relation to Behavior of Early Life History Stages

Acipenseriformes comprise the most species-rich clade of extant non-teleostean actinopterygians. As such, they occupy a unique place in the evolutionary history of fishes. Despite this importance, patterns of ontogeny have been thoroughly investigated for only a few members of the clade. In this presentation, we will present the results of a study of the patterns of ossification during early ontogeny of the lake sturgeon, Acipenser fulvescens, based on study of a growth series (16.5 to 43.4 mm TL). We will make comparisons to ontogenetic data from other members of the family Acipenseridae. Specifically, we will present new data on the development of the dermal skeleton, including the skull roof, median and paired fins, and body armor (scutes and scales). Relationships between the development of the dermal skeleton and the ecology and behavior of early life history stages of this species will be explored.

0306 Fish Conservation, Symphony III, Saturday 9 July 2011

Lynda Dirk[1], Lawrence Glenn[2]

[1]Florida Atlantic Unversity, Boca Raton, Fl, USA, [2]South Florida Water Management District, West Palm Beach, Fl, USA

Interim Fish Community Response of the Kissimmee River Restoration.

The Kissimmee River in central Florida was once a winding river with an expansive floodplain, but was channelized in the 1960s to provide flood control. Phase I of construction to restore it to its historical morphology was completed in 2001, restoring flow to 12 km of river channel and reestablishing floodplain connectivity. Fish assemblage surveys were conducted prior to restoration in river sections to be restored (impact sites) and in sections to remain channelized (control sites) to establish the baseline condition. Additionally, fish assemblage data were compiled for three rivers in Florida to serve as reference, since historic data from the Kissimmee River were limited. Post-restoration targets for relative abundance of specific species and taxa were developed because they have critical life history requirements tied to ecosystem characteristics (i.e., dissolved oxygen regimes) or processes (i.e., seasonal flood pulse) expected to change following restoration. The fish selected were Florida gar (*Lepisosteus platyrhinchus*), bowfin (*Amia calva*), redbreast sunfish (*Lepomis auritus*) and all Centrarchids. Surveys were conducted in 2001, 2004, 2007, 2010 and 2011 to assess trends in response relative to post-restoration targets. Elevated dissolved oxygen regimes and floodplain connectivity persisted in the Phase I area for most of 2001-2011 and the response trends of selected taxa followed expected trajectories of increase or decline and target values were met in some years. Further increases in Centrarchids and decreases in relative abundance of *L. platyrhinchus* and *A. calva* are expected once historic flow regimes have been implemented following the completion of the restoration.

0619 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Laura Dixon[1], Charles Dieter[2]

[1]USFWS, Bismarck, ND, USA, [2]South Dakota State University, Brookings, SD, USA

False Map, Spiny Softshell and Smooth Softshell Turtle Nest and Nest-site Habitat Characteristics along the Lower Stretch of the Missouri National Recreation River in South Dakota

I conducted surveys for spiny softshell (*Apalone spinifera*), smooth softshell (*A. mutica*) and false map turtle (*Graptemys pseudographica*) nests along the lower stretch of the Missouri National Recreation River in South Dakota in 2006 and 2007. I recorded number of eggs, egg size, depth to top egg, and distance from water for each intact excavated nest. To determine habitat variables female turtles were selecting for, I examined nest site, on-site location and off-site location land cover classification and habitat vegetation. Of the nest located intact, 17 were *G. pseudogeographica* and 45 were

Apalone spp. Mean number of eggs in an *Apalone* spp. clutch was 15 + 0.553 (SE). Mean number of eggs in a *G. pseudogeographica* nest was 11 + 0.526 (SE). Mean straight-line distance from water to nest for *Apalone* spp. was 61.27 m + 7.123 (SE) and the mean straight-line distance from water to nest for *G. pseudogeographica* was 54.24 m + 8.768 (SE). In 2007, the depredation rate of monitored nests was 36%. I observed no depredation of nests on man-made sandbars and spatial analyses of the depredated nests suggest those turtle nests were clustered in bare open sand. Slopes were greater on man-made sandbars than on natural sandbars ($p = 0.003$). *Apalone* spp. nested exclusively in bare sandy areas while *G. pseudogeographica* tolerated sparse vegetation around the nest site. Turtle populations along the Missouri National Recreation River are at risk for further decrease if conservation efforts are not focused on providing quality nesting habitat.

0390 Poster Session II, Saturday 9 July 2011

Tiffany Doan

Central Connecticut State University, New Britain, CT, USA

Biogeographic Patterns of Bolivian Lizards

Bolivia is home to approximately 92 lizard species, 11 of which are endemic to the country (approximately 12%). Relatively few studies of the Bolivian herpetofauna have been conducted. Therefore, I mapped the distributions of all lizards within Bolivia using all available literature and museum records. The country was divided into 122 1-degree latitude/longitude cells and presence/absence of each species was recorded. Thirty-two of the 1-degree grid cells had zero records of lizards. The absence of lizards from many large regions of Bolivia is likely due to two factors: (1) poor sampling in some areas may underestimate lizard species presence in certain cells, and (2) due to high elevations and harsh habitats of the Oruro and Potosí departments of Bolivia, few lizards may be able to occupy such habitats. Lizards occur primarily in the lowland habitats and Andean slopes of the central and eastern portions of the country. The exceptions are two high elevation genera, *Liolaemus* and *Proctoporus*, which extend throughout the higher Andean habitats to over 4000 m. Factors affecting Bolivian lizard distribution patterns, endemicity, and herpetological sampling patterns will be discussed.

0104 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

Terry Donaldson

University of Guam Marine Laboratory, Mangilao, Guam, USA

Periodicity of Spawning Aggregation Formation and Function of the Triggerfish *Balistoides viridescens* (Balistidae)

The Indo-West Pacific triggerfish species *Balistoides viridescens* (Balistidae) migrates to specific sites to form transient spawning aggregations that may persist for days before participants spawn and then return to their offsite home ranges. These home ranges may be located relatively distant from the spawning aggregation site. GPS-tracked underwater visual surveys conducted weekly Guam show that the distribution of spawning aggregation sites of this species is limited, non-random and linked to specific habitat types. The location and use of spawning aggregation sites is predictable both temporally and spatially because participants show site fidelity and may migrate hundreds of meters or more to court and spawn at them during appropriate lunar phases. Spawning aggregations form just prior to the new moon and full moons, with no apparent seasonality. The size of the population increases daily until the time of spawning. Smaller-sized and apparently immature individuals also migrate to the site. Social interactions are common but most are not aggressive. Unlike many other species of fishes that mate in spawning aggregations and produce pelagic gametes, this species spawns in nests that are essentially holes in coral pavement. Prior to courtship, males defend these nest sites and attempt to attract females to spawn in them. There is limited post-spawning defense of the nest after spawning has been completed. Afterwards, individuals generally disperse to their home range sites within a few days but then begin to return to the site around the following quarter moon before the next spawning period.

0761 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Sean Doody

Monash University, Melbourne, Victoria, Australia

How Social are Turtles?

Turtles, like other reptiles, are socially less advanced than most of their vertebrate counterparts, and are indeed frequently referred to as ‘asocial' when compared to birds, mammals and fish. This dichotomization of social tendency, however, masks important social behaviours occurring in these reptiles and can impede our understanding of how social behaviour evolves in vertebrates. In the meantime recent research has revealed considerable social interactions in reptiles including turtles. Herein I will discuss our current state of knowledge of social behaviour in turtles with emphasis on freshwater turtles, and its relevance to preconceived notions about social behaviour in reptiles.

0125 Fish Morphology, Symphony I & II, Friday 8 July 2011

Michael Doosey, E. O. Wiley

University of Kansas, Lawrence, KS, USA

Segmentation and Centra Formation in Euteleost Caudal Skeletons

Phylogenetic analysis depends on an accurate assessment of homology. We suggest that there are problems in homology assessment in the identity of caudal centra. In basal teleosts and protacanthopterygians studied, preural and ural centra initially form from chordacentra inside the notochordal sheath. With the exceptions of some atheriniforms, ctenosquamates studied to date lack caudal or trunk chordacentra, and centrum formation is entirely in the form of autocentra. One or two of these autocentra are formed in the caudal region, but these do not seem to correspond to any metameristic pattern in more basal groups; in fact, it is not clear that the notochord basal cells impose a segmentation pattern in the caudal region at all, as they do in body vertebrae. Because of this apparent loss of expression of segmentation, these caudal autocentra are not serially homologous with the metameristic caudal centra of more basal teleosts that are composed initially of chordacentra. Segmentation is expressed in the ventral sclerotomal caudal fin (i.e. hypurals), but studies in both *Danio* and *Oryzias* demonstrate that this segmentation is independent of both notochordal and dorsal sclerotomal segmentation in the caudal region. Thus, it is not surprising that vertebral formation, a notochordal phenomenon, is decoupled from epural formation dorsally and parhypural and hypural formation ventrally in those ctenosquamates examined.

0312 Invasive Species, Symphony I & II, Sunday 10 July 2011

Michael Dorcas[1], John Willson[2], Ray Snow[3], Michael Rochford[4], Melissa Miller[5], Walter Meshaka[6], Robert Reed[7], Paul Andreadis[8], Frank Mazzotti[4], Christina Romagosa[5]

[1]Davidson College, Davidson, NC, USA, [2]Virginia Tech, Blacksburg, VA, USA, [3]Everglades National Park, Homestead, FL, USA, [4]University of Florida FLREC, Davie, FL, USA, [5]Auburn University, Auburn, AL, USA, [6]State Museume of Pennsylvania, Harrisburg, PA, USA, [7]US Geological Survey, Fort Collins, CO, USA, [8]Denison University, Granville, OH, USA

Dramatic Declines in Mid-Sized Mammal Abundance Coinciding With Proliferation of Invasive Burmese Pythons in Southern Florida

The Burmese python (*Python molurus bivittatus*), a native of Southeast Asia, is well established in southern Florida including Everglades National Park (ENP). The python population has increased dramatically in both abundance and geographic range since 2000 and pythons are now routinely encountered throughout ENP and surrounding areas. Pythons are top predators and pose a substantial risk to native wildlife, having been documented to consume a wide variety prey, particularly mid-sized mammals,

marsh birds, and American alligators. Although the diet of captured pythons has been examined in detail, the impacts this predation may have on prey populations remain unknown. In this study, we use historical and recent road surveys to examine spatiotemporal variation in relative abundances of Everglades mammals, particularly raccoons, Virginia opossums, and marsh rabbits. Prior to 2000, mid-sized mammals were frequently encountered during 6,600 km of road surveys within ENP (raccoon: ~36 km/sighting; opossum: ~112 km/sighting; marsh rabbit ~1100 km/sighting) and raccoons were routinely cited as a nuisance to park visitors. Over 48,000 km of road surveys conducted within ENP between 2005 and 2010 revealed only 5 opossums (~9,500 km/sighting), 0 raccoons, and 0 marsh rabbits. Mid-sized mammals remain relatively common in areas outside ENP where pythons have only recently been discovered and abundant at one site outside of the python's current range. We conclude that predation by pythons has likely resulted in dramatic declines in mammals within ENP. How such changes will affect food webs and ecosystem processes has yet to be determined.

0588 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Karen Dove

Duke University, Beaufort, NC, USA

The Presence of Great White Sharks: Associations with Environmental Factors

The great white shark (*Carcharodon carcharias*) can be regarded as one of the greatest ambush predators on Earth. White sharks have learned the best techniques, places, and times to hunt to maximize their success. This paper looks at the frequency of white shark sightings compared to wind speeds in Mossel Bay, South Africa. The hypothesis is that more sharks will be on the prowl during high wind speeds because this affects water visibility and swell height. Ambush predators like the white shark benefit from poor water visibility and large swells which put their prey at a visual disadvantage. Stronger winds also blow seal excreta farther out to sea which attracts young roving sharks in the area. Sharks in Mossel Bay must rely on water visibility more than water depth to conceal their presence because it is relatively shallow thus making wind speed especially important here.

0592 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Karen Dove

Duke University, Beaufort, NC, USA

The Presence of Great White Sharks: Associations with Environmental Factors

The great white shark (*Carcharodon carcharias*) can be regarded as one of the greatest ambush predators on Earth. White sharks have learned the best techniques, places, and times to hunt to maximize their success. This paper looks at the frequency of white shark sightings compared to wind speeds in Mossel Bay, South Africa. The hypothesis is that more sharks will be on the prowl during high wind speeds because this affects water visibility and swell height. Ambush predators like the white shark benefit from poor water visibility and large swells which put their prey at a visual disadvantage. Stronger winds also blow seal excreta farther out to sea which attracts young roving sharks in the area. Sharks in Mossel Bay must rely on water visibility more than water depth to conceal their presence because it is relatively shallow thus making wind speed especially important here.

0304 Poster Session III, Sunday 10 July 2011

Dana Drake[1], Stanley Trauth[1]

[1]University of Missouri, Columbia, MO, USA, [2]Arkansas State University, State University, AR, USA

What's the Fuzz? Algal Symbiosis in Larval Anurans - A Mechanism for Survival

The beneficial role of algal symbiosis has long been recognized in the aquatic eggs of ambystomatid salamanders and wood frogs, with embryos benefiting from oxygen provided by alga, and alga benefiting from the waste products of the developing embryos. It is easy to imagine algal symbiosis occurring in larval anurans, as tadpoles are often found in low oxygen, high temperature environments, where they, too, would benefit from algal input. A mutualistic epizooic alga has been found on tadpoles inhabiting hot, low oxygen puddles and tanks. Field experiments on tadpoles of *Bufo americanus charlesmithi* indicated that the presence of the epizooic alga, *Chlorogonium*, raised the upper thermal tolerances (CTMs) of the tadpoles, with both species surviving at higher temperatures as a result of reciprocal gas exchange in depleted waters. To date we have found *Chlorogonium* on larval anurans of five species, representing three families (Bufonidae, Hylidae and Pelobatidae), in three states (Arkansas, Missouri and Utah). Based on field observations, we hypothesize that this symbiotic relationship: 1) occurs in shallow, ephemeral sites that may be subject to reduced dissolved oxygen availability caused by high water temperatures, 2) likely affects species with a shorter larval development stage, and 3) more commonly occurs with larval anurans at later developmental stages, when gulping air is not an option due to the mechanisms of lung development in the late stages of metamorphosis. We believe algal symbiosis in larval

anurans is more widespread than previously reported, and encourage fellow researchers to take note while in the field.

0598 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Andrea Drayer, Stephen Richter

Eastern Kentucky University, Richmond, KY, USA

Management Implications for Amphibian Communities Utilizing Constructed Ponds of Various Water Depths

Wetlands provide critical habitat for a diverse group of amphibians and also provide important services to humans. Despite this, most natural wetlands have been lost to land-use practices. Consequently, constructing ponds has become a common practice to mitigate for removed wetlands and to manage for wildlife populations. The objective of this study was to determine whether constructed pond depth influenced amphibian communities in ridge-top wetlands in eastern Kentucky. Three types of ponds were sampled within Daniel Boone National Forest: natural ephemeral, shallow constructed (<20 cm - minimum depth), and deep constructed ponds (>20cm - minimum depth). Amphibian sampling protocol included dipnetting, minnow trapping, and visual encounter surveys. Within this system, natural ponds are ephemeral, whereas constructed ponds typically do not go dry. As a result, many species of the natural amphibian community were present in low abundances in shallow constructed ponds, but were absent in deep constructed ponds. Additionally, due to the presence of these deep constructed ponds, species that are primarily associated with permanent bodies of water were in greater abundances on ridge tops than would occur naturally. These results underscore the need for a thorough understanding of natural amphibian communities when attempting to mitigate habitat. These data have influenced Daniel Boone National Forest land managers to revise pond construction methods to better replicate natural ridge-top wetlands by making ponds shallower and adding coarse woody debris. In addition, land managers have renovated older deep constructed ponds by reducing water depth and increasing habitat variability.

0597 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

Joshua Drew[1], Beth Sanzenbacher[1], Johanna Thompson[1], Stacy Jupiter[2], Ron Vave[3]

[1]Field Museum of Natural History, Chicago, IL, USA, [2]Wildlife Conservation Society, Suva, Fiji, [3]Fijian Locally Managed Marine Area Network, Suva, Fiji

Conservation Connection: Using Digital Games and Social Media to Teach Coral Reef Biology and Conservation Across the Pacific

Conservation Connection demonstrates how digital technology can be used to teach reef ichthyology, marine ecology and conservation to high school students simultaneously in the U.S. and Fiji. This program used multiple learning strategies, including digital media production (blogs, photos, videos), game play (virtual world simulations), peer-to-peer critique (via social media), and mentor-based instruction (e.g., scientists and educators). A major goal was to increase students' knowledge of functional morphology, trophic interactions, the impacts of disturbances, and current conservation practices. This program provided students with the opportunity to apply their new found knowledge to participate in conservation efforts for disturbed reef ecosystems in Fiji. With collaborating partners Wildlife Conservation Society Fiji (WCS-Fiji) and Fiji Locally Managed Marine Areas (FLMMA), students identified a conservation threat to Fijian reefs and authored a plan to mitigate that threat. Through participation in this project, students in two countries 1) gained knowledge of reef biology, 2) improved digital literacy skills, and 3) became active stewards of the environment - three accomplishments that will make them more informed and engaged citizens in the future.

0667 Poster Session II, Saturday 9 July 2011

Joshua Drew, Mark Westneat

Field Museum of Natural History, Chicago, IL, USA

A Multi-locus Approach to the Phylogeny of the Coral Reef Genus *Amblyglyphidodon* (Pomacentridae) Supports a Center of Origin for Coral Triangle Biodiversity

The pattern of species diminution away from the coral triangle has been well documented for over a century, yet the processes underlying this pattern have remained recondite. Using a new multi-locus approaches we construct a highly resolved phylogeny for the reef fish genus *Amblyglyphidodon* (Pomacentridae). When interpreted from a biogeographic perspective we find species endemic to the coral triangle consistently occupying basal positions, while species endemic to the periphery appear derived - meeting the predictions of the Center of Origin theory. Additionally, we find evidence for a secondary radiation in the south Pacific with a species endemic to Fiji

appearing older than endemic species from Samoa and Tonga. In addition, this analysis has identified at least two new species in the genus highlighting the yet to be discovered alpha biodiversity within the region.

0725 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Marcus Drymon[1], Matthew Ajemian[2], Sean Powers[2]

[1]Dauphin Island Sea Lab, Dauphin Island, AL, USA, [2]University of South Alabama, Dauphin Island, AL, USA

Monitoring Movements of Bull Sharks (*Carcharhinus leucas*) in Coastal Alabama Using Acoustic Telemetry

Many commercially and ecologically important species have complex life histories that involve ontogenetic and behavioral movements over large marine and estuarine landscapes. The highly mobile nature of many of these species has made it historically difficult to evaluate their habitat use and seasonal distribution in these large water bodies, and thus has potentially impeded effective management measures. We sought to address these concerns for the bull shark (*Carcharhinus leucas*) using acoustic telemetry implemented through the Coastal Alabama Acoustic Monitoring Program (CAAMP). During 2009 and 2010, 40 bull sharks were tagged with LOTEK MM-MR-16-50 transmitters, two of which were detected during both 2009 and 2010, indicating a small degree of fidelity or homing behavior between consecutive years. Bull shark detections ranged from the mouths of barrier islands to the entrances of multiple rivers that comprise the Mobile-Tensaw delta. In particular, bull sharks utilized the Tensaw, Blakely and Apalachee rivers within this area. In addition, bull sharks were detected through Dog and Fowl rivers, though were less commonly reported in these areas compared to Mobile-Tensaw rivers. Bull sharks were also found to utilize the main passes between Dauphin Island and Fort Morgan, as well as the Katrina cut entrance to Mississippi Sound. Gillnet, longline and acoustic monitoring data also suggest that the region of Mobile Bay north of Gaillard Island (including the associated rivers) represent prime nursery habitat for bull sharks. Future acoustic monitoring of these important predators will continue to identify important habitats and how these shift with ontogeny.

0351 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Amanda Duffus

Gordon College, Barnesville, GA, USA

Ranaviruses in European Amphibians

Ranaviruses are emerging pathogens in amphibian populations on nearly a global scale. Recently, ranavirus infections in amphibians were classified as notifiable infections/pathogens by the Office International des Epizooties (OIE, World Organization for Animal Health). In Europe, ranaviruses were first documented in mortality and morbidity events affecting amphibians approximately 20 years ago. These events were documented in the southeast United Kingdom in adult common frogs (*Rana temporaria*) and still continue. Since then, reports of ranavirus-associated morbidity and mortality events have grown to include both urodeles and anurans in the UK and on Continental Europe. The emergence of ranavirus infection and disease in UK common frogs provides the longest temporal data set documenting ranavirus infections and their effects in any amphibian species. Here we will examine the current state of knowledge of ranavirus infections in European amphibians, by using species specific examples. A conclusive summary of amphibian species known to be infected by ranaviruses in Europe will be presented and the current infection status, past morbidity and/or mortality events, potential reservoirs of the virus and where appropriate the disease dynamics will be discussed. Future research directions should include structured infection surveillance, increased vigilance for mortality and morbidity events, greater communication between scientists and cooperative multidisciplinary investigations into the causes of these events.

0352 Poster Session I, Friday 8 July 2011

Amanda Duffus[1], Richard Nichols[2], Trent Garner[3]

[1]*Gordon College, Barnesville, GA, USA,* [2]*Queen Mary, University of London, London, England, UK,* [3]*Insitute of Zoology, Zoological Society of London, London, England, UK*

Experimental Assessment of Virulence and Host Specificity of the Ranavirus in *Rana temporaria* and *Bufo bufo* Tadpoles

Ranaviruses are emerging pathogens in amphibians which were first reported in UK common frogs (*Rana temporaria*) in the late 1980s/early 1990s. To date, only preliminary assessments of host-specificity and virulence have been conducted. In this chapter, I assess the relationship of infection, signs of disease, and mortality with viral isolate and dose for four UK ranavirus isolates from UK amphibian hosts in R. *temporaria* and *Bufo bufo* tadpoles. In *R. temporaria* tadpoles exposed to low doses of strains that originated from *R. temporaria,* experienced higher mortality than those exposed to strains from *B. bufo*. There was no such difference at the high dose. This result suggests some degree of host-specificity at low dose. The origin of the isolate had no significant effect on the

presence of infection, or signs of disease at death at the high dose. The most common sign of disease was abdominal haemorrhages and/or bloating. In *B. bufo*, reduced survivorship, the presence of infection, and signs of disease at death were all associated with dose, not isolate. The most common sign of disease at death for *B. bufo* tadpoles was skin sloughing. Taken together, these experiments demonstrate host specificity at low doses, which is lost at higher doses; it also suggests that *R. temporaria* is the primary host of the ranavirus in the UK since virulence can be higher in a primary host where secondary hosts exist.

0728 AES Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Nicholas Dulvy

Simon Fraser University, Burnaby, Canada

Global Shark Abundance Before Fishing

We are familiar with food chains and food webs as the typical way of viewing energy flow in ecosystems. However, size is often a more important biological attribute than species identity because most marine species grow throughout their lives. Consequently, many important properties, such as prey size and mean trophic level, change ontogenetically throughout a fish's life. These biological attributes lead to a regular size-based theory of ecosystem structure and dynamics, whereby the abundance, biomass and production varies in a predictable manner across a wide range of body mass classes. Indeed the depreciation of energy, abundance and biomass with increasing body size can be characterized using only two parameters: average predatory-prey mass ratio and transfer efficiency. If we assume only 12.5% transfer efficiency of energy from one trophic level to the next and that predators are on average 1000 times heavier than their prey and we combine these parameters with satellite-derived estimates of primary production we can calculate the theorectical abundance, biomass and production of fishes and sharks across the world's oceans. Here I summarise some recent work that suggests there could be as much 8.6 million tonnes of coastal and oceanic epipelagic sharks under current climate conditions in the absence of fishing.

0580 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Andrew M. Durso, Stephen J. Mullin

Eastern Illinois University, Charleston, IL, USA

Interactions of Sex, Age and Behavior in Death-feigning Snakes (*Heterodon*)

The three species of hog-nosed snakes (*Heterodon*) are well-known for their defensive behavior, termed 'death-feigning' because the snakes invert their bodies and gape their

mouths. Whether this behavior actually mimics death or discourages vertebrate predators has been questioned, with some previous research suggesting that it is a physiological effect of eating toads. We tested this hypothesis in nature by comparing the behavior of individual *H. nasicus* with differing frequencies of toads in their diet, as determined by stable isotope analyses. We predicted that those individuals with lower proportions of toads in their diet will exhibit either longer latency to death-feigning or shorter death-feints, or both. Our results show that behavioral differences between sexes are present, an observation consistent with the difference in degree of adrenal gland enlargement between males and females, and that these differences depend on the body size of the snake. Toads were enriched in carbon relative to other anurans, small mammals, lizards and turtle eggs from the same site. The individual hog-nosed snakes most enriched in carbon were females, but high isotopic overlap precludes direct inference regarding sexual dimorphism in diet. Further work is needed to elucidate the complex relationship between diet, behavior and physiology in *Heterodon* and other toad-specialist snakes.

0113 Poster Session II, Saturday 9 July 2011

Andrew M. Durso, John D. Willson

Savannah River Ecology Lab, Aiken, SC, USA

Dietary Plasticity of Southeastern Aquatic Snakes

A high degree of dietary segregation has been reported among sympatric North American aquatic snake species, suggesting that competitive interactions may be important in structuring snake communities. However, this generalization is based on a limited number of studies, the majority of which have focused on permanent aquatic habitats with diverse prey communities. We examined diet composition of aquatic snakes in a variety of aquatic habitats in the upper Coastal Plain of South Carolina and compared patterns of diet overlap in permanent (n = 13) and nonpermanent (n = 10) wetlands. In accordance with previous studies, we found a low degree of dietary overlap among aquatic snake species inhabiting permanent wetlands. However, diet overlap among the same species in nonpermanent wetlands was very high, perhaps as a consequence of lower prey species richness and evenness in these habitats. Despite the high degree of dietary overlap, only one snake species (*Regina rigida*) was absent from non-permanent wetlands, although species evenness was lower in these systems. We demonstrate that many aquatic snakes exhibit a high degree of dietary plasticity and that patterns of diet overlap can be highly context-specific. Our results suggest that generalizations about snake diets should be made with caution and question the importance of interspecific competition in structuring snake communities.

0202 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Julia Earl, Ray Semlitsch

University of Missouri, Columbia, MO, USA

Habitat-induced Diet Shifts in Tadpoles: A Study Using Stable Isotopes

Differences in habitat can alter many aspects of an organism's biology, including survival and growth. All of these habitat-associated changes are affected by food quantity and quality, and organisms often shift their diets with these changes. Anuran larvae are known to perform better in open canopy ponds than closed canopy ponds, which has been attributed to lower food quality in closed canopy ponds. However, understanding diet changes is important to understand the mechanisms associated with differences in performance. To investigate this, we raised tadpoles (spring peepers, gray treefrogs, and toads) in mesocosms where we manipulated shading and litter (grass, leaves or none). We collected tadpoles at metamorphosis and possible food items and analyzed tissues for carbon and nitrogen stable isotopes. We found that carbon, but not nitrogen, isotopes in frog tissue were affected by both shading and litter input. We consistently found that carbon isotopic ratios (CIR) decreased with increases in shading. Metamorph tissues in all three species also had higher CIR when raised in mesocosms with no litter than other litter types. Additionally, spring peeper metamorph tissue had lower CIR when raised with leaves than with grass. The significant effects of shading and litter on CIR in frog tissue indicate distinct shifts in diet relating to canopy cover. Additionally, the similar responses of all three species indicate that they likely shift their diet in similar ways with changes in canopy cover. Analysis of food items will help us characterize these diet shifts.

0204 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Julia Earl, Ray Semlitsch

University of Missouri, Columbia, MO, USA

Reciprocal Subsidies in Ponds: Does Leaf Input Increase Frog Biomass Export?

Spatial subsidies are resources that cross ecosystem boundaries. Reciprocal subsidies occur when ecosystems are paired, both importing and exporting resources to each other. We predicted that increases in primary productivity and the input of detrital subsidies would increase reciprocal subsidy exports. We tested these predictions using the pond-forest paired system, where forests export leaves to ponds and ponds export frogs to forests. We used pond mesocosms placed along a primary productivity gradient (created by changes in light), manipulated the input of subsidies, and assessed the frog biomass produced. Our subsidy treatments consisted of subsidy input (leaves), within system input (grass), and no input. We conducted this study for three years, using a different species of frog each year. Frog species included wood frogs, American

toads, and leopard frogs. Primary productivity decreased or did not affect frog biomass in all three years. We consistently found primary productivity did not affect the export of frogs with subsidy inputs (leaves), indicating that subsidies may be more important than algae for frog production in these systems. Information on diet may help explain some of these differences. Some predictions may not have been supported, because we only examined a portion of reciprocal subsidies exported. Further tests should take a whole system approach, examining all system inputs and exports.

0213 Poster Session I, Friday 8 July 2011

David A. Ebert[1], Heidi Dewar[2], Suzanne Kohin[2], Joseph J. Bizzarro[3], Russ Vetter[2], Erin K. Loury[1], Jennifer S. Bigman[1]

[1]Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, USA, [2]Southwest Fisheries Science Center, La Jolla, CA, USA, [3]University of Washington, Seattle, WA, USA

Basking Sharks: A Research Strategy for Filling Severe Data Gaps

The basking shark (*Cetorhinus maximus*) is the second largest shark species in the world, reaching a total length of up to 10 m. The species has been reported globally from high latitude seas, including Arctic waters, to the lower latitudes including the tropics. The eastern North Pacific basking shark population has now been designated a "Species of Concern" by the National Marine Fisheries Service (NMFS). It fits this criteria for three main reasons: 1) the population observed off Canada and California appears to have declined dramatically. Where thousands of individuals were once observed early in the 1900's now only a few individuals, if any, are seen in a given year; 2) although there have been no targeted fisheries for basking sharks in the eastern North Pacific for more than 50 years, there does not appear to be any increase in population size and in fact it may have declined significantly. This dramatic decline and lack of recovery is common across the globe where basking sharks have been targeted. This lack of recovery may be linked to persistent, undocumented mortality, their low intrinsic population growth rates, and/or potential changes in contemporary distribution patterns; 3) a severe lack of data makes it difficult to develop a recovery plan. Therefore, given the lack of knowledge on its distribution, abundance, population status, and occurrence along the Pacific coast, a collaborative project has been initiated between the NMFS and the Pacific Shark Research Center to investigate these aspects of basking shark biology.

0027 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011; ASIH STOYE GENERAL HERPETOLOGY AWARD

Mallory Eckstut

University of Nevada, Las Vegas, Las Vegas, NV, USA

PACT Protocol Modifications to Reduce Pseudo-congruence, Distinguish Unique from General Patterns, and Facilitate Likelihood Reconstruction: A Case Study of Five Lineages of North American Warm Desert Reptiles and Amphibians

Phylogenetic Analysis for Comparing Trees (PACT) is a multi-clade analytical method that can integrate both phylogenetic patterns of distributions as well as ecological patterns of species richness and reveals patterns of the taxon pulse, Progression Rule, and species-area relationships. However, this algorithm is conducted without concern for a temporal component, which can be problematic because pseudo-congruence of temporally and spatially discordant events result in identical cladogram patterns. Additionally, there is currently no way to distinguish unique from general diversification events, and only parsimony-based optimization can be implemented for ancestral range reconstruction. To alleviate these issues, I developed a modified PACT protocol that incorporates a temporal component and branch lengths. To test the performance of this modification, I conducted modified and standard PACT (mPACT and sPACT, respectively) analyses on data previously generated for one amphibian and four reptiles lineages in the North American warm deserts, including side-blotched lizards (*Uta stansburiana*), chuckwallas (*Sauromalus*), western whiptail lizards (Aspidoscelis tigris), mud turtles (*Kinosternon flavescens* species-group), and red-spotted toads (Anaxyrus punctatus). The North American warm desert reptiles are ideal to experimentally test integrative historical biogeographic frameworks because they occupy extreme arid environments, have been subject to an array of geologic and climatic processes, a large amount of high quality datasets have been generated, and are constrained to respond, at least to some degree, in concert with alterations of suitable habitat. My results show that sPACT underestimated the total number of diversification events and mPACT reveals distinct instances of unique and general patterns.

0279 Poster Session II, Saturday 9 July 2011

Kerstin Edberg, Senija Vehab, Robert Wood

Saint Louis University, St. Louis, MO, USA

Within Stream Population Dynamics of *Etheostoma flabellare*

Etheostoma flabellare (subgenus *Catonotus*) is an abundant and wide-spread darter throughout Eastern North America. Previous movement studies have showed that movement within *E.* flabellare is minimal, with movements greater than 200 meters being rare. Phylogenetic studies using haplotype data suggest species subdivision

within river drainages, but studies looking at small-scale isolation in darters inhabiting unfragmented streams and rivers are virtually non-existent. The current study uses microsatellite DNA to quantify population isolation and subdivision within a second order stream in the Ozark Highlands of Missouri. Initial results with 5 microsatellite loci indicate a high degree of fragmentation within this species. These data will be explored in the context of the overall paradigm of movement within darters at large.

0536 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Corey Eddy[1], Diego Bernal[1], Greg Skomal[2], Lisa Natanson[3], Nancy Kohler[3]

[1]University of Massachusetts, Dartmouth, MA, USA, [2]Massachusetts Division of Marine Fisheries, New Bedford, MA, USA, [3]National Marine Fisheries Service, Narragansett, RI, USA

The Life History and Feeding Ecology of the Galapagos shark (*Carcharhinus galapagensis*) in the Waters off Bermuda.

The Galapagos shark (*Carcharhinus galapagensis*) is distributed worldwide in warm, temperate waters and is known to prefer oceanic islands. As such, it is the most common species in Bermuda, where commercial fishermen land approximately 200 sharks each year, primarily for their liver oil or as bait in lobster traps. The International Union for the Conservation of Nature has classified this species as "Near Threatened" because intense fishing pressure, a limited rebound potential, and evidence of local extinctions have cast doubt upon the survival of this species. Despite its ubiquitous presence, Bermuda's Department of Environmental Protection has only limited regulations in place to manage this species and the risk of local extinction due to severe overfishing is a real possibility. To help develop a management plan, this study was begun to investigate the life history and ecological role of these sharks. Size-at-maturity was investigated by examining the reproductive system of sharks collected from landings of commercial fishermen. Size-at-age and age-at-maturity estimates were derived from band pairs in the vertebral centra of these sharks. Elements of feeding ecology, such as trophic position and diet shifts, were investigated via stable isotope analysis of muscle, liver, and vertebrae. Stomach contents were analyzed to reinforce these results. Preliminary results suggest the largest shark sampled was only four years old, a few years short of reaching maturity, which is thought to occur at approximately seven years of age, at 200 to 250 cm fork length. This finding reinforces the need to effectively manage this fishery.

0630 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Corey Eddy[1], Nancy Kohler[2], Patricia Turner[2]

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Movement Patterns and Habitat of the Scalloped Hammerhead Shark (*Sphyrna Lewini*) Based Upon Tag and Recapture Data

The scalloped hammerhead shark, *Sphyrna lewini*, is found circumglobally in temperate to tropical seas. In the northwest Atlantic Ocean, this species is found from the shores off New York, to the Caribbean Sea, and throughout the Gulf of Mexico. They range from the relative shallows along the coast to the continental shelf and beyond, and are frequently encountered in both benthic and pelagic fisheries. Despite their common occurrence worldwide and frequent encounter in fisheries, very little is known of this species' habitat preferences or movement patterns. The objective of this study is to analyze tag and recapture data from the National Marine Fisheries Service (NMFS) Cooperative Shark Tagging Program (CSTP), to investigate movement patterns and habitat selection, as well as the possible role that gender and age may play in determining these characteristics.

0164 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Jacob Egge, Taylor Hagbo, Andrew McDermott

Pacific Lutheran University, Tacoma, WA, USA

Comparative Phylogeography of Mississippi Embayment Fishes

The Mississippi Embayment stretches from the confluence of the Ohio and Mississippi Rivers in southern Illinois to the Gulf of Mexico in Louisiana. In addition to the Mississippi River itself, the Embayment is comprised of several smaller tributaries including the Obion, Forked Deer, Hatchie, Wolf, Yazoo, Big Black, Bayou Pierre, and Homochitto rivers located primarily in western Tennessee and Mississippi. The lowland habitat that characterizes the Embayment has presumably served as a barrier to dispersal between fishes in the Appalachian Highlands and those in the Interior Highlands (Ozarks and Ouachitas). While numerous studies have addressed the pattern and timing of divergences among highland fishes, very little is known about the phylogeographic structure of Embayment distributed fishes. We examined the phylogeography of four co-distributed Embayment species: the Least Madtom, *Noturus hildebrandi*, Brown Madtom, *Noturus phaeus*, Brindled Madtom, *Noturus miurus*, and Bluntface Shiner, *Cyprinella camura,* sampled from across their ranges. Phylogenetic analyses based on cytochrome b (mtDNA) sequences indicate that populations of each

species are isolated by drainage, with some common patterns among all species. Common patterns include the recovery of a southern clade consisting of populations from the Big Black, Bayou Pierre, and Homochitto rivers, and a northern clade consisting of populations from Obion and Forked Deer rivers. Hatchie River populations were recovered as basal in both *N. miurus* and *N. hildebrandi*. Divergence time estimates indicate most divergences have occurred in the last 2 million years, with *C. camura* estimated to be the most recent arrival in the Embayment.

0730 Poster Session I, Friday 8 July 2011

Jennifer Eichelberger[1], Timothy King[2], Edward Heist[1]

[1]*Southern Illinois University, Carbondale, IL, USA,* [2]*United States Geological Survey, Leetown Science Center, Kearneysville, WV, USA*

SNP Discovery Using 454 Transcriptome Data in *Scaphirhynchus* Sturgeons

Modern DNA sequencing technologies are revolutionizing the discovery of polymorphic genetic markers. We are using 454 sequencing of the transcriptomes of pallid sturgeon (*Scaphirhynchus albus*), a federally endangered species endemic to the Missouri and Mississippi river drainages, and its more common congener, the shovelnose sturgeon (*S. platorhynchus*), which is found in sympatry throughout its range and with which it hybridizes. We are developing a panel of Single Nucleotide Polymorphism (SNP) markers for more efficient discrimination of *Scaphirhynchus* sturgeons. Karyological evidence suggests that all extant sturgeons are derived from a tetraploid ancestor. Initial investigations using primers designed from cDNA sequences obtained by traditional Sanger sequencing have amplified duplicated loci (homeologs) in 5 out of 6 nuclear protein-coding genes (approximately 20 total kilobases) examined thus far. On average, SNPs are observed at a frequency of only 1 per 200 base pairs (bps) within introns, and to date, only 3 unlinked SNPs have proved to be taxonomically informative for pallid and shovelnose sturgeons. We have recently obtained 454 pyrosequencing data for both species. Approximately 100 million bps of cDNA sequence (over 275,000 reads, average length 355 bp) have been generated and are currently being annotated and assembled with multiple thresholds for sequence similarity in order to detect variability between homeologs versus allelic variation within individual loci. An annotated transcriptome for *Scaphirhynchus* will provide valuable information for examining taxonomic and geographic variation in these closely related taxa.

0065 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Evan Eskew, Steven Price, Michael Dorcas

Davidson College, Davidson, NC, USA

Effects of Flow Regulation on Anuran Occupancy and Abundance in Riparian Zones

The natural flow regimes of rivers worldwide have been heavily altered through anthropogenic activities, and damming in particular represents a pervasive disturbance to riverine ecosystems. Dams are known to negatively impact a variety of aquatic animals, with abundance and species richness typically increasing downstream from dams. For this study, we conducted anuran calling surveys at 42 study locations along the Broad and Pacolet Rivers in South Carolina to address the potential effects of flow regulation through damming on anuran occupancy and abundance. Occupancy and abundance were estimated using Program PRESENCE, and models incorporated distance upstream and downstream from nearest dam as covariates with urbanization levels representing an alternate hypothesis to explanation population metrics. Of the seven anuran species analyzed, three showed distance to dam effects on occupancy and four showed such an effect on abundance. In all cases, distance downstream from nearest dam was a better predictor of population metrics than distance upstream from nearest dam, and, for all but one species, distance downstream from nearest dam was positively correlated with both occupancy and abundance. Reduced occupancy and abundance of anurans in the river reaches just downstream from dams may be the result of downstream flow alterations resulting from damming which lead to reduced riparian wetlands that serve as anuran breeding habitat. This study is one of the first to show that damming may have a strong negative effect on semi-aquatic species, and further studies should more closely examine the mechanisms by which damming affects anuran populations.

0066 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Evan Eskew, Steven Price, Michael Dorcas

Davidson College, Davidson, NC, USA

Survivorship and Population Densities of Painted Turtles (*Chrysemys picta*) in Recently Modified Suburban Landscapes

Populations of long-lived animals, such as semi-aquatic turtles, that depend on high survivorship of reproductive adults are particularly susceptible to the negative effects associated with habitat modification in suburban areas. Survivorship of semi-aquatic turtles in suburban landscapes may be reduced as a result of a number of factors including the elimination of appropriate nesting habitat and the introduction of human-subsidized predators. Unfortunately, few studies on turtle populations in anthropogenically-modified habitats estimate vital rates, and researchers are rarely able

to study populations both before and after development. We studied painted turtle (*Chrysemys picta*) vital rates at five ponds in the Charlotte-metropolitan area; two ponds and their surrounding habitat underwent development after the first year of study, one pond was on a golf course, and two were farm ponds. We used Program MARK to generate open population models examining the effects of location and sex on turtle survivorship. Our results showed relatively stable population densities over 4 years across all ponds, with the largest density (approximately 100 turtles/ha) occurring at a recently developed site. Among ponds, turtles had variable annual adult survivorship (approximately 60–95%), and males generally had lower survivorship than females. Our results emphasize the importance of site-specific habitat factors that influence turtle population demography and indicate that for long-lived species, whose population densities may not respond immediately to habitat change, long-term monitoring efforts examining population vital rates are needed to more fully evaluate the effects of anthropogenic modification.

0258 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Vinícius Espíndola, Marcelo Britto

Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil

A New Sinapomorphy of the Clade II in the Subfamily Corydoradinae

The Neotropical catfish family Callichthyidae is characterized by the two rows of overlapping bony plates on each side of the body and swim bladder encased in bone. Several hypotheses were used to express the interrelationships of the subfamily Corydoradinae, containing the complex genus *Corydoras* the largest in Siluriforms with more than 170 species, plus the genus *Aspidoras*. The previously species analyze were defined in nine different clades. The clade II is supported by five sinapomorphy between the remaining *Corydoras* and represented by the following species: *C. agassizi*, *C. ornatus*, *C. elisae*, *C. acutus*, *C. stenocephalus*, *C. septentrionalis*, *C. aurofrenatus* and *C. vittatus*. New evidence was provided by new taxa, featuring a new synapomorphy: The presence of fleshy skin, bearing odontodes, on the proximal portion of the dorsal-fin rays. The phylogenetics implications is important for the understanding the relationships within *Corydoras*.

0621 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Luke Etchison, Mark Pyron

Ball State University, Muncie, IN, USA

Diel Variation in Substrate Preference of Cyprinidae Fishes

Diel substrate preference variation will be observed in eight species of cyprindae; central stoneroller (*Campostoma anomalum*), spotfin shiner (*Cyprinella spiloptera*), sand shiner (*Notropis stramineus*), creek chub *(Semotilus atromaculatus),* silver shiner *(Notropis photogenis),* striped shiner *(Luxilus chrysocephalus),* bluntnose minnow (*Pimephales notatus*), and redfin shiner (*Lythrurus umbratilis*). Artificial stream setups containing varying substrate types (silt, sand, cobble, and gravel) will be used to test if habitat preferences of cyprinid fishes shift between day and nighttime behavior. Tanks will be arranged with two substrate types whereby fishes will be observed twice daily (am / pm) and substrate preference recorded.

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

Vincent Farallo

Ohio University, Athens, OH, USA

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

Cornell University, Ithaca, NY, USA

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

Terence Farrell[1], Brooke Deak[1], Paul Andreadis[2]

[1]Stetson University, DeLand, FL, USA, [2]Denison University, Granville, OH, USA

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

Auburn University, Auburn, AL, USA

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 Ferrara[1], Richard Vogt[1], Renata Sousa[2]

[1]Instituto Nacional de Pesquisas da Amazonia, Manaus, Amazonas, Brazil, [2]Cornell University, Ithaca, NY, USA

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 Podocnemidiae 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

Lara Ferry[1], Peter Reiser[2]

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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 callorhinchus* 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

Daniel Figueroa[1], Santiago Barbini[2], Lorena Scenna[2], Gabriela Delpiani[2], Cecilia Spath[2], Mauro Belleggia[3], Luciano Izzo[1]

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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

University of Wisconsin Stout, Menomonie, WI, USA

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 Jeffery'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

North Dakota State University, Fargo, ND, USA

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

The University of Alabama, Tuscaloosa, AL, USA

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 Sipsey 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 Folt[1], Kelsey Reider[1]

[1]Ohio University, Athens, OH, USA, [2]Florida International University, Miami, FL, USA

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 macroloba*, *Virola 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 ± .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. kochnyi* 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 Ford[1], James Gelsleichter[1], Bryan Frazier[2], Carolyn Belcher[3], R. Dean Grubbs[4], Andrew Piercy[1]

[1]University of North Florida, Jacksonville, FL, USA, [2]South Carolina Department of Natural Resources, Columbia, SC, USA, [3]Georgia Department of Natural Resources, Brunswick, GA, USA, [4]Florida State University Coastal Marine Lab, Saint Teresa, FL, USA

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

Armstrong Atlantic State University, Savannah, GA, USA

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

Steven Freedberg[1], Michael Pappas[2], Justin Congdon[3], Bruce Brecke[1], Chee Lee[1]

[1]St. Olaf College, Northfield, MN, USA, [2]Michaels Restaurant, Rochester, MN, USA, [3]Savannah River Ecology Laboratory, Aiken, SC, USA

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

Chris Friesen[1], Randolph Krohmer[2], Robert Mason[1]

[1]Oregon State University, Corvallis, OR, USA, [2]Saint Xavier University, Chicago, IL, USA

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 Froeschke[1], Bridgette Froeschke[1]

[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 nebulous*. 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 Froeschke[1], Bridgette Froeschke[2]

[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 Gallagher[1], Neil Hammerschlag[1]

[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 Minnesora, 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, coagulapathy 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. Gardiner[1], Jelle Atema[3], Robert E. Hueter[2], Philip J. Motta[1]

[1]University of South Florida, Tamp, 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 investigaed 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, Julienne 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 George[1], Brett Albanese[2], David Neely[1], Lee Friedlander[1], Katharine Owers[2], Josh Smith[3]

[1]Tennessee Aquarium, Chattanooga, TN, USA, [2]Georgia Department of Natural Resources, Social Circle, GA, USA, [3]Conasauga 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 Germano[2], Natalie Calatayud[1], Phillip Lyons[3], Matt Dowling[2], Andrew Kouba[2]

[1]Mississippi State University, Starkville, MS, USA, [2]Memphis Zoo, Memphis, TN, USA, [3]Rhodes 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 Germano[1], Michael Drake[1], Matthew Dowling[1], Michelle Wilkes Martin[2], Sara Hasenstab[1], Sheena Townsend[3], Andy Kouba[1]

[1]Memphis Zoo, Memphis, TN, USA, [2]University of Memphis, Memphis, TN, USA, [3]University of Otago, Dunedin, Otago, New Zealand

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 Germano[1], Paula Kahn[1], Ron Swaisgood[2]

[1]Desert Tortoise Conservation Center/San Diego Zoo Global Institute for Conservation Research, Las Vegas, NV, USA, [2]San 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 Gersch[1], Harold Pratt[2], Theo Pratt[2], Jeffrey Carrier[3], Edward Heist[1]

[1] Southern Illinois University Carbondale, Carbondale, IL, USA, [2]Mote Marine Laboratory, Summerland Key, FL, USA, [3]Albion 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 (FST = 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 (*Phrynosma 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 Ghose[1], Steven Whitfield[2]

[1]Occidental College, Los Angeles, CA, USA, [2]Florida 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 LC_{50} data from the EPA ECOTOX database to allow comparison of findings with our own. LC_{50} 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 LC_{50} 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 LC_{50} 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 Giannini[1], Christopher Swarth[2], Marilyn Fogel[3], Roxane Bowden[4]

[1]Jug Bay Wetlands Sanctuary, Lothian, MD, USA, [2]Jug Bay Wetlands Sanctuary, Lothian, MD, USA, [3]Geophysical Lab., Carnegie Institution of Washington, Washington, DC, USA, [4]Geophysical 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 ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotopic compositions. Isotopic compositions of diet items (mean +sd) differed significantly between the beaver pond ($\delta^{15}N=7.2 \pm 3$) and tidal marsh ($\delta^{15}N=12.1 \pm 4$). Beaver pond turtles had $\delta^{15}N$ values that were 5‰ more negative than tidal marsh turtles. Mud turtles in both locations had more positive $\delta^{15}N$ and $\delta^{13}C$ values than musks. A sequential Bonferroni correction was used with a Mann-Whitney pairwise comparison of turtle samples. $\delta^{13}C$ 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 Giery[1], Craig Layman[1], Brian Langerhans[2]

[1]Florida International University, Miami, FL, USA, [2]North 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 Gifford[1], Kenneth Kozak[1]

[1]University of Arkansas at Little Rock, Little Rock, AR, USA, [2]University 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 Gifford[1], Kenneth Kozak[1]

[1]University of Arkansas at Little Rock, Little Rock, AR, USA, [2]University 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 abroad 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 diversication 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 Gregory[1], Krysia Tuttle[2]

[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 Gross[1], Lorin Neuman-Lee[2], Andrew Durso[1], Stephen Mullin[1]

[1]Eastern Illinois University, Charleston, IL, USA, [2]Utah 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 flambouyant, 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 (CTmax). 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 CTmax. 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 Guzy[1], Anna Deyle[1], Neal Halstead[1], Shannon Gonzalez[1], Earl McCoy[1], Henry Mushinsky[1]

[1]*University of South Florida, Tampa, FL, USA,* [2]*Davidson College, Davidson, NC, USA*

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 homogenously 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

University of Idaho, Moscow, ID, USA

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

Nathan Haislip[2], Matthew Gray[1], Jason Hoverman[3], Debra Miller[1]

[1]University of Tennessee, Knoxville, TN, USA, [2]Fort Worth Zoo, Ft. Worth, TX, USA, [3]University of Colorado, Boulder, CO, USA

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

Brian Halstead[1], Glenn Wylie[1], Melissa Amarello[1], Jeffrey Smith[1], Michelle Thompson[2], Eric Routman[2], Michael Casazza[1]

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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

M. Kevin Hamed[1, 2], Matthew Gray[1], Thomas Laughlin[3]

[1]University of Tennessee, Knoxville, TN, USA, [2]Virginia Highlands Community College, Abingdon, VA, USA, [3]East Tennessee State University, Johnson City, TN, USA

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 Plethdontid 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

Neil Hammerschlag[1], Jiangang Luo[2]

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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

Carroll University, Waukesha, WI, USA

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

Shane Hanlon[1], Jacob Kerby[2], Matthew Parris[1]

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

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 though metamorphosis with newly metamorphed 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

Maggie Hantak[1], Ralph Saporito[1], Maureen Donnelly[2]

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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 Harless[1], Casey Huckins[1], Jacqualine Grant[2], Thomas Pypker[1]

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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 (CH_4N_2O), sodium chloride (NaCl), magnesium chloride ($MgCl_2$), potassium acetate (CH_3COOK), calcium chloride ($CaCl_2$), and calcium magnesium acetate ($C_8H_{12}CaMgO_8$). 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 CH_4N_2O, NaCl, and $MgCl_2$ and most sensitive to acetates ($C_8H_{12}CaMgO_8$, CH_3COOK) and $CaCl_2$. Our observed $LC50_{96\text{-}h}$ 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 Harrison[1], Timothy Collins[1], Joel Trexler[1], Ella Vazquez[2], Ulises Razo Mendivil[2]

[1]Florida International University, Miami, FL, USA, [2]Universidad Nactional Autonoma de Mexico, Mexico City, Mexico

Determing 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

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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 Hedges[1], Angela Marion[2], Nicolas Vidal[3]

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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 morpholgy 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 Hendon[1], Eric Hoffmayer[1], Christian Jones[2], Gregg Poulakis[3], Joseph Quattro[4], Justin Lewandowski[4], William Driggers[2], Matthew Ajemian[5]

[1]University of Southern Mississippi, Ocean Springs, MS, USA, [2]NOAA Fisheries, Pascagoula, MS, USA, [3]Florida Fish and Wildlife Conservation Commission, Tallahassee, FL, USA, [4]University of South Carolina, Columbia, SC, USA, [5]University 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. Hendrickson[1], Adam E. Cohen[1], Ben Labay[1], F. Douglas Martin[1], Sahotra Sarkar[2], Blake Sissel[2], Michael Ciareglio[2], Jeremy Harrison[1], Melissa Casares[1], Gary P. Garrett[3], Robert J. Edwards[4]

[1]University of Texas Austin, Texas Natural Science Center, Texas Natural History Collection, Austin, TX, USA, [2]University of Texas Austin, Section of Integrative Biology, Austin, TX, USA, [3]Texas Parks and Wildlife Department, Heart of the Hills Fisheries Science Center, Mountain Home, TX, USA, [4]University 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 are 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 ± 26.9) than mosquitofish populations sympatric with tui chubs (22.1; SE ± 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 Universiy, 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- Alvarez[1], Xavier Chiappa-Carrara[1], Felipe Galvan-Magaña[2]

[1]UNAM,ICMyL, Distrito Federal, Mexico, [2]CICIMAR, La Paz, Mexico

Trophic Ecology of Giant Manta (*Manta birostris*, Walbaum 1792) Using Stable Isotopes of $\delta^{15}N$ and $\delta^{13}C$ 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 $\delta^{13}C$ 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 zoeas of crustaceans contribute the largest proportion of manta ray diets; this was most evident in July when the zoeas ^{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 zoeas 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 $\delta^{15}N$ 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- Alvarez[1], Diaz-Jaimes Píndaro[1], Galvan-Magaña Felipe[2]

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

Based on coloration and morfological 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 Carribean. 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 cyt*b*, 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 Hoaglund[1], Liz Harper[2], Amy Kizer[3]

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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 m^2. 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 Hoffmayer[1], Jill Hendon[2], Lisa Jones[1], William Driggers[1], Madison Walker[2], Travis Holland[2], James Sulikowski[3]

[1]National Marine Fisheries Service, Mississippi Laboratories, Pascagoula, MS, USA, [2]University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS, USA, [3]University 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 Hoffstatter[1], Aimee Finley[1], Joe Strande[1], Gerrick Meyer[1], Marty Engel[2], Michael Bessert[1]

[1]University of Wisconsin - Stout, Menomonie, WI, USA, [2]Wisconsin Department of Natural Resources, Baldwin, WI, USA

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*) wereseparated 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 endemicity. 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 occuring in this region, to address the hypothesis of whether drainge 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 Hollensead[1], John Carlson[2], Dana Bethea[2], Dean Grubbs[1]

[1]Florida State University, Tallahassee, FL, USA, [2]NOAA 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 Honebrink[1], Robert Buch[2], Peter Galpin[3], George Burgess[4]

[1]Hawaii Division of Aquatic Resources, Honolulu, HI, USA, [2]NOAA Fisheries Service, NERO, Gloucester, MA, USA, [3]Maui Memorial Hospital, Wailuku, HI, USA, [4]University of Florida, Gainesville, FL, USA

First Documented Attack by a Cookiecutter Shark on a Human

Anecdotal reports of bites by the cookiecutter shark (Squaliodea, 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 oxyrhynchus oxyrhynchus*), 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 Hoverman[1], Matthew Gray[2], Debra Miller[2]

[1]University of Colorado, Boulder, CO, USA, [2]University 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 Hupy[1], Chad Montgomery[3], Julius Frazier[2], Nathan Reid[1], Roger Schultz[1]

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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 Hussey[1], Aaron MacNeil[2], Jill Olin[1], Bailey McMeans[1], Demian Chapman[3], Michael Kinney[4], Aaron Fisk[1]

[1]GLIER, University of Windsor, Windsor, Ontario, Canada, [2]Australian Institute of Marine Science, PMB3, Townsville MC, Townsville, Queensland, Australia, [3]Institute for Ocean Conservation Science and School of Marine and Atmospheric Science, Stony Brook University, Stony Brook, NY, USA, [4]Fishing and Fisheries Research Centre, School of Earth and Environmental Sciences, James Cook University, Townsville, Queensland, Australia

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 Imhoff[1], Jason Romine[1], George Burgess[1]

[1]*Florida Museum of Natural History, University of Florida, Gainesville, FL, USA,* [2]*Columbia River Research Laboratory, USGS, Cook, WA, USA*

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 Islam[1], Md. Mukhlesur Rahman Khan[2], Mitsuru Kuramoto[3], Tjong Hon Djong[4], Masayuki Sumida[1]

[1]Hiroshima University, Higashihiroshima shi, Hiroshima, Japan, [2]Bangladesh Agricultural University, Mymensingh, Bangladesh, [3]3-6-15 Hikarigaoka, Munakata, Fukuoka, Japan, [4]Andalas 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. isknadari*. Within the Indian group, Bangladesh small type showed no isolation with Sri Lanka one or Indian *F. caperat*a, 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 Jackman[1], Aaron Bauer[1], Matthew Heinicke[1], Eli Greenbaum[2]

[1]Villanova University, Villanova, PA, USA, [2]University 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 *Hemiphyllodactyus* 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. Jadin[1], Gilson Rivas Fuenmayor[2], Laurie J. Vitt[3], Cesar Barrio-Amoros[4], Robert P. Guralnick[1], Frank T. Burbrink[5]

[1]University of Colorado at Boulder, Boulder, CO, USA, [2]La Universidad del Zulia, Maracaibo, Venezuela, [3]University of Oklahoma, Norman, OK, USA, [4]Institut de Biologia Tropical, Merida, Venezuela, [5]City 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 elasombranchs 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_∞ = 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 Jancovich[1], Michel Bremont[2], Jeffrey Touchman[1], Bertram Jacobs[1]

[1]*Arizona State University, Tempe, AZ, USA,* [2]*Institut 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 re-arrangements 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 Jaszlics[1], Jason Pardo[2]

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Ontogeny and Crocodilian 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. Crocodilians 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 crocodilian 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 Johnson[1], Brad Shaffer[1]

[1]Western Kentucky University, Bowling Green, KY, USA, [2]University of California, Davis, CA, USA

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 Johnson[1], Jennifer Olker[1], Patrick Schoff[1], Glenn Guntenspergen[2], Catherine Johnson[3], Angela Wagner[4], Jason Rohr[5], Val Beasley[6]

[1]NRRI University of Minnesota Duluth, Duluth, MN, USA, [2]USGS Patuxent Wildlife Research Center, Laurel, MD, USA, [3]USDA Forest Service Monongahela National Forest, Elkins, WV, USA, [4]USDA ARS North Central Ag Research Lab, Brookings, SD, USA, [5]University of South Florida, Tampa, FL, USA, [6]University of Illinoius 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 Johnson[1], James Williams[2], James Austin[1]

[1]University of Florida, Gainesville, FL, USA, [2]Florida 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 Jordan[1], John Mandelman[2], Stephen Kajiura[1]

[1]Florida Atlantic University, Boca Raton, FL, USA, [2]New 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 2.5mm^2 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 Kacev[1], Rebecca Lewison[1], Andrew Bohonak[1], Daniel Cartamil[3], Russ Vetter[2], John Hyde[2]

[1]San Diego State University, San Diego, CA, USA, [2]Southwest Fisheries Science Center, La Jolla, CA, USA, [3]Scripps 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 Kaiser[1], John Pollinger[2]

[1]University of California, Riverside, Riverside, CA, USA, [2]University of California, Los Angeles, Los Angeles, CA, USA

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 (*Oxyeleotis marmoratus*) in 2000 and diseased goldfish (*Carrasius arrarus*) 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, ±4.7mg/day)) while the parchment shelled egg of *Chelydra* gained mass at an average rate of 40 mg/day (±20mg/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 Karns[1], Vimoksalehi Lukoschek[2], Jennifer Osterhage[1], John Murphy[3], Harold Voris[3]

[1]Hanover College, USA, Hanover, IN, USA, [2]James Cook University, Townsville, Queensland, Australia, [3]Field Museum of Natural History, Chicago, IL, USA

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

Nancy Karraker[1], Margaret Murphy[2], Qian Niu[1], David Dudgeon[1]

[1]University of Hong Kong, Hong Kong, Hong Kong, [2]City University of Hong Kong, Hong Kong, Hong Kong

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 ≤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

Ushio Kawai[1], Akira Mori[2]

[1]*Texas Tech University, Lubbock, TX, USA,* [2]*Kyoto University, Kyoto, Japan*

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. Keevil[1], Ronald J. Brooks[1], Jacqueline D. Litzgus[1]

[1]Laurentian University, Sudbury, Ontario, Canada, [2]University of Guelph, Guelph, Ontario, Canada

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

Christopher Kehrier[1], Suzanne Kohin[2], Kathryn Dickson[1]

[1]California State University Fullerton, Fullerton, CA, USA, [2]National Marine Fisheries, Southwest Fisheries Science Center, La Jolla, CA, USA

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

Nova Southeastern University Oceanographic Center, Dania Beach, FL, USA

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 $\delta^{15}N$ 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 $\delta^{15}N$ 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, decapods 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

University of Washington, Seattle, WA, USA

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 the 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 Kerby[1], Andrew Storfer[2]

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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 Kessel[1], Samuel Gruber[2], Katie Gledhill[2], Mark Bond[3], Rupert Perkins[1]

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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 Kim[1], Tim Tinker[3], James Estes[3], Paul Koch[2]

[1]University of Wyoming, Laramie, WY, USA, [2]University of California, Santa Cruz, Santa Cruz, CA, USA, [3]U.S. Geological Survey, Western Ecological Research Center, Long Marine Laboratory, Santa Cruz, CA, USA, [4]Center for Ocean Health, Long Marine Laboratory, University of California, Santa Cruz, Santa Cruz, CA, USA

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 ($^{13}C/^{12}C$) and nitrogen ($^{15}N/^{14}N$) 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 $\delta^{13}C$ and $\delta^{15}N$ 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 $\delta^{13}C$ and $\delta^{15}N$ 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}: 0.0.096) 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

Bruce Kingsbury[1], Christopher Woodley[1], Joanna Gibson[2]

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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^{o} 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 Kinziger[1], Rodney Nakamoto[2], Eric Anderson[3], Bret Harvey[2]

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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

Lucas Kirschman[1], Seth Kerr[1], Eric Chapman[2], Kurt Regester[1]

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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

Thomas Kleinteich[1], Felix Beckmann[3], Julia Herzen[3], Adam P. Summers[1]

[1]University of Washington, Friday Harbor Laboratories, Friday Harbor, WA, USA, [2]Universität Hamburg, Biozentrum Grindel, Hamburg, Germany, [3]Helmholtz-Zentrum Geesthacht, Institute of Materials Research, Geesthacht, Germany

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 chydtridiomycosis, 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 Kneebone[1], John Chisholm[2], Greg Skomal[2], Diego Bernal[1]

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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 Knuckey[1], David Ebert[1], George Burgess[2]

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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 Korfel[1], Eduardo Toral[2], Gabriella Maldonado[3], Morley Read[4], Thomas Hetherington[1]

[1]The Ohio State University, Columbus, OH, USA, [2]Pontifica 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. Kot[1], Donald G. Buth[2], Julianne Kalman Passarelli[3]

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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

Andrew Kraemer[1], Dean Adams[1], Jessica Kissner[2]

[1]Iowa State University, Ames, IA, USA, [2]Texas Tech University, Lubbock, TX, USA

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 captured 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 Kraft[1], Naomi Winburn[1], Kenneth Cabarle[2], Ryan Winburn[1], Christopher Beachy[1]

[1]Minot State University, Minot, ND, USA, [2]University 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 chrysoscelis* (Cope's Gray Treefrog), *Hyla cinerea* (Green Treefrog), *Hyla gratiosa* (Barking Treefrog), and *Hyla squirella* (Squirrel Treefrog). Historically, only *H. chrysoscelis* 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 Kuchta[1], Alexis Rose[1]

[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 resembles *E. e. platensis* (splotched) were attached 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

Nagasaki University, Nagasaki, Japan

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 norvegic*a).

0176 Poster Session II, Saturday 9 July 2011

Kazuki Kurita, Tsutomu Hikida

Kyoto University, Sakyo-ku, Kyoto, Kyoto, Japan

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.

0547 Poster Session II, Saturday 9 July 2011

Shea Lambert

University of Rochester, Rochester, NY, USA

Molecular Systematics of Hispaniolan Crown-giant Anoles

Hispaniolan crown-giant anole diversity consists of three recognized species and eighteen total subspecies, indicative of extensive geographic variation. I present a multi-locus phylogenetic analysis of the group using one mitochondrial and nine nuclear loci. Sampling is fairly comprehensive for the Dominican Republic, comprising sixty-six total individuals from twenty-seven populations, with representatives from all three species and eleven subspecies. I use traditional concatenation, Bayesian, and maximum-likelihood approaches to infer phylogenetic relationships. I also include more recently developed analyses for inferring species trees from gene trees.

0029 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Cecilia J. Langhorne[1], Natalie E. Calatayud[1], Tricia M. Rowlison[1], Andrew J. Kouba[2], Carrie K. Vance[2], Jennifer M. Germano[2], Kevin Thompson[3], Elaine Davinroy[3], Scott T. Willard[1]

[1]Mississippi State University, Mississippi State, MS, USA, [2]Memphis Zoo, Memphis, TN, USA, [3]Colorado Division of Wildlife - Native Aquatic Species Research Facility, Alamosa, CO, USA

Sperm Motility and Hormonal Induction Timing in the Boreal Toad (*Bufo boreas boreas)*

In recent years the southern Rocky Mountain population of boreal toad (*Bufo boreas boreas*) has experienced dramatic declines, therefore captive assurance colonies have been established to safeguard genetic diversity and facilitate reintroductions. Boreal toads can be difficult to breed naturally in captivity and exogenous hormones are being used to initiate spermiation and ovulation to assist with reproduction. Sperm induction in *B. boreas* can be achieved through treatment with hCG; however, further investigation of sperm quality parameters is required in order to optimise this protocol. Therefore, our objective is to characterise hormone dose requirements for spermiation by evaluating sperm production over time in response to administration of 100, 300 or 500 IU hCG. Urine was collected at 0, 2, 3, 5, 7, 9, 12 and 24hr post-injection and variables measured include: concentration; % motility; % forward motility; forward progressive movement and morphology. We will also explore the potential for short-term cold storage of spermic urine and recovery of viable sperm by investigating the process of sperm motility activation. These studies will allow us to develop breeding programmes to increase numbers and maintain high genetic diversity of captive populations of *B. boreas* and, ultimately, contribute to the re-introduction and recovery of this species. Further

studies include determining hormone protocols for stimulating egg production and exploring cryopreservation as a means of long-term gamete storage and genome security.

0685 Poster Session II, Saturday 9 July 2011

Matthew Lattanzio, Donald Miles

Ohio University, Athens, OH, USA

Multiple Effects of Disturbance on Intraspecific Variation in Tree Lizard (*Urosaurus ornatus*) Populations: Behavioral and Isotopic Evidence

Individuals faced with altered thermal regimes and habitat structure due to broad-scale disturbance may respond in three ways: 1) shift in distribution, 2) exhibit plastic or evolutionary responses (behavioral compensation, phenotypic plasticity, or response to selection), or otherwise 3) fail to adapt and go extinct. Most often, species must attempt to maintain populations in a shifting environment by relying on the second choice. In particular, population persistence may be facilitated if individuals within the populations differentially use available resources (i.e., exhibit resource polymorphisms) and minimize potential competition. The success of this strategy however is contingent on external factors including both spatial and temporal resource availability and disturbance frequency. In addition, these polymorphisms may be associated with other behaviors and possibly variation in fitness. Here, we will discuss on-going findings of our research investigating the demographic, performance, and behavioral components of tree lizard (*Urosaurus ornatus*) populations across sites in southeast Arizona that differ significantly in resource availability and disturbance frequency. In 2009, we found evidence of resource polymorphisms among existing morphs (yellow, orange, and blue throated lizards, $\chi 2=7.869$, $P = 0.02$). Since then, we have also accumulated evidence that intraspecific behavioral and morphological variation is also associated with the variation in diet selection that contributes to these polymorphisms. Data will be presented from both 2009 and 2010 study seasons to more fully illustrate the effects of disturbance on this species.

0324 Poster Session II, Saturday 9 July 2011

Katie May Laumann, Casey Dillman, Eric Hilton

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

Development of the Jaws of the White Sturgeon, *Acipenser transmontanus* (Acipenseridae)

The jaw morphology of sturgeons is distinct from that of other actinopterygians, and includes such specialized characters as the complete loss of the maxilla and premaxilla,

the rotation of the palatoquadrate such that the left and right sides meet in a palatine symphysis, complete loss of dentition as adults, the decoupling of the anterior part of the suspensorium from the neurocranium, and the presence of a post-palatoquadrate cartilaginous structure, the palatal complex. This reorganization results in a largely ventrally directed jaw apparatus. Despite this, and the intrinsic interest in sturgeons in the context of actinopterygian systematics, developmental studies of the jaw of sturgeons are rare. White sturgeon (*Acipenser transmontanus*) are native to North America, distributed from Alaska to central California, and east to northwestern Montana. In this presentation we will present new data on the development of the jaw in *A. transmontanus* based on a closely spaced growth series of hatchery-reared specimens ranging from 15 to 140 mm TL; in addition, skeletal specimens of adults (>1500 mm TL) were examined. In larvae there are well-developed teeth present on the dentary and dermopalatine; these are extremely reduced by about 45 mm TL. The shift from a forward facing to ventrally oriented set of jaws is nearly complete by 125 mm and complete by about 140 mm TL. We will draw on the published literature on behavior and ecology of early life history stages of sturgeons to test for correlation between ecology and developmental osteology.

0057 Poster Session III, Sunday 10 July 2011

Anne-Claire Lautredou[1], Cyril Gallut[1], Christina Cheng[2], Arnaud Couloux[3], Guillaume Lecointre[1], Agnes Dettai[1]

[1]MNHN, Paris, France, [2]University of Illinois, IL, USA, [3]Genoscope, Centre National de Sequenc¸age, Evry, France

Antarctic Radiations: The Trematominae (Notothenioidei, Teleostei)

Many studies have argued that the adaptive radiation of the suborder Notothenioidei (Teleostei) is equivalent to the species flocks of the African cichlids. The Trematominae are a particularly interesting subfamily within the suborder. Trematomus species occupy a large range of ecological niches, extremely useful for evolutionary and biogeography studies in the Antarctic Ocean. The genus contains eleven species but is monophyletic only when the two species *P. borchgrevinki* and *P. brachysoma* are included in the group. Moreover, a recently described species, *Cryothenia amphitreta*, appears to also belong within the subfamily. Even if Trematominae are well studied, relationships between these fourteen species are still unclear. Several recent studies have tried to resolve these relationships, but a low number of insufficiently variable markers, as well as incomplete lineage sorting problems, have precluded the attainment of stable results. The only repeated results place *T. scotti* as the most divergent species and *T. loennbergii* and *T. lepidorhinus* always in the same clade. We analyze here four nuclear markers and a mitochondrial marker with several approaches to get a better insight of the complex history of this possible recent radiation.

0056 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011

Anne-Claire Lautredou[1], Cyril Gallut[1], Corinne Cruaud[2], Guillaume Lecointre[1], Agnes Dettai[1]

[1]MNHN, Paris, France, [2]Genoscope, Centre National de Sequenc¸age, Evry, France

Exploring the Relationships among Serraniformes (Teleostei)

Since the beginning of the 21st century, thanks to important Japanese, French and American molecular studies, the phylogeny of Acanthomorpha is getting better resolved. Some groups are repeated from one study to another and from one marker to another. This is the case for the "clade X", first identified by Dettaï & Lecointre (2004, 2005), then confirmed by other studies and named « Serraniformes » by Li et al. (2009). Serraniformes include groupers (Serranidae), perches (Percidae), sticklebacks (Gasterosteidae), searobins (Triglidae) or « super families » like icefishes (Notothenioidei), sculpins and snailfishes (Cottoïdei), eelpouts (Zoarcoïdei) and scorpionfishes (Scorpaenoïdei). Within this group, some clades are repeated among independent molecular data and are therefore considered as reliable, but many of the relationships are not resolved convincingly yet. In order to better resolve relationships among Serraniformes, we have tested two new nuclear markers, MC1R and MC4R (melanocortin-1 receptor and melanocortin-4 receptor) in addition to the datasets already in use in the lab. By including as many families as possible from Scorpaeniformes and Perciformes, and multiple outgroups, we provide a clearer picture of which are included in Serraniformes, and what the relationships within this group are.

0721 Poster Session II, Saturday 9 July 2011

J.P. Lawrence, Gerald Urquhart

Michigan State University, East Lansing, MI, USA

Population Demographic Changes Due to Addition of Artificial Rearing Sites in the Strawberry Poison Dart Frog (*Oophaga pumilio*)

Limiting resources have often been used for determining species distributions across a landscape. These resources not only determine species assemblages, but can also influence male and female distributions in relation to these resources. The Strawberry Poison Dart Frog, *Oophaga pumilio*, is a small, territorial species of frog that has shown a great divergence in color in the Bocas del Toro region of Panama. Given the diversity there, effective conservation methods are needed in order to preserve the genetic diversity in the species. Addition of limiting resources may provide effective methods of promoting population growth. We established six year-long quadrats (with three replicates) with manipulations of rear sites, leaf litter addition, and leaf litter removal. The rearing sites used were large diameter drinking straws folded in half to mimic bromeliads. Quadrats were monitored in June 2009, July 2009, August 2009, May 2010,

and June 2010. Leaf litter addition and removal were not found to have any effect on population density, but addition of rearing sites was found to have a large difference; on average, the addition of rearing sites doubled the population. This strong dependence to rearing sites offers insight to the possibility of effective conservation of populations in threat of extirpation, whether from overcollection or from habitat loss. The use of large diameter drinking straws can be utilized my managers as a cheap and effective method for supplementing small dendrobatid populations that are in threat of being lost.

0322 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Lisa Marie Leclerc[2], Christian Lydersen[1], Tore Haug[3], Lutz Bachmann[4], Aaron T. Fisk[5], Kit M. Kovacs[1]

[1]Norwegian Polar Institute, Tromsø, Norway, [2]University of Tromsø, Department of Arctic and Marine Biology, Tromsø, Norway, [3]Institute of Marine Research, Tromsø, Norway, [4]National Centre for Biosystematics, Natural History Museum, University of Oslo, Oslo, Norway, [5]University of Windsor, Windsor, Ontario, Canada

Analyses of Gastro-intestinal Tracts of Greenland Sharks (*Somniosus microcephalus*) from Svalbard, Norway

Gastrointestinal tracts (GITs) from 45 Greenland Sharks (*Somniosus microcephalus*) collected in Svalbard, Norway, in 2008 and 2009, were analyzed to study the diet of this sleeper shark. The role of these sharks as potential seal predators was of particular interest in this study. The sharks ranged from 229-381 cm (fork length) and 136-700 kg (body mass), and all were sexually immature. Seal and whale tissue were found in 42.3% and 18.2% of the GITs that had contents (N = 33), respectively. The dominant seal prey species found in the sharks was ringed seal (*Phoca hispida*) while bearded seal (*Erignathus barbatus*) and hooded seal (*Cystophora cristata*) tissues were each found in a single GIT. Ringed seal tissues found in the sharks were derived from both pups and adult animals. All of the whale tissue was from minke whales (*Balenoptera acutorostrata*) that had been harvested in the commercial fishery near Svalbard. The sharks also ate various fish species, with Atlantic cod (*Gadus morhua*), Atlantic wolffish (*Anarhichas lupus*) and haddock (*Melanogrammus aeglefinus*) being the most important prey species. The largest fishes swallowed whole were an Atlantic wolffish (8.6 kg) and an Atlantic cod (4.2 kg). Strong circumstantial evidence suggests that the sharks actively preyed on the seals and fishes, in addition to eating carrion such as the whale tissue. Active predation on seals, in combination with the apparently high numbers of Greenland sharks in the Svalbard area, makes this predator a potentially significant source of mortality for seals that is generally neglected.

0193 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Guillaume Lecointre[1], Marie Fisler[1], Anne-Claire Lautredou[1], Cyril Gallut[1], Arnaud Couloux[2], Corinne Cruaud[2], Bruno Chanet[1], Agnès Dettaï[1]

[1]UMR7138, Museum National d'Histoire Naturelle, Paris, France, [2]Genoscope, Evry, France

Acanthomorph (Teleostei) Phylogeny and Classification

Acanthomorph fish represent one third of the known extant vertebrates. The last ten years have been rich in results. We will focus on the state of the art of our knowledge of their phylogeny, including new results obtained from new nuclear markers. The consequences of the recent unexpected phylogenetic relationships for acanthomorph classification have not been fully measured and taken into account. The list of polyphyletic groups is growing (Perciformes, Percoidei, Scombroidei, Trachinoidei, Labroidei sensu lato, Scorpaeniformes, Gasterosteiformes sensu lato, Zeiformes sensu lato...), that have not yet been fully transformed into new monophyletic groups. All the 314 acanthomorph families have not yet been included in a single matrix, whether for the morphology (although the Phenoscape project is building in this direction), nor for the molecules. Further discoveries are therefore expected.

0502 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Joël Leduc, Pierre Échaubard, David Lesbarrères

Laurentian University, Sudbury, Ontario, Canada

Metal-Induced Fitness Response of Leopard Frog (*Lithobates pipiens*) Larvae in Tailings Wetlands: A story of Trace Metals Mingling with the Ranavirus

Within the past decades, we have witnessed an increase in mass die-offs of amphibians through the Americas, Europe and Asia. Two causal stressors of these mass mortalities are metal contaminants and emerging infectious diseases. In one instance, trace metals can have a subtle, yet indirect impact on an organism's survival by inducing a decrease in its immune response and nervous system. Meanwhile, the Ranavirus is becoming a prevailing explanation for mass die-offs of amphibian communities which makes it an imminent cause for concern. Given these considerations, we hypothesize that the immune depletion from smelting trace metal contaminants would allow the emergence of infectious diseases to easily and more adversely affect an already stressed amphibian population. The objectives of this study are, thus, to assess the survivorship effects of several sub-lethal concentrations of Cu^{2+} and Ni^{2+} trace metals on leopard frog tadpoles (*Lithobates pipiens*) and to investigate the impact of these trace metals on the tadpole's fitness response and ultimately how it influences their susceptibility to the Ranavirus within tailings wetlands. Leopard Frog tadpoles from three different metal contaminated wetland environments (severe, moderate and no contamination) were

subjected to a trace metal acclimation period followed by an acute Ranavirus infection; therefore, investigating the synergistic effects between metal exposure and Ranavirus infection. In line with recent advances in the ecological literature, synergistic functionalities are becoming increasingly important in understanding how to forecast and control the epidemiology of these newly emerging diseases on wild populations, especially in highly stressed ecosystems.

0058 SSAR SIEBERT PHYSIOLOGY & MORPHOLOGY AWARD, Conrad B & C, Thursday 7 July 2011

Jose Lefebvre[1], Stephen W. Mockford[1]

[1]Dalhousie University, Halifax, Nova Scotia, Canada, [2]Acadia University, Wolfville, Nova Scotia, Canada

Tickle-Me Softly: A New Non-Invasive Technique for Sperm Extraction in Male Freshwater Turtles.

The reproductive cycles of Blanding's turtles (*Emydoidea blandingii*) are poorly understood; the male reproductive cycle has never been studied. Both sexes show promiscuity during reproduction and females can store sperm for long periods. Because of the above factors, multiple paternity within single clutches has a high frequency in this species. However, the frequency of this phenomenon is much lower in the populations of Nova Scotia. Previous work showed only 4-33% multiple paternity within clutches. Algorithm models suggest a low male contribution to the gene pool (2-5%). Low fertility is one of the hypotheses to explain this phenomenon. There are three recognized methods for sperm collection in turtles; flushing of the oviducts of females, removal of the epididymis and electroejaculation. The first method doesn't allow the identification of the donor, and the last two are invasive or lethal. Nova Scotia's populations are small, and designated under COSEWIC, and we are aiming in a less invasive method to apply on a Species At Risk. During notching of carapace on new captures, it was noticed that the vibration produced an erection. I hypothesized that slightly stronger vibration applied at a specific location could induce ejaculation. The method was tested on male Blanding's turtles, using a vibrator, first applied to the plastron to induce an erection, and then to the vial where the hemipenis was inserted. The method was successful in inducing ejaculation, was fairly quick to minimize handling time, and did not require any intrusion or removal on the specimens.

0105 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Bryan Legare[1], Bryan DeAngelis[2], Richard Nemeth[1], Simon Pittman[3], Greg Skomal[4]

[1]University of the Virgin Islands, St Thomas, VI, U.S. Virgin Islands, [2]NOAA Restoration Center, Narragansett, RI, USA, [3]NOAA Biogeography Branch, St Thomas, VI, U.S. Virgin Islands, [4]Massachusetts Division of Marine Fisheries, New Bedford, MA, USA

Site Fidelity, Residency, and Movements of Juvenile Blacktip (*Carcharhinus limbatus*) and Lemon (*Negaprion brevirostris*) Sharks in Nursery Areas of St John, USVI.

Nearshore areas utilized by juvenile sharks are under increasing amounts of anthropogenic stresses globally. Characterizing and quantifying the extent to which sharks utilize nearshore areas is important for conserving populations. Fish Bay and Coral Bay on the island of St John, United States Virgin Islands, have been identified as supporting large numbers of juvenile and neonatal lemon (*Negaprion brevirostris*) and blacktip (*Carcharhinus limbatus*) sharks; both embayment's are impacted by land-based development. We examined the temporal and spatial movement patterns of juvenile and neonatal lemon and blacktip sharks in these two bays and the surrounding coastal waters of St John. During the summers of 2006-2010, we surgically implanted acoustic transmitters into 25 lemon sharks (42.5-68.0 cm FL) and 48 blacktip sharks (48.0-81.3 cm FL) in Fish Bay (25 blacktips; 15 lemons) and Coral Bay (23 blacktips; 10 lemons). Local movements were tracked by an acoustic array of 32 receivers in and outside of these embayments. Only 8% of lemon sharks and14.5% of blacktip sharks exhibited long-term residency (> 180 days) within the bays while most of the sharks moved out by the fall and early winter months. Although several sharks were detected outside of Fish and Coral bays and a few (5 blacktips) traveled between the two bays, each species exhibited strong site attachment to the bay in which they were tagged. Efforts to examine intra- and inter-specific patterns of habitat use as they relate to the biotic and abiotic characteristics of each embayment are ongoing.

0175 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

John Legler

University of Utah, SaltLake City, UT, USA

Turtles: A Paradigm of Versatility and Venerability

The chelonian Bau Plan is the most specialized to have evolved in tetrapods. The axial skeleton, fused to certain dermal elements, forms a shell that contains or surrounds the appendicular skeleton. This unique specialization has existed for at least 200 million

years with few and relatively minor modifications. Turtles have survived and prospered where other specialized tetrapods have become extinct. Although the protection offered by the shell has always had a high selective value, certain aspects of life history have also played an important role in this venerability. Dietary versatility is discussed as one such factor.

0451 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

David LeGros, Brad Steinberg, David Lesbarrères

Laurentian University, Sudbury, Ontario, Canada

Logging Roads, Road Effects and Mitigation Techniques for Amphibians in a Central Ontario Forest

Habitat fragmentation is a serious threat to wildlife in many regions including Canada. There are extensive networks of roads that fragment habitat even in remote areas. For amphibians, which are small and slow moving with specific environmental requirements, roads are a physical barrier that prevent migration and dispersal. In Algonquin Provincial Park, Ontario, we have the opportunity to study the impacts of roads on amphibians without vehicular traffic causing road mortality. We sampled forest amphibians perpendicular to roads of different sizes to determine the extent of road effects. Attempts to mitigate road mortality using tunnels have been successful, however they would be too costly to be used on logging roads. As there are no vehicles currently using the roads, permanent structures are not needed, so we are testing semi-permanent mitigation treatments using natural materials applied to the road in two habitats; forest and wetland-adjacent roads. Using brush, rotten timber and mulch we can test and determine if these provide a suitable area for amphibians to cross. In the first field season, 10 species were captured, for a total of 3507 individuals. Total capture were similar between both habitats (Forest 1701, Wetland-adjacent 1806), but did vary considerably in species composition with *Notophthalmus v. viridescens, Pseudacris crucifera, Plethodon cinereus,* being most common in the wetland-adjacent portion of the study. *Anaxyrus americanus and Lithobates clamitans* were most commonly encountered on the forest road portion of the study.

0281 Poster Session II, Saturday 9 July 2011

Edgar Lehr[1], Alan Brus[1], Alessandro Catenazzi[2], Cindy Gregory[1], Rudolf von May[3]

[1]Illinois Wesleyan University, Bloomington, IL, USA, [2]Gonzaga University, Spokane, WA, USA, [3]University of California, Berkeley, CA, USA

New Anurans (Hemiphractidae, Strabomantidae) from the Río Abiseo National Park in Peru

We studied the amphibian fauna of the Río Abiseo National Park. This national park is located in the eastern Andes at 7°45'S and 77°30'W in the San Martín Region of Peru between the Marañón and Huallaga rivers. The park covers an area of approximately 2,745 square kilometers including 70% of the Abiseo river basin. Elevations inside the park reach from 350 m to 4200 meters. We examined museum specimens collected during biological expeditions to puna and montane habitats in the Río Abiseo National Park between 1987 and 1999. Our examination of these specimens revealed several new hemiphractid and strabomantid frogs. We present two new species of *Gastrotheca*, and two new species of *Pristimantis* and provide data on trombiculid mites (*Hannemania* sp.) parasitizing the skin of one species of *Pristimantis*.

0318 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

Richard Lehtinen[1], Gerardo Carfagno[2], James Witter[1]

[1]The College of Wooster, Wooster, OH, USA, [2]Gettysburg College, Gettysburg, PA, USA

Five Years of Life on the Edge: Results from a Long-Term Monitoring Program for Blanchard's Cricket Frog (*Acris blanchardi*)

While once a common frog in the Midwestern United States, Blanchard's cricket frog (*Acris blanchardi*) is now rare or absent in much of the northern portion of its range. However, little information is available on the causes of this decline and whether it is ongoing. To assess distributional change in this species, we established a long-term monitoring study in three regions of western Ohio, U.S.A. that straddle the presumptive range edge. We monitored 315 randomly selected aquatic sites using chorusing surveys from 2004 to 2008. These 315 sites were sampled a total of 1,807 times over this five year period to document occupancy patterns, establish detection probabilities and analyze turnover dynamics. While only approximately 15% of all sampled sites were occupied overall, the trends in occupancy over time markedly increased during the study period. In south-western Ohio, the number of occupied sites increased from eight in 2004 to 18 in 2008 (an increase of 125%). In west central Ohio, the number of occupied sites increased from four in 2004 to seven in 2008 (an increase of 75%). In north-western Ohio the number of occupied sites increased from 17 in 2004 to 28 in 2008 (an increase of 65%). Further, there was some evidence of eastward expansion towards portions of Ohio that

historically had cricket frogs but currently do not. While what the future holds is uncertain, our results suggest that presently cricket frogs in Ohio are not continuing to decline.

0223 Poster Session III, Sunday 10 July 2011

Lee Lemenager, Richard Tracy

University of Nevada, Reno, Reno, NV, USA

Seat Patch Water Potentials of Two Anuran Species, *Lithobates pipiens* and *Pseudacris cadaverina.*

The water potentials of the seat patches of two anuran amphibians (Northern leopard frog, *Lithobates pipiens;* and California Treefrog, *Pseudacris cadaverina)* were inferred from experiments of water exchange between frogs and environments in which the water potential was controlled. Water exchanges of frogs were inferred from changes in their body mass when they were allowed to exchange water with sucrose solutions differeing in water potential. Rates of water exchange by frogs were plotted against the osmotic potentials of experimental solutions, and the x-intercept of this graph was taken to be the water potential of the seat patch of the frogs (the point at which the water potential of the environment is equal to the water potential of the seat patch). Seat patch water potentials for *L. pipiens* were different from the water potential of their blood, and this implies that individuals of this species have some control of water uptake. Seat patch water potentials for *P. cadaverina* were similar to the water potentials of blood implying that they have no control of water uptake.

0211 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Christian Lenhart[1], John Nieber[1], Jason Naber[2]

[1]University of Minnesota, St. Paul, MN, USA, [2]Emmons & Olivier Resources, Inc., Oakdale, MN, USA

Impact of Prolonged High Summer Streamflow Duration on Turtle Nesting Success in Minnesota Rivers

The smooth softshell (*A. mutica*) and wood turtle (*G. insculpta*), are two rare species threatened by alteration of streamflow regime, particularly the ability to nest successfully on river sandbars. Recent research shows that there has been a prolonged duration of high flows during the nesting season of June and July in Minnesota potentially reducing nesting success. We assessed streamflow change using the Indicators of Hydrologic Alteration (IHA) software, changes to geomorphogy using field metrics and historic channel change using aerial photos on five rivers: the Cannon, Minnesota, Root, Kettle and St. Louis. Using USGS stream gauge data and aerial

photos, we developed a river stage-sandbar area relationship to determine the effect of prolonged high flow duration on nesting success. Based on the fact that most turtle eggs cannot survive > 2 days of submergence, we were able to identify the frequency of suitable nesting conditions in June and July over the 1940-2009 time period. Suitable water levels have declined in the 1980-2009 time period compared to the pre-1980 time span in the agricultural watersheds of southern Minnesota (Root, Cannon and Minnesota) meaning that turtle hatchlings are likely delayed and/or have lower survival rates. There was no significant change in the Kettle and St. Louis River streamflow and sandbar availability during the nesting season. Widespread hydrologic alteration could mean that there is reduced reproductive success of these riverine turtles in many southern Minnesota Rivers. Enhanced management of the riparian corridor and maintenance of longitudinal connectivity could help to mitigate impacts on these rare turtle populations.

0247 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Corissa Lennon, Joshua Mantooth, Jacob Grace, Donald Schneider, Kevyn Wiskirchen, Lauren Ross, Melissa Wright, Chad E. Montgomery, Michael I. Kelrick

Truman State University, Kirksville, MO, USA

Distribution and Habitat Characteristics of the Wood Frog (*Lithobates sylvaticus*) in the Cloud Peak Wilderness, Bighorn National Forest, Wyoming

Populations of wood frogs (*Lithobates sylvaticus*) in Wyoming are genetically distinct and isolated from other populations in the Rocky Mountain Region. *L. sylvaticus* exists as isolated, relict populations at high elevations in the Bighorn National Forest. Despite existence as isolated relictual populations, there is a paucity of information on the number of populations or status of individual populations across the Bighorn National Forest. The purpose of our study was to determine the distribution of *L. sylvaticus* in the northern portion of the Cloud Peak Wilderness within the Bighorn National Forest, Johnson County, Wyoming. Our goal was to create a predictive model for presence versus absence and breeding versus non-breeding sites for *L. sylvaticus*. We surveyed 39 potential *L. sylvaticus* sites located using topographic maps or incidental encounter. We recorded biotic and abiotic characteristics based on those used for amphibian surveys in the Greater Yellowstone ecosystem. We captured *L. sylvaticus* individuals by hand or dip-net and any uncaptured frogs were listed as observed. We identified individuals by sex, body length, and age class, and tadpole numbers were estimated where present. Wood frogs were present at 11 sites and 6 of these were breeding sites. We used multivariate analysis to determine influential variables on presence versus absence and breeding versus non-breeding.

0141 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

David Lesbarrères

Laurentian University, Sudbury, ON, Canada

Ranaviruses and Amphibians: Outside the Box of Host-parasite Relationships

Pathogens are known to affect their hosts in a variety of manners and ranaviruses are no different. Traditional investigation of host-parasite relationships have focused on host life-history traits and have used the variation in those traits to assess pathogen virulence. However, the dynamic nature of adaptation and counter-adaptation between the host and the parasite may be particularly sensitive to environmental influence. Here, I will focus on the role of potential abiotic and biotic mechanisms such as temperature, larval developmental stages, and competition for resources on the prevalence and virulence of the virus. For instance, I will show that ranavirus virulence is likely density-dependent, with the effect of ranavirus infection being relatively more severe in animals held in low density. I will also present the relative susceptibility of amphibians during their different life-history stages and the potential consequences of egg infection for disease screening and experimental studies. Additionally, amphibian species differ in their susceptibility to ranaviruses and significant isolates within different strains (ATV, FV3) are numerous. An investigation of the host-pathogen genotypic interactions, in the environmental context, is needed to improve our understanding of ranavirus virulence. Ranavirus is a serious threat to amphibian populations throughout the world; therefore there is a need to investigate the environmental factors that influence its virulence so that we might begin to understand the epidemiology of ranaviral diseases and forecast disease outbreaks.

0383 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Timothy Lewis[1], John Moriarty[2], Erin Curran[1]

[1]University of St Thomas, St Paul, MN, USA, [2]Ramsey County Parks, Maplewood, MN, USA

A Long Term Study of a Metropolitan Minnesota Lake Population of Painted Turtles (*Chrysemys picta*)

Painted Turtles (*Chrysemys picta*) inhabit both lakes and rivers in Minnesota and much of North America. Long-term monitoring of long-lived species is helpful for management of wildlife resources. This study was conducted in a 5.5 ha lake in the Minnesota Twin Cities metro area from 2003 to 2011. Turtles were captured during summers using 12 basking traps at fixed locations throughout the study period. Turtles were measured, weighed, marginal cutes were drilled or notched, and beginning in 2010, PIT tagged. Ten turtles were radio-tagged in 2010 and followed throughout the winter of 2010-11. Turtles were sexed based on body size, location of cloaca, plastron shape, and claw

length. Annual population size was estimated two ways: by the minimum number of turtles alive each year based on direct captures and by using the Lincoln-Petersen mark-recapture analysis. A total of 462 different turtles were captured and uniquely identified. Sex ratios varied from 1:2.03 (F:M) in 2005 to 1:0.80 in 2006. The population of the lake seemed to be increasing over this period of time with LP estimates ranging from a low in 2003 of 90 to over 1000 in 2010. Turtle winter locations were consistent with fall locations, with movements less than 50 m per day under the ice.

0579 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

Chenhong Li[1], J. Andrés López[2], Tuuli Makinen[2], Richard Broughton[3], Guillermo Ortí[4]

[1]University of Nebraska, Lincoln, NE, USA, [2]University of Alaska & Museum, Fairbanks, AK, USA, [3]University of Oklahoma, Norman, OK, USA, [4]The George Washington University, Washington, DC, USA

Ostariophysan Phylogeny: Characiformes and Siluriformes are Sister Taxa

The Ostariophysi is group of fishes that includes the orders Gonorynchiformes plus Cypriniformes, Gymnotiformes, Siluriformes and Characiformes. Close relationships of ostariophysans with Clupeiformes and Alepocephaliforms have been proposed but remain poorly defined. In contrast relationships among ostariophysan taxa have been well defined by a landmark study of their morphology (Fink and Fink, 1981) and remained uncontested for over 15 years. The first molecular phylogenetic studies, with few genes and taxa, did not support this hypothesis and were inconclusive, but more recent efforts based on whole mitochondrial genome sequences have challenged previous results. Contra Fink and Fink, these studies proposed a sister group relationship either between characiforms and gymnontiforms or between characiforms and siluriforms. In this study, we collected and analyzed DNA sequences from 10 nuclear loci (10,653 bp) from 59 taxa to test these competing hypotheses. Our data are congruent with a monophyletic Ostariophysi and support a sister group relationship between siluriforms and characiforms with the gymnotiforms as the sister group to this clade. Alternative hypotheses of relationship among siluriforms, gymnotiforms and characiforms were significantly rejected. The evidence presented as synapomorphies and the methodology used by Fink and Fink are discussed. Finally, our results also show with high confidence that Alepocephaliformes (formerly placed within Euteleostei) is the sister-group to the Clupeiformes and should be included in the supraordinal taxon Ostarioclupeomorpha.

0071 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Chenhong Li, Gavin Naylor

College of Charleston, Charleston, SC, USA

Target-enrichment and Next-generation Sequencing for Assembling the Chondrichthyan Tree of Life

An important objective of various Assembling the Tree of Life projects is to sequence many independent loci to reconstruct the phylogenies. PCR-based methods and Sanger sequencing are still the most commonly used techniques for this purpose, but involve considerable lab work and do not lend themselves well to high throughput approaches. Furthermore they often yield data sets that contain a large proportion of missing data, and sometimes paralogs amplified in different groups. To circumvent these problems, we developed a target-enrichment and next-generation sequencing strategy to collect the data from hundreds of genes and species simultaneously. Single-copy nuclear coding sequences were identified from genomes of six vertebrates, including a Chimaeriform ghost-fish. Baits totalling 400 kb were designed based on those genomic sequences and used to capture the putative orthologous sequences in target species. Eighteen chondrichthyans in addition to ten other vertebrate species were tested in this study. Different hybridization temperature and enrichment protocols were compared. The implication of our new strategy for reconstructing the Chondrichthyan Tree of Life is discussed.

0533 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Ana Liedke[1], Sergio R. Floeter[2]

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Feeding Ecology of the Banded Butterflyfish *Chaetodon striatus* along Its Range of Distribution

The degree of gene flow among populations is defined as genetic connectivity. For the successful establishment of a species with tropical affinities in peripheral (and colder) subtropical areas, it is crucial that, at least, favorable biotic factors, like habitat availability and food resources, are present. Understanding the balance between ecological plasticity and gene flow among populations along all the distribution range is fundamental to identify ecological and evolutionary patterns. The banded butterflyfish (*Chaetodon striatus*) was chosen as a model system because it occurs in two distinct reef systems: tropical coral reefs in the Caribbean and NE Brazil and subtropical rocky reefs in southern Brazil. Samples were collected in Puerto Rico and in four localities along the Brazilian coast (two localities per reef system). We obtained feeding data through 3min. focal animal observations of approximately 80 individuals per site as well as 20

individuals sampled for gut contents and population genetic analyses. The benthic cover was estimated through the photoquadrat method using the software CPCe 3.5. The electivity index – IvLev – was applied to check if there is selectivity of specific items on the benthic coverage. To evaluate the phylogeographic patterns, mitochondrial and nuclear genes are going to be amplified. Preliminary results show that the mean number of bites/3min in all localities ranges between 4 and 6.5. Benthic cover composition and food consumption varied among localities. Food consumption by *Chaetodon striatus* was also found to be disproportional to its availability, suggesting selective feeding habits.

0522 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Flávio C.T. Lima

Museu de História Natural "Adão José Cardoso", Universidade Estadual de Campinas, Campinas, SP, Brazil

A Revision of the Cis-andean Species of the Genus *Brycon* Müller & Troschel (Characiformes: Characidae)

A revision of the cis-andean species of *Brycon* is presented. Twenty-two *Brycon* species (including *B. pesu*) are recognized: *Brycon stolzmanni* Steindachner, from the Río Marañon basin, Peru; *Brycon coxeyi* Fowler, from the Río Marañon basin, Ecuador; *Brycon polylepis* Moscó Morales, from the Lago de Maracaibo, Río Orinoco, upper rio Amazonas, and rio Tocantins basins; *Brycon coquenani* Steindachner, from the upper Río Caroni, Río Orinoco basin, Venezuela; *Brycon insignis* Steindachner, *Brycon vermelha* Lima & Castro, *Brycon ferox* Steindachner, and *Brycon opalinus* (Cuvier), from coastal river systems of eastern Brazil; *Brycon nattereri* Günther, from the upper rio Paraná, rio São Francisco, and upper rio Tocantins basins; *Brycon orthotaenia* Günther, from the rio São Francisco basin; *Brycon orbignyanus* (Valenciennes), from the rio Paraná and rio Uruguai basins; *Brycon hilarii* (Valenciennes), from the rio Paraguai, middle rio Paraná, and upper rio Amazonas basins; *Brycon whitei* Myers & Weitzman, from the Río Orinoco basin; *Brycon amazonicus* (Agassiz), from the Rio Amazonas and Río Orinoco basins; *Brycon gouldingi* Lima, from the rio Tocantins basin; *Brycon melanopterus* (Cope), from the western and central rio Amazonas basin; and *Brycon falcatus* Müller & Troschel, from the the rio Amazonas, Orinoco, and guyanese basins. Four new species are described, one from the Río Maranõn basin in Peru and three from coastal rivers from eastern Brazil. All species are redescribed and illustrated, and a key to the species is provided. Comments on the diagnosis of the genus *Brycon*, the biogeography of the cis-andean species, and their current conservation status, are made.

0614 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Charles Linkem

University of Kansas, Lawrence KS, USA

Species Tree Despite Gene-Tree Incongruence in Large Datasets: The Phylogeny of the Sphenomorphus Group (Squamata: Scincidae)

Advances in molecular techniques have allowed researchers to quickly collect multiple independent genes across large taxonomic groups. When the coalescent history of the individual gene trees are significantly different (ie. Support for alternative clades) then analyses incorporating gene-tree incongruence are necessary. These methods become computationally difficult as the number of species increases, and an alternative strategy is warranted for large data matrices. The Sphenomorphus group consists of approximately 500 species in 30 genera distributed throughout Australia, the West Pacific Islands, Indonesia, the Philippines, Indochina, Asia, and North and Central America. This large group has substantial morphological and physiological variation making it interesting for comparative studies. This project uses 350 samples from the Sphenomorphus group and six independently evolving genes to resolve the species phylogeny of this diverse clade. Using a combined approach, I explore different methods for overcoming gene-tree conflict in large datasets.

0523 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

Shawn E. Liston[1], Jerome J. Lorenz[1]

[1]Audubon of Florida, Corkscrew Swamp Sanctuary, Naples, FL, USA, [2]Audubon of Florida, Tavernier Science Center, Tavernier, FL, USA

Fish in Forests: Seasonal Dynamics of South Florida's Freshwater Forested Wetland Fish Communities

Freshwater forested wetlands are notably understudied compared to their graminoid counterparts, yet they provide critical habitat for fish and macroinvertebrate communities. An important part of the regional hydrologic system of the greater Everglades, the Big Cypress Swamp encompasses a large area of interior southwestern Florida and provides nesting and feeding sites for threatened wading bird populations who rely on an aquatic prey base. The marked seasonal variation in hydrology that is characteristic of this sub-tropical region creates a dynamic environment for aquatic fauna and intra-annual pulses in productivity. We describe variation in the community structure and abundance of fishes and macroinvertebrates in freshwater forested wetlands based on five years of data collected in Big Cypress National Preserve. These data reveal a shift from a crayfish-dominated aquatic prey community early in the hydrologic year, to a fish-dominated aquatic prey community throughout the dry

season. The microtopography of this region typically causes dry-season fish populations to concentrate, becoming high-density (up to 3,000 fish/m^2) prey patches that are a critical food source for nesting wading birds. Atypical dry-season rain events (or water management activities) can significantly disrupt this pattern, raising water levels and drastically reducing fish density and availability to wading birds. Improving our understanding of the connections between these wetlands, their hydrology, and the trophic interactions of native species will help in guiding western Everglades restoration efforts and environmentally-responsible development in the Big Cypress region.

0473 Poster Session III, Sunday 10 July 2011

Robert Literman, Kevin Wenceslao, Amanda Harris, Sarah Luchtel, Jennifer Neuwald, Nicole Valenzuela

Iowa State University, Ames, IA, USA

The Effect of Thermal Variance on Plastic Growth Rate Responses in TSD Turtles

The adaptive value and maintenance of environmental sex determination (ESD) remains a biological enigma with molecular, ecological, and evolutionary implications. To understand why this trait has persisted throughout evolutionary time it is essential to uncover the effects that developmental plasticity imparts to ESD organisms. In this study, we tested the hypothesis that incubation conditions with varying degrees of temperature fluctuation induce differentially plastic responses with respect to juvenile growth rates in males and females of *Chrysemys picta* turtles, a species with temperature-dependent sex determination. Eggs were incubated under thermal profiles encompassing controlled fluctuations, natural male- and female-producing profiles, as well as natural profiles with increased mean and variance. Hatchlings were reared under common-garden conditions and weighed periodically. The effect of incubation temperature and sex were analyzed with respect to weight and growth rate. We detected significant differences in growth rates among treatments in a more complex manner than expected by the sex ratios produced by the incubation conditions. We discuss the implications of these findings for the evolution of ESD and the response of ESD taxa to climate change.

0349 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Caitlyn Little[1], Devin Flawd[2], James Sulikowski[1]

[1]University of New England, Biddeford, ME, USA, [2]NOAA, Pascagoula, MS, USA

Analysis of Habitat Utilization and Reproductive Potential of Atlantic Sturgeon, *Acipenser oxyrinchus*, in the Saco River, ME

The Atlantic sturgeon inhabits river systems and coastal waters along much of the eastern coast of North America. However, anthropogenic fishing pressures and habitat degradation have caused reductions in population sizes of this once prolific species. This decline in abundance has led to the listing of the Atlantic sturgeon as federal species of concern throughout its range in the United States. Until recently, Atlantic sturgeon were not known to inhabit the Saco River and its estuary in Maine. Their sudden appearance in this river in the fall of 2008, and the subsequent appearance of the endangered shortnose sturgeon in the summer of 2009, has raised many questions about sturgeon populations inhabiting the river. This study utilizes a variety of methods to examine habitat use of these species within the river and its estuary. Internal acoustic transmitters have been implanted in 39 Atlantic and one shortnose sturgeon to monitor movement within the river. Data obtained from acoustic receivers is being compared to tidal cycles and salinity at the mouth of the river to determine if these environmental conditions influence sturgeon movement patterns within this system. Additionally, gastric lavage has been utilized to obtain stomach contents to examine the food habits of captured sturgeon in this region. Finally, radioimmunoassay techniques have been utilized to quantify circulating levels of estradiol and testosterone in blood plasma. These values are coupled with ultrasound imaging in an effort to determine the reproductive status and sex of sturgeon in the river.

0215 Fish Conservation, Symphony III, Saturday 9 July 2011

Ken Longenecker, Ross Langston

Bishop Museum, Honolulu, HI, USA

Population Characteristics of Exploited Fishes from Hawaii's Mesophotic (50-100 m) Coral Ecosystems

We describe population characteristics of six fishes expected to occur at depths between 50 and 100 meters, and compare these to shallow-water (<50 m) results. Our ultimate goal is to compare depth-specific biomass production and reproductive output of these exploited species. This information will allow resource managers to determine whether deep reefs act as refugia for fishery species. To date, we have not encountered *Acanthurus triostegus* or *Mulloidichthys flavolineatus* on mesophotic (deep) reefs. Mean densities of *Centropyge potteri*, *Ctenochaetus strigosus*, *Dascyllus albisella*, and *Parupeneus multifasciatus* on deep reefs are not statistically different from those on shallow reefs. Mean lengths of *C. potteri* and *C. strigosus* on deep reefs do not differ from shallow areas,

but *D. albisella* and *P. multifasciatus* are significantly shorter on deeper reefs. Length-weight relationships for *C. potteri* and *P. multifasciatus* are similar in both habitats, however, body condition indices for *C. strigosus* and *P. multifasciatus* on deep reefs are less than those calculated for shallow areas. To date, our results suggest fish production on deep reefs does not exceed that of shallow reefs. However, results from ongoing efforts to describe growth rates, mortality, size-at-maturity, fecundity, and size-specific sex ratios are likely to influence our final estimates and will be discussed.

0414 Poster Session II, Saturday 9 July 2011

Sarah Longo, Amy McCune

Cornell University, Ithaca, NY, USA

Evolution of the Actinopterygian Swimbladder: Insights from High Resolution 3D Images of the Arterial Vasculature of Basal Osteichthyans

The prevailing hypothesis since the mid-nineteenth century has been that lungs and swimbladder of vertebrates are homologous. Because sarcopterygians and a basal actinopterygian, *Polypterus*, have lungs, lungs are considered to be the primitive condition of the air-filled organ (AO) and a synapomorphy of Osteichthyes. Comparative studies seeking to understand the morphological transformation from paired respiratory lungs to an unpaired buoyancy-regulating swimbladder often refer to characteristics of the AO blood supply in basal osteichthyan fishes that possess either lungs or respiratory swimbladders. However, previous studies have excluded extant Acipenseriformes (sturgeon and paddlefishes), which are phylogenetically embedded in this array of air-breathing fishes, and as such must be considered when attempting to distinguish between conserved, derived, and convergent circulatory traits among basal actinopterygians. This study uses micro-CT analysis of fish with barium-injected vessels to reevaluate the arterial characters associated with the AOs of basal osteichthyans including *Protopterus*, *Polypterus*, *Polyodon*, *Acipenser*, *Lepisosteus*, and *Amia*. Digitized images reconstructed from the scans were used to make readily comparable diagrams of the arterial circulation associated with the AOs of these fishes. The ability to examine the circulatory system in high-resolution 3D offers new insights into the evolution of pulmonary arteries in actinopterygians and highlights a previous oversight in the literature: the grouping of sturgeon and paddlefish as circulatory equivalents with little to add to the discussion of early swimbladder evolution.

0426 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

J. Andres Lopez

University of Alaska Museum, Fairbanks, AK, USA

Common and Contrasting Phylogeographic Patterns in *Aphredoderus* and *Esox*

Esox americanus and *Aphredoderus sayanus* share a strikingly similar geographic distribution. A subspecies within each of these taxa is found east and west of the Appalachian range and populations with uncertain subspecific membership inhabit the coastal plains of the southeastern U.S. producing a continuous U-shaped distribution in each of the two species. In both species, phenotypic data suggests that southeastern coastal plain populations represent varying mixtures of the subspecific forms. Based on the observed distribution of phenotypic variability, it has been hypothesized that these mixed populations are the product of a secondary contact zone formed by the meeting between incipiently differentiated lineages. The secondary contact hypothesis invokes glacial cycling and concomitant sea level changes as the underlying vicariant event leading to population isolation and subsequent formation of the subspecific forms. Analyses of genotypic variability across the range of both species reveal patterns in the level of genetic diversity and its spatial distribution that are incongruent with expectations derived from the secondary contact hypothesis. The genotypic data supports a more complex model where differentiated groups subdivide eastern subspecies and where considerable genetic diversity is endemic to the southeastern coastal plains. This last observation is incompatible with a scenario where sea transgression extirpates coastal plain populations in the recent past.

0457 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

J. Andres Lopez[1], Michael Sandel[1]

[1]*University of Alaska Museum, Fairbanks, AK, USA,* [2]*University of Alabama, Tuscaloosa, AL, USA*

Pattern and Process in the Distribution of Freshwater Biodiversity in Southeastern Coastal Drainages: A Review

The coastal plain drainages that span across the Gulf of Mexico to the Atlantic coast are home to a large proportion of North America's freshwater biological diversity. Understanding the processes that have shaped the origin and distribution of that diversity motivated the pioneering studies of molecular-based phylogeography that uncovered broad scale biogeographic partitions and guided hypotheses of their formation. We review classical phylogeographic studies for Gulf-Atlantic coastal plain freshwater faunas in the context of more recent developments in population and landscape genetics. We identify and describe the following open questions regarding

the evolution and distribution of freshwater fishes in this region: 1) What are common patterns in the level and distribution of genetic variability? 2) What are the relative roles of geological and ecological processes in the establishment of population and species level spatial structure? 3) To what extent do phenotype- and genotype-based geographic partitions differ?

0302 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY

Erin Loury

Moss Landing Marine Laboratories, Moss Landing, CA, USA

Diet of the Gopher Rockfish (*Sebastes carnatus*) Inside and Outside of Marine Protected Areas in Central California

No-take marine reserves are predicted to increase the density of fishes within their boundaries, which may in turn cause changes in predation or prey availability. In 2007, a series of no-take marine reserves was established along the central California coast. During the summers of 2007-2009, the California Collaborative Fisheries Research Program collected a total of 1,018 gopher rockfish (*Sebastes carnatus*) for stomach content analysis inside and outside of reserves at Año Nuevo, Point Lobos, Piedras Blancas and Point Buchon. A highly diverse diet of mostly invertebrate taxa was observed for the 710 fish with prey in their stomachs. Prey types with the highest Index of Relative Importance values included brittle stars, and crabs of the family Pisidae and the genus *Cancer*. Diet composition was highly similar inside and outside of the Point Lobos State Marine Reserve, the oldest of all reserves (74.5 percent similarity index). Although fish inside the reserve appeared to have more specialized diets than outside, the high extent of overlap suggests similar feeding habits in the protected and unprotected sites. Similar analyses are currently underway for the three other marine reserves.

0683 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Corey A. Love, Ayesha S. Burdett, Thomas F. Turner

University of New Mexico, Albuquerque, NM, USA

The Feeding Habits of Larval Fishes: Abiotic Influences and Food Web Impact

Larval fishes are often underrepresented in aquatic food web studies. Their small size and great numbers tend to complicate the identification process and make it difficult to include larvae at all. However, to completely disregard larvae likely generates a severe mischaracterization of trophic dynamics. We hypothesize that larvae play a major role due to initial abundance and rapid growth. A two-year mesocosm experiment was conducted to assess the effect of larval fishes on invertebrate populations and

subsequent effects on overall food web dynamics. Larval fishes were stocked in mesocosms adjacent to the Rio Grande main channel at the Sevilleta National Wildlife Refuge, New Mexico. Fish and invertebrates were collected biweekly for six weeks. We found that allochthonous inputs play an important role in the overall composition of invertebrate communities. In addition, gut content analysis and invertebrate abundance data confirm that fishes are consuming invertebrates in proportion to what is available. Together, these results suggest that feeding habits of fishes are largely subject to abiotic factors, an important finding in a variable desert system. This study demonstrates the necessity of incorporating larval fishes in aquatic food web studies and the importance of understanding the links between biotic and abiotic components of an ecosystem.

0727 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Elliot Love, Mark Bee

University of Minnesota - Twin Cities, St. Paul, MN, USA

A Co-evolutionary Mismatch Between Signaler Behavior and Receiver Preference in Noise in Cope's Gray Treefrog (*Hyla chrysoscelis*)

Animals that communicate acoustically must cope with the problem posed by environmental background noise. One strategy signalers may use to ameliorate this problem for receivers involves changing characteristics of the signal itself to make it stand out against loud background noise. Frogs provide an excellent model organism for studying this problem because they call in dynamic and noisy social environments. We used Cope's gray treefrog (*Hyla chrysoscelis*) to investigate whether changes in male signaling behavior in noise match female preference under similar conditions. In one experiment, we investigated how males change their calling behavior in the presence of background noise. Males increased the duration of their calls (pulses/min) while decreasing calling rate (calls/min), thus maintaining a constant pulse effort (pulses/min). In a second experiment, we tested the hypothesis that, when pulse effort is similarly held constant, females preferred long duration calls produced at a slow rate over short duration calls produced at a fast rate in both quiet and noisy conditions. Interestingly, females actually preferred short calls at a fast rate as opposed to long calls at a slow rate. The changes male gray treefrogs make to their advertisement calls in noisy environments are opposite of what the females really prefer. It appears that, in the case of gray treefrogs, there is a co-evolutionary mismatch between signaler behavior and female preference under noisy conditions.

Robert Lovich[1], Michael Lannoo[2], Chris Petersen[3], Priya Nanjappa[4], Christopher Phillips[5]

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Do Frogs Still Get Their Kicks on Route 66? Transcontinental Department of Defense Transect Reveals Spatial and Temporal Patterns of *Batrachochytrium dendrobatidis* Infection

The chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), has been devastating amphibian populations globally. Two general scenarios have been proposed for the nature and spread of this pathogen: 1) Bd is an epidemic, spreading as a wave and wiping out individuals, populations, and species in its path; and 2) Bd is endemic, widespread throughout many geographic regions on every continent except Antarctica. Resolving these hypotheses requires broad-scale studies using standardized techniques. We conducted a transcontinental transect on United States Department of Defense (DoD) installations from California to Virginia. We addressed the following questions: 1) Does Bd occur in amphibian populations on secure and protected DoD environments? 2) Is there a spatial pattern to the presence of Bd? 3) Is there a temporal pattern to the presence of Bd? and 4) Do our results shed light on whether Bd is acting as an epidemic or endemic infection across North America? This study represents the most geographically extensive survey for Bd conducted to date, and included 10% of United States amphibian species. Half the amphibian species surveyed (15/30) were Bd positive. There was a strong spatial component—the ten eastern temperate DoD installations had higher rates of Bd infection (18.9%) than the five bases situated in the arid west (4.8%). There was also a strong temporal (seasonal) component. In total, 78.5% of all positive samples came in the first (spring/early-summer) sampling period. These data support the conclusion that Bd is now widespread, and argues that Bd can today be considered endemic across much of North America, extending from coast-to-coast, with the exception of remote pockets of naïve populations.

0467 Poster Session III, Sunday 10 July 2011

Ben Lowe, Kenneth Kozak

University of Minnesota, St. Paul, MN, USA

Molecular Characterization of Hybrid Zones between Southern Appalachian *Plethodon*

Hybrid zones represent model systems for studying the causes and consequences of gene exchange between closely-related evolutionary lineages. The salamanders *Plethodon shermani* and *P. teyahalee* show remarkable variation in the extent to which they hybridize along different elevational gradients in the southern Appalachian Highlands. In this study, we address whether timing of secondary contact alone can explain variation in the genetic structures of these replicate hybrid zones. Using a novel, coalescent-based method, we disentangle gene tree incongruencies to estimate the timing of secondary contact. These estimates are used in concert with estimates of dispersal and generation time to estimate expected width of a hybrid zone under a model of neutral diffusion, and then are compared to actual hybrid zones. These analyses reveal that at least in some instances, hybrid zones between *P. shermani* and *P. teyahalee* have been in existence longer than expected under a model of neutral diffusion. Furthermore, they reveal that some variation in hybrid zone width may be explained by variation in the timing of secondary contact. These findings are important, as they confirm that divergent lineages are capable of maintaining their evolutionary distinctiveness indefinitely despite ongoing gene flow with heterspecific populations.

0405 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

William Ludt[1], Moises Bernal[1], Brian Bowen[2], Luiz Rocha[1]

[1]University of Texas Marine Science Institute, Port Aransas, TX, USA, [2]Hawaii Institute of Marine Biology, Kane'ohe, HI, USA

Sea Level Fluctuations and Genetic Diversity in Two Habitats: Comparisons of Two Lagoon and Two Seaward Reef Wrasses (Genus: *Halichoeres*)

Glacial cycles and associated sea level changes during the Pleistocene have been known to affect the distribution of plants and animals both in terrestrial and marine environments. These sea level fluctuations exposed the continental shelf in many areas during the last glacial maxima, restricting reefs to vertical or steep slopes and limiting the habitat area for shallow water species. Currently it is thought that species inhabiting lagoons or other shallow habitats went through population bottlenecks, resulting in present day low genetic structuring across populations. Contrary to this, species inhabiting steep, seaward reefs should not have been limited by habitat during glacial periods, allowing these species to build up genetic differences between populations. This study examined this process on an entire ocean basin scale using four different

wrasses in the genus *Halichoeres*. *H. trimaculatus* and *H. margaritaceus* inhabit lagoons and shallow habitats, whereas *H. claudia* and *H. ornatissimus* inhabit seaward reefs throughout the Pacific. Two different mitochondrial markers were used (cytochrome oxidase I and control region) to determine population structure among species, along with haplotype and nucleotide diversities. Haplotype and nucleotide diversity were similar among all four species. Furthermore, across the range of *H. margaritaceus* and *H. trimaculatus*, *H. claudia* showed less genetic structuring than the former two shallow water species. These results do not agree with the current hypotheses and suggest that those species maintain high levels of population differentiation and genetic diversity despite sea level fluctuations that potentially affected their habitat.

0537 Poster Session III, Sunday 10 July 2011

Alissa L. Luken, Jason R. Warner, Denita M. Weeks, Beck A. Wehrle, Robert E. Espinoza

California State University, Northridge, Northridge, CA, USA

Sprint Speed is Not Altered by Diel Cycle in a Nocturnal Gecko: Implications for Performance Studies

Performance typically differs between nocturnal and diurnal ectotherms because of differences in the body temperatures they can achieve during their respective activity periods. However, other factors, including diel cycles, may also influence performance. Comparisons between nocturnal and diurnal species have revealed that the time of testing can significantly alter performance, but insufficient comparative data are available to ascertain whether this phenomenon is widespread. We tested the hypothesis that nocturnal geckos will sprint at similar rates when tested at night vs. by day. We measured the sprint speed of 10 adult *Ptychozoon kuhli* (Gekkonidae) at four ecologically relevant temperatures (15, 23, 30, and 40 °C), both during the day (0800–1700 h) and at night (1800–0300 h). We found that sprint speed did not differ between nocturnal and diurnal testing periods for *P. kuhli* at any of the temperatures tested. If confirmed in a diversity of other species, such results would suggest that the time of testing is not a critical factor in performance studies. Comparable studies are planned that include a diversity of nocturnal as well as diurnal gecko species.

0459 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Daniel Lumbantobing

The George Washington University, Washington, DC, USA

Morphology and Molecules in the Phylogenetic Study of the Genus *Rasbora sensu lato* (Teleostei; Cyprinidae)

The genus *Rasbora sensu lato* is one of the most species-rich groups of freshwater fishes distributed throughout South and Southeastern Asia. Although phylogenetic studies of *Rasbora* have been conducted, the systematics of the group is still problematic. Here, I report on the phylogenetic systematics of the genus *Rasbora s. l.* using both morphology and molecules. One hundred forty six morphological characters (77 newly-described characters) from 72 taxa (5 outgroups) were used, which resulted in a consensus of most parsimonious trees revealing the monophyly of *Rasbora s. l.* supported by two novel synapomorphies: the dorsomedial membranous tendon of the adductor mandibulae A1 muscle and the the socket-like structure of the anteroventral joint of the quadrate connecting with the angulo-articular. Four mitochondrial markers (COI, 16S rRNA, cytochrome-b, and d-loop region) and four nuclear genes (RAG1, rhodopsin, and 2 EPIC markers) were sequenced from 98 taxa (7 outgroups). The concatenated alignment of sequences of eight markers was analyzed using Maximum Parsimony and Maximum Likelihood methods. Both molecular methods resulted in similar topologies, which do not support the monophyly of *Rasbora s. l.*, contradicting the morphological phylogeny. Both molecular and morphological trees show agreement on the split of two major clades, the basal Indian clade and the more derived Indochina-Sundaland clade. Also, both approaches resulted in the topologies supporting the monophyly of several species-group of *Rasbora s. l.*, such as: the *R. argyrotaenia*-group, the *R. einthovenii*-group, and the *R. sumatrana*-group.

0508 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

Amy Luxbacher, Kenneth Kozak

University of Minnesota, St. Paul, MN, USA

Inferring Past Demographic Patterns of the Montane Salamander, *Plethodon jordani*

Climate fluctuations during the Pleistocene altered species distributions, but the number and location of climatic refuges in topographically complex areas in eastern North America are not well understood. I use the Red-cheeked Salamander (*Plethodon jordani*), a species that is endemic to Great Smoky Mountain National Park, to investigate how past climate has shaped contemporary patterns of population genetic structure. Preliminary results suggest several distinct evolutionary lineages within the current

geographic distribution of this narrow-ranging species. I will present research that integrates physiological data, models of variation in microclimate over time, and phylogeographic data to explore how *P. jordani* responded to past changes in climate. Because past changes in geographic distributions should be coupled with changes in population size, I also evaluate evidence for past demographic changes in each lineage. Understanding how past climate explains geographic genetic structure in this species offers broad insight into how climatic processes influence the formation of evolutionary lineages and will guide efforts to mitigate the effects of climate change on distributions and genetic diversity.

0658 Poster Session I, Friday 8 July 2011

Kady Lyons, Gwen Goodmanlowe, Christopher Lowe

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

Organochlorine Contaminants in Round Stingrays (*Urobatis halleri*) from Southern California

While contaminant concentrations have been reported for elasmobranchs around the world, very few have monitored levels for southern Californian species despite the high volume of industrial and residential inputs into the coastal environment. The round stingray (*Urobatis halleri*) is a local benthic species that forages near areas of high organochlorine contamination and represents a good model to monitor contaminant accumulation in local elasmobranchs. PCBs, DDT (and metabolites), chlordanes, and PBDEs were measured and compared in juvenile male and female and adult male stingrays from areas in southern California. Organochlorine contaminants were extracted and cleaned via gel chromatography and analyzed using an Agilent gas chromatograph equipped with a mass selective detector. Juveniles and adult males from Seal Beach, California were found to have higher mean concentrations of PCBs (4803±2300 ng/g, lw) than chlordanes (316.87±120 ng/g, lw), PBDEs (284.66±130 ng/g, lw), DDE (145.26±102 ng/g, lw). Preliminary data did not show significant differences in contaminant concentrations between juveniles and adult males for any of the contaminants; however, there was high variability in contaminant concentrations among individuals, which may be influenced by the round stingray's migratory patterns. Conversely, male and female stingrays collected from Santa Catalina Island had significantly lower mean concentrations of PCBs (257.62±125 ng/g, lw; $P<0.003$), chlordanes (6.1±15 ng/g, lw; $P<0.0001$), and DDE (9.93±22 ng/g, lw; $P<0.02$). The large difference in contaminant concentrations between animals from these two areas may suggest that stingrays from the mainland could be affected more by contaminant impacts than stingrays from Catalina Island.

0192 SSAR SIEBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Chui Ying Ma, Nancy E. Karraker, Billy C.H. Hau

University of Hong Kong, Hong Kong SAR, Hong Kong

Managing Amphibians in Agricultural Wetlands in South China: Effects of Fertilizers on Tadpole Performance

Agricultural practices have altered natural wetland habitats, and this is particularly true in lowland areas of Southeast Asia. Recently, decreasing area of arable land and increased use of chemicals may limit the persistence of lowland amphibian populations. We investigated how the management of the wet agricultural farms helps to promote amphibian biodiversity. As one part of this study, we examined fertilizer use in traditional and organic farmlands, and in field mesocosm experiments, compared the effects of a chemical fertilizer (granular urea) and an organic fertilizer (peanut cake) on the survival and growth of hatchlings of the brown tree frog (*Polypedates megacephalus*) and marbled pygmy frog (*Microhyla pulchra*). Experiments assessed fertilizers at low, manufacturer-recommended, and high levels, and after 21 days we measured survival, snout-vent-length, and the weight. Survival of *P. megacephalus* and *M. pulchra* was extremely low (0%) in the chemical fertilizer at the recommended level. Conversely, survival was 98% for *P. megacephalus* and 55% for *M. pulchra* at the recommended level for the organic fertilizer. All tadpoles showed significantly increased growth in elevated concentrations of organic fertilizer. In fact, *P. megacephalus* were three times larger in mass in low concentration and seven times larger in high concentration. Similarly, increased growth in *M. pulchra* in all organic treatments resulted in abbreviated time to metamorphosis. For South China, our study suggests that where conservation of amphibians is a priority, chemical fertilizers should be avoided, and land managers should encourage the use of the organic fertilizer on long-term water crops.

0418 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

Vivian Maccachero[1], Ralph Saporito[2], Craig Guyer[3], Maureen Donnelly[1]

[1]Florida International University, Miami, FL, USA, [2]John Carroll University, University Heights, OH, USA, [3]Auburn University, Auburn, AL, USA

Amphibians and Reptiles at Ponds at the La Selva Biological Station, Costa Rica: Assemblage Variation through Space and Time

Swamp-breeding anurans form conspicuous components of many tropical forest sites, yet very little is known about the ecology of these systems. We analyzed a long-term data set to describe patterns of species composition and habitat use of amphibians and reptiles from two ponds at the La Selva Biological Station, northeastern Costa Rica. In addition, we describe long-term population-level trends in hylid frog relative abundance at a pond at La Selva and discuss whether these patterns are indicative of population

declines. Results will be presented at JMIH 2011. In light of evidence that populations of terrestrial amphibians and reptiles have experienced declines at this lowland site, knowledge of patterns of pond-breeding anuran assemblage structure is particularly critical at the present time.

0444 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Laura Macesic, Gary Gillis

Mount Holyoke College, South Hadley, MA, USA

Avoid Falling Flat on your Face: A Lesson from Toads

In contrast to a typical frog, which often lands on its belly or face after a hop, the cane toad (*Bufo marinus*) is exemplary at landing. Toads use their forelimbs to balance the body for extended periods after impact as the hindlimbs are rocked into contact with the ground. Recent investigations of antagonistic muscles acting at the elbow demonstrated that both the timing and intensity of pre-landing electromyographic (EMG) activity are tuned to hop distance. Longer hops lead to more intense pre-landing EMG activity, and in elbow extensors the onset of activity occurs at a nearly fixed interval before landing, regardless of the length of the hop. In this study, we report results from antagonistic muscles acting at the wrist and shoulder joints to test whether pre-landing recruitment patterns of muscles acting more proximally and more distally to the elbow also change in response to hop distance. Preliminary data from wrist flexors (palmaris longus and flexor carpi ulnaris) show similar patterns of tuning with distance in both pre-landing activation timing and intensity. Likewise, an antagonistic wrist extensor (palmaris carpi radialis) also exhibits tuned pre-landing activity patterns. This study demonstrates the importance of forearm muscles in stabilizing and controlling whole body movements of the toad during landing and provides a model system for understanding motor control strategies for controlled deceleration more generally.

0363 Poster Session II, Saturday 9 July 2011

Jessica Maciel[1], Maribel Pinon[1], David Zaragoza[2], Gerardo Antonio Cordero[1], Lorin Neuman-Lee[3], Jeramie Strickland[4], Shannon Thol[1], Daniel Warner[1], Timothy Mitchell[1], Aaron Reedy[2], Fredric Janzen[1]

[1]Iowa State University, Ames, IA, USA, [2]Kelly High School, Chicago, IL, USA, [3]Utah State University, Logan, UT, USA, [4]U.S. Fish & Wildlife Service, Thomson, IL, USA

Planting a TREE: Designing a Program to Facilitate Ecological Research, Outreach, Education, and Mentoring for Underrepresented Students

There is a serious dearth of female and minority representation in the sciences. To help remedy this problem in the field of ecology, we carefully developed a program called TREE (Turtle Camp Research and Education in Ecology). We seeded the program with an economically and racially diverse group of high school students from rural Iowa and Illinois, as well as Des Moines and Chicago, along with undergraduate and graduate student mentors from four different institutions. Participants converged at a field site known as "Turtle Camp" in June of 2007-2010 (totaling 22 high school students, 10 undergraduate students, 8 graduate students, and 2 post-doctorates over the four years). All students worked toward four main goals at Turtle Camp: research experience, local outreach, education, and mentoring. The program utilized the extensive local diversity in reptiles to allow students to receive hands-on experience with research and related activities. Overall, TREE provides an excellent environment for advancing interest in, and knowledge of, science and for positively influencing career plans of the participants. We hope that this program can serve as a model to help other organizations develop programs to expose students from diverse background to the benefits of ecological research, outreach, education, and mentoring.

0435 Fish Physiology, Minneapolis Ballroom G, Monday 11 July 2011

Samantha Macks, Heather Masonjones

University of Tampa, Tampa, FL, USA

The Effects of Temperature on the Reproductive Behavior and Metabolic Rates of the Dwarf Seahorse (*Hippocampus zosterae*)

Oceans all over the globe, including shallow coastal ecosystems, are increasing in average sea surface temperature due to global warming. Dwarf seahorses (*Hippocampus zosterae*) occupy seagrass beds along the shallow coasts of the Gulf of Mexico, and given their low mobility and high site fidelity, the effect of increasing sea surface temperatures on this coastal marine species may be devastating, because of their inability to move to cooler microhabitats to avoid high temperatures during the peak summer months. The purpose of this experiment was to measure the mating behavior and routine metabolic rates of dwarf seahorses in both the non-breeding and breeding condition at 27.5°C and

31°C, temperatures commonly found during the spring and summer months in Florida seagrass beds. Our findings suggest there was no significant increase in mass-adjusted metabolic rate due to increasing temperature, but females were observed to have a higher metabolic rate than males in the non-breeding state, which switched to a higher male metabolic rate during breeding. Increasing temperature did have a dramatic effect on successful pregnancies, with no successful offspring produced at the higher temperature. Although this study, using animals collected in the Florida Keys, indicated no significant changes in metabolic rate, pilot data collected on dwarf seahorses collected in Tampa Bay indicated a significant increase in metabolic rate with temperature, with behavioral cues suggesting severe stress at 31°C. We plan to explore this difference in future studies to identify potential local adaptations to increased temperatures across the latitudinal range of this species.

0380 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

Jami E. MacNeil, Rod N. Williams

Purdue University, West Lafayette, IN, USA

The Effects of Timber Harvests on Terrestrial Salamanders

Terrestrial woodland salamanders are widespread and abundant in eastern US forests and play a key role in nutrient cycling in forest ecosystems. These small, lungless salamanders are sensitive to environmental change and may serve as indicators of ecosystem health. We sought to assess the immediate effects of timber harvests on terrestrial salamanders within the context of experimentally manipulated forests. We monitored the relative abundance and species richness of plethodontid salamanders via wood cover objects among nine experimental units (three even-aged, three uneven-aged, and three controls). We sampled 1980 cover objects representing 66 grids bi-weekly during the fall of 2007 and the spring of 2008, prior to the implementation of harvests. We continued to monitor these and an additional 540 cover objects (i.e. 18 grids) for four seasons post-harvest (spring and fall 2009-2010). The pre-harvest sampling seasons yielded 5092 encounters, with an average of 8.6 individuals per sampling occasion, while post-harvest seasons yielded 11,273 encounters, with an average of 7.9 individuals per sampling occasion. Pre-harvest captures of the most commonly detected species differed significantly among some study sites but not among designated treatment types. Species richness ranged from two to five per grid for both pre- and post-harvest periods, but post-harvest sampling detected a total of nine species while pre-harvest detected five. We quantified additional site and habitat components such as slope aspect, downed woody debris, precipitation, and temperature in order to determine how these factors influence relative abundance and detection probability of the most commonly encountered species.

0518 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Anabela Maia[1], Cheryl D. Wilga[1], George V. Lauder[2]

[1]University of Rhode Island, Kingston, RI, USA, [2]Harvard University, Cambridge, MA, USA

Shark Dorsal Fin Function: an Integrated Functional Morphological Approach

Dorsal fins have diverse morphologies among shark species. However, little is known about the ability of sharks to control fin movements. White-spotted bamboo sharks, *Chiloscyllium plagiosum*, and spiny dogfish, *Squalus acanthias*, are two unrelated species that occupy different niches and have distinct dorsal fin morphology. During steady swimming, the first dorsal fin of *Squalus* moves independently of the body with higher lateral amplitudes at lower speeds, indicating a stabilizing function. The dorsal fins in *Chiloscyllium* move in synchrony with the trunk with relatively higher lateral range of motion than dogfish at both speeds. Electromyography data show simultaneous muscle activity on both sides of the first dorsal fin in *Squalus* regardless of speed, indicating active stiffening. The second dorsal fin in *Squalus* and both dorsal fins in *Chiloscyllium* have left and right alternating muscle activity, indicating active beating. Flow acceleration and vortex shedding in the wake of the second dorsal fin of *Squalus* and both dorsal fins in *Chiloscyllium* was revealed by particle image velocimetry. The first dorsal fin in *Squalus* contributes to stability while the second dorsal fin, as well as both dorsal fins in *Chiloscyllium*, contribute to thrust production. During maneuvers, the dorsal fin muscles are active on both sides in both species. *Squalus* have longer burst duration on the contralateral side, consistent with opposing resistance to the medium. In *Chiloscyllium*, activation might be insufficient to counteract the water resistance. Function of dorsal fins is more flexible and diverse than first thought and might underlie the morphological diversity.

0424 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Aleksandra Maljkovic[1], Sabine Wintner[2], Geremy Cliff[2], Isabelle Côté[1]

[1]Tropical Marine Ecology Lab, Biological Sciences, Simon Fraser University, Burnaby, BC, Canada, [2]KwaZulu-Natal Sharks Board, Umhlanga, South Africa, [3]Biomedical Resource Unit, University of KwaZulu-Natal, Durban, South Africa

Decadal-Scale Shifts in the Isotopic Signatures of Predatory Sharks in the Western Indian Ocean

Because the elemental signatures in the tissues of consumers predictably reflect those of their diets, stable isotope analysis has proven useful as an alternative to dietary analysis in elucidating food web architecture, as well as temporal, spatial and ontogenetic trends in species' diets. Using a time series of vertebrae from sharks caught in the protective

nets off KwaZulu-Natal, South Africa, we investigated trends in $\delta^{13}C$ and $\delta^{15}N$ signatures across ontogeny, and over a 20-year time period, for seven predatory shark species. While $\delta^{13}C$ values were highly variable within species and showed only weak patterns over time, larger sized individuals of *Carcharhinus limbatus, C. brevipinna, Carcharias taurus and Isurus oxyrinchus* exhibited stepwise declines in $\delta^{15}N$, and an overall reduction in $\delta^{15}N$ range across ontogeny, between 1985 and 2004. A single species, *Sphyrna lewini*, showed a stepwise increase and concomitant expansion of $\delta^{15}N$ range over ontogeny, during the same period. No such patterns were observed in the isotope signatures of *Carcharhinus leucas* and *Galeocerdo cuvier*. Our results therefore suggest tropho-dynamic shifts in sharks that exploit a relatively narrow range of prey guilds. Food web restructuring, resulting from fisheries and/or climate change impacts, is the most likely driver of change in shark prey populations the western Indian Ocean. Our study provides a novel method by which broad-scale ecological change may be measured over time in marine ecosystems.

0112 Poster Session III, Sunday 10 July 2011

Margaret Malone, Terry Grande

Loyola University Chicago, Chicago, IL, USA

Applying Foraging Theory and Giving-Up Densities to the Secondary Invasion of Round Goby, *Neogobius melanostomus*, into Tributary Streams

Foraging theory has traditionally been used to model behaviors in competition and predation in predator prey interactions of mammal species. Recently, these theories have been applied to fishes to monitor behavior on different spatial scales, as well as to gain insight on optimal habitat in freshwater ecology. In this study we use foraging theory techniques to assess the giving-up density (GUD) of the invasive round goby, *Neogobius melanostomus* with respect to the native Johnny darter, *Etheostroma nigrum*, and rainbow darter, *Etheostoma caeruleum,* in stream habitats. Much has been studied on *N. melanostomus* behavior in lake habitats, but little is known about the effects of the secondary invasion of *N. melanostomus* in tributary streams. Round goby invasion is hypothesized to negatively impact Johnny and rainbow darter populations in stream habitats, where they at present coexist. Through our behavioral experiments we hope to test these hypotheses. Preliminary data suggests that the round goby is able to out compete with the Johnny darter and rainbow darter for primary patch use. Therefore, in our experiments patch use showed evidence of direct effects of an invasive species on native organisms via competition. The results of this study provide support to the validity of GUD use in fluvial habitats. The insights from behavioral mechanisms of the invasive round goby in streams provides a basis for understanding the impact the round goby will have on native stream species.

0709 Poster Session I, Friday 8 July 2011

David Marancik[1], Aimee Berliner[2], Tonya Clauss[2], Al Dove[2], Julie Cavin[2], Alvin Camus[1]

[1]University of Georgia, College of Veterinary Medicine, Athens, GA, USA, [2]Georgia Aquarium, Atlanta, GA, USA

Disseminated Fungal Infections in Two Species of Captive Sharks

There are limited numbers of case reports describing fungal infections in elasmobranchs and most have involved cutaneous, rather than disseminated disease. We characterize the lesions associated with two cases of systemic mycosis in captive sharks demonstrated by histopathology and culture. These cases were progressive, and ultimately culminated in terminal disease. *Paecilomyces lilacinus*, an uncommon pathogen in human and veterinary medicine, was associated with areas of necrosis in the liver and gill in a great hammerhead shark (*Sphyrna mokarr)*. Fungal growth was observed from samples of kidney, spleen, spinal fluid, and coelomic cavity swabs. A dual fungal infection caused by *Exophialia pisciphila* and *Mucor circinelloides* was diagnosed in a juvenile zebra shark (*Stegostoma fasciatum*). Both fungi were present in the liver, with more severe tissue destruction associated with *E. pisciphila* than *M. circinelloides*. *E. pisciphila* was also associated with significant necrosis in the spleen and gill while *M. circinelloides* was present in the heart with minimal tissue changes. Fungal cultures from liver, kidney and spleen were positive for both *E. pisciphila* and *M. circinelloides*. These cases, and a lack of information in the literature, highlight the need for further research and diagnostic sampling to further characterize the host/pathogen interaction between elasmobranchs and fungi.

0708 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

David Marancik[1], Donald Champagne[1], Alistair Dove[2], Alvin Camus[1]

[1]University of Georgia, College of Veterinary Medicine, Athens, GA, USA, [2]Georgia Aquarium, Atlanta, GA, USA

Elasmobranch Infestations by the Marine Leech *Branchellion torpedinis* in Aquarium Settings

The marine leech *Branchellion torpedinis* is a parasite exclusive to elasmobranchs. When inadvertently introduced into aquaria, infestations have proven to be difficult to manage due to the leech's direct life cycle, high reproductive capability, and a lack of proven chemotherapeutants. Infestations on the skin, gill slits, oropharynx, and cloaca can be severe, resulting in ulceration, lethargy, anorexia, anemia, and death. Secretory proteins of the *B. torpedinis* salivary gland are thought to be directly involved in the feeding mechanism of the leech and a main contributor to lesion development in elasmobranch tissue. Genetic sequencing of bioactive salivary gland compounds reveals proteins

potentially involved in lesion development including proteases, anticoagulants, and thrombocyte inhibiting proteins. This data correlates with gross and microscopic lesions observed in elasmobranchs at leech attachment sites. The objective of this study is to investigate the pathologic potential of *B. torpedinis* with the goal that it will lead to better prevention and treatment techniques in aquarium, aquaculture, and natural environments.

0201 Poster Session II, Saturday 9 July 2011

Elizabeth Marchio, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Phylogeography of the Pike Livebearer *Belonesox belizanus* (Poecilidae)

The Pike livebearer, *Belonesox belizanus* (Poecilidae), occurs on the Atlantic slope from southern Mexico and throughout Belize, Guatemala, Honduras, and northern Costa Rica. Kner described *Belonesox belizanus* in 1860 from Belize. The subspecies *B. belizanus maxillosus* was described by Hubbs from the Yucatan in 1936. The subspecies designation of *maxillosus* is due to more robust anterior features including greater average head length, beak length and beak width in comparison to populations elsewhere. Hubbs' data shows there is preliminary evidence for splitting the monotypic genera into two separate taxa; however, no comprehensive study has been conducted to assess the degree of morphological or genetic variation within *Belonesox*. At present, cytochrome *b* sequence data has been obtained from individuals from Honduras and southern Mexico. Preliminary analysis of 932 bp of cytochrome *b* recovered two deeply divergent clades based on maximum parsimony analysis. On average, genetic divergence between these clades was more than 7.1%, with little to no genetic structure within clades. These results suggest that *B. belizanus* may indeed be more diverse than currently recognized. However, these preliminary results suggest the genetic differences do not conform to currently recognized subspecific designations within *Belonesox*. Future work will focus on investigating taxonomic diversity within this species using morphological data including geometric morphometric and meristic analyses.

0036 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Julie Marin[1], Blair Hedges[2], Steve Donnellan[3], Mark Hutchinson[3], Paul Doughty[4], Nicolas Vidal[1]

[1]MNHN, Paris, France, [2]Penn State, University Park, PA, USA, [3]South Australian Museum, Adelaide, Australia, [4]Western Australian Museum, Welshpool, Australia

Blindsnake Evolution: Tracing the History and Biogeography of an Australian Radiation

Worm-like snakes (scolecophidians) are small, burrowing species with reduced vision. A recent analysis showed that blindsnakes (typhlopids) reached Australia about 28 (19-39) Ma, apparently by oceanic dispersal from Southeast Asia or Indonesia. There are 43 living species resulting from this colonization, but the streamlined and simplified external morphology of these snakes makes recognition of species a challenging task. A dense sampling of three species (*Ramphotyphlops bituberculatus*, *R. nigrescens*, and *R. ammodytes*) allowed us to show evidence of cryptic diversity. These results suggest that the species number of Australian typhlopids is underestimated. The major environmental change that has shaped the Australian biota since the approximately Late Oligocene arrival of blindsnakes is the onset of arid conditions. Typhlopids appear to be one of several Australian squamate lineages with tropical-humid origins that successfully adapted to the expansion of open, then arid, environments during the Miocene and now show evidence of relatively recent evolutionary radiation across Australia.

0516 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011; ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD

Tricia Markle

University of Minnesota, St. Paul, MN, USA

Ecophysiological Analysis of Species Variation in Geographic Range Size

Understanding the factors that limit species' geographic distributions is a fundamental question in the fields of ecology and evolution. It is also central to predicting whether species ranges will shift, contract, or remain stable in response to rapid climate change. Yet, despite far-reaching implications, it is poorly understood why some species have very restricted distributions while others are more widespread. In this study, we use eastern North America's species-rich plethodontid salamander fauna to dissect the causes of one the most widespread and poorly understood patterns in biogeography—the tendency of species' latitudinal extents to increase from the equator to the poles. This pattern may be caused by greater seasonal variation towards the poles driving the evolution of broader climatic tolerances (climate variability hypothesis). Alternatively, the presence of fewer competitors at higher latitudes could allow species to achieve greater latitudinal range sizes in the absence of variation in thermal-tolerance breadth

(leading-edge hypothesis). We compared thermal-tolerance breadth (measured as CTMax – CTMin) with latitudinal extent for 20 species of plethodontid salamanders. We found a significant correlation between thermal-tolerance breadth and latitudinal extent, a result that lends support for key predictions of the climate variability hypothesis.

0637 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011; NIA BEST STUDENT PAPER AWARD

Arlen Marmolejo, Donald J. Stewart

State University of New York, Syracuse, NY, USA

Community Assemblage Patterns of Inland Fishes in Southern Regions of the Dominican Republic

The fish community assemblage patterns were analyzed for selected lagoons and rivers (-30 to 735 m of altitude) of the southern area of the Dominican Republic from June to August, 2010, using various standard collecting gears. The study area encompasses Enriquillo Lake, an endorheic, hypersaline system that is below sea level. Multivariate methods of Detrended Correspondence Analysis (DCA) and cluster analysis (Ward's Method) revealed community patterns that corresponded primarily to water salinity and secondarily to altitude. Tributaries of Enriquillo Lake were more similar to the lake than to other fluvial sites in the Yaque del Sur river basin. Within the Yaque del Sur basin, patterns reflected a gradient from lowland lagoon to the mainstream river plus a reservoir on the mainstream, and finally to an upland tributary. Rivers and freshwater lagoons had relatively high diversity and evenness, while Enriquillo Lake had intermediate values, and the reservoir had the lowest diversity. The Yaque del Sur River mainstream had the highest species richness, while Enriquillo Lake had more characteristic species. This study provides critical data to determine the conservation status of the native fish fauna of the area. It can be applied to establish conservation priorities and to enhance public outreach and educational programs. It also provides a baseline from which future changes in fish assemblages might be evaluated as human populations and related habitat effects increase.

0046 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Rachel E. Marschang[1], Anke Stöhr[1], Silvia Blahak[2], Tibor Papp[3], Maria Filomena Caeiro[4], Antonio Pedro Alves de Matos[6], Jawad Nazir[1]

[1] University of Hohenheim, Stuttgart, Germany, [2]Chemisches und Veterinäruntersuchungsamt OWL, Detmold, Germany, [3]Veterinary Medidal Reserch Institute of the Hungarian Academy of Sciences, Budapest, Hungary, [4]University of Lisbon, Lisbon, Portugal, [5]Aveiro University, Aveiro, Portugal, [6]Curry Cabral Hospital, Lisbon, Portugal

Ranaviruses in European reptiles

In Europe, ranaviruses have been isolated from chelonians and lizards. There are three reports of ranavirus infections in tortoises in Europe, two in Hermann's tortoises (*Testudo hermanni*) and one in a leopard tortoise (*Geochelone pardalis*). All of the tortoises were kept in captivity and developed disease. In two cases, disease spread from one animal to another and one recent case has been associated with an outbreak among several different collections of tortoises and spread from Hermann's tortoises to other species. Ranaviruses have also been isolated from lizards in Europe. In one case, a virus was isolated from a gecko (*Uroplatus fimbriatus*) kept in a private collection. In another, a ranavirus was isolated from an iberian rock lizard (*Lacerta monticola*). The second is the only documented case of ranavirus infection in a wild reptile in Europe. Characterization of the ranavirus isolates obtained from these reptiles has been carried out by various methods, making a direct comparison between the European reptile ranaviruses somewhat difficult. Sequencing parts of the genomes of several of these viruses is ongoing. Available sequence data show that the reptilian ranaviruses are each more closely related to various described amphibian ranaviruses than to one another. However, available restriction enzyme analysis of some of the reptilian ranaviruses does show considerable differences between these and specific amphibian isolates. Future research directions include further comparison of ranaviruses from reptiles, environmental persistence of reptilian, amphibian, and fish ranaviruses, and screening of reptiles for ranavirus infections by virus and antibody detection.

0222 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Edie Marsh-Matthews, Rosemary Knapp, David McCauley, Eric Lee

University of Oklahoma, Norman, OK, USA

Brood Reduction in Response to Stress in Western Mosquitofish: Implications for the Trexler-DeAngelis Model of Matrotrophy Evolution

The ability of females to abort embryos and reclaim nutrients for distribution to the remaining brood is a key assumption of the Trexler-DeAngelis model of matrotrophy evolution, which posits that females may initiate development of more embryos than can be provisioned by post-fertilization nutrient transfer if maternal resources decline

during gestation. Several studies in livebearing fishes have examined brood reduction in females exposed to food limitation imposed during gestation, but results have been equivocal. We examined brood reduction in Western Mosquitiofish (*Gambusia affinis*) exposed to the stress hormone cortisol, which is known to reduce energy stores in some fishes. Females were exposed every 3 days to one of five treatment levels of cortisol (0.05, 0.1, 0.5, 1.0, or 2.0 mg/l) or to a control treatment (ethanol or water) delivered directly into the water housing the female. Females exposed to the highest doses of cortisol had reduced somatic lipids and the highest number of late stage embryos showing arrested development and decomposition. Numerous females also showed evidence of early stage brood reduction as evidenced by the presence of yolkless embryo remnants. These yolkless embryos suggest that females can rapidly reclaim nutrients from embryos early in development. Yolkless embryos were observed in control as well as cortisol-treated females, but numbers were higher in females exposed to the highest cortisol doses. These results suggest that females are able to reclaim, and presumably re-distribute, nutrients to the remaining brood under stressful or other conditions that affect the resources available for post-fertilization provisioning.

0209 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Heather Marshall[1], Richard Brill[2], Peter Bushnell[1], Greg Skomal[4], Diego Bernal[4]

[1]University of Massachusetts Dartmouth, North Dartmouth, MA, USA, [2]Virginia Institute of Marine Science, Gloucester Point, VA, USA, [3]Indiana University South Bend, South Bend, IU, USA, [4]Massachusetts Division of Marine Fisheries, New Bedford, MA, USA

Preliminary Assessment of Differences in Fishing-induced Stress Response between the Sandbar (*Carcharhinus plumbeus*) and Dusky (*C. obscurus*) Sharks (Family Carcharhinidae)

In recent years, exploitation of many shark species has incited management organizations to revise commercial fisheries management plans (FMPs) with the hopes of conserving shark populations. Specifically in the western Atlantic, amendments to the Consolidated Highly Migratory Species FMP demand the post-capture release of several coastal species, including the sandbar (*Carcharhinus plumbeus*) and dusky (*C. obscurus*) sharks (Family Carcharhinidae). Although these FMPs are designed to conserve populations, they result in an increased number of sandbar and dusky sharks released after capture. The assumption is that 100% of these sharks will contribute to future population growth. However, recent research on capture-related stress indicates that the extent of survival is not well understood. This preliminary study aims to create a better understanding of the differences in stress response between sandbars and duskys and investigate the likelihood of post-release mortality. Hematological secondary stress parameters (electrolytes, metabolites, and heat shock protein 70) were collected from longline captured sandbar and dusky sharks and compared to baseline "unstressed" blood values collected from sandbar sharks. Preliminary analysis reveals a clear physiological effect of longlining on both species, with elevated blood parameters

(e.g., lactate and glucose, $p<0.05$), as well as a species-specific difference in response, with the dusky showing a higher magnitude of stress than the sandbar. Data show that longline capture results in physiological disruption, possibly leading to post-release impairment or mortality. The interspecific difference found in stress response highlights the need for species-specific fisheries management.

0481 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Bradley Martin[1], Neil Bernstein[2], James Koukl[1], John Placyk[1]

[1]University of Texas at Tyler, Tyler, TX, USA, [2]Mount Mercy University, Cedar Rapids, IA, USA

Range-wide Molecular Phylogenetics of the North American Box Turtles (*Terrapene*)

The current classification of the North American box turtles (*Terrapene*) is based primarily on morphological data with the analyses that have utilized genetics being characterized by incomplete taxon sampling, small sample sizes with restricted geographic representation, and limited types of genetic markers. Therefore, a more thorough molecular phylogeographic study using a variety of genetic markers is warranted to support or reject the current classification scheme. We sampled all currently recognized *Terrapene* subspecies/species from across their ranges and used both mitochondrial and nuclear sequence data in an attempt to resolve the evolutionary history of the group. Our results strongly support the division between the western (*T. ornata*) and eastern (*T. carolina*) groups, but subspecific classifications within these groups do not necessarily conform to the current classification scheme. In addition, the current placement of the historically more distantly related spotted box turtle (*T. nelsoni*) and Coahuilan box turtle (*T. coahuila*) is called into question. Based on our data, the *Terrapene* genus requires substantial taxonomic revisions and we provide suggestions in this regard. In addition, since the *Terrapene* are of conservation concern throughout much of their range and since conservation efforts are typically species-based, this work may have significant conservation management implications.

0759 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

David Martin

Canorus Ltd., San Jose, CA, USA

Forensic Identification of Reptile Species Using Scale Morphology

The legitimate international trade in wildlife and wildlife products is estimated to be worth 20 billion US dollars a year. A significant percentage of this trade includes products manufactured from reptile skins and other reptile body parts. Products range

from entire tanned skins to manufactured goods to "native craft" objects to traditional medicines and food products. This legitimate trade is predicated on the killing of 10-15 million reptiles a year with most being harvested from the wild. Over 40 species of reptiles are regularly recorded in the trade. Unfortunately, the extent of the illegal trade in reptile skins and products is nearly impossible to quantify, but it includes many protected species. The prosecution of smuggling suspects requires a forensic identification of the species involved. Proper species identification of products such as leather requires a working knowledge of the variation in scale morphology between and within species. Wildlife products are often imported with little information regarding the origin. The species identification, if provided, is often questionable, and products often consist of a small portion of the animal. In such cases, traditional methods of identification, such as distribution and physical characteristics, e.g., scale counts, are lost or incomplete, thereby, making species identification practically impossible using traditional methods. Further complicating the identification task is the likely destruction of genetic material during processing into leather. Thus, scale morphology is often the only clue to species identification. This talk will review current knowledge of scale morphology and discuss the information gaps that must be filled.

0216 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

F. Douglas Martin, Ben J. Labay, Adam E. Cohen, Dean A. Hendrickson

University of Texas, Texas Natural History Collection, Austin, TX, USA

Exploring Recent Range Changes for Some Stream and Marsh Fishes on the Texas Coastal Prairie

Changes in species range may reflect changes in the local environment, events that alter the ability of a species to disperse and, sometimes, evolution of tolerance for new habitats previously inhospitable. The coastal prairies of Texas have a number of river basins in close proximity to each other with unimpressive barriers to interbasin dispersal. Additionally, the Fishes of Texas Project has comprehensively compiled historical records for this region going back to 1851, and provided MaxEnt distribution models that map extent of suitable habitat, making this area a good laboratory for examining recent species range changes. We examined changes in species ranges for seven stream and marsh fish species in this area and compare them to five others with static ranges. Many species appear to have successfully invaded habitats that the MaxEnt models indicated to be suitable.

0528 Poster Session III, Sunday 10 July 2011

Jennifer Martin, Eric Hilton

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

A Taxonomic Revision of Lampridiform Genera

The taeniosomous lampridiforms, a putatively monophyletic group including five families (Stylephoridae, Radiicephalidae, Lophotidae, Regalecidae, Trachipteridae) and nine genera, are rare mesopelagic fishes distributed in all oceans. Despite their striking appearance, numerous issues arise with regards to genus-level identification. In some cases, taxa are even misidentified at the family-level. This is because of their rarity, combined with inadequate type descriptions and specimens, incomplete diagnoses, and the conservative morphology displayed within some families (particularly the genus *Trachipterus*), all of which has greatly confounded taxonomy. This lack of taxonomic clarity constrains identification and basic research on biogeography and phylogeny. While working through lampridiform material for a new genus-level phylogenetic analysis of the order, new morphological observations were obtained from larval, juvenile, and adult life stages of all putative genera. A synthesis of these data, combined with published information, will be presented, and updated differential diagnoses for taeniosome genera will be formulated.

0493 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Karen Martin, Jennifer Raim

Pepperdine University, Malibu, CA, USA

Avian Predation on Runs of Beach Spawning California Grunion, *Leuresthes tenuis*

Spawning aggregations of marine fishes attract predators, but actual take and kills are rare during spawning rushes. On the other hand, egg predators may be highly successful when pelagic eggs are released during spawning rushes. It has been suggested that beach spawning in *Leuresthes tenuis,* the California Grunion, evolved as a way to avoid egg predation, because the embryos are buried under sand on shore. However beach spawning is synchronized with the highest semilunar tides. Thus, spawning takes place within a narrow window of time, requiring mass aggregations of potential spawners in a specific area with appropriate substrate. Tidal cycles are readily predictable and most marine animals are well aware of tidal rhythms. Beach spawning fishes are forming aggregations at a predictable time in a particular place. This may seem to indicate an increased likelihood of predation on the adults. We have observed numerous predators on both spawning adults and nests over a wide area of the habitat range of this species. In particular, avian predators target the spawning runs in certain locations. We hypothesize that avian predation on *L. tenuis* during spawning runs and eggs after the runs is site-specific and learned, possibly culturally transmitted.

0656 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011; ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY AWARD

Natalie Martinez-Takeshita

California State University, Northridge, Northridge, CA, USA

The Global Genetic Diversity of *Seriola lalandi* (Yellowtail)

The Yellowtail (*Seriola lalandi*), one of the most important sport and commercial species off southern California, is the largest member of the Jack family (Carangidae). These cosmopolitan fish can be found in subtropical and temperate waters. *Seriola lalandi* are commercially fished, recreationally fished, and farm raised in the regions they occupy, thus providing an important food source and a sizeable economic impact for the people in these countries. DNA samples were collected from California (Channel Islands, Catalina Island & San Clemente Island), the Pacific Coast of Baja California, the Gulf of California, New Zealand, Japan, South Africa and Chile. A mitochondrial DNA analysis using the d-loop was used to determine the population structure and genetic variation between distinct sites. It may also be possible to identify subspecies and changes in population structure due to fishing pressures, as well as, migratory patterns of this global species. The genetic analysis will provide valuable information to help properly manage and sustain these fish populations in the future.

0490 Poster Session II, Saturday 9 July 2011

Heather Masonjones

University of Tampa, Tampa, FL, USA

Site Fidelity and Population Estimates of Dwarf Seahorses (*Hippocampus zosterae*) in Tampa Bay, Florida, USA

We investigated the site fidelity and spring population size estimates of dwarf seahorses (*H. zosterae*) in a Tampa Bay, Florida (USA) estuarine system. The main purposes of this work were to increase the precision of our earlier population estimates of this species and to determine their home range size to identify reasonable conservation targets to better manage their populations on a landscape level. Eight permanent transects were established in a small bay off the South Tampa peninsula, and were sampled at least weekly during the late winter and early spring of 2011. On each census date, fish were collected either by hand or by pushnet from each 12-20 m^2 transect (varying based on the shape/size of the seagrass patch). Each animal was marked with latex dye under the skin, photographed for body size and reproductive condition estimation, and returned either to the location from which they were visually captured or to a flag at the center of the transect. Recapture rates increased dramatically over our previous study, going from 0.4% in our previous study to over 30% recaptured with this smaller scale sampling

design. No gender differences were observed in movement patterns, but males were more often recaptured than females. With the restriction of *H. zosterae* to the Gulf of Mexico region, accurate population estimates and a thorough understanding of their patchy distribution is critical to management of their population in the wake of the oil spill in April 2010 off of the coast of Louisiana, USA.

0114 Poster Session II, Saturday 9 July 2011

Wilfredo Matamoros, Matthew Davis, Prosanta Chakrabarty, Caleb McMahan

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

Historical Biogeography, Divergence Times, and Diversification Patterns of New World Poeciliid

Fishes of the family Poeciliidae are distributed throughout tropical and subtropical America and Africa, the majority of new world poeciliids are livebearers in the subfamily Poeciliinae. This group is one of the most examined groups of Cyprinodontiformes, due in large part to their use as model organisms in sexual and natural selection studies. We estimate divergence times and patterns of diversification using one nuclear (RAG1) and two mitochondrial (Cyt B and ND2) genes in order to reconstruct the evolutionary and biogeographic history of new world poeciliid fishes. Taxonomic sampling was robust and included 138 species from almost all major lineages from North America, Middle America, South America, and the Greater and Lesser Antilles. Using this phylogeny and detailed data on extant distributions, we reconstructed the historical distribution of the new world poeciliids in a temporal framework. This time-calibrated phylogeny allows for the assessment of the tempo and mode of diversification within new world poeciliids using lineage-through-time plots and tests to detect rate-shifts. Our analysis suggests that the subfamily expanded from Northern Middle America during the late Cretaceous/Paleogene and radiated to Nuclear and Southern Middle America and to the proto-Greater Antilles.

0269 Herp Behavior, Symphony I & II, Monday 11 July 2011

Alicia Mathis, Michael Lampe, Adam Crane

Missouri State University, Springfield, MO, USA

Behavioral and Metabolic Responses of Ozark Zigzag Salamanders (*Plethodon angusticlavius*) to Alarm/stress Secretions from Heterospecific Members of the Same Prey-guild

When different species have common predators, selection should favor individuals that respond to alarm/stress cues of the other species. Ozark zigzag salamanders (*Plethodon angusticlavius*) are often found under rocks and logs during wet conditions, but they also

use subterranean borrows during harsh environmental periods. By using the vomeronasal organ, these salamanders can assess chemical cues in their environment, including cues from predators and alarm/stress cues from conspecifics. Earthworms (*Lumbricus terrestris*) are abundant, syntopic to zigzag salamanders, and are vulnerable to the same predators. We tested whether salamanders would respond to alarm/stress cues from earthworms in ways that are consistent with antipredator behavior. We obtained alarm/stress cues from earthworms by simulating a predatory attack (grasping them with forceps) and collecting the secretions in water. Salamanders significantly increased their time spent in escape behavior, decreased their chemosensory behavior, and increased oxygen consumption when exposed to cues from stressed earthworms, whereas their responses to cues from unstressed earthworms were similar to responses to blank water. These results suggest that salamanders can recognize alarm/stress cues from earthworms as dangerous.

0305 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Philip Matich, Michael Heithaus

Florida International University, North Miami, FL, USA

Ontogenetic Shift in the Habitat Use and Diet of Juvenile Bull Sharks in a Coastal Estuary

Ontogenetic niche shifts are experienced by a variety of species and numerous factors have been found to be important drivers. Yet, we lack a strong understanding of the ecological importance these shifts may have on both the species and ecosystem(s) they reside within, especially for large, aquatic predators. We investigated the potential drivers of shifts in the habitat use and diet of juvenile bull sharks during their growth within a nursery, and their potential ecological impacts. Acoustic tracking and quantitative longline fishing revealed that sharks expanded their use of the estuary as they grew until reaching a size of 135 cm total length or greater, at which time they inhabited coastal waters adjacent to the Gulf of Mexico. Stable isotope data suggested that bull shark diet also changed with size, and their role within the trophic systems of the estuary shifted from that of a freshwater predator to a marine predator. Environmental factors, such as salinity, may be important drivers of juvenile bull shark behavior, but these size-based shifts were most likely influenced by site-specific competition and predation risk. This ontogenetic niche shift helps shape the role of juvenile bull sharks within this coastal ecosystem, and provides a functional link between the freshwater and marine habitats through trophic interactions within our study area. As predator populations continue to decline and climate change alters ecosystems, it is important that we continue to investigate the drivers of ontogenetic niche shifts, especially in highly mobile predators, and their ecological importance.

0428 Fish Ecology I, Symphony I & II, Friday 8 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Joie Matillano

SUNY ESF, Syracuse, NY, USA

Biodiversity of Cyprinids in Northern Palawan, Philippines

This study aimed to update the taxonomy, distribution patterns, and conservation status of the endemic cyprinid populations of Palawan Island, Philippines. The study sites include one endorheic lake and five of the largest river basins in the city of Puerto Princesa and the towns of Taytay and Roxas, in northern Palawan. Morphometric and meristic characterization was used for taxonomic studies while for distribution, GIS tools were utilized to map out the extent of occurrence and area of occupancy of cyprinids. For conservation status, the threatened status of these endemic fishes were evaluated according to the criteria set by International Union for Conservation of Nature. Results of the study revealed that the cyprinid life of Palawan is more diverse than previously thought. At least one undescribed species from genus *Barbonymus* was collected, which is also a new genus record for Palawan and the Philippines. In addition, several morphotypes of the genus *Puntius, Rasbora* and *Nematabramis* were caught. For distribution patterns, at least two species of *Puntius* are found in a single locality in Lake Manguao, while one *Rasbora* species is so far recorded only from the town of Taytay. Based on IUCN criteria, the conservation status of at least four cyprinid species should be elevated to either Critically Endangered or Endangered category. This research highlights the needs for conservation of the endemic cyprinid life in Palawan, which to date has no protected inland wetland habitats for wetland biodiversity.

0317 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

William Matthews[1], Edie Marsh-Matthews[2], Ginny Adams[3], Reid Adams[4]

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Flood of the Century in Piney Creek -- It Happened Again!

In December 1982, Piney Creek, Izard County, Arkansas, experienced a physically destructive "flood of the century", but the fish community in August before (1982) and after (1983) the flood was very similar, as documented in Copeia 1986:388-397. In March 2008, Piney Creek again experienced an erosive flood of magnitude comparable to that of 1982, followed by another equally deep "back flood" from the White River in April 2008. In May 2008 we documented flood heights from debris lines and interviewed local residents, confirming that floodwaters reached levels as much as 12 meters above baseline, and that the entire watershed suffered severe erosion and habitat disturbance.

We had sampled fish at 12 localities throughout the watershed in summer 2006, providing a "before" survey, and we re-sampled six of those sites in summer 2008 and again in 2010. We now summarize the effect of this second catastrophic flood on the fish community of Piney Creek, and compare the effects of this springtime flood to that of the winter flood in 1982. In general, the fish community was resilient to both these extreme floods, but details differ between these two events.

0040 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Rolando Mazzoni

Universidade Federal de Goiás, Goiânia, Goiás, Brazil

Current Understanding of Ranaviruses in South America

Knowledge on ranaviruses in South America is scarce. Ranaviruses have been detected in Venezuela (Zupanovic et al., 1998), Argentina (Fox et al., 2006), Uruguay (Galli et al., 2006) and Brazil (Galli et al., 2006; Mazzoni et al., 2009). Wild amphibians from Venezuela appear to be infected with at least two different ranaviruses, one isolated from toads (*Bufo marinus*) and the other from *Leptodactylus* frogs. In Argentina, one ranavirus has been detected in *Atelognathus patagonicus*, which showed 100% homology with FV3 and other family members within a 500 base pair fragment of the major capsid protein. In Brazil, a ranavirus was detected in morbid tadpoles (*Lithobates catesbeianus*) originally imported from North America. For this isolate, the sequences for the complete MCP coding region, and partial regions of the RNA polymerase DNA dependent gene, and of the immediate early protein-ICP 18 were highly homologous to FV3. These results suggest that importation of *L. catesbeianus* may have introduced ranavirus into Brazil. Despite detection of ranaviruses in captive and wild amphibians in some South American countries, no ranavirus infections or disease have been reported in fish and reptiles but few pathogen surveillance programs exist. A major research need in South America is to understand the current distribution of ranaviruses and their threat to native ectothermic vertebrate populations. Controlled studies also are needed that challenge native species with ranavirus isolates known to occur in South America.

0510 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Michael McCallister, Ryan Ford, Christina Walker, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

A Survey of the Shark Fauna in Northeast Florida Estuaries: Abundance, Distribution, and Identification of Potential Nursery Habitat

It is widely accepted that essential fish habitat (EFH) plays a crucial role in the life-history of many marine species. For many shark species, EFH includes nearshore and estuarine waters that serve as nursery habitat where sharks are born and/or juveniles spend the early part of their life. Examination of the literature shows the presence of shark nurseries in most major estuaries along the Atlantic and Gulf Coasts of the United States, however, there is a noticeable gap in data from the Northeast region of Florida. In May 2009 a long term bottom longline survey was initiated to assess the use of estuaries in Northeast Florida as shark nursery habitat. A total of 204 longlines were set in Nassau and Cumberland Sounds from June 2009 - October 2010 and 506 sharks, comprising 10 species, were caught. Atlantic sharpnose sharks (57.48% and 55.28%), blacktip sharks (15.35% and 19.88%), and bonnethead sharks (11.81% and 9.32%) were the most abundant species in both Cumberland and Nassau Sounds. Young of the year and juvenile individuals were caught for 9 of the 10 species. The data from this survey represents the first attempt to characterize the abundance and distribution of sharks in northeast Florida waters and to identify potential shark nursery habitat in this area.

0345 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Heather McCann[1], Aaron Fisk[1], Sabine Wintner[2], Geremy Cliff[2], Sheldon Duffy[2], Mike Meyer[3], Brian Fryer[1], Nigel Hussey[1]

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Trophic Ecology and Movement Dynamics of South African White Shark (*Carcharodon carcharias*) Inferred from Stable Isotope Profiles in Vertebrae

The white shark (*Carcharodon carcharias*) is a large, highly mobile keystone predator that is known to prey on pinnipeds and spend associated periods of residency at seal haul outs interspersed with coastal and oceanic migrations. Understanding trophic dynamics of regional populations, both at the individual (i.e. over ontogeny) and population level is important for species-specific management plans. Elasmobranch vertebrae grow incrementally and record a seasonal 'isotopic diary' ($\delta^{15}N$ and $\delta^{13}C$) throughout ontogeny, providing a measure to examine trophic ecology and coarse level movement patterns. White shark vertebrae from KwaZulu-Natal, South Africa (55), and Kenya (1)

were serially sampled and analyzed for stable isotopes. Sharks ranged in size from 124cm to 487cm PCL. Stable isotope values varied across individuals and ontogeny, $\delta^{13}C$ values ranged from -17.68 to -10.59‰ and $\delta^{15}N$ values ranged from 10.96 to 18.67‰. For animals <200 cm PCL, $\delta^{13}C$ values were more variable compared to sharks > 200 cm PCL. Additionally $\delta^{15}N$ values increased at approximately 220-280 cm PCL (~4 years of age), indicating a shift to higher trophic level prey in agreement with stomach content data and previous stable isotope work on Pacific and North Atlantic populations. The $\delta^{13}C$ values of a large near-term pregnant female (487 cm) declined in the year before capture and then increased in the year of capture which supports an offshore migration and a return to coastal waters while pregnant. These data demonstrate that trophic ecology and habitat use vary widely across ontogeny, which needs to be considered in regional management plans.

0629 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Katelyn McCann, Kevin Wood, Patrick McNeal, Jeff Forrester, Charles Zwemer, Scott Boback

Dickinson College, Carlisle, PA, USA

Analyzing a Predator-Prey Interaction: Muscular Performance in Boas (*Boa constrictor*) and Cardiovascular Response in Rats during Constriction

Constricting snakes must balance the energetic cost of constriction with the potential danger in releasing their prey too early. Therefore, it would be advantageous for these snakes to possess a mechanism to determine the minimum pressure and duration required to ensure that a prey item has been subdued and no longer capable of inflicting harm. We hypothesized that Boas (*Boa constrictor*) modulate their constriction based on endogenous cues from their prey such as a heartbeat. In previous work we demonstrated that Boas respond to a simulated heartbeat in a deceased rat model by constricting with greater pressure and duration than when constricting rats without a simulated heartbeat. We extend this work in the current study by testing how Boas respond to a more realistic model; a rat whose cardiovascular system fails during the constriction event. We presented snakes with rats with a simulated heartbeat that "failed" halfway into the constriction. Preliminary analysis of these data suggests that Boas respond to this failed heart model differently than our continuous heart model by rapidly decreasing total constriction pressure when the simulated heart is turned off. We have also initiated experiments to test the snake's response while constricting live, anesthetized rats. This system allows us to observe the snake's response to an actual rat heartbeat while simultaneously monitoring cardiovascular function in the rat during the constriction.

0591 Poster Session III, Sunday 10 July 2011; ASIH STORER HERPETOLOGY AWARD

Pamela McClain

Emporia State University, Emporia, KS, USA

Correlating Corticosterone Levels to Leukocyte Ratio for Five Snake Species in Kansas

Stress hormones, such as corticosterone, have routinely been used by researchers as a measure of stress that an animal is experiencing. The rise in corticosterone is a direct physiological reaction to being exposed to stress in all vertebrate classes. Stress hormones are known to affect an animal's physiology and behavior, requiring that a "non-stressed" level of these measures be established. Currently, the most commonly used method to measure the change in hormones is with a blood assay (EIA) kit. The use of an EIA kit requires that the user be skilled in the technique, and also requires a number of safety precautions. We have validated a simpler method of measuring change in stress hormone using a less invasive and inexpensive method; the ratio of two types of white blood cells (heterophils to lymphocytes, or H:L) in reptiles. No less than 5 individuals from 5 species of snakes were captured at rest. Blood samples were taken immediately after capture and after one week to establish H:L ratios. Ratios were calculated using a stained 100 cell count from a blood smear slide. Corticosterone levels from the same samples were analyzed using a blood assay. Corticosterone levels and H:L ratios in "pre-stressed" and "post-stressed" conditions were correlated for each species.

0096 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Mikki McComb-Kobza[1], Tamara Frank[1], Robert Hueter[3], Stephen Kajiura[2]

[1]Harbor Branch Oceanographic Institute at Florida Atlantic University, Fort Pierce, FL, USA, [2]Florida Atlantic University, Boca Raton, FL, USA, [3]Mote Marine Laboratory, Sarasota, FL, USA

Temporal Resolution and Spectral Sensitivity of the Visual System of Three Coastal Shark Species From Different Light Environments

Elasmobranchs have radiated into nearly every aquatic habitat on earth including the deep benthos, brightly lit coral reefs and even the murky freshwaters of the Amazon. As such, they experience tremendous variability in ambient lighting conditions which have resulted in remarkable adaptations within the visual system. Therefore, elasmobranchs represent an excellent group with which to compare and contrast visual function. Elasmobranch eyes rival higher vertebrates in function and complexity and aspects of the visual system are correlated with environmental factors. In this study, the visual temporal resolution (eye speed) and scotopic spectral sensitivity of three coastal shark species (bonnethead *Sphyrna tiburo*, scalloped *Sphyrna lewini*, and blacknose shark

Carcharhinus acronotus) were investigated by electroretinogram. Temporal resolution was quantified under photopic and scotopic conditions using response waveform dynamics and maximum critical flicker-fusion frequency (CFF). Photopic CFFmax was significantly higher than scotopic CFFmax in all species. The bonnethead had the shortest photoreceptor response latency time (23.5 ms) and the highest CFFmax (31 Hz), suggesting that its eyes are adapted for a bright photic environment. In contrast, the blacknose had the longest response latency time (34.8 ms) and lowest CFFmax (16 Hz), indicating its eyes are adapted for a dimmer environment or nocturnal lifestyle. Scotopic spectral sensitivity revealed maximum peaks (480 nm) in the bonnethead and blacknose sharks that correlated with environmental spectra measured during twilight, which is a biologically relevant period of heightened predation.

0060 Fish Morphology, Symphony I & II, Friday 8 July 2011

Amy McCune, Mark Riccio, Amanda Cass, Sarah Longo, William Bemis

Cornell University, Ithaca, NY, USA

A Fantastic Voyage Through the Lungs and Swimbladders of Basal Osteichthyans

Swimbladders have been regarded as a modification of osteichthyan lungs since the middle of the 19th century (Owen 1846). A classic figure by Bashford Dean (1895), based on the work of Burt Green Wilder (1977), shows cross-sectional and lateral views of the air-filled organs (swimbladders and lungs) of *Amia*, *Lepisosteus*, *Acipenser*, *Polyodon*, *Hoplias*, *Protopterus*, *Lepidosiren*, *Neoceratodus* and tetrapods. Dean's figure has been reproduced in textbooks, such as Romer (1970), and it continues to influence ideas about the evolution of lungs and swimbladders. CT scans yield excellent high resolution 2D and 3D images, even of internal structures, that are difficult or impossible to view with traditional dissection techniques, and critical for gas-exchange in many of these fishes. Our CT studies of air-filled organs in the taxa illustrated by Dean (1895) reveal new insights into internal features, vascularization, overall shape and size, and connections with the pharynx. We find that Dean's often-reproduced figure, while visionary for its time, is, in many ways, inaccurate. This will be an image-rich presentation in which we view the structure of osteichthyan air-filled organs in anatomical context and take a 3D voyage deep inside these remarkable organs.

0596 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Sara McCutcheon, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Efficacy of Lanthanide Elements as Shark Repellants

Sharks make up the largest portion of bycatch in most of the world's longline fisheries and their prevalence as bycatch is problematic for several reasons. Their life history characteristics make them vulnerable to overfishing, the loss of large apex predators can have adverse ecological consequences, and shark bycatch is an economic burden to commercial longline fishermen. Naturally electrogenic lanthanide metals have been proposed as a method to reduce shark bycatch by deterring sharks from biting at treated bait. We quantified the voltage produced by several lanthanide metals and alloys and determined that neodymium and praseodymium produced the greatest voltage per gram (1.9±0.57μV/g and 1.4±0.27 μV/g at 10cm respectively). Dissolution time varied significantly among metals with xxx lasting the longest in seawater. Upon factoring in voltage, dissolution time, cost, and difficulty to machine, neodymium was determined to be the most promising metal for subsequent trials. The efficacy of neodymium as a repellent was tested in behavioral trials with bonnethead, *Sphyrna tiburo,* and lemon sharks, *Negaprion brevirostris*. For bonnethead sharks tested individually, bait was removed from the neodymium significantly less than from the control treatments (lead, stainless steel, acrylic). However, for bonnetheads tested in groups the Neodymium provided no significant repellent effect, and for lemon sharks tested in groups significantly more bait was removed from the neodymium treatment. Lanthanide metals provide mixed results as shark bite deterrents with efficacy varying by species and school size.

0311 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Suzanne McGaugh

Duke University, Durham, NC, USA

Population Genetics of Two Endemic Turtles from Cuatro Cienegas, Coahuila, Mexico

Cuatro Cienegas is one of the most diverse ecosystems in North America. This ecosystem is extremely stressed, and many of the endemic plant and animal species are at risk of extinction. Local extinctions throughout the valley have been documented, and this is especially true for some of the most genetically diverse populations. Among those affected, three endemic species of turtle, with ancestral distributions across the valley, are rapidly becoming restricted to the eastern lobe of the basin. We assayed genetic diversity and population structure of *Apalone ater* and *Trachemys taylori* using microsatellite markers and mitochondrial DNA. For both species, striking population structure across the basin exists, and some of the most genetically diverse areas are those at most risk of environmental degradation.

0449 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

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Mating System, Male Reproductive Success, and Population Connectivity of Blanding's Turtles (*Emydoidea blandingii*)

Data on the habitats needed to complete life-history functions (core habitat) combined with reproductive data facilitates the quantification of population connectivity. Long-term mark-recapture (spanning 50 years) and nesting ecology data (32 years) on Blanding's turtles (*Emydoidea blandingii*) were used to identify individuals that were residents of two major wetlands on the E. S. George Reserve (ESGR) in southeastern Michigan (650 ha) and to define their core habitat. Many non-resident individuals use ephemeral wetlands and nesting areas on the ESGR. We used genetically-determined parentage and estimates of reproductive success of males and females based on 77 nests collected over 7 years (1999-2006) to 1) characterize the mating system, 2) quantify sources of variation in male reproductive success, and 3) quantify the frequency of successful matings between resident and non-resident individuals. Males and females had multiple mates within and among years. Incidence of multiple paternity was high and variable among years (mean = 47.6%, Min-Max = 15.4% - 55.6%). Repeated paternity was observed among years (mean = 46.7%, N=15 among-year comparisons). Male reproductive success varied as a function of the number of mates and clutches sired. Resident and non-resident females were equally likely to have offspring sired by non-resident males. The core habitat data and the reproductive data establish that the population of Blanding's turtles includes individuals from areas beyond the ESGR. Given the species' propensity for frequent and extensive terrestrial movements, the integrity of aquatic and terrestrial habitats are crucial to the persistence of the population.

0750 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Anna McKee[1], Lora Smith[2], John Maerz[1], Travis Glenn[1]

[1]University of Georgia, Athens, GA, USA, [2]Joseph W. Jones Ecological Research Center, Newton, GA, USA

Landscape Predictors of Genetic Diversity in Amphibians with Differing Dispersal Abilities

Amphibian species that exist as metapopulations rely on dispersal for maintaining population genetic diversity. Habitat alteration can affect amphibian dispersal capabilities, thereby affecting genetic diversity within their populations, however the effect of habitat alteration on amphibian dispersal and genetic diversity is likely to depend on species dispersal capabilities and habitat preferences. We investigated the relationship between landscape features in a region that has undergone major habitat changes and genetic diversity within populations of two amphibian species with differing dispersal abilities and habitat preferences. A total of 350 *Lithobates sphenocephalus* and 278 *Eurycea quadridigitata* were collected from 11 and 9 isolated wetlands, respectively, located on Ichauway, an 11,800 ha longleaf pine habitat reserve surrounded by center-pivot agriculture, in Baker County, Georgia. Species were screened at 16 and 11 microsatellite loci, respectively. Landscape composition was characterized for buffers surrounding sampled wetlands at scales relevant to the dispersal abilities for each species (0.5, 1, and 2.5km for *E. quadridigitata*; and 1, 2.5, and 5km for *L. sphenocephalus*). Model selection was used to determine which features at each scale best predicted population heterozygosity for each species. For *E. quadridigitata*, heterozygosity was positively correlated with forested wetlands and/or negatively correlated with row crops at scales up to 1km, and at 2.5km evergreen forest (positive correlation) and row crops (negative correlation) were the best predictors. Heterozygosity in *L. sphenocephalus* was negatively correlated with commercial/industrial/transportation (roads) at each scale. These patterns suggest that genetic diversity in both species is lower in habitat with greater anthropogenic alterations.

0627 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Jennifer McKinney, Eric Hoffmayer, Wei Wu, Richard Fulford

University of Southern Mississippi, Ocean Springs, MS, USA

Predicting Suitable Habitat for Whale Shark, *Rhincodon typus*, Aggregations in the Northern Gulf of Mexico

Whale shark, *Rhincodon typus*, aggregations have been documented in large numbers in the northern Gulf of Mexico since 2003 through the Gulf Coast Research Laboratory

Whale Shark Sighting Survey. Species distribution modeling provides a unique approach to analyzing this presence data. Due to their protected status, understanding critical habitat for whale sharks is essential on a regional basis for proper management. The goal of this study was to describe the probable distribution of whale shark aggregations in the northern Gulf of Mexico using Maximum Entropy (MaxEnt) and Ecological-Niche-Factor-Analysis (ENFA), two algorithms designed for predicting species distribution. Models were developed using sightings locations with feeding animals (>2 individuals) for the temporal period of June through September of 2008 and 2009 with the following predictor variables: bathymetric slope, distance from physical features and remotely sensed sea surface temperature, chlorophyll concentrations and sea surface height anomalies. Cohen's kappa and the area under the receiver operating characteristic curve (AUC) were used to evaluate model performance with an external testing dataset. Kappa values ranged from 0.28 - 0.69 and AUC values ranged from 0.73 - 0.80, indicating that the predicted distribution had a fair to substantial agreement with the testing data. Distance to continental shelf edge, petroleum platforms and chlorophyll were the predominant contributors to model output, likely due to an associations with high food availability. The spatial distribution of suitable habitat is dynamic; therefore, a long-term study is recommended to delineate trends in distribution and consistent areas of high suitability.

0097 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Caleb McMahan

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Investigating the Tempo of Diversification among Major Cichlid Lineages

Cichlids are well known for their remarkable diversity, and this diversity has been attributed to potentially increased rates of diversification in relation to potential adaptive radiations. However, the tempo and mode of cichlid diversification has rarely been quantitatively addressed. Recent studies exploring diversification rate variation in New World cichlids suggest that Heroini (the tribe comprising the majority of Middle American cichlids) did not undergo a burst of diversification upon invading Central America. In this study, I utilize the likelihood based MEDUSA method to analyze New and Old World cichlids in an effort to detect significant shifts in birth and death rates among the major lineages (Cichlinae, Pseudocrenilabrinae, Ptychochrominae, Etroplinae). A time-calibrated phylogeny was constructed with Bayesian methodology from nuclear and mitochondrial sequence data that includes all major lineages of cichlids. Multiple calibration points were assigned based on fossil cichlid taxa, as well as several outgroups. Species richness information for the major cichlid lineages was integrated with the resulting chronogram to perform the MEDUSA analysis. I use the results of this study to address whether any cichlid lineage has undergone a significant increase or decrease in diversification rates over time and to examine notions of adaptive radiation among cichlids.

0633 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Tamara McPeek, Michelle Boone

Miami University, Oxford, OH, USA

Effect of Exposures to Common Pesticides During Multiple Aquatic Life Stages of Spotted Salamanders (*Ambystoma maculatum*)

Pesticides are considered to be a risk to amphibians, but their impact on salamander species is poorly understood. Pools that spotted salamanders rely upon for reproduction are being threatened by contamination with common pesticides such as the herbicide atrazine and the insecticide carbaryl. This study aims to determine how metamorphosis in spotted salamanders is affected by exposure to pesticides at different life stages. Additionally, I will investigate how alterations in metamorphosis due to pesticide exposure may alter growth and survival in the terrestrial environment. Animals were exposed to pesticides during either the embryonic, larval, or both life stages in a mesocosm experiment. These pesticide concentrations are considered to be sublethal to salamanders, represent realistic exposure concentrations in the environment, and can affect the aquatic food web. Salamanders' time to metamorphosis, SVL, and mass at metamorphosis were monitored; additionally, we monitored the phytoplankton and zooplankton communities. After metamorphosis, juveniles were reared in terrestrial enclosures until the following spring. Mass and SVL measurements of juveniles will be taken this spring. Current results from this experiment have shown that the animals exposed to the insecticide during the larval stage had decreased mass at metamorphosis. SVL at metamorphosis and time to metamorphosis were unaffected in all treatments. Furthermore, I hypothesize that these impacts on metamorphosis will impact terrestrial growth and survival. Understanding how pesticides may affect amphibians in the embryonic, larval and juvenile stages will help determine which amphibian life-stage is at greatest risk to contaminants.

0091 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Romney McPhie[1], Jackie King[1], Sandy McFarlane[1], Heather Brekke[1]

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Have You Seen This Shark? Successes and Challenges in Monitoring the Endangered Basking Shark (*Cetorhinus maximus*) in British Columbia Waters through a Sightings Network

The Basking Shark (*Cetorhinus maximus*) is the second largest fish in the world, and one of the most imperilled. Historically, large groupings of this gentle, plankton-feeding giant were observed along the coast of British Columbia (B.C.), Canada, during the summer months; however, the entire northeast Pacific Ocean population ranging from Mexico to northern B.C. now numbers less than approximately 500 individuals. In February 2010, the Pacific population of Basking Shark was listed as endangered under Canada's *Species at Risk Act*. Broad strategies and approaches to recovery were identified by Fisheries and Oceans Canada, including Communication and Outreach, Monitoring and Inventory, and Stewardship. Integral to each of these strategies is the on-going implementation of a Basking Shark Sightings Network. Outreach materials are distributed yearly, and on-line, phone or e-mail reports of possible sightings are received from the public to determine how many Basking Sharks remain in B.C. waters and their potential for recovery. Since 2008, 58 reports have been made of both historical and current sightings, with 13 recent sightings (1996-2010) being confirmed. Future successes in connecting and cooperating with marine users in remote regions where Basking Sharks were historically abundant will ultimately determine the fate of this large - yet little-known - shark.

0632 Poster Session I, Friday 8 July 2011

Doreen McVeigh[1], Drew Ferrier[1], Susan Carney[1], John Morrissey[2], Claire Hudson[3]

[1]Hood College, Frederick, MD, USA, [2]Sweet Briar College, Sweet Briar, VA, USA, [3]Society for Ocean Sciences, Damascus, MD, USA

Development of Genetic Markers for Analysis of Cownose Ray (*Rhinoptera bonasus*) Populations in the Northern Chesapeake Bay.

Cownose Rays, *Rhinoptera bonasus* (Rhinopteridae), are elasmobranchs found in the Western Atlantic from Brazil to Massachusetts. In the spring and early summer months, large schools of Cownose Rays migrate into the Chesapeake Bay to forage. In addition, the rays use the Bay as a nursery ground young-of-the-year pups. *Rhinoptera bonasus* quickly becomes the most abundant elasmobranch found throughout the Chesapeake

Bay during the summer months. Throughout the summer Cownose Rays separate into subgroups, but it is not currently known if these are genetically isolated subgroups. In this study, we have begun to develop and characterize variable mitochondrial and microsatellite DNA markers to assist in the understanding of Cownose Ray population structure. DNA was extracted from tissue samples collected from St. George Island, Maryland to develop the genetic markers, which will be characterized in at least 30 individuals to identify patterns of variable nucleotides and shared alleles. These data will be analyzed to assess the population structure of Cownose Rays to determine relatedness of subpopulations in the Chesapeake Bay.

0464 Poster Session II, Saturday 9 July 2011

Jesse Meik[1], Jeffrey Streicher[1], Estrella Mociño-Deloya[2], Kirk Setser[2]

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Shallow Phylogeographic Structure in the Declining Mexican Lance-Headed Rattlesnake, *Crotalus polystictus*

We investigated matrilineal relationships among populations of the Mexican lance-headed rattlesnake (*Crotalus polystictus*), an enigmatic pitviper inhabiting high elevation valleys of the densely populated southern Mexican Plateau. A fragment of the mitochondrial ATPase 6 and 8 genes revealed comparatively low levels of genetic diversity, with few nucleotide polymorphisms across the portion of the geographic distribution sampled. The shallow intraspecific sequence divergence (< 1%) in *C. polystictus* ATPase 6 and 8 genes contrasts with the divergences observed within other montane rattlesnake lineages from the Mexican highlands. We posit that low genetic diversity in *C. polystictus* compared to other highland rattlesnakes may reflect fundamental ecological differences resulting in a different evolutionary response to shared Pleistocene climatic events. The high sequence divergence between *C. polystictus* and a large selection of other North American pitvipers supports the premise that *C. polystictus* represents an ancient branching event in rattlesnakes, and understanding its relationship to other species will likely be hindered until considerable comparative data have been amassed. Our finding of apparently low genetic diversity in *C. polystictus* highlights the importance of conservation initiatives to protect high elevation grasslands in central Mexico, and may inform management decisions targeted specifically to protect this species from further decline.

0525 Fish Morphology, Symphony I & II, Friday 8 July 2011

Marcelo Melo

Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, Brazil

Morphology and Innervation of the Lateral-Line Organs in Deep-Sea Swallowers (Chiasmodontidae: Teleostei)

The family Chiasmodontidae is composed of four genera and 32 species of meso- and bathypelagic fishes: *Chiasmodon*, *Dysalotus*, *Kali* and *Pseudoscopelus*. Characteristic of the family is the presence of numerous superficial neuromasts on head, lower jaw, dorsal part of body between the supraoccipital and first dorsal fin, and along the lateral line. Neuromasts are mechanoreceptors that form part of lateral line system in aquatic vertebrates; they are generally enclosed in canals but can also be found on the surface of skin. Canal neuromasts are present in all four genera of chiasmodontids. Superficial neuromasts vary in shape among chiasmodontids: circular, in *Chiasmodon*, *Dysalotus* and *Pseudoscopelus*; oval, in *Chiasmodon* and *Pseudoscopelus*; and rod-like, exclusively in *Kali*. The superficial ophthalmic ramus of anterodorsal lateral-line nerve innervates the supraorbital, otic, the two posterior infraorbital canal neuromasts and three superficial neuromasts on frontal bone. The buccal ramus of anterodorsal lateral line nerve innervates remaining infraorbital canal neuromasts and the superficial neuromasts on tip of snout. The anteroventral lateral-line nerve innervates the preopercular and mandibular canal neuromasts, and superficial neuromasts on opercle, cheek and lower jaw. The middle lateral line nerve innervates the lateral line, temporal, supratemporal, and postotic canal neuromasts, and the superficial neuromasts along the lateral line, between head and first dorsal fin, and remaining neuromasts on cranium. Some patterns of morphology and innervation of superficial neuromasts in chiasmodontids are unique to the group and others vary among its different subgroups. This paper explores the implications of neuromast characters on the relationships among chiasmodontids.

0710 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011

Abebe Ameha Mengistu[1], Peter Nagel[1], Abebe Getahun[2], Samy Saber[3], Breda Zimkus[4], Michele Menegon[5], David Gower[6], Rafael de Sá[7], Simon Loader[1]

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Phylogeography of *Leptopelis* and *Ptychadena* (Anura, Amphibia) in the Ethiopian Highlands: Implications for Taxonomy and Conservation

About one-third of the 63 known species of Ethiopian amphibians belong to the genera *Leptopelis* and *Ptychadena*, represented by six and thirteen species, respectively.

Following field sampling between 2006 and 2010 from several localities, mainly on plateaus across the Rift Valley, phylogeographic assessment was conducted for the first time using partial mitochondrial gene sequences. Phylogenetic relationships were reconstructed using Maximum Likelihood methods. Morphological observations were made on fresh collections, holotypes and non-type museum materials. The reconstructed phylogenetic relationships show endemic monophyletic highland species and populations within Ethiopian *Leptopelis* and *Ptychadena*. Cryptic diversity of highland endemics was revealed, highlighting some candidate species awaiting description: four species of *Leptopelis* and four species of *Ptychadena*. Two other species of *Ptychadena* from lower altitudes are interpreted to be conspecific with widely distributed African species. Wide overlaps in several morphological features made it difficult to identify specimens of geographically and genetically distinct populations within these clusters. Relatively small evolutionary distances among species could explain a possibly very recent radiation. We observed congruence of phylogenetic groups with clear patterns of geographic distribution allowing us to identify distinct biogeographic categories that can potentially serve as units for conservation of Ethiopian amphibians. The highland *Leptopelis* and *Ptychadena* comprise more diverse endemic species than known before, contributing substantially to the biodiversity value of the Ethiopian Highlands. Unfortunately, the current findings shrink substantially ranges proposed previously for some endemic species, implying an urgent need for revision of the conservation status of these taxa in rapidly changing environments.

0273 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Tricia Meredith, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Electrophysiological Evidence for Multiple Types of Amino Acid Olfactory Receptors in Elasmobranchs

Marine environments contain a vast number and variety of dissolved chemicals that may be detected by the olfactory systems of the resident organisms. In vertebrates, odorants are detected when they bind to molecular olfactory receptors (ORs) on olfactory sensory neurons (OSNs). Each OSN expresses primarily a single type of OR, each OR can detect multiple odorants, and each odorant can be detected by multiple ORs; therefore, the discrimination of odorants results from the activation of different combinations of ORs and OSNs. Cross-adaptation experiments with teleost fishes, which aim to determine whether two agonists interact with independent or overlapping OR populations, found 4-6 OR types that detect particular groups of amino acid odorants based on their side-chain structure. The olfactory system of elasmobranch fishes is highly stimulated by amino acids; however it is unknown whether they possess similar amino acid OR types as teleosts. We performed cross-adaptation experiments with two distantly related elasmobranch species, the bonnethead shark (*S. tiburo*) and Atlantic stingray (*D. sabina*) (n≥8 each), by testing their electro-olfactogram (EOG) responses to

ten test amino acids delivered separately over five background regimes. Under all adapting regimes, the test EOG responses were reduced in varying degrees compared to the unadapted state. The major cross-reactivity between adapting and test stimuli occurred when they shared side-chain characteristics, whereas amino acids with distinct side-chains evoked less cross-reactivity. Our preliminary results suggest that elasmobranchs, like teleosts, possess different ORs for neutral, basic, and aromatic amino acids. Further testing may reveal additional amino acid OR types.

0129 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Debra Miller

University of Tennessee, Knoxville, TN, USA

Comparative Pathology of Ranaviral Disease among Amphibians, Reptiles and Fish

Pathogens within the family Iridoviridae have been identified as etiologic agents in amphibian, reptile and fish morbidity and mortality events throughout the world. In many cases, the pathogens of concern belong to the genus *Ranavirus*. In amphibians, gross lesions associated with ranaviruses can include swelling, erythema, ulceration and hemorrhage. Microscopic lesions in amphibians include renal tubular, hepatocellular and splenic necrosis. Although larval amphibians are most often affected, ranaviral disease has been reported in adults of some species, especially in captivity and in wild populations in Europe. In adult amphibians, hemorrhages and cutaneous ulcerations are most often reported. In reptiles, juveniles and adults can be affected. Lesions in reptiles are frequently reported in the digestive tract, but also can include erythema and ulcerations in the skin, nasal cavities and, in chelonians, the shell. In fish, erythema and hemorrhage can be seen grossly, and necrosis of the hematopoietic tissue and occasionally other organs can be seen microscopically. In all cases, intracytoplasmic inclusion bodies are seen variably. We are just beginning to understand the cells and organs that ranaviruses target, which may differ among viral types and host species. Future research directives should include the use of advanced molecular techniques, such as *in situ* hybridization and immunohistochemistry, to elucidate the pathogenesis of ranaviruses among species. We need to further explore the possibility of vertical transmission in hosts and investigate the likelihood of interclass disease transmission. Finally, vaccine development is an important research need for control of ranaviral disease in captive populations.

0564 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Mark Mills[1], Jacob Haley[1], Nicole Wallace[1], Colton Zirkle[2]

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Population Ecology of Turtles on the Campus of Missouri Western State University: Year Two

Over the past two years we have marked 60 turtles of four species on the campus of Missouri Western State University: 29 *Chelydra serpentina*, 22 *Chrysemys picta*, 8 *Trachemys scripta*, and 1 *Apalone spinifera*. Based on mark-recapture estimates, we have at least 100 turtles living in the nine ponds on campus, with estimates ranging from 2-24 turtles per pond. One individual, a female painted turtle, moved between two ponds, a distance of about 200m. In the summer of 2010 we captured no turtles or invertebrates in Pond 3, perhaps as a result of ongoing construction near this pond. Our invertebrate samples during the summer of 2010 revealed a negative correlation between turtle species richness and invertebrate abundance. We had the opportunity to conduct necropsies on two turtles, and we documented nematodes in the lung of a snapping turtle and the intestine of a painted turtle. The same painted turtle was carrying 10 shelled eggs and 10 unshelled eggs.

0197 Poster Session II, Saturday 9 July 2011

Timothy Mitchell, Jessica Maciel, Fredric Janzen

Iowa State University, Ames, IA, USA

Experimental Analysis of the Influence of Nest-site Choice on Offspring Survival, Phenotypic Development, and Sex Ratio in *Chrysemys picta*

In oviparous taxa, nest-site choice is a maternal effect that influences the early life environment experienced by developing offspring. By selecting nests with particular attributes, females can improve survival and partially control developmental trajectories experienced by offspring. By experimentally manipulating *Chrysemys picta* nests, we explore whether microhabitats of maternally-selected nest sites differ from random sites, and what consequences any differences have on offspring survival and phenotype, particularly sex ratio because *C. picta* has temperature-dependent sex determination (TSD). To do this, we split clutches between nests constructed in the maternally-selected site and a random site nearby for incubation. Subsequently, hatchlings were redistributed for hibernation, such that some spent both life stages in the maternally-selected nest, some spent both stages in a random nest, and some spent one stage in each. This design allowed us to determine how nest-site choice affects survival and development across both stages by decoupling summer and winter nest environments. Maternally-selected nests had less overstory vegetation cover at oviposition and were warmer during incubation than random nests, yet egg survival and offspring

morphology did not differ significantly between treatments. Sex ratios, post-hatching survival, and neonatal morphology after hibernation will be assessed when nests are excavated this spring. If we find no survival difference between treatments, but a difference in sex ratio, then our field study would provide the first experimental evidence that sex-ratio selection is an important component of nest-site choice in a species with TSD.

0196 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Timothy Mitchell, Daniel Warner, Fredric Janzen

Iowa State University, Ames, IA, USA

Phenotypic Effects of Clutch and Nest-site Choice Revealed by Cross Fostering during Two Life-history Stages

Identifying the relative contributions of genetic, maternal, and environmental factors to generating phenotypic variation is critical for evaluating how phenotypic traits may evolve in response to selection. In oviparous organisms, offspring phenotypes are a result of genetic effects, maternal effects, and the environmental conditions experienced by embryos. We employed a cross-fostering experiment using eggs of the painted turtle (*Chrysemys picta*) to evaluate the relative contributions of clutch (i.e., maternal identity) and maternally-chosen nest site to variation in embryo development, hatchling morphology, and performance during hatchling migration to water. Moreover, because hatchling *C. picta* overwinter inside nests, we used a double-cross-fostering design to decouple the effects of the summer nest (during egg incubation) with that of the overwintering nest. Maternal identity and the nest in which eggs incubated contributed substantially to variation in incubation duration, egg water uptake, and offspring morphology. Although maternal identity contributed to the variation in all post-winter hatchling variables, the effects of the incubation and overwintering nest site varied among traits. The effect of 'nest of incubation' on hatchling mass did not persist through winter and most of the variation in post-winter body mass was due to the overwinter nest site regardless of maternal identity or pre-winter body size. Both summer and winter nest sites contributed to variation in mass loss during the overwinter period, but only the overwinter nests affected mass loss during spring migration to water. These results suggest that adaptive nest-site choice must involve complex interactions between summer and winter nest conditions.

0135 Poster Session II, Saturday 9 July 2011

Masaki Miya[1], Masanori Nakatani[2], Kohji Mabuchi[2], Kenji Saitoh[3], Mutsumi Nishida[2]

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Evolutionary History of Otophysi (Teleostei), a Major Clade of the Modern Freshwater Fishes: Pangaean Origin and Mesozoic Radiation

Freshwater harbors approximately 12,000 fish species that correspond to 43% of all modern fish diversity. Surprisingly, a single ancestral lineage evolved into about two thirds of this enormous biodiversity (≈ 7900 spp. placed in four orders, 64 families and 1068 genera), and is currently distributed throughout the world's continents except Antarctica. Despite such remarkable species diversity and ubiquity, the evolutionary history of this major freshwater fish clade — Otophysi — remains largely unexplored. To provide an overview of the history of otophysan diversification, we constructed a timetree based on whole mitogenome sequences across 110 species representing 55 of the 64 families. Partitioned ML analysis confidently recovered monophyly of Otophysi and the two constituent subgroups (Cypriniformes and Characiphysi). Within the latter clade that comprises three orders (Gymnotiformes, Characiformes, Siluriformes), Gymnotiformes was placed as the most basal clade. One of the two suborders in Characiformes (Characoidei) was reproduced as more closely related to Siluriformes than to its own suborder (Citharinoidei), rendering the characiforms paraphyletic. A relaxed molecular-clock Bayesian analysis of the divergence times and reconstruction of ancestral habitats on the timetree suggest that a common ancestor of the Otophysi entered freshwater around the end-Permian (251 Ma) when mass extinction events dramatically altered the ecological structure of marine communities under super anoxic conditions. Furthermore the timetree demonstrates that survival of the ancestral lineages through the two consecutive mass extinctions on Pangaea and subsequent radiations during the Jurassic through early Cretaceous shaped the modern familial diversity of otophysans.

0297 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Masaki Miya[1], Tetsuya Sado[1], Kenji Saitoh[2], Michael H. Doosey[3], Henry L. Bart, Jr.[3], Ignacio Doadrio[4], Yazdan Keivany[5], Jiwan Shrestha[6], Vachira Lheknim[7], Rafael Zardoya[4], Mutsumi Nishida[8], Richard L. Mayden[9]

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The Mitogenomic Supermatrices to Resolve Cypriniformes Tree of Life: An Empirical Approach Based on 472 Complete and 2171 Partial mtDNA Sequences

Fishes of the order Cypriniformes are almost completely restricted to freshwaters and comprise over 4,000 species placed in 6+ families, each with poorly defined subfamilies and/or tribes. This study attempts comprehensive resolution of the cypriniform phylogenies by combining a mitogenomic tree as a backbone constraint for the robust higher-level relationships and numerous partial sequences downloaded from GenBank for the reconstruction of lower-level relationships within the constrained clades. The mitogenomic tree is based on 472 sequences (including 6 outgroups) and the resulting best-scoring ML tree is congruent with the previous molecular phylogenies based on both mitogenomes and nuclear genes. A total of 17,057 partial sequences from cypriniforms were available from GenBank and they were sorted into 9 mitochondrial genes from 1138 species, of which 1039 species were those from the cyt *b* gene alone. Thus we constructed two matrices comprising 1) cyt *b* gene only (CB dataset: 1134 bp from 1511 spp.; missing data 2.53%) and 2) all 9 genes (ALL dataset: 9784 bp from 1610 spp.; missing data 57.6%) and the two matrices were subjected to partitioned ML analyses with the mitogenomic tree as a backbone constraint. The best-scoring ML tree based on the CB dataset derived from 24 runs using a fast bootstrap (BS) option in RAxML places all species from the partial sequences (1039 spp.) in reasonable positions, with 62.2% of the internal branches being supported by ≥80% BS probabilities. The ALL dataset is currently analyzed in a similar manner and the preliminary results will be presented.

0085 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Frank Molinia[1], Dianne Gleeson[1], Edward Narayan[2], Jennifer Germano[3], Alison Cree[4], Phil Bishop[4], Richard Jakob-Hoff[5], John Cockrem[6]

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Building the Anuran Reproductive Technology Toolbox - Progress from New Zealand

The foremost value of developing reproductive technologies is for understanding species-specific reproductive mechanisms. Contemporary techniques have been used for managing and even conserving wildlife, including a recent anuran example where tadpoles produced from an endangered species were released to the wild. Of New Zealand's four extant endemic frogs (*Leiopelma* species), three are classified nationally as 'threatened' and one 'at risk'. Three introduced *Litoria* species are also abundant although two are threatened in their country of origin (Australia). Low technical approaches have formed the basis of much anuran reproductive technology work in New Zealand. To date urinary hormone analysis has been developed in four anurans (including the monomorphic Maud Island frog) to non-invasively assign sex and/or monitor the hormones of reproduction or stress. These will be key tools for assisting current captive breeding efforts and the same is planned for Archey's frog and Hochstetter's frog, inclusive of exploring a DNA-based sexing approach if required. While methods have been attempted to induce release of sperm and oviposition in native New Zealand frogs, there is a need to establish robust repeatable procedures. In the longer term, these will underpin development of assisted breeding techniques like liquid- and frozen-storage of sperm (the latter through establishment of a properly managed GRB) and artificial fertilization. These techniques will significantly increase our knowledge of native frog reproduction and offer much promise as tools to improve production of genetically valuable offspring bred in captivity for release to restored ecosystems and secure genetic repositories for future restoration needs.

0067 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Don Moll, Jean Elbers

Missouri State University, Springfield, MO, USA

Ingestion By a Freshwater Turtle Alters Germination of Bottomland Hardwood Seeds

Seed dispersal by animals is well documented in many habitats; however, this knowledge is depauperate in bottomland hardwood forests. The alligator snapping

turtle (*Macrochelys temminckii*) is a large freshwater turtle of the southeastern United States that consumes primarily fish but also eats vegetation, including seeds of trees. To evaluate the role this species may play as a seed disperser in bottomland hardwood systems, we investigated the effect of ingestion by *M. temminckii* on germination of seeds of the following trees: common persimmon (*Diospyros virginiana*), water tupelo (*Nyssa aquatica*), and willow oak (*Quercus phellos*). Captive turtles were presented seeds of these three species in a series of feeding trials. Ingestion had no effect, reduced, or increased the proportion of seeds that germinated compared to uneaten controls for *N. aquatica*, *D. vriginiana*, and *Q. phellos* respectively. Ingestion had no effect, reduced, or increased how quickly seeds germinated compared to uneaten controls for *D. vriginiana*, *N. aquatica*, and *Q. phellos* respectively. This study suggests *M. temminckii* could play some role as a disperser of *Q. phellos*, *N. aquatica*, and *D. virginiana*; however, information on post-dispersal seed fate is needed to completely assess this species and other freshwater turtles as dispersers of wetland vegetation.

0130 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Edward Moll

Eastern Il University, Charleston, IL, USA

Field Biology Legler Style

In the field of turtle biology, John Legler has been a leader, an innovator, a curator and a teacher. He has contributed to his discipline in subjects as diverse as taxonomy, ecology, anatomy and reproductive physiology. However, if one should ask him how he would most like to be remembered, I suspect 'field biologist' would be his characterization of choice. Over a 40 year period Legler carried out extensive field studies of turtles in the US, Mexico, Central America, and Australia. As his graduate student from 1963 to 1968, I experienced field biology Legler style on projects in Mexico, Nicaragua, and Panama and lived to tell about it. Legler-style field work might best be categorized as adventure. In the course of these studies, I was bitten by snakes, turtles, and a multitude of dipterans, threatened with guns and divorce, thrown out of the chalet of the top general of Nicaragua, had one associate decapitated, and made a harrowing nocturnal trip down the Rio Chagres to try and find a hospital that would treat knife wounds of an illegal Columbian. My final and most difficult challenge was to complete an acceptable draft of my dissertation. In the end it was all worth it and I left the University of Utah, a confirmed field biologist having been trained by one of the best - John Legler.

0146 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Chad Montgomery[1], Scott Boback[2], Robert Reed[3], Stephen Green[1]

[1]Truman State University, Kirksville, MO, USA, [2]Dickinson College, Carlisle, PA, USA, [3]USGS, Fort Collins, CO, USA, [4]University of Kent, Canterbury, Kent, UK

Body Size, Growth, and Demography in the Dwarf *Boa constrictor* in the Cayos Cochinos Archipelago, Honduras

The *Boa constrictor* in the Cayos Cochinos Archipelago, known as the Hogg Island Boa, is an insular-endemic form and morphological variant of *B. c. imperator*. From June, 2004 to December, 2010 we have been examining the natural history of the boa populations on the two land mass islands within the archipelago, Cayos Menor and Cayos Grande. As part of the long term monitoring of the populations we have been conducting a capture mark recapture study on both populations. Female larger sexual size dimorphism exists in both populations. In addition, snout vent length is significantly greater on Cayo Grande than Cayo Menor for both sexes. On Cayo Menor growth rates decrease exponentially with increased body size for both sexes, with growth decreasing at a faster rate in males. Growth rates vary across years, with greater growth rates seen in those years with greater resource availability. Sex ratio of the population is not significantly different from 1:1. Growth rates and asymptotic size of boas in the Cayos Cochinos are likely regulated by local resource availability. Understanding this relationship will allow managers to make better decisions for conservation and management of the populations.

0185 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Melissa Moody[1], Rory Telemeco[2], Jason Kolbe[3], Daniel Warner[2]

[1]Pennsylvania State University, University Park, PA, USA, [2]Iowa State University, Ames, IA, USA, [3]Harvard University, Cambridge, MA, USA

Egg Environments have Large Effects on Embryonic Development, but have Minimal Consequences for Fitness-Related Phenotypes in a Lizard (*Anolis sagrei*)

Plastic responses of embryos to developmental environments shape phenotypes in ways that impact fitness. The mechanisms by which developmental conditions affect offspring phenotypes vary substantially among taxa and they are poorly understood in most systems. In this study, we evaluate the effects of thermal and hydric conditions on patterns of egg water uptake, embryonic development, and yolk metabolism in embryos of the lizard *Anolis sagrei* to gain insights into how these factors shape morphological variation in hatchlings. Our 3x2 experimental design (3 thermal and 2 hydric conditions) revealed that developmental temperature had strong effects on rates of development and yolk metabolism, but the impacts of moisture were minimal. The effects of incubation temperature on offspring morphology differed from that of moisture. The

interactive effect of incubation temperature and moisture on offspring body size depended on egg size; large eggs generally produced heavy offspring, but this pattern was reversed under dry and warm incubation conditions. Increased water uptake by eggs under relatively wet conditions resulted in larger hatchlings with less internalized residual yolk than hatchlings from dry-incubated eggs. Despite these phenotypic effects, however, the relatively small differences among treatments may have minimal fitness consequences. These results demonstrate that embryos of *A. sagrei* can tolerate a broad range of environmental conditions without substantial impacts on critical morphological traits. Such tolerances may facilitate the successful colonization and establishment of organisms into novel environments.

0745 Poster Session III, Sunday 10 July 2011

Brad Moon

University of Louisiana at Lafayette, LA, USA

The Relationship between Oxygen Consumption and Respiratory Water Loss in Rattlesnakes

Rattlesnakes increase their oxygen consumption to support the energetic demand of rattling. The ventilation associated with oxygen consumption causes some respiratory water loss. In this study, we tested the relationship between rates of oxygen consumption and respiratory water loss using a mass flow meter to measure air flow rates, a water vapor analyzer to measure respiratory water loss, and an oxygen analyzer to measure oxygen consumption at rest and during 15-min bouts of rattling in 10 western diamond-backed rattlesnakes (*Crotalus atrox*). To determine rates of oxygen consumption, we measured the air flow rates and the difference in oxygen concentration between incurrent and excurrent air, and for rattling we subtracted the resting rate from the rattling rate of oxygen consumption. To determine rates of water loss, we measured air flow rates and excurrent water vapor density, and subtracted the water vapor density of the incurrent air. Resting incurs low levels of oxygen consumption (averaging 0.0009 mL/g snake/min) and respiratory water loss (averaging approximately 0.25 mg/g snake/hr). Rattling incurs about four times more oxygen consumption and two to five times more water loss. Coupled with infrequent and brief use of rattling, these relatively low levels of oxygen consumption and water loss probably do not cause any significant energetic or osmoregulatory stress in the snakes.

0241 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

John Moriarty

Ramsey County Parks, Maplewood, MN, USA

Commercial Turtle Harvesting on the Upper Mississippi River

Historic and current commercial turtle harvesting regulations for Minnesota, Wisconsin, Iowa, and Illionois will be reviewed. Harvest rates related to recent changes in Minnesota turtle harvesting laws will be detailed. This will include renewal restrictions, allowable species, season changes, and size limits.

0300 Poster Session II, Saturday 9 July 2011

Matthew Most, Lauren Grande, Terry Grande

Loyola University of Chicago, Chicago, IL, USA

Spatial Ecology of the Eastern Garter Snake, *Thamnophis sirtalis*, in Relationship to Hibernacula

The Eastern Garter Snake (*Thamnophis sirtalis*) is a common, widely distributed North American snake species, and holds a fundamental ecological niche within wetland habitats. However, in spite of *Thamnophis sirtalis*' environmental value and unrivaled adaptability, many threats, such as habitat loss, stand to destroy this species. This study was designed to investigate the *Thamnophis sirtalis* population of Lake Forest, Illinois' Open Lands with an emphasis on the movement and dispersion of individuals in relationship to utilized hibernacula. Spatial ecology holds many important implications for the understanding of a species' fitness and can often reveal other aspects of a species' ecology. By incorporating passive sampling (Gibbons and Semlitsch) and mark-recapture techniques data including: a population estimate, snout-vent length (cm), weight (g), density, habitat category, and predator/prey density were monitored by the location of capture(s) input into a Global Information Systems (GIS) program, ArcView. GIS data, provided by Lake County, IL, was used to gain distance and area measurements of habitat categories (i.e. Agriculture, Wetlands, etc.) from recapture points of *Thamnophis sirtalis*. With the incorporation of the DS1923 Data Logger (iButton Themochron; Dallas Semiconductorâ, Dallas, Tex.), repeated measures ANOVAs were employed to test whether temperature and humidity variables had an effect on the weight (g), Snout-Vent Length (cm), and/or density during temporal sampling. Our results suggest that there is a complex relationship between population structure, snout-vent length, temperature, humidity, and habitat type with utilized hibernacula within our PIT tagged sample (N=150), that is likely the result of microhabitat selection.

0118 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Philip Motta[1], Maria Laura Habegger[2], Amy Lang[3], Robert Hueter[4]

[1]University of South Florida, Tampa, FL, USA, [2]University of South Florida, Tampa, FL, USA, [3]University of Alabama, Tuscaloosa, AL, USA, [4]Mote Marine Laboratory, Sarasota, FL, USA

Placoid Scale Morphology, Erection and Function in the Shortfin Mako *Isurus oxyrinchus*

The shortfin mako *Isurus oxyrinchus* is perhaps the fastest swimming shark and exhibits a suite of physiological and morphological adaptations for sustained and rapid swimming. We investigated the functional morphology of the placoid scales from 16 regions on the body to investigate putative scale erection leading to drag reduction and compared this to the scales of a slower swimming blacktip shark *Carcharhinus limbatus.* Scanning electron microscopy, histological staining, and manipulation of scales overlying pressurized skin revealed regions on the flank with extremely small (0.18 mm crown length) and flexible scales that can be manually erected to 50 degrees in mako sharks. The lateral flank scales had significantly greater erection angles (mean = 44^{o} ± 1.44 SE) than both the dorsal (mean = 25.8^{o} ± 0.78 SE) and ventral regions (mean = 25.1^{o} ± 1.9 SE). Highly flexible scales were also found at the trailing edge of the pectoral fins. The scales on the trailing edge of the pectoral had the highest erection angles compared to the leading edge and the central region of the fin. Conversely, blacktip scales were larger (0.32 mm) and less flexible. Scale flexibility appears to be related to the length of the scale crown and base, the shape of the base, and anchoring to the dermis. These flexible scales on the flank and pectoral fin occur in regions most prone to flow separation and reversal, and scale erection most likely occurs passively at these regions of flow reversal resulting in a reduction of form drag.

0532 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Krista Mougey, Gad Perry

Texas Tech University, Lubbock, TX, USA

Radio Transmitter Mass: Impacts on Home Range, Daily Displacement, and Nesting Movement in Texas Horned Lizards

One of the assumptions that influences the validity of radio telemetry studies is the idea that neither the radio tag nor its method of attachment causes appreciable negative impacts to the marked organism. Traditionally, scientists have used a set of guidelines known as the "percent rules" to determine the maximum acceptable mass of radio transmitter that can be applied to an individual without violating this assumption. For reptiles, this is usually 10% of the individual's body mass. However, this rule is a

relatively arbitrary figure with questionable origins. During 2008 and 2009, I radio tracked 74 Texas horned lizards (carrying encumbrance masses constituting between 3.5 and 22.3% of their average body masses) to evaluate the efficacy of this traditional transmitter-to-body mass tolerance limit. I focused on the impacts of instrumentation to the field movement parameters of daily displacement rate, nesting movement distance, and seasonal home range area. Mass of instrumentation was significantly correlated to a decrease in both displacement rates ($F_{1,26} = 4.208$; $p = 0.05$) and nesting movement distances ($F_{1,9} = 9.875$; $p = 0.009$). However, the predictive value of treatment mass was non-significant ($F_{1,27} = 2.316$; $p = 0.140$) in relation to seasonal home range area. Hindrances to normal movement patterns may have fitness consequences. The results of my studies indicate that the standard "percent rules" commonly applied to radio telemetry technology may well induce serious bias into a broad range of studies, placing some of the commonly accepted insights derived from radio telemetry in doubt.

0534 Poster Session III, Sunday 10 July 2011

Krista Mougey, Gad Perry

Texas Tech University, Lubbock, TX, USA

Radio Transmitter Mass: Impacts on Endurance in Texas Horned Lizards and Bearded Dragons

Locomotor performance in laboratory studies has been causally linked to fitness in natural field settings for a variety of species and, therefore, has received extensive attention for its potential ecological implications. I examined the impacts of radio transmitter mass on the stamina of bearded dragons and Texas horned lizards in laboratory settings. Individuals of both species were assigned treatments that accounted for between 0 and 25% of their body masses and were induced to run to exhaustion on a small motorized treadmill. The endurance running times recorded for the bearded dragons ranged from 54 to 256 seconds, and I determined that treatment mass, SVL, and brood were all significantly correlated with stamina times ($F_{1,43} = 138.643$; $p < 0.0001$; $F_{1,43} = 4.519$; $p < 0.0001$; and $F_{2,43} = 4.317$; $p = 0.020$ respectively). In the tests of adult and sub-adult horned lizards, stamina times ranged from 143 seconds (just under 2.5 minutes) to 884 seconds (nearly 15 minutes). Treatment mass ($F_{1,16} = 27.326$; $p < 0.0001$), sex ($F_{1,16} = 9.601$; $p = 0.007$), and age ($F_{1,16} = 8.700$; $p = 0.009$) all had significant predictive value within the model. Treatment masses of 5%, 10%, and 20% produced endurance times that were 14%, 27%, and 46% reductions from the average endurance times of the control horned lizards. Similar trends were seen within the bearded dragons, indicating that the mass of instrumentation from radio telemetry research could have large impacts on the locomotor performance of marked individuals.

0543 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Anna Moyer[1], Barney Luttbeg[1]

[1]*Oklahoma State University, Stillwater, OK, USA*

The Effects of Short Term and Long Term Exposure to Elevated Cadmium Levels on Predator Avoidance Behavior in Southern Leopard Frog (*Rana sphenocephala*) Tadpoles

The effects of heavy metals on amphibian behavior are poorly understood. We hypothesize that cadmium (Cd) in the water column inhibits olfaction in tadpoles. Tadpoles detect predators by smelling chemical alarm cues that are released when predators prey on nearby conspecifics. We tested how Cd levels in the water altered the predator avoidance behaviors of southern leopard frog (*Rana sphenocephala)* tadpoles. We exposed tadpoles to various concentrations of Cd and alarm cues created from feeding dragonfly (*Anax sp*.) nymphs. This determined if sub-lethal levels of Cd in the water prevents tadpoles from detecting these cues. To test if tadpole populations have adapted to Cd contamination, these tests were also conducted on tadpoles collected from ponds with a history of elevated Cd. These results were compared to tests conducted on tadpoles from an environment without Cd. *Rana sphenocephala* tadpoles decrease activity when they detect predators. The higher levels of Cd reduced the activity of tadpoles even before alarm cues were added. With this initial change of behavior accounted for, adding alarm cues decreased tadpole activity of the tadpoles tested in the lower levels of Cd, and increased it in tadpoles that were tested in the higher concentrations of Cd. At high Cd concentrations tadpoles were unable to detect the alarm cues and continued to actively swim.

0284 Poster Session I, Friday 8 July 2011

Joshua Moyer

Millersville University, Millersville, PA, USA

Sex Pheromones in Elasmobranchs: A Preliminary Investigation using *Mustelus canis* and *Carcharhinus plumbeus*

This study is a preliminary investigation of the use of sex pheromones by elasmobranch fishes through examinations of olfactory receptor cell morphology in the smooth dogfish shark, *Mustelus canis*, and the behaviors exhibited by captive sandbar sharks, *Carcharhinus plumbeus*, at the Adventure Aquarium in Camden, NJ. Using scanning electron microscopy, it was determined that the morphology and distribution of a microvillous receptor cell type present on the olfactory epithelium of *M. canis* matches descriptions of a cell type of unknown function found in the literature. Overall organ and cellular morphology does not preclude the use of sex pheromones by elasmobranchs. Although no reproductive behavior was observed in the captive population of *C. plumbeus*, statistical analysis revealed a significant difference between

the sexes in paired swimming patterns. These results indicate that males of a captive population of *C. plumbeus* distinguish the sex of conspecifics when not actively breeding. Together, these findings strengthen the argument in favor of more research in the field of pheromones and their role in elasmobranch biology.

0495 Poster Session II, Saturday 9 July 2011

Peter Muelleman, Chad Montgomery

Truman State University, Kirksville, MO, USA

Ecology of a Snake Community in Northwestern Missouri

Much of the landscape in Northern Missouri has been converted to agricultural fields, leaving relatively few places where natural snake communities can be found. One such community was located on a small piece of unused, protected property of a commercial pig farm in Daveiss County, MO. A three year (2008-2010) survey was conducted to determine the richness of the snake community on the site. A total of 205 individuals, representing eight species, were captured, processed, and marked. *Lampropeltis triangulum* (n = 65) was the most abundant species, followed by *Crotalus horridus* (n = 61), *Diadophis punctatus* (n = 38), *Nerodia sipedon* (n = 16), *Coluber constrictor* (n = 7), *Thamnophis sirtalis* (n = 7), *Pantherophis obsoletus* (n = 6), and *Carphophis vermis* (n = 5), respectively. Recaptures were rare until the last year of the survey and only occurred in the three most abundant species. These data indicate the importance of maintaining suitable snake habitat on privately owned land in agriculturally dominated regions.

0394 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Christopher Mull[1], Kara Yopak[2], Nicholas Dulvy[1]

[1]Simon Fraser University, Burnaby, BC, Canada, [2]University of California San Diego, La Jolla, CA, USA

Does More Maternal Investment Lead to Larger Brains? Evolutionary Relationships Between Reproductive Mode and Brain Size in Chondrichthyans

Chondrichthyans have the most diverse array of reproductive strategies of any vertebrate group, ranging from egg-laying to live-bearing with placental matrotrophy. Matrotrophy is defined as additional maternal provisioning beyond the yolk to the developing neonate; in chondrichthyans, this occurs through a range of mechanisms including uterine milk, oophagy, uterine cannibalism, and placentotrophy. Chondrichthyans also exhibit a wide range of relative brain sizes and patterns of brain organization. Brains are energetically expensive to produce and maintain, and represent

a major energetic constraint during early life in vertebrates. In mammals, more direct maternal-fetal placental connections have been associated with larger brains. We test for a relationship between reproductive mode and relative brain size across 85 species from 6 major orders of chondrichthyans using several phylogenetic comparative analyses. Maximum body size had a significant influence on relative brain size, with the largest-bodied species (body mass > 100 kg) having smaller relative brains, across all analyses. Ordinary least squares (OLS) and reduced major axis (RMA) regression of body mass versus brain mass suggest that increased maternal investment results in larger relative brain size. Our findings were supported by a regression method that incorporates the evolutionary relatedness of species. This study suggests there may be a link between reproductive investment and relative brain size in chondrichthyans, but a more definitive test requires a better resolved phylogeny and a more nuanced categorization of the level of maternal investment in chondrichthyans.

0148 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Thomas Munroe

National Systematics Laboratory, NMFS/NEFSC, Smithsonian Institution, Washington, DC, USA

Systematic Revision of the Flatfish Genus *Peltorhamphus* Günther, 1862 (Pleuronectiformes: Rhombosoleidae), with Description of a New Species

The rhombosoleid genus *Peltorhamphus* Günther was thought to contain only three species, *P. novaezeelandiae* Günther, *P. latus* James, and *P. tenuis* James, that are widespread in shallow, continental shelf waters of New Zealand, and also at nearby Chatham Islands and Norfolk Island. The only systematic revision of *Peltorhamphus* (in 1972) developed a key to assist in identifying specimens. During on-going studies updating taxonomic information for *Peltorhamphus*, problems were encountered when attempting to identify specimens, especially juveniles. Examination of 1106 specimens of *Peltorhamphus*, representing 203 lots, revealed that 81 of 203 lots (40%) contained misidentified specimens (including lots with paratypes). In addition to three previously-described species, a fourth species, with a much more limited geographic range than the others, was also discovered. Discovery of this undescribed species, most often misidentified as juvenile *P. novaezeelandiae* or as adult and juvenile *P. latus*, in addition to the large number of other misidentified specimens in collections required taxonomic re-evaluation and redescription of all species in the genus, and an appraisal of characters used to differentiate them. Some characters traditionally used to differentiate species continue to be useful, whereas, others were found to overlap too much to be useful in separating the species. Novel characters related to scales, gillrakers and pigmentation were also discovered during this study that further facilitate species identifications of *Peltorhamphus*. Re-assessment of the number of valid species of *Peltorhamphus* provides better understanding of species diversity within this genus as well as that of the flatfish assemblage residing in New Zealand waters.

0413 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Christopher Murray

Southeastern Louisiana University, Hammond, LA, USA

Salinity and Alligator Egg Shape Variation: A Geometric Morphometric Analysis

The harvest and incubation of American alligator eggs is an important component to the commercial alligator harvest industry in the southeastern United States. As a result, various methodologies have been used to monitor alligator populations including abundance counts, stress quantification, and nesting surveys. Past studies have dismissed the importance of egg shape in crocodilians, Squamates, and turtles and deemed eggs shape in birds and other amniotes as similar, in relation to functionality. The complexity of crocodilian eggs has been examined and both turtle and Squamate eggs have recently been regarded as physiologically more intricate than bird eggs. This study takes an eco-physiological approach to monitor alligator populations from freshwater and low salinity environments. In addition, we introduce a fractional semilandmark shape template method to quantify egg shape within a geometric morphometric framework. This approach is beneficial because it allows for the quantification of shape for curved structures, such as eggs, which lack homologous landmarks. The results from this study suggest that alligator egg shape is correlated with varying salinity levels, such that variation in alligator egg shape at low salinities changes in gradient-like fashion while salinities high enough to be deemed stressful result in reversion back to a low salinity egg shape or desiccation.

0107 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

David Mushet[1], Ned Euliss, Jr.[1], Craig Stockwell[2]

[1]U.S. Geological Survey, Jamestown, ND, USA, [2]North Dakota State University, Fargo, ND, USA

The Effects of USDA Conservation Programs on Northern Leopard Frog Habitat Suitability in North Dakota

The western population of the northern leopard frog (*Lithobates pipiens*) is currently being considered for listing as threatened under the federal Endangered Species Act. One threat of concern is the declining availability of suitable habitat. Changes in habitat suitability resulting from landscape alterations associated with modern agricultural production and related conservation programs can significantly alter occurrence of leopard frogs on the prairie landscape. To evaluate how northern leopard frog habitat suitability varies in response to land-use change, we conducted night-time amphibian call surveys within a 260 km^2 study plot in central Stutsman County, North Dakota. We

then mapped areas of suitable habitat using ecological niche factor analyses and measurements of environmental variables obtained from various GIS, remote sensing, and climate data sources. Leopard frog habitat suitability varied markedly between the eastern and western portions of our study area. While significant areas of grasslands and wetlands in the western portion of our study area provided an abundance of suitable habitat for northern leopard frogs, suitable habitat in the eastern portion was limited to areas maintained by U.S. Department of Agriculture conservation programs (e.g., Conservation Reserve Program, Wetlands Reserve Program). Our study highlights the importance of such conservation programs in providing habitat for the northern leopard frog in areas on intensive agricultural activity.

0145 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Henry Mushinsky, Earl McCoy

University of South Florida, Tampa, FL, USA

The Value of Enclosures When Studying Cryptic Species

We study the Florida Sand Skink (FSS) (*Plestiodon reynoldsi*), a threatened fossorial lizard found only on the Lake Wales Ridge of central Florida. Because it rarely comes above ground and has a body mass of less than 3 gm it is a challenge to study. To estimate population size in response to periodic fires we installed 12 20m X 20m enclosures in plots of land with three distinct burn histories (1-6, 7-19, 20-40 year intervals between fire) to use a simulated removal trapping method to estimate FSS densities in relation to fire periodicity. To monitor responses to burning and movement patterns each captured FSS was given an individual mark and a tip of the tail was removed for genetic analysis. To establish relationships among environmental variables and FSS densities we quantified the microhabitats within each of the 36 enclosures. To monitor the success of a translocation effort we placed more than 500 FSS into 24 enclosures at another site further north in Florida and followed them for three years to establish rates of survival and reproduction. To improve our ability to judge changes in population sizes, we installed eight cover boards (0.6 X 0.6m) within the enclosures to establish a relationship between the number of "hits" under a cover board to the number of FSS in an enclosure. The results of these efforts will be discussed.

0359 Poster Session III, Sunday 10 July 2011

Steven Mussmann[1], Marlis Douglas[1], Michael Douglas[1]

[1]University of Illinois, Champaign, IL, USA, [2]University of Illinois, Champaign, IL, USA, [3]University of Arkansas, Fayetteville, AR, USA

Molecular Determination of Parentage in Bowfin (*Amia calva*)

Refined methods for assessing genetic relatedness in vertebrates have greatly improved our perspectives on parentage, parental care, and mating systems. Use of microsatellite markers (msats) has been particularly influential in this regard by allowing for a more accurate determination of parent-offspring relationships, thereby giving new insights into multiple paternity, sib-sib competition, and offspring survival. This study evaluates 10 msats as a means of determining parentage in the Bowfin (*Amia calva*), a basal Actinopterygian fish that provides an elevated level of parental care, particularly given its high fecundity. Bayesian and Maximum Likelihood methods were used to reconstruct family groups and to quantify parental genotypes. These analyses provided a baseline for evaluating male-mediated Bowfin parental care in the context of genetic relatedness, in that some broods appeared to be sired by multiple males. Results promote an understanding of the Bowfin mating system in particular, and contribute broadly to categorizing the evolution of male parental care in fishes.

0237 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Erin Myers

University of Houston, Houston, TX, USA

A Phylogenetic Assessment of Morphological Evolution within a Radiation of Turtles

Morphological and species diversification are often linked in species radiations. However, it is not often clear whether morphological diversification contributed to speciation, or whether it occurred as a by-product of other speciation processes. I addressed this question using a species and morphologically rich turtle radiation, the map turtles (*Graptemys*), characterized by unique facial colorations. To assess the role that color pattern variation has played in the diversification of this genus, this project sought to determine the evolutionary relationships among the species within the map turtles and to subsequently assess patterns of morphological evolution across the phylogeny. Map turtles formed a monophyletic group with two major clades. However, species-level resolution was limited, consistent with rapid speciation within the genus. I found parsimonious evolution of four major morphological patterns across the genus and less parsimonious evolution within morphological groups. This pattern suggests possible early sexual selection on these facial coloration traits during the formation of the major species clades and then subsequent stochastic morphological evolution.

0047 Poster Session I, Friday 8 July 2011

Jawad Nazir, Marisa Spengler, Rachel E. Marschang

University of Hohenheim, Stuttgart, Germany

Persistence of Amphibian and Reptilian Ranaviruses in Ponds

The present study was conducted to compare the persistence of amphibian and reptilian ranaviruses in the pond habitat. Four viruses were included in the study: two amphibian ranaviruses (FV 3, the type species of the genus *Ranavirus*, and an isolate from a *Pelophylax kl. esculentus*) and two ranaviruses of reptile origin (from a *Testudo hermanni* and from a *Uroplatus fimbriatus*). A sandwich germ carrier technique was used to study the persistence of these viruses in sterile and unsterile pond water (PW) and soil obtained from the bank of a pond. For each virus, virus loaded carriers were placed in each of the three substrates and incubated at 20 and 4 °C and titrated at regular intervals. Serial data were analyzed by linear regression model to calculate T-90 values. Resistance of the viruses to drying was also studied. All four viruses were resistant to drying. At 20 °C, T-90 values of the viruses were 22-31 days in sterile PW, 22-34 days in unsterile PW, and 13-22 days in soil while at 4 °C the values were 102-182 days, 58-72 days, and 30-48 days. At lower temperatures, viral persistence was highest in the sterile PW followed by the unsterile PW and the lowest in the soil. There were no significant differences in the survival times between the amphibian and reptilian viruses. The results of the present study suggest that ranaviruses can survive for long periods of time in pond habitats at low temperatures.

0488 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Thomas Near

Yale University, New Haven, CT, USA

Molecular Inferred Phylogeny of Darters (Teleostei: Percidae).

The phylogenetic relationships of darters were investigated using a dataset comrpising DNA sequences sampled from mtDNA and nuclear encoded genes. The taxon sampling included 245 of the 248 recognized darter species. External fossil calibrations, external molecular evolutionary rates, and relaxed clock models were used to investigate divergence times. Comparisons among gene trees indicated that more than 12% of all extant darter species carry a mtDNA genome of heterospecific origin. The phylogenies inferred from analyses that ignore mtDNA haplotypes of heterospecific origin indicate *Nothonotus* is not nested in *Etheostoma* and these trees provide phylogenetic resolution for the enigmatic *Etheostoma cinereum*. The divergence time analyses resulted in age estimates for the darter radiation at approximately 35-40 million years ago. The well-resolved phylogeny was used to develop a rank-free classification for darters.

0155 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Brandi Neifert[1], Alton Dooley[1]

[1]Roanoke College, Salem, VA, USA, [2]Virginia Museum of Natural History, Martinsville, VA, USA

A Comparison of Tooth Breakage Rates in Miocene Carcharhinid Sharks from the Carmel Church Quarry, Caroline County, VA

Excavation of marine sediments of the middle Miocene Calvert Formation at the Carmel Church Quarry has resulted in the collection of thousands of shark and ray teeth. Genera of teeth commonly found include *Hemipristis*, *Carcharhinus*, and *Galeocerdo*, among others. Unlike most large collections of shark teeth, the Carmel Church specimens were all collected *in situ* from a single bed with a maximum thickness of less than 1 m. While the majority of teeth from Carmel Church represent clearly reworked specimens, a substantial portion show no evidence of reworking and provide a sample that may represent the local population of sharks over a relatively short period of time. Multiple shark taxa with similar tooth morphologies and body sizes may have coexisted through niche partitioning. This could have been achieved through behavioral variations such as temporal segregation (diurnal or nocturnal habits, or seasonal movements) or through variations in dietary preferences. In order to test for evidence of variation in dietary preferences, tooth breakage frequency and height-thickness ratios were examined in three shark genera that are broadly similar to each other in size and tooth morphology – *Hemipristis, Galeocerdo and Carcharhinus*. Preliminary results show *Carcharhinus* with a low frequency of breakage at the apex of the tooth. Further results pending.

0479 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Jennifer Neuwald, Nicole Valenzuela

Iowa State University, Ames, IA, USA

The Lesser Known Challenge of Climate Change: Thermal Variance and Sex-Reversal in Vertebrates with Temperature-Dependent Sex Determination

Climate change is expected to disrupt biological systems. Particularly susceptible are species with temperature-dependent sex determination (TSD), which includes many reptiles and some fish. While the potentially devastating effect of rising mean temperatures on sex ratios in TSD species such as turtles is appreciated, the consequences of increased thermal variance predicted to accompany climate change remain obscure. Surprisingly, no study has tested if the effect of thermal variance around high-temperatures (which are particularly relevant given climate change

predictions) has the same or opposite effects as around lower temperatures. Here we show that sex ratios of the painted turtle (*Chrysemys picta*) were reversed as experimental fluctuations increased around low and high unisexual mean-temperatures. Unexpectedly, the developmental and sexual responses around female-producing temperatures were decoupled in a more complex manner than around male-producing values. Tests using naturally-fluctuating thermal conditions are also discussed. Our novel observations are not fully explained by existing ecological models of development and sex determination, and provide strong evidence that thermal fluctuations are critical for shaping the biological outcomes of climate change.

0666 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Kyle Newton[1], James Wraith[1], Kathryn Dickson[1]

[1]California State University, Fullerton, Fullerton, CA, USA, [2]National Oceanic and Atmospheric Administration, Southwest Fisheries Science Center, LaJolla, CA., USA

Potential Benefits of Visceral Endothermy in the Shortfin Mako Shark, *Isurus oxyrinchus*

Lamnid sharks, including the shortfin mako (*Isurus oxyrinchus*), maintain digestive tract temperatures elevated above ambient water temperature (visceral endothermy). These sharks have evolved a vascular counter-current heat exchanger, the suprahepatic *rete*, which conserves metabolic heat produced by digestion and assimilation. It has been hypothesized that visceral endothermy results in higher food-processing rates in lamnid sharks. We tested the hypothesis that visceral endothermy results in higher digestive enzyme activities in lamnid sharks, by comparing the shortfin mako shark, *Isurus oxyrinchus*, to two sharks that cannot elevate visceral temperatures, the thresher, *Alopias vulpinus*, and the blue, *Prionace glauca*. Sharks were collected by longline, and stomach tissue samples were frozen in liquid nitrogen and stored at -80°C until assays were performed. Specific activities of the protease pepsin (units g-1) were measured spectrophotometrically at physiological temperatures. Pepsin activity in *I. oxyrinchus* (mean ± SD: 26.0 ± 18.9 U g-1 at 25C, N = 16) was significantly greater than in both *A. vulpinus* (4.3 ± 2.8 U g-1 at 15C, N = 6) and *P. glauca* (15.5 ± 8.3 units g-1 at 15C, N = 16). These data support the hypothesis that maintaining a higher digestive enzyme activity was a selective advantage leading to the evolution of visceral endothermy in lamnid sharks. We plan to collect additional specimens of *A. vulpinus* and also measure pancreatic typsin and lipase activities in all three species.

0325 Poster Session II, Saturday 9 July 2011

Kirsten Nicholson[1], John Phillips[1], Jennifer Deitloff[2], Craig Guyer[2], Kevin DeQueiroz[3]

[1]Central Michigan University, Mt. Pleasant, MI, USA, [2]Auburn University, Auburn, AL, USA, [3]National Museum of Natural History, Washington, DC, USA

Evolutionary and Biogeographic Relationships Among Species of the *Anolis humilis* Complex

The biogeographic relationships among *Anolis* lizards are still unresolved, and very little has been investigated regarding mainland anoles of the Norops clade. The prevailing hypothesis is that an ancestral Norops member traveled overwater from the Caribbean and landed somewhere in the vicinity of Mexico. Subsequently, the ancestor rapidly speciated and descendents disbursed southwards and eventually invaded South America. This hypothesis has never been specifically tested, nor other alternatives explored. As part of a larger project to investigate the biogeography of the Norops clade, here we present results regarding the biogeographic relationships of the *Anolis humilis* complex. Using molecular data, we investigated (1) the monophyly of the *A. humilis* species group, (2) support for some debated species within the group, and (3) tested the proposed north to south pattern for this group. We find no support for the monophyly of the *A. humilis* species group, and support for some debated species but not others (*A. marsupialis* and *A. humilis/quaggulus*). The biogeographic pattern that emerges is contrary to the expected pattern and appears to go from south to north, although data collection was not quite complete at the time of this writing. Completed results will be presented at the meetings.

0261 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Philip Nicodemo, Bruce C. Jayne

University of Cincinnati, Cincinnati, OH, USA

Longitudinal Variation in the Axial Muscles of Snakes

In snakes, as in other vertebrates, both the axial muscles and axial skeleton have a segmented organization. However, many of the axial muscles of snakes are notable for having individual segments that often span several vertebrae. Consequently, muscles that extend anteriorly have a constraint on their length as their origins are located closer to the skull. However, this and other aspects of longitudinal variation in axial muscle morphology are poorly documented either within or between species of snakes. Thus, we compared patterns of segmentation and morphology of the anterior trunk (< 50% SVL) spinalis muscle (SP) in several phylogenetically and morphologically distinct species of snakes. We found a variety of mechanisms for reducing segmental length, some of which varied among taxa. In both Henophidians and Caenophidians, anterior decreases in total segmental length of the SP resulted primarily from reducing the length

of tendon rather than contractile tissue. At mid-body, the more anterior segment within an adjacent pair both arises and inserts one vertebra anterior to the locations of the neighboring segment, whereas in the neck region of some Caenophidians, the more anterior segment within an adjacent pair may arise from a location as many as five vertebrae anterior to the origin of the neighboring segment but the anterior sites of muscle attachment differ by only a single vertebra. *Ahaetulla prasina* had an unusual mechanism of reducing segmental length, in which the anterior tendons of several adjacent SP muscles fused to insert on a single vertebra.

0408 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Mark Nielsen

University of Utah, Salt Lake City, UT, USA

Comparative Analysis of Aquatic and Terrestrial Walking Morphologies within the Order Testudines

The functional and mechanical determinants of the structure of the posterior appendage are analyzed and compared in terrestrial walking chelonians and aquatic walking chelonians. The order Testudines is unusual in having some species that are adapted for walking on land and others that are specialized for a similar gait on a submerged substrate in an aquatic environment. In the terrestrial environment the vertical force of gravity is the primary loading factor the animal must overcome during locomotion. In the water the buoyant nature of water reduces gravitational loading and the water column imposes resistance to movement in the horizontal plane. Models based on engineering principles predict the optimal morphologies for the pelvic apparatus and posterior appendage of turtles specialized for walking gaits in these two contrasting environments. The models are tested with a morphometric analysis of the skeletal and muscular systems in a representative terrestrial walker, *Xerobates agassizi*, and a representative bottom walker, *Chelydra serpentina*. Analyses support the adaptive nature of evolution; that is, different environmental constraints lead to morphologies that optimize functions for the environmental conditions.

0103 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Andrew Nosal, Daniel Cartamil, Nicholas Wegner, Jeffrey Graham

Scripps Institution of Oceanography, University of California - San Diego, La Jolla, CA, USA

Aggregation Behavior of the Leopard Shark (*Triakis semifasciata*) Associated with the Head of La Jolla Submarine Canyon, San Diego County, California

We investigated the demographics and movement patterns of leopard sharks (*Triakis semifasciata*), which aggregate by the hundreds near the head of La Jolla Submarine Canyon (LJSC) from spring to autumn. The function of this behavior remains unclear. Sampling to date (n=124) indicates these sharks are mature (111-159 cm TL) and mostly female (96.7%). To quantify the fine-scale movement patterns and long-term presence-absence of leopard sharks at LJSC, sharks were manually tracked (n=8) for uninterrupted periods of 24-48 h or surgically implanted with coded transmitters (n=12) and passively monitored by an acoustic receiver array (July 2009-present). Detection patterns varied among individuals, however some displayed marked synchrony. For example, 2 sharks returned to LJSC within 1.5 h of each other after absences of 218 and 306 days, respectively. Sharks also exhibited strong site fidelity, with some individuals detected at LJSC for >70 consecutive days. Manually tracked sharks occupied significantly greater depths at night (mean ± SD night: 4.52 ± 8.45 m, day: 1.71 ± 1.62 m), occasionally exceeding 50 m during roundtrip offshore excursions. Detection data also reflect these nocturnal departures. Leopard sharks may be attracted to the canyon head due to locally calm waters caused by bathymetric wave refraction and proximity to an abundant supply of market squid (*Loligo opalescens*), which spawn in the canyon and are the primary dietary component of these sharks.

0668 Poster Session I, Friday 8 July 2011

Schyler Nunziata, Stephen Richter, Stacey Lance

Eastern Kentucky University, Richmond, KY, USA

Influence of Within- and Among-stream Movements on Population Structure of Two-lined Salamanders

Destruction and degradation of habitat is considered one of the leading causes of the worldwide amphibian decline. Amphibians that require both aquatic and terrestrial habitat in their life-cycle are sensitive to the loss of either. By understanding how amphibians utilize the landscape, land planning can be established to maintain healthy populations. Most research looking at spatial dynamics of amphibian populations has focused on pond-breeding amphibians, with less focus on stream-breeding amphibians, which have very different spatial ecologies. Stream salamanders, e.g. the southern two-lined salamander (*Eurycea cirrigera*), can disperse either along the stream channel or over

land. However, previous studies have failed to quantify these dispersal patterns or establish population boundaries for the species. Population connectivity is critical in maintaining dispersal and corresponding gene flow in amphibian populations, as well as in decreasing local extinction risk and allowing for recolonization after local extinction events. *Eurycea cirrigera* is considered a terrestrial stream salamander, but understanding of its spatial ecology is lacking. We used 12 microsatellite loci to investigate (1) the population boundaries of *E. cirrigera* along stream channels and (2) dispersal patterns both within the stream and across land. To investigate these patterns we performed whole-stream salamander surveys in two forested stream systems that flow into the Kentucky River in the Bluegrass Region of Kentucky. Results of this study provide data on the aquatic and terrestrial spatial ecology of *E. cirrigera* and have application to land-use planning in and around streams aiming to maintain viable amphibian populations.

0682 Fish Physiology, Minneapolis Ballroom G, Monday 11 July 2011

Lois O'Boyle, Wayne Bennett Jr.

University of West Florida, Pensacola, FL, USA

Evaluating Thermal Ecology of Dusky Pipefish, *Syngnathus floridae*, and Gulf Pipefish, *Syngnathus scovelli*

Little is known about the thermal tolerance of pipefishes that, across their latitudinal range, regularly experience large seasonal and diel shifts in water temperature. In this study, chronic thermal acclimation ranges determined acclimation temperatures for dusky (*Syngnathus floridae*) and gulf pipefish (*Syngnathus scovelli*) inhabiting seagrass beds in the Gulf of Mexico. Critical thermal methodology (CTM) was employed to estimate upper and lower thermal limits for each species as well as construct a thermal tolerance polygon demonstrating each species' thermal niche. Daily water temperatures were collected and used to identify specific variation encountered by pipefish in this study. Chronic thermal ranges were significantly different ($p<0.0001$) and provided acclimation temperatures of 11-33°C for gulf and 12-32°C for dusky pipefish. Critical thermal maxima and minima were significantly correlated with acclimation temperature ($p<0.0001$ in both species) and accounted for 93-98% of the variability in CTM. Gulf pipefish had both the highest CTmaxima, 39.6°C, and the lowest CTminima, 3.2°C. Polygons calculated for dusky and gulf pipefish had total areas of 617°C² and 736°C², respectively. Gulf pipefish possess significantly larger intrinsic and total tolerance area compared to dusky pipefish, which may indicate disparate use of seagrass habitats. Both species utilize well developed mechanisms for thermal tolerance as well as behavioral adaptations when temperatures fluctuate. Continued patterns of sea surface warming could impact local pipefish populations and challenge them to seek new habitats.

0132 Poster Session I, Friday 8 July 2011

Christopher O'Bryan, Chad Brooks, A. Floyd Scott

Austin Peay State University, Clarksville, TN, USA

Presence of Ranavirus in Syntopic Amphibian Larvae in West Tennessee, USA

Ranaviruses have been linked to pervasive die-offs in amphibian populations throughout the Americas, Europe, Asia, and Australia. Studies have found ranaviruses throughout the Southeast United States; however, no research has identified this pathogen in West Tennessee. It has been shown that anthropogenic induced stress is a pivotal cause of amphibian susceptibility to disease and this could exacerbate ranavirus infected amphibian mortalities. Poor water quality from cattle-access (an anthropogenic stressor) has been suggested to be linked with ranavirus infection. This study describes the presence of Frog Virus 3, an aggressively pathogenic strain of ranavirus, at cattle-access and non-access ponds from select sites in West Tennessee. Frog tissues tested were shown to contain ranavirus DNA and to be prolific in the ponds examined. These data support the notion that Frog Virus 3 could be more widespread than previously known and point to the need for developing management and conservation techniques to reduce ranavirus-derived amphibian declines.

0660 Poster Session I, Friday 8 July 2011

Katherine M. O'Donnell[1], Frank R. Thompson III[2], Raymond D. Semlitsch[1]

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Does Fire Alter Salamander Housing Options?: Potential Effects of Fire on Terrestrial Salamander Microhabitat Use

Prescribed fire and timber harvest are human-caused disturbances that can have substantial effects on forest ecosystems. Terrestrial salamanders may play an integral role in nutrient cycling and forest productivity, but might be negatively affected by disturbances that alter their microhabitat. Therefore, we investigated the effects of prescribed fire and timber harvest on terrestrial salamanders. The study occurred in the Sinkin Experimental Forest, located within the Mark Twain National Forest in the Ozark Highlands region of southeastern Missouri. The site consists of mature, fully-stocked oak-hickory stands. Twenty 5-hectare experimental plots will be burned or shelterwood-harvested in 2011-2012. We sampled two locations within each of the 20 sampling plots in the spring and fall of 2010. We conducted 3 x 3 meter area-constrained searches of natural cover objects and leaf litter, and measured (SVL) and recorded the capture location of all salamanders (*Plethodon serratus, Plethodon albagula*). We recorded 1025 captures of *P. serratus* and 18 of *P. albagula*. We found most salamanders (75%) within the leaf litter; the remaining 25% were found under natural cover objects (logs, rocks, etc.). Salamander density was positively correlated with recent rainfall events. We did

not find any significant pre-treatment differences between groups. Our results suggest that including leaf litter in area-constrained searches for terrestrial salamanders allows for a more complete understanding of their distribution among microhabitats. This sampling technique will allow us to detect changes in cover object use following prescribed fire and timber harvest and reveal the role of leaf litter loss in population persistence.

0773 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Eric O'Neill, David Weisrock

University of Kentucky, Lexington, KY, USA

Population Genomics of the North American Tiger Salamander Radiation

The genetic delimitation of recently diverged species and the reconstruction of their underlying phylogeny is likely to require and assessment of the population genetic and genealogical histories of numerous independent nuclear loci. Next generation sequencing technology provides novel opportunities for gathering genome-scale sequence data in natural populations. In this talk we will present the preliminary results of a first attempt to use the next generation methods to sequence, in parallel, ~9,000 barcoded PCR amplicons across the range of the tiger salamander species complex, a widely distributed North American clade containing many endangered and imperiled species, and likely more cryptic and undiscovered species lineages. Prior to sequencing, we screened over 250 EST loci for positive PCR from a test pool of representative individuals. From this set of loci we identified 95 that amplified across all individuals. We used standard PCR methods to amplify all 95 loci from 94 individual samples representing most of the currently described species and subspecies of the tiger salamander (*Ambystoma tigrinum*) complex. PCR amplicons from each individual were then uniquely barcoded and pooled for 454 next generation sequencing. Our preliminary work has produced over 400,000 sequence reads and a recently-completed bioinformatic pipeline to process these data into analyzable data matrices. Preliminary population structure and phylogenetic analyses indicate that these data contain considerable information about the evolutionary history of the *A. tigrinum* complex, and that these techniques are likely to become extremely useful for the rapid and large-scale sequencing and genotyping of populations for systematic research.

0687 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

Ronald G. Oldfield[1], Rayna M. Harris[2], Dean Hendrickson[2], Hans A. Hofmann[2]

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Expression of Arginine Vasotocin and V1a Receptor in the Brain is Higher in a Polygamous Fish Species than in a Closely Related Monogamous Species

The nonapeptide arginine vasopressin (AVP; including its non-mammalian homolog arginine vasotocin, AVT), and its receptor V1a, regulate social behavior across vertebrates. In monogamous prairie voles, the AVP pathway is necessary for pair-bond formation, specifically by stimulating affiliative behavior toward the mate and aggression toward non-mates. Recently we used a receptor antagonist to find that during pair bond formation a nonapeptide pathway stimulated aggression toward competitors and affiliation toward a potential mate in the monogamous convict cichlid, *Amatitlania nigrofasciata*. In the current study, we use qPCR to compare AVT and V1a gene expression in the brains of free-living reproductively active males of two closely related North American cichlid species, one of which is monogamous (*Herichthys cyanoguttatus*) and another that is polygamous/haremic (*H. minckleyi*). We found that expression of AVT and V1a are elevated in the polygamous species. This pattern appears opposite to the pattern observed in voles, but it can be explained by male *H. minckleyi* defending larger territories and pair-bonding with more females than *H. cyanoguttatus*. This study indicates that the expression of AVP/AVT is not a universal switch that 'turns on' monogamous behavior, which is consistent with other recent studies that have found cases of monogamy that are not associated with up-regulation of the AVP/V1a system. Instead, this study highlights the fact that there are many forms of monogamous and polygamous mating systems, and that the brain mechanisms that underlie each form are tied to the particular patterns of social behavior performed in a particular population.

0585 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Jennifer Olker[1], Lucinda Johnson[1], Patrick Schoff[1], Rodney Johnson[2]

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Development, Size, and Gonadal Endpoints Differ in Two Native Frog Species Exposed to Atrazine and Accelerated Pond-drying

The herbicide atrazine (2-chloro-4-ethylamino-6-isopropyl-amino-s-triazine) is one of the most widely used pesticides in the U.S. and has been shown to reduce amphibian size and health at metamorphosis and alter gonadal function, presumably through endocrine disruption. Climate change directly impacts amphibian populations through habitat loss, and could alter development through accelerated drying of their habitats, but may

also have indirect impacts through interactions with pesticides and other stressors. We evaluated the effect of environmentally relevant atrazine concentrations (0.1, 20, 200 μg/L) and interactions with pond-drying rate (normal and accelerated drawdown) on metamorphic size, development, and gonadal anomalies in two native frog species grown in outdoor mesocosms: northern leopard frog (*Rana pipiens*) and wood frog (*Rana sylvatica*). Exposure to atrazine slightly reduced survival in both species. Exposure to 200 μg/L atrazine was significantly associated with increased mortality during metamorphosis (Gosner stage 42-46) in *R. sylvatica*. This highest atrazine concentration also significantly altered development. In *R. sylvatica*, initiation and completion of metamorphosis was delayed and metamorphic size was reduced. In *R. pipiens*, significantly fewer tadpoles initiated and completed metamorphosis; however development time and metamorphic size did not differ in those that reached metamorphosis. Drawdown rate did not independently affect growth or development, but in *R. sylvatica* interacted with atrazine concentration to alter metamorphic size. Testicular oocytes (TOs) were found in both species, with no relationship between atrazine concentration and proportion of individuals with TOs. By altering amphibian growth and development, atrazine may contribute to amphibian declines through reduced survival and reproductive capabilities.

0676 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Lance Olsen, Todd Crail, Jonathan Bossenbroek

University of Toledo, Toledo, OH, USA

Quantifying the Habitat Utilization of Darters in the Central Great Lakes Region

Darters are a group of North American fishes that includes both common species that live in many rivers and several species that are considered imperiled. The goal of this research is to quantify habitat utilization patterns of riffle-dwelling *Etheostoma* darters in the Central Great Lakes Region. The specific objectives of this study are (1) to determine if darters are partitioning riffles, and if so, what environmental variables being partitioned, and (2) determine if darters partition the environmental variables in the same manner across the landscape. To address these objectives, we sampled seven riffles in six rivers in Ohio (Grand River, Ashtabula River, and Conneaut Creek) and Michigan (Chippewa River, Mill Creek, and the River Raisin). In each riffle, between 25 & 100 samples were collected using a kick-seining method. Each darter was measured and identified to species. Local habitat variables including depth, flow, and percent substrate composition were measured after each seine sample. A GIS was used to compile data from our local study and paired with additional locality data from agency and academic site databases across Ohio and Michigan. This allowed us to analyze patterns of use at the regional scale such as river size, slope, drainage accumulation and bedrock type/age. The four *Etheostoma* species observed in our surveys were: *E. blenniodies*, *E. nigrum*, *E. caeruleum*, and *E. flabellare*. Results suggest a realtionship

between darter species and the habitat variables, with each species exhibiting preferential habitat selection in the presence of congeners.

0205 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Sarah A. Orlofske, Robert C. Jadin, Amanda V. Johnson, Pieter T.J. Johnson

University of Colorado at Boulder, Boulder, CO, USA

Dispersal Barriers and Phylogeographic Patterns of the Pacific Chorus Frogs (Hylidae: *Pseudacris regilla*)

Pacific chorus frogs (*Pseudacris regilla*) are a species complex that spans the west coast of North America from British Columbia, Canada, to Baja California, Mexico. Historically, across this range, the species was considered to include up to seven subspecies. More recently, the complex has been divided into 3 distinct species: *P. regilla*, *P. pacifica*, and *P. hypochondriaca*. However, previous studies lacked sampling at species boundaries for *P. pacifica* and *P. regilla*. Therefore, additional sampling is needed to delimit possible contact zones and to investigate barriers to dispersal and historical biogeography. During the summer of 2010, we obtained tissues of *P. regilla* from 48 sites across California, Oregon, Washington, and Montana. We conducted a molecular phylogenetic analysis of the *P. regilla* complex throughout the range, including new sampling across previously identified lineage breaks and species range limits of several co-distributed taxa. We used 12S-16S and cyt b mitochondrial gene fragments in order to compare our phylogeny of the *P. regilla* complex to other species in the genus *Pseudacris* and to incorporate divergence dating methods. Our analysis filled in several distributional gaps in sampling from previous studies, allowing us to better distinguish species boundaries. We found that populations from western Montana and Idaho belong to the species *P. regilla*, and that these populations result from recently dispersing *P. regilla* from the southwest, rather than from *P. pacifica* populations directly to the west. This study contributes to a better understanding of dispersal barriers for amphibians and phylogeographic patterns across the Pacific Coast.

0712 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Clint Otto, Gary Roloff

Michigan State University, East Lansing, MI, USA

Coarse Woody Debris Surveys Reveal Sampling Disturbance Effects and Seasonal Occupancy Differences of Red-backed Salamanders

Coarse Woody Debris (CWD) surveys are a standard, but potentially invasive technique for sampling terrestrial salamanders. We used dynamic occupancy models to

investigate two sources of potential bias in CWD transect surveys for red-backed salamanders (*Plethodon cinereus*): 1) seasonal differences in occupancy estimates, presumably due to salamanders emigrating from natural cover objects later in the summer and 2) repeated CWD survey disturbances being associated with local turnover of salamanders within and between primary sampling periods. Initial occupancy estimates of red-backed salamanders were higher for transects initially surveyed in May (ψ_{May} = 0.59; 95% CI: 0.43 − 0.73) than those initially surveyed in June (ψ_{June}= 0.52; 0.40 − 0.64), or July (ψ_{July}= 0.42; 0.27 − 0.60); however 95% CIs overlapped. Between each primary sampling period, the probability that an occupied site went locally extinct was 0.16 (95% CI; 0.07 - 0.31). The beta parameter for our sampling disturbance covariate overlapped zero ($\beta_{Disturbance}$ = -0.04; -0.10 – 0.02), suggesting repeated CWD surveys did not decrease salamander occupancy across primary periods. Within each primary period, however, we observed evidence of a disturbance effect on salamander detectability during the second sampling event, presumably due to temporary salamander emigration (p_{1st} = 0.31; 0.23 – 0.41, p_{2nd} = 0.22; 0.16 – 0.29). We provide multiple solutions, within design- and model-based frameworks, for minimizing bias associated with seasonal changes in occupancy and repeated sampling disturbances.

0355 Poster Session III, Sunday 10 July 2011

Patrick Owen, Christopher Brown

University of Cincinnati, Cincinnati, OH, USA

Relative Response Levels to Visual and Acoustic Stimuli in Territorial Male Green Frogs, *Lithobates* (*Rana*) *clamitans*

Acoustic information (the calls of neighbors and intruders) seems to be of primary importance in advertisement and territorial defense, at least in most North American frogs. It is becoming increasingly clear that many species of frogs also use visual information to mediate encounters. The green frog, *Lithobates* (*Rana*) *clamitans*, is a species that has been well studied in terms of how territorial males acoustically respond to the calls of other males. However, males of this species also exhibit behaviors that add a visual dimension to their advertisement and aggressive displays. This study refines a previous series of experiments on the close-range territorial encounters of green frogs by adding an acoustic-only stimulus, allowing the determination of relative response levels to visual and acoustic stimuli. We demonstrate that visual stimuli could be important in territorial signaling under ambient light conditions at night. Supporting previous work, the present study indicates that responses directed at visual stimuli are relatively stronger than responses directed at acoustic stimuli, but that acoustic stimuli are more likely to trigger an aggressive response.

0411 Fish Ecology I, Symphony I & II, Friday 8 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY AWARD

Hannah Owens

University of Kansas, Lawrence, KS, USA

Climate Change and the Distributions of Atlantic Fishes: A Correlative Ecological Niche Modeling Approach

Commercially fished species with distributions in the North Atlantic Ocean, such as Atlantic cod (*Gadus morhua*), play key roles not only within their ecosystems, but also as important economic resources. Climate models suggest that the North Atlantic is likely to see dramatic climate changes in coming decades. First indications of shifts in geographic distributions of cods and other fishes have already been observed in the North Atlantic, including northward shifts of some populations and precipitous declines in others. It is hypothesized that these range shifts may alter not only community composition, but also the availability of these species as resources within the current fisheries management framework. Correlative algorithms (GARP and Maxent) were used to generate ecological niche models for multiple species with distributions in the North Atlantic Ocean, including Atlantic cod, Atlantic halibut (*Hippoglossus hippoglossus*), Atlantc herring (*Clupea harengus*), and haddock (*Melanogrammus aeglefinus*). These models were projected into several future climate change scenarios to investigate possible effects of climate change on species' ranges and fish community composition. This information has the potential to inform strategies for future fisheries management regarding necessary adaptations to changing climates.

0713 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011

Diego Páez-Moscoso, Juan Manuel Guayasamin

Pontificia Universidad Católica del Ecuador, Quito, Pichincha, Ecuador

Diversity and Speciation Patterns in the Andean Genus *Osornophryne* (Anura: Bufonidae)

Using the Andean toad genus *Osornophryne* as a study taxon, we address the following questions: (1) How many evolutionary species are within *Osornophryne*? (2) Are molecular and morphological datasets congruent when delimiting species? (3) Which morphological traits are the most variable among species? (4) Is speciation driven by ecological or non-ecological processes? and (5) What biogeographic model better explains the observed speciation pattern? To evaluate species limits, we performed molecular analyzes (2 mitochondrial and 2 nuclear genes), morphometric analyses (12 variables; 183 individuals), and niche comparison (14 ecological variables; 28 unique localities). The inferred phylogeny is mostly congruent with the morphological data, supporting the reality of most of the recognized species in *Osornophryne*; however, the genetic analysis revels the presence of an undescribed taxon. The most morphological

divergent characteristics are limbs and head, traits that might be associated with the habits of the species (terrestrial or arboreal). In relation to patterns of speciation, evidence suggests that there are no major ecological differences in closely related species; nevertheless, different ecological requirements were found in the two main *Osornophryne* clades (forest species and paramo species). We conclude that the most consistent model of diversification in *Osornophryne* is an allopatric model without ecological change, but the first event of cladogenesis seems to have been accompanied by an ecological shift.

0203 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Erin (Misty) Paig-Tran, Adam Summers

U. of Washington, Seattle, WA, USA

Doing it Their Way: Exploring the Filter Morphology and Filtration Mechanisms in Mobulidae

Filter feeding has evolved independently four separate times in three lineages of cartilaginous fishes (Lamiformes: *Megachasma* and *Cetorhinus*, Orectolobiformes: *Rhincodon*, and Mobulidae: *Manta* and *Mobula*). Each lineage has morphologically distinct filtering structures and presumably very different mechanisms for removing food particles from the water. Recent work has posited engulfment (Nakaya et al. 2007) and cross flow filtration (Motta et al. 2010) as dominant modes in mega mouth shark and whale shark, respectively. The structure of *Manta* and *Mobula* filtering pads are quite different and we suppose a different mechanism may be in use. In the rays, the filter pads are chevron shaped structures composed of many rows of filtering lobes located on both anterior and posterior edges of the gill filaments, facing toward the incoming flow of water and also toward the posterior buccal cavity. We used scanning electron microscopy to examine the filtering pads of *Manta birostris*, *Mobula tarapacana*, and *Mobula thurstoni* and have found evidence that the surfaces of the lobes are covered with a blanket of cilia, which likely serve as a surface for capturing and transporting particles by hydrosol filtration. Using histology, we identified mucus secreting cells on the distal edge of the epithelium, presumably to provide a sticky coating for capturing food particles and for transferring to the esophagus. Finally, we identified the presence of denticles along the leading edge of the lobes which may serve a protective layer by intercepting large, fast-moving particles.

0133 Poster Session III, Sunday 10 July 2011

Daniel J. Paluh, Christopher A. Sheil

John Carroll University, University Heights, OH, USA

Anatomy of the Fully Formed Chondrocranium of *Emydura subglobosa* (Chelidae), a Pleurodiran Turtle

The chondrocranium is a cartilaginous structure that forms around and protects the brain and sensory organs of the head. Through ontogeny, the chondrocranium may become more elaborate, remodeled and reabsorbed, and/or ossified. Though considerable attention has been given to the formation of the chondrocranium, and a great amount of data has been gathered on the development of this structure among many craniate groups, the anatomy of this structure in turtles often is neglected. We describe the mature chondrocranium of the pleurodiran turtle, *Emydura subglobosa* (Chelidae). Formation and ossification of skeletal elements has been studied in this species (Werneburg et al., 2009); however, a detailed description of this pleurodiran turtle has not been presented. We compare the chondrocranium of this species to those of previously-described cryptodiran turtles (*Apalone spinifera, Pelodiscus sinensis, Chelydra serpentina, Macrochelys temminckii, Trachemys scripta, Chrysemys picta,* and *Eretmochelys imbricata*) to identify possible differences in anatomy observed among these taxa. Anatomy of the chondrocranium was described by examination of cleared and double-stained specimens.

0474 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Michael Pappas[1], Justin Congdon[1], Bruce Brecke[1]

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Tactics of Nesting and Patterns of Hatchling Orientation in 8 species of Backwater Wetland and River Turtles during Nest Dispersal in an Upper Mississippi River Floodplain

The Weaver Bottoms and adjacent Weaver Dunes of the Upper Mississippi River supports one of the most diverse chelonian communities in the northern U.S. representing 8 species of turtles (*Apalone spp.*, *Chelydra, Chrysemys*, *Graptemys spp.,* and *Emydoidea*). We examined the orientation problems presented to naïve hatchlings during initial dispersal from experimental nests in large (~ 90 m diameter) circular arenas in natural nesting habitat near Weaver Bottoms. Hatchlings' of Blanding's turtles oriented toward far dark horizons and Map turtles toward near dark horizons; whereas, hatchling Snapping, Painted, and Softshell turtles primarily orient and disperse toward near open and highly illuminated horizons. Orientation by naïve hatchlings was almost always non-random and primarily based on visual cues. We found no evidence that geotaxis, olfaction or humidity were important environmental cues during initial dispersal of hatchlings. Naïve hatchlings in some situations were unexpectedly

influenced by the time of day during dispersal. We examined among species patterns for evidence that nest site selection by females and orientation and dispersal of hatchlings are co-evolved. Selection of nest sites by females and orientation cues presented to dispersing hatchlings seeking recruitment habitats may be compromised by the current and historic alteration of the nesting dunes (agriculture, silviculture, fire suppression) and river habitats (dams, channel maintenance, sedimentation, wind fetch and recreational use).

0412 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Sebastian Pardo[1], Andrew Cooper[2], Nicholas Dulvy[1]

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Does it Fit? Choice of Growth Model can Bias Vulnerability Estimates in Sharks

Growth is an intrinsic ability of living organisms, and is of particular importance in marine systems where an individual's size can increase numerous orders of magnitude during their lifetime, and determines the niche they occupy in the ecosystem. Quantifying growth rates allows the calculation of parameters which are important in demographic modelling and for assessing the vulnerability of a species to extinction. In elasmobranchs, the von Bertalanffy growth function (VBGF) is commonly used as it provides biologically meaningful parameters, such as asymptotic size (Loo) and growth rate (k). A variant of the VBGF has been recommended for use in elasmobranchs; fixing the size at age-0 (L0) to an empirical estimate of size at birth. Using simulation modelling we demonstrate that this does not improve model fit but in fact biases growth parameters, resulting in the underestimation of vulnerability. Incorporating variability in L0 also biases results. The assumption that the L0 parameter from the VBGF is equal to actual size as birth is erroneous, with the former usually being ~15% lower than the latter; an analogous difference between asymptotic size and observed maximum length. The limitations of certain growth functions need to be taken into account as well as the difference between model parameters and life history traits in order to accurately predict demography and vulnerability of a species.

0016 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

Lynne Parenti[1], Renny Hadiaty[2], Daniel Lumbantobing[3]

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Discovery and Description of an Endemic Freshwater Fish Biota in Southeastern Sulawesi, Indonesia

The ricefish *Oryzias woworae* (Beloniformes: Adrianichthyidae) was discovered on Muna Island, Sulawesi Tenggara (Southeastern Sulawesi), in 2007 and described in 2010. Prior to 2007, scientific collection of freshwater fishes in Sulawesi was limited largely to Sulawesi Selatan (Southern Sulawesi) and Sulawesi Tengah (Central Sulawesi). The discovery was notable for several reasons: ricefishes had not been reported previously from the geologically distinct Sulawesi Tenggara; the new species was abundant; and, it was distinguished by a distinctive blue and red color pattern in both sexes. It prompted a joint field trip by US and Indonesian ichthyologists to Sulawesi Tenggara, June 2010, to collect freshwater and coastal fishes. Comparative morphology and molecular sequence data were used to recognize species-level taxa. We report at least five *Oryzias* from Sulawesi Tenggara: 1) *O. woworae*; 2) a golden species compared to *O. woworae,* 3) a short-bodied species compared to *O. woworae,* 4) *O. celebensis,* and 5) a species compared to *O. javanicus.* The species do not form a monophyletic group; following a monographic revision of ricefishes, they represent at least two ricefish lineages. Other endemic fishes in the biota include species of the halfbeak *Nomorhamphus* and the gobiid *Mugilogobius*. Continued exploration throughout Sulawesi is needed to confirm the natural distribution of known species and identify and describe new species. Endemic species are ideal icons to draw attention to the endemic freshwater fish fauna of Sulawesi and encourage its conservation and its pivotal role in understanding the history of the biota of the Indo-Australian Archipelago.

0778 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Scott L. Parker[1], Martha Patricia Ramírez-Pinilla[2], Joanna Biazik[3,4], Christopher R. Murphy[3], Michael B. Thompson[4]

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Influence of the progesterone receptor antagonist mifepristone on uterine blood vessel development and epithelial surface morphology in viviparous Australian skinks

Structural and functional changes to the uterus associated with maintenance of pregnancy are controlled primarily by steroid hormones such as progesterone. We tested the hypothesis that progesterone regulates uterine surface morphology and blood vessel development during pregnancy in the viviparous skinks, *Pseudemoia entrecasteauxii* and *Niveoscincus coventryi*, by treating females with the progesterone receptor antagonist mifepristone at different stages of pregnancy. Mifepristone treatment resulted in altered uterine epithelial cell surface morphology and high embryo mortality in pregnant females of *P. entrecasteauxii* with recently ovulated embryos, but did not affect females at mid and late stages of pregnancy. Females treated with mifepristone at very early stages of pregnancy exhibited increased cellular blebbing and presence of wide gaps between epithelial cells. In *P. entrecasteauxii*, mifepristone may prevent successful embryo attachment in early pregnancy through its effects on uterine epithelial cells but may have little effect on pregnancy once maternal-embryo interaction is established. In contrast, there was no apparent effect of mifepristone treatment on uterine surface morphology or blood vessel proliferation in pregnant females of *N. coventryi* at any stage of pregnancy. Both species exhibited distinct regionalization of uterine ridges and in the shape of uterine epithelial cells which may relate to the function of both chorioallantoic and yolk sac placentae during gestation. Differences in progesterone receptor amino acid sequence in *P. entrecasteauxii* and *N. coventryi* may account for the differences in response to mifepristone treatment observed between the two species.

0038 Poster Session II, Saturday 9 July 2011

James Paterson[1], Brad Steinberg[2], Jacqueline Litzgus[1]

[1]Laurentian University, Sudbury, ON, Canada, [2]Algonquin Park, Whitney, ON, Canada

Not Just Any Old Pile of Dirt: Evaluating the Use of Artificial Nesting Mounds for Turtles

The viability of a turtle population is largely dependent on the survivorship of reproducing females. However, road mortality that occurs as females move to terrestrial nesting sites is decimating many freshwater turtle populations via direct mortality and lowered recruitment. One possible solution is to install artificial nesting mounds that may increase recruitment and decrease the risk of mortality for gravid females by enticing them to nest closer to aquatic habitats. Before the widespread implementation of this conservation tool, incubation conditions and nest success at artificial nesting mounds should be compared to natural nests. We installed four artificial nesting mounds in Algonquin Provincial Park, ON, and transplanted clutches of Painted Turtle (*Chrysemys picta*) and Snapping Turtle (*Chelydra serpentina*) eggs from natural nests to these mounds. Hatching success was significantly higher in nests transplanted to artificial mounds than in natural nests for Snapping Turtles, despite no differences in heat units, moisture, or canopy cover between treatment groups. Painted Turtle clutches had very high hatching success and both treatment groups experienced similar hatching success and incubation conditions. Hatchlings of both species emerging from artificial nesting mounds had similar body conditions and deformity rates compared to hatchlings from natural nests. High hatching success, low deformity rates, and healthy hatchlings emerging from artificial nesting mounds suggest promise for the use of these sites as conservation tools. However, low rates of mound use by females at our study site suggest that future studies should identify spatial attributes to increase encounters with artificial nesting mounds.

0039 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

James Paterson[1], Brad Steinberg[2], Jacqueline Litzgus[1]

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Generally Specialized or Especially General? Habitat selection by Snapping Turtles (*Chelydra serpentina*)

Central to our understanding of animal ecology is habitat use and resource selection. By comparing habitat use to availability, preferences for specific habitats may become evident, and this information is important for creating management plans for species at risk. While most studies of habitat selection have focused on specialists, very few have considered selection in species that are generalists. We tested for habitat selection in a supposed generalist, the Snapping Turtle (*Chelydra serpentina*) in Algonquin Provincial Park, Ontario. Radio telemetry was used to follow adult turtles (n = 22) during 2009 and

2010. We tested for habitat selection at two spatial scales during the active season (selection of a home range from the population range, and selection of habitat from within the home range) by comparing random points to turtle home ranges and individual locations. Although turtle home ranges were significantly closer to several wetland types than random points, there was no difference in preference among aquatic habitats. We compared habitat composition in individual home ranges to the composition of the population range to test for individual specialization in habitat selection. Over half of the individuals showed evidence of specialization on different habitats, and this causes the population to be portrayed as a habitat generalist. Although capable of living in a wide range of aquatic habitats, certain characteristics such as nesting sites and hibernacula may represent limiting resources in populations. These findings have implications for the evolution of resource generalists in freshwater communities and the conservation of this species.

0554 Poster Session I, Friday 8 July 2011

Crystal D. Paulson, Robert J. Visalli, Mark A. Jordan

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

Mexican Axolotls (*Ambystoma mexicanum*) Appear to be Resistant to *Ambystoma tigrinum* Virus

Disease outbreaks are linked to declines in amphibians. Among the best characterized examples of this phenomonon is the infection of wild tiger salamanders (*Ambystoma tigrinum* spp.) by the ranaviral pathogen *Ambsytoma tigrinum* virus (ATV). Relatively little is understood of how tiger salamanders mount an immunological response to infection. The goal of this study was to test the effects of ATV infection on laboratory reared Mexican Axolotls (*A. mexicanum*), a close relative of the tiger salamander that is a likely candidate for the development of an infection model in ambystomatids. Four groups of 20 axolotl larvae each were infected with increasing doses of virus ranging from 10^1 to 10^4 plaque forming units, and compared to a control group with no exposure over a 40 day period. Before and after the experiment, all larvae were measured and weighed. Whole body tissues were collected to screen individuals for infection using PCR to detect viral DNA. We surprisingly found a high survival rate across viral titers. Of the 23 axolotls that tested positive for the virus, 15 survived the experimental period. Larvae from infected groups grew less in length but more in mass, relative to those not exposed to the virus. The data suggests that axolotls can be infected with ATV and demonstrate sub-lethal responses to infection, but may also clear the infection and survive with persistent infection more often than wild congeners.

0603 Fish Ecology I, Symphony I & II, Friday 8 July 2011

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Applicability of the Flood-Pulse paradigm to largemouth bass *Micropterus salmoides* in the highly regulated Arkansas River

Modern-day large river systems are frequently characterized by regulated flows, leveed floodplains, and potential temperature-flow asynchronies. Thus, expected relationships between fishes and hydrology as hypothesized under the Flood-Pulse Concept may be weak or non-existent. Relationships between river hydrology and fish growth have not been widely studied, with the few studies done produce mixed results. Using the Arkansas River, Arkansas as a study area, annual growth increments were generated via backcalculated length at age data from largemouth bass collected during 2004, 2005, and 2010 (n=2,192). Between these sampling intervals, the Arkansas River experienced three consecutive years (2007-2009) with long durations of elevated flows. When examining age-1 through age-6 cohorts from 2004 and 2005 (n=1,715), largemouth bass growth increments were positively correlated with growth years (March through February) containing longer durations of lower flows (<15,000 ft^3/s). Conversely, largemouth bass growth increments were negatively correlated with growth years containing sustained periods of higher flows (>50,000 ft^3/s). Two-way ANOVA analyses containing backcalculated age and growth year classification (i.e., high, medium, and low flows) as main effects also suggested significant ($P<0.05$) hydrologic effects on growth. Significant ($P<0.05$) interaction between backcalculated age and growth year classifications further suggested that flow affected growth differently across ages, with more pronounced effects observed with age 1-3 cohorts. Results presented here suggest high-flow events that are typically beneficial to largemouth bass populations in large river-floodplain systems may be dampened or non-existent in more highly regulated, impounded river systems such as the Arkansas River.

0731 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

Joseph Pechmann[1], Jeremy Hyman[1], Robert Warren[2], Kenneth Kozak[3], R. Haven Wiley[4]

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Trends in a *Plethodon* Hybrid Zone Along an Elevational Gradient in the Southern Appalachians from 1976-2010

We and Nelson Hairston, Sr. studied a hybrid zone between *Plethodon shermani*, a high-elevation species, and *P. teyahalee*, a low-elevation species, in the Nantahala Mountains of NC from 1976-2010. *Plethodon shermani* is characterized by red legs, *P. teyahalee* by white spots, and hybrids by intermediate phenotypes. We scored the amount of red and the amount of white spotting separately on a scale of 0-3 for approximately 20 *Plethodon* along an altitudinal gradient at 686, 777, 869, 960, and 1052 m annually during September. Subtracting the white score from the red score provided a phenotype index. The average amount of white spotting relative to red legs increased at the highest elevation whereas the reverse occurred at the lowest elevation over time, indicating expansion of the hybrid zone. Generalized least squares with autoregressive error identified significant relationships between the phenotype index and the cool season North Atlantic Oscillation index (NAO). There was a significant positive relationship with no lag at low elevations and a significant negative relationship with a 2-3 year lag at high elevations. At low elevations, more red/less white was found in years with warm wet winters; the lack of lag suggests this signal reflects different activity patterns of different phenotypes. At high elevations there was more white/less red 2-3 years after warm wet winters; the lag likely indicates a population shift. These observations suggest that the expansion of the hybrid zone is influenced by climatic changes.

0485 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Iva Peklova[1], Aaron Fisk[1], Nigel Hussey[1], Kevin Hedges[2]

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Depth and Temperature Preferences of Arctic Skate (*Amblyraja hyperborea*) and Greenland Halibut (*Reinhardtius hippoglossoides*) in a Deep Water Arctic Marine Ecosystem

Animal movement plays a key role in determining the spatial, demographic and genetic structure of populations, and ultimately underpins species management. Quantifying movements can reveal behavioral patterns that provide insight into habitat preferences and responses of animals to environmental or human-induced changes. Given concerns

about climate changes and exploitation of arctic marine resources, it is critical to expand our knowledge of the movements of largely unstudied deep-water arctic fishes. To address this knowledge-gap, we employed satellite telemetry in two arctic marine species, Arctic Skate (*Amblyraja hyperborea*) and Greenland Halibut (*Reinhardtius hippoglossoides*) in Cumberland Sound, Nunavut, Canada. MiniPAT tags were attached to fish for 70, 100 and 300 days and recorded depth and temperature at 150, 300 and 600 second intervals, respectively. Data obtained between August and November 2010 (70 and 100 day deployments) showed the mean water temperature encountered was 2.1 ± 0.007 °C for skates and 2.4 ± 0.001 °C for halibut. In general, skates showed higher vertical activity levels and traversed a larger depth range (400-1400 m) than halibut (800-1400 m). Skates moved repeatedly across the Sound between deep and shallow waters. Halibut remained in deep water pockets for the entire period and mean distance traveled between tagging and pop-off locations (11.5 ± 4.6 km) was shorter than in skate (30.1 km). Depth and temperature profiles provide evidence for overlapping habitats but also suggest differences in activity levels and behavioral patterns in these two species. These data will contribute to regional species-specific management plans.

0195 Invasive Species, Symphony I & II, Sunday 10 July 2011

Gad Perry[1], Robert Powell[2], Robert Henderson[3], Michael Farmer[1], Michel Breuil[4], Arthur Echternacht[5], Gerard van Buurt[6], Christina Romagosa[7]

[1]Texas Tech University, TX, USA, [2]Avila University, KS, USA, [3]Milwaukee Public Museum, WI, USA, [4]Muséum national d'Histoire naturelle, Paris, France, [5]University of Tennessee, TN, USA, [6]None, Curaçao, Netherlands Antilles, [7]Auburn University, AL, USA

Introduced Amphibians and Reptiles in the Greater Caribbean: Patterns and Conservation Implications

Non-native species, including amphibians and reptiles, are often second only to habitat destruction and alteration as a cause of extirpations and extinctions. We documented the arrival and establishment of alien herpetofauna in the greater Caribbean region. These include 130 species (25 amphibians and 105 reptiles) responsible for 364 individual introductions, of which 70.3% resulted in populations established for at least a short period, often in urban settings. The impact of those 256 established populations ranges from minimal to severe. Intentional introductions for pest control and food are factors in some (primarily historical) instances, but the primary pathways for introductions today are inadvertent. Nearly all are associated with either the pet trade or stowaways in cargo and ornamental plants. We review the surprisingly large numbers of documented individuals exported from the Caribbean into the United States (US) and from the US to the Caribbean. The extent of such trade and the rates of non-native arrivals continue to increase, and both are related to indices of regional economic activity. Because prevention is far better - and more economical - than eradication of an established alien, we recommend increased scrutiny of transported goods and animals to and from the islands. An integrated policy response is clearly necessary to address this regional issue.

Although the region is highly fragmented, we urge an increased regional cooperation for fighting invasive species in general and invasive herpetofauna in particular. Precedents for such cooperation include the Caribbean Community and Common Market and the Caribbean Cooperation in Health initiative.

0722 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Beth Pettitt[1], Mark Bee[1], Godfrey Bourne[2]

[1]*University of Minnesota, St Paul, MN, USA,* [2]*University of Missouri – St. Louis, St. Louis, MO, USA*

Oviposition and Tadpole-rearing Site Selection of a Phytotelm-breeding Frog, *Anomaloglossus beebei*

For many organisms, selection of suitable breeding habitat is essential for successful reproduction. Species that care for offspring at separate breeding sites during different developmental stages have the added task of selecting different sites for offspring with unique requirements for survival and growth. Such a situation occurs with the phytotelm-breeding frog, *Anomaloglossus beebei*, where tadpole-rearing sites are spatially separated from oviposition sites. We investigated abiotic and biotic factors at both types of sites to (i) examine the impact these factors have on hatching success at oviposition sites and (ii) to compare these factors between oviposition and tadpole-rearing sites. We visited 60 oviposition and 29 tadpole-rearing sites in May -July 2009 in Kaieteur National Park, Guyana. During daily visits we documented the presence of predators, egg survival and hatching rates as well as water temperature, water volume, dissolved oxygen, bromeliad size, leaf height, and leaf angle. Results showed that dissolved oxygen concentrations and the presence of predators were related to hatching success at oviposition sites. Specifically, egg clutches with one or more hatched larva were found in phytotelm with higher dissolved oxygen concentrations, while egg clutches in phytotelm containing predators were more likely to have one or more eggs depredated. Further, tadpole-rearing sites were more often found in phytotelm with greater water volumes and in leaves at greater angles (i.e., closer to the center of the bromeliad) compared to oviposition sites. We discuss how these findings relate to the specific requirements of eggs and tadpoles.

0094 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Angela Picco[1]

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Amphibian Commerce and the Threat of Pathogen Pollution

The global trade of amphibians has the potential to spread diseases into new areas and contribute to amphibian die-offs and declines around the world - a phenomenon known as pathogen pollution. Amphibians are widely traded as pets, food, bait, and for biomedical and research purposes. Recent studies show that ranaviruses, a group of ectothermic vertebrate pathogens, affect a variety of hosts and are common in the global amphibian trade. Studies in North America indicate that pathogen pollution is likely occurring with the translocation of larval tiger salamanders (*Ambystoma tigrinum*) used in the fishing bait industry and the sale of market bullfrogs (*Rana catesbeiana*) for human consumption. Further, strains from bait shops and ranaculture facilities may be more pathogenic than wild strains. What we do not know is the likelihood that ranaviruses are transmitted from trade to amphibians in the wild, how trade is responsible for the spread of diseases into new areas, what effects released pathogens may have on native populations, how pathogen pollution contributes to amphibian declines around the world, and what the most effective approaches are for curbing the spread of ranaviral disease into new areas. Future research on these topics is needed to help address this risk of pathogen pollution to native amphibians and to formulate intervention strategies.

0563 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Melissa Pilgrim[1], Terence Farrell[2], Peter May[2], Marcus Vollman[2], Richard Seigel[3]

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Secondary Sex Ratios in Six Snake Species

Sex ratios at birth or hatching in snake populations are often assumed to be 1:1 in agreement with Fisherian Theory. This hypothesis has rarely been tested in snake populations and recent theoretical efforts indicate that individual females may deviate from sex ratio equality due to a diversity of factors, including selective pressures associated with maternal condition, differential pre-partum mortality, and parthenogenesis. We evaluated secondary sex ratios (SSRs) in two viperids (*Sistrurus catenatus* and *S. miliarius*) and four natricine colubrids (*Nerodia rhombifer, Thamnophis proximus, T. radix and T. sirtalis*). We captured 274 gravid females that produced 2443 living offspring. Population-level SSRs in our focal species did not differ significantly from 1:1. In addition, variation in individual litter SSRs conformed to expectations generated by the binomial distribution with an even sex ratio. In our study, each species showed individual variation in SSRs. However, the majority of variation in litter SSRs was not explained by variation in the maternal characteristics we examined. The three

exceptions were a very strong negative association between mean offspring mass and litter SSR in *T. radix* (r^2=0.96), a strong positive association between mean offspring mass and litter sex ratio in *T. proximus* (r^2=0.40), and a strong positive association between maternal condition and litter SSR in *T. proximus* (r^2=0.40). Whether or not these relationships have functional or adaptive significance warrants further study. The significance of our results within the conceptual framework of vertebrate sex allocation will be discussed.

0200 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

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Evolutionary Diversification of Shape Disparity in New World Silversides (Atherinopsidae)

Investigating patterns of morphological diversity can offer important insight into an organism's evolutionary history. Silverside fishes (Tribe Menidiini) have diversified in numerous lakes on the Central Mexican Plateau and in many ways, display similar patterns of diversification as have other aquatic taxa. *Chirostoma* is the most ecologically and morphologically diverse group in the tribe. Previously we showed the group displays replicated patterns of generalist to specialist mode of trophic evolution among inland lakes in Central Mexico. This replicated pattern and large degree of morphological variation, allow for the investigation of morphological disparity, the variability in shape or form, among the lakes, genera, and clades of silverside. We took a comparative approach to examine disparity within the Tribe Menidiini by incorporating geometric morphometrics, a fossil-calibrated multilocus phylogeny, and diversification analyses to make several phylogenetic and ecological comparisons. Lake Chapala silversides were found to possess the largest degree of disparity in shape compared to all other groups and lakes. Silversides from Lake Patzcuaro were the second most disparate group, followed by other genera, *Menidia*, and *Poblana*, respectively. The results suggest that morphological disparity is greatest in freshwater species in the Central Mexican Lakes and may be the result of niche expansion into the depauperate lakes of the region.

0194 Poster Session III, Sunday 10 July 2011

Maribel Piñon[1], Jessica Maciel[1], David Zaragoza[3], Aaron Reedy[3], Andrew Durso[2], Timothy Mitchell[1], Daniel Warner[1], Fredric Janzen[1]

[1]Iowa State University, Ames, IA, USA, [2]Eastern Illinois University, Charleston, IL, USA, [3]Kelly High School, Chicago, IL, USA

Microhabitat Use by Hognose Snakes with Respect to Vegetation and Temperature within a Sand Prairie Landscape

Most animals have very specific resource requirements. For reptiles, these requirements often involve suitable microhabitats for efficient thermoregulation, but many studies that quantify habitat use tend to focus at much larger scales (i.e., geographic range and landscape). To better understand how reptiles use their habitat, researchers must measure microhabitat selection at a finer resolution. To address this issue, we studied microhabitat use by western hognose snakes (*Heterodon nasicus*) in a sand prairie in northwest Illinois. At our study site, we established four 30x30 meter plots, subdivided into 2x2 meter quadrats. Each quadrat was thoroughly searched for *H. nasicus* twice daily for a 10-day period in summer and a 2-day period in fall. Detailed thermal measurements were taken throughout each plot, and cloacal temperatures were taken for each snake immediately after capture. At this fine resolution, patterns of habitat use varied with time of day and showed strong associations with the plant *Tephrosia virginiana*. Many snakes were captured in leaf litter under this plant, presumably because of the relatively constant thermal conditions in this specific micro-environment. Body temperatures of individual snakes were also associated with microhabitat use. Due to seasonal changes in the abundance of *T. virginiana* at our site, it is likely that *H. nasicus* shifts habitat use during other times of the year. Given the threatened status of *H. nasicus* in Illinois, information on fine-scale microhabitat use will be useful for conservation efforts.

0607 Poster Session III, Sunday 10 July 2011

Shannon Pittman, Grant Connette, Raymond Semlitsch

University of Missouri-Columbia, Columbia, MO, USA

Identifying Optimal Natal Dispersal Behavior of Spotted Salamanders (*Ambystoma maculatum*) in Modified Landscapes Using Individual-based Modeling

Empirical work has shown that juvenile pond-breeding salamanders exhibit considerable variation in natal dispersal behaviors such as speed of movement, path linearity, and settlement propensity. Habitat alteration and landscape change may alter the benefits associated with different dispersal strategies. Using individual-based simulation techniques, we built a movement model of initial natal dispersal in juvenile salamanders using empirical data from spotted salamanders to parameterize movement

tendencies. We investigated the consequences of behavioral decisions in differing habitat modification scenarios by altering size of buffer zones, distance to forest habitat, and microhabitat density. We found that some movement strategies were optimal under different habitat modification scenarios. We discuss the implications of our simulations for pond breeding salamander population persistence in modified landscape and the usefulness of this modeling approach for determining conservation strategies.

0604 Herp Behavior, Symphony I & II, Monday 11 July 2011

Shannon Pittman, Raymond Semlitsch

Univesity of Missouri-Columbia, Columbia, MO, USA

Fine-scale Movement Behavior of Recently-metamorphosed Spotted Salamanders (*Ambystoma maculatum*)

Pond breeding amphibian populations are highly susceptible to changes in habitat quality, but little is known regarding the individual behaviors affecting population-level processes. Natal dispersal is an important but extremely risky stage in the life of recently-metamorphosed amphibians; behaviors at this life stage have a substantial impact on future survival. We investigated fine-scale movement decisions of recently-metamorphosed spotted salamanders released in a harsh grassland environment different distances from a forest edge. We combined powder-tracking with drift fence mark-recapture to investigate both short and long-term movement decisions following release. Individuals were released in grassland habitat 5, 10, 20, and 35 meters from a forest edge. Drift fences were placed along the forest edge. We released a total of 388 salamanders the summer of 2010 and recaptured 107 in the forest fences. We found significant initial orientation toward forest of individuals released 5 and 10 meters from the forest ($p=0.0054$ and 0.038), and random orientation at 20 and 35 meters, indicating either a small perceptual range or decreasing motivation to move towards forest with distance. However, orientation even at 5 and 10 meters was highly variable (mean vector length=0.181, 0.138). Juveniles in this study generally moved straight and with a low tendency to respond to habitat even at close distances, potentially reflecting a motivation to move quickly away from the natal wetland rather than attraction to forest. We discuss the potential consequences of the observed behavior to juvenile salamanders dispersing into modified habitat.

0370 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

John Placyk[1], Ben Fitzpatrick[2], Gary Casper[4], Randall Small[2], Graham Reynolds[2], Daniel Noble[3], Ronald Brooks[3], Gordon Burghardt[2]

[1]University of Texas at Tyler, Tyler, TX, USA, [2]University of Tennessee, Knoxville, TN, USA, [3]University of Guelph, Guelph, Ontario, Canada, [4]University of Wisconsin-Milwaukee Field Station, Saukville, WI, USA

Historical Perspective Suggests the Hybrid Zone between Two Snakes of Conservation Concern is an Important Natural Interaction

Distinguishing between hybrid zones formed by secondary contact vs. parapatric divergence-with-gene-flow is an important challenge for understanding geographic isolation and local adaptation in the origin of species. A similar challenge, distinguishing between natural hybrid zones vs. those formed as a consequence of recent human activities, is important for conservation. Recent work has demonstrated the existence of a hybrid zone between the plains gartersnake (*Thamnophis radix*) and Butler's gartersnake (*T. butleri*), raising questions about the history and conservation of genetically admixed populations. Both taxa are of conservation concern, and it is not clear whether to regard hybridization as a threat or a natural interaction. Here we use phylogeographic and population genetic methods to assess the timescales of divergence and hybridization. We assayed AFLPs and mtDNA sequences from *T. radix*, *T. butleri*, and the closely related short-headed gartersnake (*T. brachystoma*) throughout their ranges. We find shallow mtDNA divergence and high levels of variation in the contact zone, patterns inconsistent with a hypothesis of long-term divergence followed by recent contact. It is not possible to distinguish true divergence-with-gene-flow from a secondary contact zone at equilibrium between gene flow and selection, but we infer that the hybrid zone is a long-standing, natural interaction. The distinctiveness of these taxa is likely maintained by ecological differences, and the hybrid zone might be an important reservoir of genetic variation.

0643 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Marloes Poortvliet[1], Jeanine Olsen[1], Donald Croll[1], Giacomo Bernardi[1]

[1]University of Groningen, Groningen, The Netherlands, [2]University of California Santa Cruz, Santa Cruz, CA, USA

Population Genetics of the Spinetail Devil Ray (*Mobula japanica*) in the Pacific Ocean

Rays of in the genus *Mobula* (Mobulidae), like other elasmobranchs of the open ocean, are subject to high mortality from bycatch and targeted fisheries. In light of the extremely low fecundity and type of life history of these species, it is clear that continued high levels of (by)catch will be detrimental. However, development of a

realistic management program is difficult given the paucity of data on mobulids. Population genetic data can provide important information for their conservation by helping to define conservation units on the basis of genetic populations. Here we focus on *Mobula japanica*, a circum-tropical pelagic species, which is one of the more common rays in the Pacific Ocean. Using twelve variable microsatellite loci and two mitochondrial genes (CO1 and ND5) we surveyed genetic structure across the Pacific Ocean. Samples were collected from six locations spanning the Pacific Ocean basin. Conventional F_{ST} analyses revealed no significant population structure for either mitochondrial or microsatellite data. The apparent absence of population structure in *Mobula japanica* provides a compelling argument for development of broad international approaches for management and conservation of this charismatic species.

0466 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Marianne Porter[1], Candido Diaz[1], Adam Summers[2], John Long[1]

[1]Vassar College, Poughkeepsie, NY, USA, [2]Friday Harbor Labs, University of Washington, Friday Harbor, WA, USA

Squalus acanthias Swims Using its Vertebral Column as a Spring

In bony fishes, dynamically bending vertebral columns operate as springs, storing and returning elastic energy, which is hypothesized to be stored mainly in the pressurized intervertebral joints. Also, we assume joints undergo more strain than the stiffer, mineralized vertebrae. The underlying assumption that vertebrae are stiffer than joints has been challenged in cartilaginous fishes. We demonstrated that both joints and centra strain during bending in *ex vivo* segments of *Squalus acanthias* vertebral column. To determine if significant centra strain occurs in life, we measured *in vivo* vertebral column strains in five *S. acanthias* during a variety of behaviors. As predicted, both centra and joints strained during volitional and manual dynamic bending, with the greatest strains (6% strain in the centrum and 10% strain in the segment) occurring during turning. Centrum strain was similar during volitional swimming and manual undulation (3% strain), but strain was greater in the vertebral segment during manual undulation (5% strain). Thus, it appears that the entire vertebral column of sharks, both joints and centra, is mechanically engaged as a dynamic spring during locomotion. NSF IOS-0922605 supported this work.

0379 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

David Portnoy, John Gold

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

Evidence of a Surprisingly Recent Vicariant Event in a Geologically Active Suture-Zone in the Gulf of Mexico.

Suture-zones are areas of contact for biotic assemblages where hybridization between related taxa is common. Formation of these zones is thought to involve single vicariant events that affect a broad variety of taxa, followed by divergence and then secondary contact. Such a suture-zone appears to be present in the northeastern Gulf of Mexico where at least 14 clades of fishes and invertebrates meet, with hybridization occurring between a number of taxa. Hypothesized vicariant events in the literature for this region all occur >100,000 years ago. Analysis of molecular data for lane snapper, *Lutjanus synagris*, revealed two divergent assemblages on either side of this zone. Coalescent simulations indicate that these assemblages began diverging ~3,600 to 21,000 years ago. This suggests that processes at the end of Wisconsin glaciation created a previously unrecognized barrier for this and possibly other marine species. These results also suggest that the Gulf suture-zones may be characterized by complex a geological/environmental history featuring multiple vicariant events.

0249 Invasive Species, Symphony I & II, Sunday 10 July 2011

Daniel Preston[1], Jeremy Henderson[2], Pieter Johnson[1]

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Community Ecology of Invasions: Direct and Indirect Effects of Aquatic Invaders from Multiple Trophic Levels

With many ecosystems now supporting multiple nonnative species from different trophic levels, principles from community ecology offer a promising context to understand the net effects of invaders. Here, we combined wetland surveys with a mesocosm experiment to examine the individual and combined effects of nonnative predators (western mosquitofish, *Gambusia affinis*) and nonnative grazers (bullfrog larvae, *Lithobates catesbeianus*) on aquatic communities. Among 139 wetlands, nonnative fish correlated negatively with native amphibian richness, bullfrogs correlated negatively with presence of endangered California red-legged frogs (*Rana draytonii*), whereas neither invader influenced western toad presence (*Anaxyrus boreas*). In mesocosms, invasive fish dramatically reduced the abundance of zooplankton and palatable amphibian larvae (*Pseudacris regilla* and *Taricha torosa*), leading to increases in phytoplankton and nutrient concentrations (through loss of zooplankton), and rapid growth of unpalatable toad larvae (through competitive release). Bullfrogs reduced the

growth of native anurans but had no effect on survival. Despite strong effects on natives, invaders did not negatively influence one another and their combined effects were additive. Our results highlight how the net effects of multiple nonnative species depend on the trophic level of each invader, the form and magnitude of invader interactions, and the traits of native community members.

0358 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Steven Price[2], Robert Browne[2], Michael Dorcas[1]

[1]Wake Forest University, Winston-Salem, NC, USA, [2]Davidson College, Davidson, NC, USA

Modeling the Effects of Urbanization on Salamander Abundances using a Before-After Control-Impact Design

Urbanization represents a threat to amphibian populations, especially stream-dwelling salamanders. Although previous studies on urbanization effects on amphibians have been conducted, there is an need to follow populations over longer time periods, account for imperfect detection, and determine the response time to urbanization. Consequently, we used a before-after control-impact (BACI) study design to estimate changes in abundances of larval and adult salamanders in urbanizing streams. From 2005 to 2009, we used standard sampling techniques to obtain a count of salamanders in 13 streams that underwent urbanization of catchment after the first year of sampling. Simultaneously, we counted salamanders in 17 streams that experienced no disturbance within stream catchments. We used Royle's binomial mixture model to estimate annual mean abundances and individual detection probabilities, and Bayesian inference was used to estimate population parameters for each stage and species. Although mean abundance estimates varied among years in control and urbanized streams, we found that both larval and adult salamander abundances decreased in urbanizing streams, with two-lined salamanders (*Eurycea cirrigera*) being more sensitive than dusky salamanders (*Desmognathus fuscus*). Despite the variance in abundance estimates, we found that abundances were significantly less at urban sites only one or two years after urbanization than at control sites, suggesting a rapid, population-level response to urbanization. Our study highlights the use of the BACI design to study how urbanization affects populations. We emphasize that inferences regarding urbanization effects on populations are more difficult without comparing abundances to control sites, especially for species in which populations fluctuate.

0354 Poster Session I, Friday 8 July 2011; SSAR POSTER AWARD

Steven Price[2], Evan Eskew[1], Kristen Cecala[1], Robert Browne[2], Michael Dorcas[1]

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Estimating Survival of a Streamside Salamander: Importance of Temporary Emigration, Capture Response and Urban Development

Estimating survival for highly secretive aquatic animals, such as stream salamanders, presents numerous challenges. Salamanders often spend a considerable time under rocks, or in other refugia where they are difficult for capture. The need to quantify vital rates for salamanders is considerable; they are threatened by a wide range of land-use stressors, especially urban development. In this study, we used 34 months of continuous field samples collected at an urbanized and nonurban stream and robust design mark-recapture analysis to evaluate the importance of capture response, temporary emigration, and urban development on survival estimates of the salamander *Desmognathus fuscus*. We constructed a set of a priori candidate models incorporating combinations of time- and location-varying capture and recapture probabilities, capture responses, temporary emigration, and survival estimates and ranked models using Akaike's Information Criterion. We found strong support for month-specific capture probabilities, recapture probabilities, and temporary emigration and a negative behavioral response to capture in the majority of months. We found no support for variation in capture probabilities, recapture probabilities, and temporary emigration between locations; however we found that location strongly influenced survival estimates. Specifically, survival estimates were significantly higher at the nonurban site than at the urban site. Our results emphasize the importance of estimating capture probabilities, recapture probabilities, capture response, and temporary emigration when evaluating survival in highly secretive aquatic animals. Failure to account for these population parameters will likely yield biased estimates of survival in amphibian populations.

0320 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Bianca K. Prohaska[1], Paul C.W. Tsang[2], James A. Sulikowski[1]

[1]University of New England, Biddeford, ME, USA, [2]University of New Hampshire, Durham, NH, USA

Utilization of Steroid Hormones Extracted from the Skeletal Muscle Tissue of the Little Skate (*Raja erinacea*) and the Spiny Dogfish (*Squalus acanthias*) to Determine Reproductive Status

Currently, circulating levels of plasma steroid hormones have been used as a non-lethal method to determine reproductive maturity and reproductive cycles in elasmobranchs.

However, this method can prove problematic to perform on large and/or endangered species, due to difficulties involved with specimen handling. These constraints make it imperative for new techniques to be developed. Previous work conducted on other vertebrates has shown that hormones can be successfully extracted from muscle tissue. The process of collecting muscle samples is quick, minimally invasive, and may be conducted without removing the animal from the water, facilitating its use on larger, and/or endangered species of elasmobranchs. The focus of this presentation will be the development of a valid method for extracting steroid hormones from the skeletal muscle tissue of the oviparous little skate (*Raja erinacea*) and the aplacental viviparous spiny dogfish (*Squalus acanthias*). For each species 80 females are currently being collected from the Gulf of Maine and will consist of 20 immature individuals, to act as control replicates, 20 maturing individuals, 20 mid-gestation individuals, and 20 near parturition individuals. Sample collections of spiny dogfish and little skates began in October 2010, and the remaining samples will be collected this spring. To verify the use of this tissue for reproductive analysis, steroid hormone levels extracted from skeletal muscle will be compared to the concentrations and patterns of those same steroid hormones extracted from plasma, via radioimmunoassay.

0472 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Kevin Purcell, Craig Stockwell

North Dakota State University, Fargo, ND, USA

Evaluation of the Introduction History and Genetic Diversity of a Serially Introduced Fish Population in New Zealand

The reconstruction of invasion routes for invasive species is crucial to the management and evolutionary study of invasive species. The western mosquitofish, *Gambusia affinis*, has been widely introduced from its native range in the southeastern United States for its putative abilities as a vector control agent. Here we evaluate the introduction history of *G. affinis*, to the north island of New Zealand. We use molecular markers to verify the published historical record of this invasion, and to evaluate the genetic diversity among populations following its serial introduction to New Zealand. We found strong support for the published introduction history, indicating that populations in New Zealand are descended from populations from central Texas. The introduced populations show significant losses of allelic richness (A_R =4.55-7.77) compared to the parental populations (A_R =11.44-12.33). By contrast, heterozygosity did not differ between parental and introduced populations. We also found evidence that the genetic divergence among introduced population in New Zealand (F_{ST} = 0.0843) is greater than that of their native source populations (F_{ST} = 0.002 -0.009). It seems that the bottleneck and founder effects of serial introductions in these populations have reduced allelic richness but have had little impact on overall genetic diversity. Understanding the relationship between the introductions and founding populations as well as the impact of serial introduction events will help to manage the introduction of invasives and assist us in understanding the differential success of some populations.

0505 Phylogeography Gulf-Atlantic Symposium, Friday 8 July 2011

Joseph Quattro

University of South Carolina, Columbia, SC, USA

Genetic and Morphological Divergence in Lake Waccamaw Endemic Fishes

Lake Waccamaw, a bay lake located on the Atlantic coastal plain in North Carolina, USA, is an interesting and appropriate system for investigating the role of environmental versus evolutionary influences on morphological diversity. Lake Waccamaw has relatively clear water and high pH and supports a diverse fish community comprised of approximately 42 species. The lake is presumed to be of recent origin, perhaps no more than 15,000 - 32,000 years ago. Despite a recent origin, the lake is unique in having a suite of endemic species, including four species of fishes that form the focus of this talk (*Etheostoma perlongum*, *Fundulus waccamensis*, *Menidia extensa* and an undescribed species of madtom). We discuss similarities and differences in the evolutionary history of these species from three perspectives: phylogeographic, phylogenetic and morphological.

0158 Poster Session II, Saturday 9 July 2011

Camila Rabelo Rievers[1], Maria Rita Silvério Pires[1], Paula Cabral Eterovick[2]

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Spatial and Temporal Distribution of Leaf Litter Anuran Communities and Potentially Influential Environmental Variables at Three Atlantic Forest Areas in Southeastern Brazil

We conducted a 12-month survey of leaf litter anuran assemblages at three areas in different stages of succession in the Parque Estadual do Rio Doce, the largest Atlantic Forest remnant in Minas Gerais state, southeastern Brazil. We measured species richness, abundance, and biomass, plus variables that could potentially affect anuran communities including aspects of invertebrate litter fauna, leaf litter biomass and structure, and microclimatic conditions. We first characterized and compared the three areas according to the variables studied, and then defined sample units that were not spatially correlated to test for spatial and temporal correlations between anuran species richness, abundance and biomass (as dependent variables) and the environmental variables (as independent variables) using multiple regression. The forest areas in later stages of succession had more anuran species and higher anuran abundance and biomass, as well as more invertebrate taxa, but lower invertebrate abundance. Leaf litter biomass was higher in the mature forest, but leaf litter depth on the soil was shallower. Humidity and temperature did not vary significantly among areas. Temporally, anurans

were more abundant during the rainy season as were invertebrates, and leaf litter biomass was greater. Spatially, anuran abundance was influenced by dry leaf litter biomass and richness of invertebrate taxa. The best model to explain variation in anuran abundance included dry leaf litter biomass and rainfall, but still it did not explain a significant amount of variation. The available data on leaf litter anuran communities indicates no general pattern concerning spatial or temporal distribution.

0468 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Morgan Raley

North Carolina Museum of Natural Sciences, Raleigh, NC, USA

The Longnose Shiner, *Notropis longirostris* (Hay, 1881), as a Case Study of Mobile Vicariance Shaping Coastal Phylogeogeography

The Longnose Shiner, *Notropis longirostris*, is a benthic cyprinid common to the coastal states (Louisiana, Mississippi, Alabama, Georgia and Florida) bordering the Gulf of Mexico. This shiner and its straw-colored congeners, *N. ammophilus*, *N. rafinesquei*, and *N. sabinae*, form a well-supported clade of notropine taxa restricted to coastal plain physiographic regions. These species typically occur over shallow shifting sand or fine gravel substrates at the lower ends of sandbars in relatively slow current. *N. longirostris* exhibits a unique allopatric distribution bifurcated by the Mobile River basin; within the Mobile itself, *N. longirostris* is uncommon and isolated to the lower-most reaches of the basin, seemingly replaced by *N. ammophilus* in the uplands. Allozyme data presented by Wiley & Titus and Titus, Wiley & Allen suggested that populations of *N. longirostris* have been genetically isolated from one another due to Mobile vicariance. Raley & Wood presented mitochondrial sequence data to support these assertions. Additional mitochondrial and nuclear sequence data have been collected for the group and results will be presented that further test perceived regional phylogeographic patterns. These results highlight the existence of an undescribed form of "Longnose Shiner" from rivers east of the Mobile River basin that have differentiated largely in crypsis. Anecdotal fin-coloration evidence exists to substantiate this assertion. Efforts to further quantify and recognize this new cyprinid are recommended.

0469 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Jason Ramsay, Cheryl Wilga

University of Rhode Island, Kingston, RI, USA

Function of The Jaw Depressors during Feeding in Little Skates, *Leucoraja erinacea*

The coracomandibularis (CM) and coracoarcualis (CA) muscles of little skates are arranged in-series, extending from the pectoral girdle to the lower jaw. Shortening of the CM and CA should result in lower jaw depression. However, the CM and CA can potentially contract isometrically or eccentrically; functioning to transfer force and motion from the coracohyomandibularis (CHYM) muscles to the lower jaw or to support the buccal cavity, respectively. Hyomandibulae, upper and lower jaw kinematics, motor activity in the CM, CA and CHYMs, and fascicle shortening in the CM and CA were recorded simultaneously with buccal pressure during prey capture and processing. During prey capture the CM and CA are active along with the left and right CHYM. However, the CM actively shortens while the CA actively lengthens as the hyomandibulae and lower jaw are being depressed. During prey processing only the CM and CA are active. The CM shortens while the CA stays the same length. Hyomandibulae depression is reduced, but lower jaw depression is similar to that of prey capture. The patterns of CM and CA activity and strain in little skate suggests that during prey capture the muscles have taken on a supportive role, stabilizing the floor of the buccal cavity similar to a skeletal hyoid. In contrast, during processing the CM actuates jaw depression, while the CA stabilizes the CM origin. Such functional plasticity of the feeding muscles may have played a key role in the increased functional versatility of the feeding apparatus of batoids compared to sharks.

0369 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011; NIA BEST STUDENT PAPER AWARD

C. Keith Ray, Jonathan Armbruster

Auburn University, Auburn, AL, USA

Redescription and Morphometric Analysis of *Isorineloricaria* (Siluriformes: Loricariidae)

The troubled history of the members of the *Hypostomus emarginatus* species group has been the subject of much taxanomic avoidance in recent years. We review the complex history of the *H. emaginatus* species group, along with resurrecting and redescribing the genus *Isorineloricaria* Isbrücker 1980. We also redescribe and diagnose the species of *Isorineloricaria*. Species recognized as taxonomically valid are: *I. ammophila* from the Apure and Orinoco Rivers in Venezuela; *I. emarginata* from the lower Amazon River and it's tributaries; *I. gomesi* from Jaguaribe River, Ceará state, Brazil; *I. horrida* from the

upper Amazon River, including the mainstem, Rio Napo, Rio Marañon, Rio Ucayali, Rio Juruá, Rio Purus, and Rio Madiera; *I. phrixosoma* from the Rio Ucayali, Peru; *I. spinosissima* from the Guayas River basin, Ecuador; *I. tenuicauda* from the Magdalena River basin in Colombia; *I. unicolor* from from upper Amazon tributaries of Bolivia, Brazil, Colombia, Ecuador, and Peru; *I. villarsi* from the Maracaibo basin in northwestern Venezuela and eastern Colombia; *Isorineloricaria n. sp. 'Apure'* is described from the Apure and Orinoco Rivers in Venezuela. Biogeorgaphic patterns and their relationships with hypothesized geologic events across South America are also discussed. *Isorineloricaria* appear to be in two main groups, a largely trans-Andean group (with one species in the Orinoco drainage) and an entirely cis-Andean group. Furthermore, the rise of the Andes may have allowed the invasion of the piedmont areas by the smaller members of *Isorineloricaria*.

0740 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011; ASIH STOYE GENERAL HERPETOLOGY AWARD

Jolene Rearick

University of New Mexico, Albuquerque, NM, USA

Evolution of Freeze Tolerance in Anurans

Tolerance of freezing is currently recognized in six anuran species belonging to two families and three genera (*Rana sylvatica*, *R. arvalis*, *Pseudacris crucifer*, *P. triseriata*, *Hyla versicolor* and *H. chrysoscelis*). Because these species are fairly distantly related (MRCA ~120mya), freeze tolerance is hypothesized to have evolved multiple times from common shared mechanisms of dehydration tolerance in amphibians. Using ancestral character state reconstructions on probability distributions of phylogenetic trees, I will test two hypotheses: 1) dehydration tolerance as the ancestral state of clades containing freeze tolerant anurans species and 2) freeze tolerance is the ancestral state of all anurans, the families Ranidae and Hylidae and clades containing freeze tolerant species. To identify characteristics significantly associated with freeze tolerance I will perform correlation analyses between freeze tolerance and other physiological, life history, and evolutionary history characters. Identification of specific preadaptions or correlated traits will be applied towards creating a predictive framework to evaluate the potential for freeze tolerance in other vertebrate species. A lack of correlation or ancestral preadaptive traits would imply that hypotheses about the evolution of freeze tolerance need to be revisited and mechanisms controlling the expression of this trait may be more complex than previously thought. Understanding the timing, frequency and characteristics associated with the evolution of freeze tolerance has broad implications in both cryomedicine and complex trait evolution.

0623 Invasive Species, Symphony I & II, Sunday 10 July 2011

Robert N. Reed[1], Bjorn Lardner[2], Gordon H. Rodda[1], Julie A Savidge[2], Amy A. Yackel Adams[3]

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Individual and Demographic Responses to Simulated Elevated Prey Densities in Brown Treesnakes (*Boiga irregularis*) on Guam

Introduced Brown Treesnakes (BTS) have ravaged the native biota of Guam, a U.S. territory in the western Pacific Ocean. While small lizards remain abundant on Guam, BTS have reduced or eliminated populations of large-bodied prey (rats, birds, etc), resulting in reduced body size, lower body condition, and lower annual survival of adult snakes as compared to when snakes reached peak population sizes several decades ago. The efficacy of control tools used on Guam to suppress and contain the local BTS population is reasonably well studied and understood. However, BTS introduced to new islands would encounter unreduced prey populations, and snake suppression on Guam may allow prey species to recover. The effects of such increased prey abundances for subsequent population growth and management of BTS are poorly understood. We experimentally examined this issue by artificially increasing prey availability for a marked population of BTS in a 5-ha area on Guam that is closed to emigration and immigration. At an individual level, increased food availability led to rapid increases in body size and condition. Rapid growth was observed in individuals that had previously displayed 'asymptotic' growth curves. Supplemental feeding also had major demographic effects in terms of proportion of reproductive females and subsequent recruitment of juveniles. We will discuss the implications of our findings for interdiction and population control of BTS.

0179 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Aaron Reedy[1], Daniel Warner[1]

[1]Thomas Kelly High School, Chicago, IL, USA, [2]Iowa State University, Ames, IA, USA

Maternal Nest-site Choice in the Lizard *Anolis sagrei*: A unique Research-based Educational Model for Youth at an Urban High School

Student understanding of the scientific method is relatively poor, particularly in urban high school classrooms. The reasons for this poor understanding are complex, but are at least partially due to a lack of research experience in the preparation of science teachers and a lack of active inquiry-based science education in the classroom. To address these issues, we developed an experiment with live lizards (*Anolis sagrei*) to serve as scaffolding for a new model of multi-layered mentoring. Students conducted an experiment to test the hypothesis that "female lizards choose nest sites with conditions that are conducive to embryonic development." Eighty lizards were housed in the

classroom, and students were responsible for animal care and management of the experiment. Female lizards (n=60) were provided five nesting substrates that differed in moisture content (0%, 12.5%, 25%, 50% 75%), and all eggs (n=128) were incubated (27°C) in one of five randomly chosen moisture levels that mirrored the five nesting substrates. The student researchers found that female lizards preferred relatively moist oviposition conditions, and these conditions had positive effects on egg survival and hatchling body size. Student learning of the scientific method was assessed by lab reports (sophomore students) or by written scientific papers formatted for a professional journal (senior zoology students), while the teacher will prepare a professional paper for peer-reviewed publication. We believe that reptiles provide excellent tools for science education, as they provide an effective way to engage high school students in professional science and provide meaningful professional development to teachers.

0654 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Brooke Reeve[1], Jesse Brunner[1]

[1]*SUNY College of Environmental Science and Forestry, Syracuse, NY, USA,*
[2]*Washington State University, Pullman, WA, USA*

Ranavirus-exposed Wood Frog Tadpoles (*Lithobates sylvaticus*) are Robust to Three Natural Environmental Challenges

Amphibian larvae in ponds and ephemeral pools cope with an array of challenges on the path to metamorphosis. Additionally, mass mortality events are increasingly being reported from ranaviruses. One hypothesis for this increase is that amphibians are becoming immunocompromised by natural and anthropogenic stressors. This study examined how high density, predator cue, and food limitation influence wood frog tadpole performance and response to ranavirus exposure in individual- and population-level experiments. Tadpole mass, development, and corticosterone levels were measured to determine the physiological effect of each treatment. Disease mortality, prevalence, and time to death were recorded to evaluate disease severity. Although the food limitation negatively impacted tadpole physiology, tadpoles exposed to high densities and/or predators remained unaffected. Amazingly, every treatment group was able to cope with disease as well or better than controls. Prevalence was similarly high for all treatments and no differences were observed in time to death. Case mortality was comparable for all treatments (~50%) except for the population-level high density treatments (12%). Competing risk analysis of metamorphosis and survival showed that tadpoles in those high density treatments were three times more likely to metamorphose than the no-stress controls, which perhaps "rescued" them from ranavirus induced mortality. These results suggest that the environmental challenges studied may not increase the severity of disease, and indeed, in the case of high density, may even promote survival. Accordingly, disease management strategies should focus less on pond conditions, and more on preventing introductions of ranavirus to naïve ponds.

0092 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Jeanine Refsnider, Fredric Janzen

Iowa State University, Ames, IA, USA

Nest-site Choice in Response to Climate Change and Effects on Offspring Performance in a Turtle with Temperature-dependent Sex Determination

Reptiles with temperature-dependent sex determination may be particularly threatened by climate change, as increasing temperatures could lead to skewed sex ratios. A potential compensatory mechanism is nest-site choice, with females selecting nest sites to match incubation conditions to climatic conditions. I studied nest-site choice in painted turtles (*Chrysemys picta*) to determine the extent to which local adaptation in nesting behavior is genetically and environmentally based. Gravid females from five populations across the species' range were housed in an outdoor common garden environment. Nest-site choice was compared among populations to evaluate variation in nesting phenology, shade cover over the nest, nest depth, incubation regime, and offspring sex ratio. Populations differed in nesting phenology and nest depth, but not in shade cover over nests; thus, when exposed to novel climatic conditions, females from transplanted populations chose nest-sites with similar shade cover to those of local females, thereby producing similar offspring sex ratios. The performance of hatchlings produced in this experiment declined with decreasing mean temperature of the mother's site of origin, and nests with greater variation in daily temperature range produced hatchlings that performed faster and more readily than nests with less variable incubation temperatures. Therefore, selection of shadier nest-sites may be a mechanism by which female turtles could compensate for climatic warming, and the increase in temperature fluctuations predicted by climate change models may result in the production of faster hatchling turtles with enhanced righting ability. Importantly, however, the fitness consequences of hatchling turtle performance are yet to be determined.

0738 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapols Ballroom E, Thursday 7 July 2011

Lisa Regula Meyer

Kent State University, Kent, OH, USA

The Impact of *Typha angustifolia* and *Phragmites australis* Invasions in Wetlands on Behavior of Larval and Adult *Rana clamitans*

Invasive plants may have chemical components to which native amphibians are naïve, and change the structure of the entire habitat by rapidly establishing a monoculture.

Invasive plants threaten amphibians and other wetland organisms more so than fully terrestrial organisms for many reasons. This study compares the behavior of *Rana clamitans* tadpoles in a swim T-maze when presented with *Typha angustifolia* or *Phragmites australis*, *Juncus effusus*, or no plant. Individuals were lab-reared. The ability to recognize and avoid unknown, possibly dangerous chemicals is advantageous to larval amphibians, which are sensitive to numerous factors. The behavior of adults caught from similarly non-invaded ponds was also investigated using arenas with *T. angustifolia*, *P. australis* or native plant mix. Samples of plant communities were obtained from previously studied wetlands. Differences in behavior based upon different plant communities may prove important for amphibians, especially if there is significant difference between invaded and non-invaded plant communities. Despite the preservation of total wetland area via no-net-loss policies, if the preserved wetlands are dominated by invasive plants, the net effect for amphibians may be negligible.

0544 Poster Session III, Sunday 10 July 2011; ASIH STORER HERPETOLOGY AWARD

Brendan Reid

University of Wisconsin-Madison, Madison, WI, USA

Estimating Population Connectivity Using Kinship Methods in Blanding's Turtle (*Emydoidea blandingii*)

Several aspects of chelonian life history, including extreme longevity and changes in habitat use across different age classes, complicate the measurement of key ecological and demographic parameters in many turtle species. Recent work in seabirds and other species has shown that the use of genetic kinship analysis can be extremely helpful in studying similarly problematic species. Kinship methods, particularly when combined with mark-recapture studies, can help to reveal dispersal patterns, source-sink dynamics, and contemporary changes in connectivity that would otherwise be difficult or impossible to observe. Here, I apply these methods to an ongoing mark-recapture study of Blanding's Turtle (*Emydoidea blandingii*) populations in Central Wisconsin. Preliminary results indicate that kinship methods can be useful in evaluating the relative degree of demographic closure among different populations and in determining lifetime dispersal ability and spatial dispersal patterns in this long-lived species and may be an extremely useful tool for studying turtle populations in general.

0140 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Roberto Reis[1], Pablo Lehmann[2]

[1]*Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, RS, Brazil,*
[2]*Universidade do Vale do Rio dos Sinos, São Leopoldo, RS, Brazil*

A New Genus and Five New Species of Cascudinhos of the Subfamily Hypoptopomatinae (Siluriformes: Loricariidae) from Northern South America

Hypoptopomatinae is a subfamily of small sized loricariid catfishes distributed over most of South America. An ongoing phylogenetic analysis of that subfamily by the authors revealed a well supported clade composed of several species usually assigned to *Parotocinclus*. This clade, however, is not closely related to the type-species and other *Parotocinclus* species, and is being transferred to a new genus. Contrary to the real *Parotocinclus* species, which are found on rivers draining the Brazilian Shield, species in this clade are distributed on the Amazon, Orinoco and the Guyanas. The new genus is composed of very small, usually long snouted, and darkly colored cascudinhos, and is diagnosed by the color pattern and osteological features not shared with any other hypoptopomine. The most important synapomorphy is a contact between a cheek canal plate and the cleithrum in the pectoral girdle, which is exclusive and unreversed in the new genus. The species *Parotocinclus longirostris*, *P. polyochrus*, *P. eppleyi*, *P. collinsae*, *P. britskii* and *P. amazonensis* are being transferred to the new genus. *Parotocinclus aripuanensis* is considered a junior synonym of *P. amazonensis*. In addition to the new genus, five new species are being diagnosed and described, totaling eleven species formally recognized in this new taxon. Considering the patchy knowledge of fish distribution in South America, it is likely that additional diversity remains to be discovered in the new genus.

0606 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Melissa Reneski, Andrew Kinziger

Humboldt State University, Arcata, CA, USA

Temporal Genetic Analysis Reveals Divergence of Hatchery Steelhead (*Oncorhynchus mykiss*) via Drift

The genetic goal of many captive propagation programs is to minimize genetic change resulting from drift and selection. The objective of this study was to assess the genetic stability of a hatchery steelhead (*Oncorhynchus mykiss*) from the Mad River, California over 35 years of captive breeding. The genetic population structure of founding (1975) and contemporary (2009-2010) hatchery and wild stocks were compared using 14 microsatellite loci. Comparative samples from four non-indigenous populations transplanted to the Mad River were also assessed. Our analysis indicated that historical hatchery and wild populations were genetically identical. From this common genetic base, founding and contemporary hatchery stocks diverged from one another whereas

wild stocks appeared to be essentially homogenous through time. Individual admixture coefficients from Bayesian cluster analysis indicated that admixture from nonlocal populations was not responsible for the observed patterns of divergence. Instead drift in the absence of migration is implicated. The hatchery population was largely closed to migration (m=0.0006) from the wild and had a low effective population size (N_e =246). In contrast, wild populations regularly received immigrants from the hatchery population (m=0.176) and had a much a larger effective population size (N_e=1,935). Thus, opening the hatchery population to immigration from the wild would likely serve to restore the genetic integrity of the hatchery population.

0494 Poster Session III, Sunday 10 July 2011

Justin Rheubert, David Sever

Southeastern Louisiana University, Hammond, LA, USA

Reproductive Morphology of the Tuatara (*Sphenodon punctatus*)

Over the past decade studies on reproductive morphology in squamates has expanded tremendously. In squamates the reproductive system consists of the testis, efferent ducts, kidneys, cloacae, and hemipenes. The squamate system components and organizational pattern is similar to that of other terrestrial vertebrates with a few exceptions. The testis is comprised of seminiferous tubules which lead to the rete testis which is extra-testicular contrasting the intra-testicular rete testis of other terrestrial vertebrates. The rete testis then divides into the ductuli efferentes which converge at the head of the epididymis which is consistent among terrestrial vertebrates. The epididymis runs posteriorly over the kidney which in squamates (and a few other vertebrates) plays a crucial role in reproduction through secretions of the sexual segment. The sexual segment has been identified in all squamates studied to date but varies in its position within the nephron. However, with *Sphenodon* being the sister taxon to the Squamata making the lepidosaurian clade, evolutionary and phylogenetic analyses cannot be accurately performed on squamates without data on the sister taxon. Few studies have attempted to describe portions of the reproductive system, but no study gives in depth coverage of the reproductive system as an entire unit or has heavily investigated these various portions. Here we investigate the morphology of the entire reproductive system in *Sphenodon punctatus* in comparison with the Squamata and other terrestrial vertebrates in an attempt to provide pertinent data within the field of reproductive biology.

0507 Poster Session I, Friday 8 July 2011

Alexandre C. Ribeiro[2], Flávio C.T. Lima[1], Édson H.L. Pereira[3]

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A New Genus and Species of a Minute Suckermouth Armored Catfish (Siluriformes: Loricariidae) from the Rio Tocantins Drainage, Central Brazil

A new genus and species of a miniature suckermouth armored catfish is described based on specimens collected from the karst region of São Domingos, upper rio Tocantins basin, Goiás State, Central Brazil. The new genus and species is unique among loricariids by presenting a unique reductive pattern of lateral dermal plates, with most of the body covered by only three series of plates (viz., dorsal, mid-ventral and ventral series). The new taxon is also unique within the family by displaying a combination of character-states traditionally used for recognizing both members of the Hypoptopomatinae and Hypostominae. Despite difficulties in elucidating the phylogenetical affinities of the new taxon based on the available published data for the family, we provisionally consider the new taxon as belonging to the subfamily Hypostominae. Achieving a maximum standard length of 22.2 mm SL, the new taxon is one of the smallest loricariids, and a discussion on the smaller known members of the family is presented.

0711 Poster Session I, Friday 8 July 2011

Stephen Richter, Schyler Nunziata

Eastern Kentucky University, Richmond, KY, USA

Relationship between Genetic Variability and Survival in a Critically Imperiled Amphibian Species

Genetic studies of isolated populations typically discover reduced genetic variation and make recommendations for alleviating genetic deficiencies. Examining the relationship between genetic variability and survival of individuals can provide more meaningful understanding of evolutionary potential and long-term viability of populations. We studied potential mechanisms for preservation of genetic variability in a population of endangered Dusky Gopher Frogs (*Rana sevosa*). We addressed the following mechanisms: (1) pairing of more genetically different mates (2) mortality of eggs based on relatedness of parents, and (3) differential survival of more genetically diverse offspring through metamorphosis. We used eight microsatellite loci to genotype individuals from three life-history stages within a single year (breeding adults, eggs, and emerging metamorphs) and compared standard measures of individual genetic variability. We found no significant differences in genetic measures between the adult

population and egg clutches, suggesting that mating was random with respect to relatedness. We documented a negative association between survival at the egg stage and genetic variability, which is strong evidence for increased fitness of more outbred individuals. Finally, we found metamorphs had significantly higher SMD^2 values and significantly lower IR scores than did eggs indicating individuals surviving to metamorphosis had parents that were more genetically divergent than non-surviving counterparts. These results indicate that selection for outbred individuals should help to alleviate genetic stress and should prolong, at least temporarily, the persistence of this isolated population. However, genetic variability will continue to decline and extinction will occur in the long term, unless populations are established nearby.

0283 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Cyrena Riley[1], Richard Cloutier[1], Eileen Grogan[2]

[1]Université du Québec à Rimouski, Rimouski, Québec, Canada, [2]St-Joseph's University, Philadelphia, PA, USA

Ontogenetic Pattern of Mineralization in the Thorny Skate (*Amblyraja radiata*)

Skeletal development of organisms provides essential data for phylogenetic, evolutionary and biomechanical studies. Compared to osteichthyans in which chondrification and ossification sequence have been described for numerous species, the exact ontogenetic progression of prismatic mineralization (tesserae) in chondrichthyans is not well known. Two different types of tesserae arrangements have already been recognized in skates: (1) catenated, corresponding to long chains of single tessera and (2) crustal, corresponding to a continuous layer of tesserae. Patterns of direction of mineralization (e.g., proximo-distal, bidirectional) and patterns of distribution of mineralization (e.g., dorso-ventral, lateral), were analyzed using a cleared and double-stained growth series of 20 specimens (embryos and juveniles) of the thorny skate (*Amblyraja radiata*). Different distribution patterns occur simultaneously in different anatomical components within an individual. Pectoral fins exhibit catenated mineralization on the dorso-ventral surfaces of radials. Pelvic fins show two distinctly different patterns; on the crus, crustal mineralization is more important on the anterior portion of the radials, while the non-crus part of the fin has crustal and catenated mineralization on the dorso-ventral surfaces of radials. The direction of radial mineralization follows a proximo-distal pattern while basal elements of pectoral fins follow a bidirectional mineralization pattern. The posterior portion of the vertebral column mineralizes first. Although a phylogenetic component is not discarded, the ontogenetic progression of mineralization in skates suggests that mechanical stress may influence the formation of mineralization. Skate developmental patterns will be compared to those present in immature and mature specimens of different elasmobranch species and in osteichthyans as well.

0477 Poster Session II, Saturday 9 July 2011

Julia Riley, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

Should I Stay or Should I go? The Influence of Environmental Factors on *Chrysemys picta* Hatchling Overwintering Strategy

In northern temperate areas, *Chrysemys picta* hatchlings spend their first winter either submerged in water after fall nest emergence, or within their natal nest chamber. The occurrence of these two strategies varies among populations throughout the species' range, and temporally within the same population; however, the natural factors that determine the strategy employed by a given clutch are not well understood. Subzero nest temperatures above -4°C can be survived by hatchlings using freeze-tolerance, but lower nest temperatures like those found in the temperate north can only be survived in a supercooled state. If overwintering strategy maximizes winter survival and is cued by environmental factors, then northern hatchlings should remain in nests when the environment promotes supercooling. Clutches that overwinter in-nest should experience lower fall nest temperatures, soil moisture and vegetation cover, higher nest soil organic content, and smaller nest soil particle size than clutches that experience fall nest emergence. In summer 2010, *C. picta* nests were caged (N = 26) in Algonquin Park, Ontario, and a data logger was placed in each to record temperature. Soil texture was quantified for each nest. Nest microhabitat variables were recorded at oviposition and monthly during incubation. In the fall of 2010, 12% of the nests emerged. From April to May 2011, spring emergence will be surveyed, and nest microhabitat data will be analysed. Knowledge of hatchling *C. picta* overwintering strategies is predominately based on laboratory studies; our study will contribute to understanding this phenomenon in nature.

0492 SSAR SEIBERT CONSERVATION AWARD, Session II, Conrad B & C, Friday 8 July 2011

Julia Riley, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

Too Hot, Too Cold, or Just Right: Evaluation of a Common Turtle Conservation Technique, Nest-caging

Conservation biology's primary goal is to mitigate anthropogenic impacts on natural ecosystems. It follows that conservation techniques themselves should not be detrimental to target species. Anthropogenic food resources increase predator numbers which can push turtle nest depredation to unnatural levels. Nest-caging, a widely-used conservation technique, counteracts this by protecting nests and promoting recruitment.

Despite these benefits, shortcomings have been identified. Entrapment in cage wire can cause mortality, and anecdotal evidence suggests that some nest-caging methods may reduce incubation temperature. The first goal of this study is to examine the effects of nest-caging on nest micro-environment. The second goal is to determine if nest-caging has an effect on hatching success and hatchling morphology. In 2010 in Algonquin Provincial Park, Ontario, *Chrysemys picta* (N=31) and *Chelydra serpentina* (N=36) nests were assigned to one of two treatment groups or a control: above- or below-ground wire nest cages or no nest cage, respectively. A data logger was placed in each nest to record incubation temperature. Once hatching occurred, incubation duration, hatching success, and proxies of hatchling fitness were quantified. Preliminary analyses indicate that incubation temperature, incubation duration, hatching success, and the average number of deformities per hatchling per clutch did not differ among treatments. Hatchling body condition was better for below-ground cages in snapping turtles, but did not differ among treatments in painted turtles. In both species, righting response varied among treatments. Analysis of conservation techniques is crucial for effective recovery of at-risk species in order to comprehend their long-term population-level implications.

0446 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Eric N. Rittmeyer, Christopher C. Austin

Louisiana State University, Baton Rouge, LA, USA

Bio-invasion of the Pacific: Human-mediated Introduction and Systematics of the *Carlia fusca* Complex in New Guinea and the Pacific

The *Carlia fusca* group consists of 18 described species of moderate-sized, typically brown scincid lizards distributed throughout the lowlands of New Guinea and adjacent islands, as well as parts of northern Australia and eastern Indonesia. As a result of anthropogenic translocations following World War II, populations of *Carlia fusca* group skinks are also invasive on the Pacific Islands of Palau, Guam, and the Northern Marianas Islands. A recent morphological review of the species group proposed numerous taxonomic changes, as well as the specific identity of the invasive populations in the Pacific: *C. tutela* (native to Halmahera) for the Palau populations, and *C. ailanpalai* (native to the Admiralty Islands) for the Guam and Northern Marianas Islands populations. However, due to the low levels of morphological divergence among species in the group, species delimitation was difficult and numerous populations could not be assigned to a species based on morphological data. We here use mitochondrial and multiple nuclear loci to examine the systematics of the species group, as well as to identify the sources for the invasive Pacific Island populations. Our findings demonstrate multiple cases of incongruence between the currently recognized species (based on morphological data) and the evolutionary lineages recovered (based on molecular data), as well as evidence for multiple waves of introductions that appear to be concordant with movements of Allied and Imperial Japanese forces in the Pacific during World War II.

0307 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Conrad B & C, Thursday 7 July 2011

Angela Rivera

Clemson University, Clemson, SC, USA

Evolution of Flapping in Turtles: A Comparative Examination of Forelimb Kinematics and Muscle Function across Three Lineages (Trionychidae, Carettochelyidae, Cheloniidae)

Evolution has resulted in a diverse array of limb-based locomotor strategies. Changes in muscle activation patterns can lead to new locomotor strategies. Aquatic turtles are an excellent group in which to test for such changes because species typically use one of two general swimming styles (rowing or flapping), both of which depend exclusively on limb-based propulsion. All but one freshwater turtle swims using asynchronous rowing of the limbs, whereas the Chelonioidea (sea turtles) swim using synchronous flapping of foreflippers. Additionally, a single freshwater species, *Carettochelys insculpta*, has converged on a flapping-like style of swimming using synchronous motions of foreflippers. To examine how different forelimb motions are produced across species with generally similar muscle arrangements, I compared high-speed video and electromyographic (EMG) data from *Carettochelys insculpta* and *Caretta caretta* (loggerhead sea turtle), as well as rowing *Apalone ferox* (a member of the Trionychidae, sister clade to Carettochelyidae). My study provides the first opportunity to evaluate whether the two 'flapping' lineages have converged on similar limb kinematics and/or motor patterns, and by including *Apalone*, provides a test of whether 'phylogenetic relatedness' or 'locomotor strategy' better predicts forelimb kinematics and motor patterns. My findings indicate that 'flapping' in *Carettochelys* is only superficially similar to flapping in *Caretta*, and is, in fact, more similar to rowing in *Apalone*. My data indicate a general conservation of motor patterns across the species. However, deltoideous serves a new function in sea turtles; interestingly, *Carettochelys*, with its intermediate kinematics, exhibits deltoideous activity intermediate to rowers and flappers.

0462 Poster Session III, Sunday 10 July 2011

Gabriel Rivera, McKenna Hansel, Dean Adams

Iowa State University, Ames, IA, USA

Evolution of Sexual Shape Dimorphism in the Shells of Emydid Turtles

Sex-based differences in shell shape have been identified in many species of turtle. Despite the functional effects of shell shape in turtles (e.g., ability to resist predatory attacks and influence on hydrodynamic resistance), sexual shape dimorphism (SShD) has received considerably less attention than sexual size dimorphism (SSD). In addition,

most studies of SShD have focused on specific species rather than evolutionary patterns. In this study we examined sexual dimorphism in carapace shape from a broad sampling of emydid turtles, including at least one species from each genus. Three-dimensional coordinates were collected for landmarks from the shells of museum specimens and superimposed using the generalized Procrustes method, thereby removing all non-shape variation. Multivariate techniques were used to quantify the magnitude and direction of differences in shell shape between sexes. We also used the comparative phylogenetic method to map SShD magnitudes onto an existing phylogeny of emydid turtles. This approach provided insight into several evolutionary patterns related to SShD in emydid turtles, including (1) variation in the direction of shape differences between sexes, (2) the correlation between the magnitudes of SShD and SSD, and (3) a comparison of evolutionary rates for SShD and SSD. Implications of findings will be discussed.

0287 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Gabriel Rivera[1], C. Tristan Stayton[2]

[1]Iowa State University, Ames, IA, USA, [2]Bucknell University, Lewisburg, PA, USA

Habitat-associated Trade-off between Mechanical Strength and Hydrodynamic Efficiency of Shell Shape in the Freshwater Turtle *Pseudemys concinna*

Aquatic species can experience different selective pressures on morphology in different flow regimes. Species inhabiting lotic regimes often adapt to these conditions by evolving low-drag morphologies that reduce the likelihood of dislodgment or displacement. However, hydrodynamic factors are not the only selective pressures influencing organismal morphology, and shapes well suited to flow conditions may compromise performance in other roles. We investigated the possibility of morphological trade-offs in the turtle *Pseudemys concinna*. Individuals living in lotic environments have flatter, more streamlined shells than those living in lentic environments; however, this flatter shape may also make the shells less capable of resisting predator-induced loads. We tested the idea that "lotic" shell shapes are weaker than "lentic" shell shapes, concomitantly examining effects of sex. Geometric morphometric data were used to transform an existing finite element shell model into a series of models corresponding to the shapes of individual turtles. Models were assigned identical material properties and loaded under identical conditions, and the stresses produced by a series of loads were extracted to describe the strength of the shells. "Lotic" shell shapes produced significantly higher stresses than "lentic" shell shapes, indicating that the former is weaker than the latter. Additionally, females had significantly stronger shell shapes than males, although these differences were less consistent than differences between flow regimes. We conclude that, despite the potential for many-to-one mapping of shell shape onto strength, *Pseudemys concinna* experiences a trade-off in shell shape between hydrodynamic and mechanical performance.

0041 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Jacques Robert[1], Guangchun Chen[1], Gregory Chinchar[2], Francisco De Jesús Andino[1]

[1]University of Rochester Medical Center, Rochester, NY, USA, [2]University Mississippi Medical Center, Jackson, MS, USA

Complex Role of Macrophages in *Xenopus* Immune Defenses and Peristence of the Ranavirus FV3

We have established *Xenopus* as a reliable model to study host immune defense in controlling infection, pathogenicity, and transmission of ranaviruses like FV3. We have shown that adult *Xenopus* resist and clear FV3 infection by developing potent anti-FV3 antibodies and efficient CD8 T cell responses that utilize macrophages as antigen-presenting cells. Despite this strong response, we have detected FV3 DNA in seemingly healthy (not deliberatly infected) *Xenopus*. This observation lead us to hypothesize that FV3 is capable of establishing covert infections as seen with certain insect iridoviruses, and to investigate the possible dual role of macrophages as immune effector and permissive hosts. Accumulation of peritoneal macrophages (pMc) began as early as 1 day post-infection and was correlated with an increased expression of IL-1β and TNFα pro-inflammatory cytokines. pMcs were shown to be susceptible to FV3 infection as evidenced by active FV3 transcription, and the detection of viral particles by electron microscopy and multicolor fluorescent microscopy. However, FV3 infection of pMcs resulted in the generation of fewer infectious particles, and involved a lower fraction (<1%) of pMcs than kidney tissue, the main site of infection. Notably, viral DNA remained detectable in pMcs for at least 3 weeks post-infection, past the point of viral clearance in the kidneys. These results suggest that pMcs harbor quiescent virus that may contribute to asymptomatic infection. Future plans are to characterize permissive pMc subsets using available and newly generated antibodies, follow them *in vivo* using fluorescent tracers, and identify viral immune evasion genes by reverse genetics.

0689 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Mark Roberts, Joseph Quattro

University of South Carolina, Columbia, SC, USA

Phylogenetic Patterns in a Crustacean Model Suggest a Shared Region-Wide Evolutionary History Shaping the Coastal Southeastern United States

Grass shrimp along the Atlantic coast of the United States, particularly *Palaemonetes pugio* and *P. vulgaris*, are ecologically important estuarine invertebrates that are widely used as crustacean models for laboratory toxicological studies. Due to its high natural

abundance and ease of culture in laboratory settings, *P. pugio* has become a 'sentinel species' in coastal ecosystems. Despite its extensive use in the laboratory, there have been relatively few attempts to describe phylogeographic patterns in the wild. We have examined sequence variation from individuals representing both species from throughout their range in an effort to examine their phylogeographic history. Our phylogenetic and population genetic analyses reveal a deep phylogenetic 'break' between Atlantic populations and those collected from the Gulf of Mexico for both *P. pugio* and *P. vulgaris*. As has been observed in phylogeographic studies of other coastal marine organisms in the Southeastern United States the genetic break occurs along the eastern coast of Florida, near Cape Canaveral. Interestingly, Atlantic populations of both species are nearly devoid of detectable variation at mitochondrial loci, while samples from the Gulf are comparatively highly diverse; however, both Atlantic and Gulf regions are quite diverse at a nDNA locus.

0774 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

Nathan Robinson[1], Sara Valentine[2], Pilar Santidrián Tomillo[3], Frank Paladino[1]

[1]Purdue University, West Lafayette, IN, USA, [2]Indiana-Purdue Fort Wayne University, Fort Wayne, IN, USA, [3]Drexel University, Philadelphia, PA, USA

Effect of Population Demographics on the Nesting Phenology of the Leatherback Turtle (*Dermochelys coriacea*) at Playa Grande, Costa Rica

A 17-year analysis of the nesting ecology of leatherback turtles (*Dermochelys coriacea*) at Playa Grande, Costa Rica has shown that the median nesting date has retreated by approximately 1-day yr^{-1} since 1994-95. The number of leatherback turtles nesting at this site has also declined from 465 to 57, resulting in a strong inverse correlation between the median nesting date and the number of nesting females each year. We hypothesise that the shift in median nesting date may be due to an increase in the time it takes for female turtles to encounter potential mates when the number of turtles at the breeding site is low. If there is a density-dependant effect of population size on median nesting date, the timing of the nesting season may continue to shift if the population continues to decline. The conservation implication is that hatching success tends to be lower later in the nesting season. A shift in the median nesting date may form a negative feedback mechanism of population decline, in which low population size leads to later nesting and this leads to low reproductive success. However, the median nesting date for remigrant turtles is on average 18.19 days earlier than new turtles. While the current shifts in nesting phenology may not be attributable to a change in the percentage of neophyte turtles over this time, increased protection of remigrant turtles may help to offset the recent patterns in median nesting date.

0253 Poster Session II, Saturday 9 July 2011

Nicole Rocha, Todd Jackman, Aaron Bauer

Villanova University, Villanova, PA, USA

Comparative Phylogeography of Two Widespread Southern African Gecko Species (*Pachydactylus purcelli and Pachydactylus montanus*)

Once considered to be subspecies of *Pachydactylus serval*, the sister taxa *Pachydactylus montanus* and *Pachydactylus purcelli* have only been recently described. Both gecko species have a relatively wide distribution, spanning the Cape Province of South Africa up into the southern half of Namibia, with their ranges overlapping in the northern end of the distribution of *P. purcelli*. This makes *P. purcelli* and *P. montanus* ideal candidates for phylogeographic study, especially considering their morphological and ecological similarities. Representative samples of these species were taken from an array of localities across their ranges. Patterns of genetic variation within the two species and in comparison to one another were analyzed by obtaining molecular data for the mitochondrial gene ND2 and the nuclear genes PDC and RAG1. Results revealed *P. purcelli* to be relatively invariant across its range, in which all samples were similar for the genes employed with relatively little geographical substructure. *P. montanus* was far more diverse, with largely concordant differentiation of both mitochondrial and nuclear markers. Interestingly, the center of diversity of *P. montanus* is in the southern part of its range, suggesting subsequent northward expansion. This pattern is in contrast to other widespread southern African lizard species whose centers of diversity are in northern Namibia and show recent expansions to the south.

0017 Herp Ecology, Symphony I & II, Sunday 10 July 2011

John Roe[1], Steve Morreale[2], Frank Paladino[3], James Spotila[4]

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Predicting Hotspots of Interaction Between Leatherbacks and Fisheries in the Pacific Ocean

Fisheries bycatch is suspected to be a critical source of mortality for leatherback turtles (*Dermochelys coriacea*) in the Pacific Ocean, where populations have declined precipitously in recent decades. Using tracks from satellite telemetry and state-space models, we describe spatial and temporal use-intensity distributions of leatherbacks from 1992 - 2008, including individuals from nesting populations in the eastern and western Pacific. Turtle distributions were integrated with data on longline fishing effort to estimate the relative intensity of these interactions over space and time. We estimated a total of 31,074 positions for 135 turtles. In addition to areas of high use near nesting beaches, several distinct migratory routes and foraging areas were identified in both

temperate and tropical regions of the Pacific. Areas of high predicted interaction between turtles and fisheries included the seas of the Western and Central Tropical Pacific, the North Pacific Transition Zone, and along the East Australian Current into the Tasman Sea. In the Eastern Pacific, areas of high predicted bycatch risk were identified between Central America and the Galapagos Islands, and extending along a broad arc from equatorial currents into the South Pacific Subtropical Gyre as far as 30° S. The locations of potential interaction hotspots shifted seasonally according to changes in turtle behavior, fishing effort, or both. Our models provide a tool that resource managers can use to plan the timing and location of fisheries activities, and to refine restrictions such as temporal closures or gear modifications aimed at reducing leatherback bycatch in longline fisheries.

0341 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Dawn Roje

American Museum of Natural History, New York, NY, USA

Evaluating the Effects of Non-neutral Molecular Markers on Phylogeny Estimation: Should We be Using Rhodopsin to Infer Fish Relationships?

Nucleotide substitution models used in molecular phylogenetics assume neutral evolution, yet neutrality is rarely tested for. If non-neutral markers violate models egregiously, it would be expected that their reconstructed topologies be incongruent with those inferred from neutral ones and conclusions made from those phylogenies should be reexamined. The use of rhodopsin as a phylogenetic marker has recently been called into question for exactly this reason. Rhodopsin is assumed to have evolved under strong positive selection for organisms that inhabit similar aquatic environments making it unsuitable for the phylogenetics of aquatic organisms, but it is unclear what the effects of non-neutrality on phylogeny estimation are. To evaluate potential incongruence of neutral versus non-neutral markers, as well as the notion that rhodopsin should not be used in the molecular phylogenetics of fishes, a real molecular dataset of spiny-rayed fishes (Acanthomorpha) was analyzed. The final dataset was comprised of 78 acanthomorph taxa and sequences from the following four nuclear, protein coding loci: RNF213, MLL, IRBP and Rho. Z-tests of selection were carried out on the sequences; RNF213 was found to be neutral while the remaining three tests rejected the null hypothesis of neutrality. To determine topology congruence among trees inferred by individual neutral and non-neutral markers as well as the combined, total evidence tree, comparisons of distances among trees and hypothesis testing were carried out. Results of the tree distance metrics and the topology testing support the notion that neutrality alone does not determine topology congruence, and those data should not be excluded.

0109 Poster Session II, Saturday 9 July 2011

Jorge Arturo Rojo Vazquez, Enrique Godinez Dominguez, Salvador Hernandez Vazquez, Gabriela Lucano Ramirez, Salvador Ruiz Ramirez, Juan Ramon Flores Ortega

Universidad de Guadalajara, San Patricio-Melaque, Jalisco, Mexico

Changes in the Structure of the Demersal Fish Assemblage of the Continental Shelf from the Central Mexican Pacific

In order to analyze the marine fish diversity of the central Mexican Pacific, demersal fishes were sampled monthly using shrimp trawl nets, from May 1995 to December 1998. During each cruise were defined two sampling sites and at each site two depth strata (10-40 m and 50-80 m). 28 cruises were conducted for a total of 158 tows in which swept 184.6 ha. More than 144,000 organisms were caught, which weighed more than 6,500 kg, belonging to 230 species, 55 families and 18 orders. Overall, of the 230 species, only ten species accumulate about 60% of the biomass and 80% of the total abundance. The most important fish species were *Porichthys margaritatus*, *Syacium ovale*, *Cynoscion nanus*, *Diodon hystrix* and *Urotrygon asterias*. The catch by unit of area of the abundance (number of individuals by hectare) was from 495 organisms by hectare in the stratum two of the El Coco site, up to 1752 organisms in the stratum two of Navidad site. However the differences observed in the abundance among sites, strata or years were not significant, except for the stratum one of the El Coco ($F=2.87$, $p<0.05$). The biomass stayed below the 75 kg/ha during the whole study, finding significant differences mainly among the strata of depth from both places (Navidad: $F=6.64$, $p<0.05$; El Coco: $F=35.97$, $p<0.05$), but don't between years. The Shannon index and species richness values showed differences between strata ($p<0.05$). The highest diversity values were found in the shallower stratum.

0651 Invasive Species, Symphony I & II, Sunday 10 July 2011

Christina Romagosa[1], Melissa Miller[1], Bart Rogers[1], Ray Snow[2], Todd Steury[1], Craig Angle[1], Terrence Fischer[1], Robert Gillette[1]

[1]Auburn University, Auburn, AL, USA, [2]Everglades National Park, Homestead, FL, USA

Canine Detection as a Potential Tool for Python Management in Florida

The establishment of nonindigenous Burmese python (*Python molurus bivittatus*) in Florida is an ecological threat that has cost approximately $2 million since 2005 for research and management. While it is unlikely that this species can be eradicated from all southern Florida habitats, land managers are looking for additional methods to help curtail the spread of this and other large constrictor species. Among vertebrates, snakes are the most difficult to detect, and additional methods to find and capture these nonindigenous snakes are worth investigating. Early Detection and Rapid Response

(EDRR) efforts combine various tools to address newly introduced or established species. Detection dogs, which use additional cues beyond the visual cues used by humans, are among the potential tools being assessed for EDRR efforts. Everglades National Park and Auburn University EcoDogs are cooperating in a pilot program to evaluate the use of dogs for python detection and also to support the multi-agency search efforts for pythons in southern Florida. During field surveys for wild pythons, the detection dogs are encountering one python for every 7 hours of dog search time. The results of this pilot program have direct management application for identifying effective tools for the capture and removal of nonindigenous species in Florida. We discuss the challenges associated with detection dogs as an EDRR tool and how lessons learned from our efforts can be used to guide current and future efforts.

0052 Fish Morphology, Symphony I & II, Friday 8 July 2011

Drew Rosati, Ivy Baremore

National Marine Fisheries Service, FL, USA

Analysis and Validation of Fin Rays for Aging Gulf Sturgeon

Fin rays were collected to analyze band pattern formation in Gulf of Mexico Sturgeon *Acipenser oxyrinchus desotoi*. Transverse segments were sectioned at approximately 0.5 mm and viewed under a microscope. Each band pair (one thin opaque, one wide translucent) was counted as an annulus. Preliminary band counts of the second marginal pectoral fin ray from 19 individuals (46.0–187.5 cm fork length (FL)) produced a range of two to 14 annuli. One juvenile (108 cm FL, seven annuli) was sampled one year after it was tagged and injected with oxytetracycline (OTC). The sectioned fin ray showed a distinct opaque band at the time of first capture, which fluoresced under UV light, followed by one complete annulus. This confirmed our assumption of one annulus formation per year. To further validate ages, sturgeon previously marked with OTC were targeted for recapture to determine whether annular band formation is consistent among sizes and sexes. This study authenticates the second marginal fin ray as a nonlethal aging structure and represents the first confirmed age validation for Gulf sturgeon.

0496 Herp Ecology, Symphony I & II, Sunday 10 July 2011; ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD

Adam Rosenblatt

Florida International University, Miami, FL, USA

Isotope Turnover Rates in Multiple Tissues of the American Alligator

Stable isotopes are increasingly being used as an ecological tool for elucidating feeding relationships amongst organisms and determining food web structure and connectivity. However, the proper interpretation of stable isotope data is difficult because many factors can affect the isotope values exhibited by individual organisms and in most cases it is not possible to account for every factor. One important factor that needs to be considered when interpreting stable isotope data is tissue-specific isotope turnover rates, which are the rates at which isotopes become incorporated into tissues. Tissue-specific turnover rates are usually also species specific and have been investigated in many mammalian, avian, and fish taxa. However, little attention has been paid to reptiles in this regard. In this study, I quantified the turnover rates for three tissues (skin, red blood cells, and plasma) in American alligators (*Alligator mississippiensis*). For all three tissues, turnover rates exceeded 112 days, much longer than most mammalian, avian, and fish taxa, and comparable to turnover rates in the few other reptile taxa that have been studied. The results from this study further confirm that interpreting stable isotope data based on estimates of turnover rates from other species and families can lead to misleading results because many taxa have different metabolic rates and physiological mechanisms. This is the first study to quantify turnover rates in any crocodilian and will be useful in elucidating crocodilian feeding patterns around the world.

0313 Poster Session I, Friday 8 July 2011

Betsie B. Rothermel[1], Emilie R. Travis[1], Robert L. Hill[2], Debra L. Miller[3]

[1]Archbold Biological Station, Lake Placid, FL, USA, [2]Atlanta Botanical Garden, Atlanta, GA, USA, [3]The University of Georgia, Tifton, GA, USA

Stream Salamander Occupancy and Pathogen Prevalence in a Protected Watershed in the Southern Blue Ridge Mountains, USA

Southern Appalachian ecosystems are being affected by multiple environmental stressors, with unknown consequences for the region's diverse salamander assemblages. To help address the urgent need for monitoring and disease surveillance of amphibians in the Southern Blue Ridge, we surveyed stream salamanders in the headwaters of the Tallulah River in northeastern Georgia and southwestern North Carolina from May-August 2010. With significant support from volunteer citizen-scientists, we implemented occupancy surveys based on cover-object searches of three 16-m^2 plots at each of 27 stream sites. We also collected samples from six stream-associated species for disease testing and followed biosecurity protocols, because both *Batrachochytrium dendrobatidis*

(*Bd*) and *Ranavirus* are present in pond-breeding amphibians in this watershed. Naïve occupancy estimates ranged from 59% for *Desmognathus marmoratus* to ≥ 85% for *Eurycea wilderae, D. ocoee,* and *D. monticola*. Black-bellied Salamanders (*D. quadramaculatus*) were captured at every site. All of the salamanders we tested (n = 101) were *Bd*-negative according to skin swab-PCR assays. However, prevalence of *Ranavirus* infection (determined by PCR assays of tail clips) ranged from 10% in *D. quadramaculatus* to 50% in *D. monticola*. Our detection of *Ranavirus* in five species and 10 of 11 stream drainages with only minimal sampling suggests this pathogen is ubiquitous even within this relatively protected watershed. Although the Upper Tallulah drainage still appears to support diverse stream salamander communities, we recommend continued monitoring to investigate the potential interactive effects of disease and future environmental changes, such as the impending loss of eastern hemlocks and climate change.

0739 Poster Session III, Sunday 10 July 2011

John Rowe, David Clark, Darren Shaw, Lawrence Wittle

Alma College, Alma, MI, USA

Histological Basis of Substrate Color-induced Melanization and Reversal of Melanization in Painted Turtles (*Chrysemys picta marginata*)

Crypsis can be facilitated by dynamic color changes that are mediated by chromatophores of the integument. The histological bases of dynamic color changes are well understood for some reptiles, such as lizards, but less so for turtles. We used pixel counts from digital images of tail-tip sections to study histological changes that occur during substrate color-induced melanization, and reversal of melanization, in Midland painted turtles (*Chrysemys picta marginata*) during two companion studies. Melanization in *C. picta marginata* can be induced in light-skinned individuals when placed on a dark substrate, and can be reversed in dark-skinned individuals when placed on a white substrate, but without the shedding of scutes. Therefore, we predicted that color change would involve variations in intracellular melanosome concentrations within melanophores, in the deepest living epidermal cells, or both. At hatching, and in individuals that were reared on a white substrate, mean pixel density was relatively low in the stratum spinosum and corneum. In contrast, melanosome densities of the melanophore layer, stratum spinosum, and stratum corneum were relatively high in turtles that were reared on a black substrate. In a second experiment, mean pixel counts of the epidermal layers of turtles reared on a black substrate and then switched to a white substrate, were relatively low when compared to turtles that were reared on a white substrate and then switched to a black substrate. Contrary to our expectations, melanosomes were deposited or degraded in both the living and non-living cells of the epidermis.

0032 Poster Session III, Sunday 10 July 2011

Tricia Rowlison[1], Scott Willard[1], Andy Kouba[2], Natalie Calatayud[1], Cecilia Langhorne[1]

[1]Mississippi State University, Mississippi State, MS, USA, [2]Memphis Zoo, Memphis, TN, USA

The Effects of Arginine Vasotocin on Mating Behavior in the Boreal Toad

Arginine vasotocin (AVT) is a neuropeptide produced in the pineal gland of the amphibian brain. AVT can induce amplexus, (male clasping), in many amphibian species during the act of mating. Lutenizing hormone releasing hormone (LHRH) and human chorionic gonadotropin (hCG) are two hormones commonly used for inducing spermiation in a wide variety of amphibian species and are also used to induce amplexus. The goal of this project is to produce a successful hormone treatment regimen that can be used by captive breeding programs to help conserve the boreal toad (*Bufo boreas boreas*). The boreal toad is currently endangered in Colorado and New Mexico, and is a protected species in Wyoming. Therefore, the objectives of this project are to: (1) determine and compare the optimal concentrations of AVT and LHRH that induce amplexus (2) compare the effectiveness of AVT and LHRH when administered concomitant with hCG; and (3) ensure optimal spermiation is maintained while eliciting optimal amplexus. Following hormone administrations, males will be paired with females and the number, time and duration of amplexus recorded via motion activated digital photography. The results of this study will aid in the ex situ conservation of this species by providing captive breeding programs with a hormone treatment regimen that is successful in attaining optimal male amplexus and reproduction. Furthermore, this project will assist in the reintroduction and recovery of the endangered boreal toad, as well as further the understanding of basic amphibian reproductive ecology and mating behaviors.

0327 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Lukas Rüber[1], Kevin Conway[2], Ralf Britz[1]

[1]The Natural History Museum, London, UK, [2]Texas A&M University, College Station, TX, USA

***Paedocypris*, Not a Cypriniform?! An Evaluation of the Evidence. Part 2 Molecules**

In part 2 of our presentation (for part 1, see Britz, Conway & Rüber) we look at the molecular evidence presented in support of the hypothesis that the genus *Paedocypris* , which includes some of the smallest and most developmentally truncated fishes and vertebrates, is "neither a cyprinid nor a cypriniform." We re-analysed the published dataset comprising nucleotide sequence information from six nuclear genes. We show

that the six genes analysed separately show greatly differing results between each other regarding the phylogenetic position of *Paedocypris*. We found that only one gene is responsible for the position of *Paedocypris* outside of all other Cypriniformes. We use additional methods to evaluate the quality of the DNA-sequence information. We conclude by presenting the most convincing hypothesis about the phylogenetic position of *Paedocypris*.

0252 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

Lukas Rüber [1], Tan Heok Hui[2], Britz Ralf[1]

[1]*The Natural History Museum, London, UK,* [2]*Raffles Museum of Biodiversity Research, Singapore, Singapore*

Patterns and Processes of Evolutionary Diversification in Snakeheads

One of the most emblematic freshwater fish groups of Africa and Asia are the snakeheads (Channidae). They are highly specialized airbreathing, primary freshwater fishes comprising roughly 30 species distributed in the freshwaters of Africa and Asia with a centre of diversity in the Indo-Burma and Sundaland biodiversity hotspots. Systematics of snakeheads is difficult, riddled with taxonomic confusion, and their phylogenetic history remains largely unknown. Part of the taxonomic confusion is due to the dramatic colour changes that may occur between juveniles and adults, a factor unknown to early taxonomists that greatly relied on colour patterns for species diagnoses. They are generally voracious piscivorous thrust predators with a partly amphibious lifestyle that enables them to cross short distances over land. Their constrained within-drainage dispersal leaves a perceptible imprint on present species diversity and therefore they are particularly well suited to test a variety of long debated and highly controversial historic hypotheses at different spatial scales (inter continental, continental, regional) and temporal scales (e.g. “Gondwana drift-vicariance” hypothesis, Southeast Asia palaeo-drainage” hypothesis). A molecular phylogeny based on roughly 4,500 base pairs of mitochondrial and nuclear nucleotide sequences of over 250 specimens is used to address their systematics and biogeography.

0438 Poster Session III, Sunday 10 July 2011

Matt Rucker, Justin Sipiorski, Erik Wild

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

Excellence in Undergraduate Education in Herpetology & Ichthyology at the University of Wisconsin-Stevens Point

The University of Wisconsin-Stevens Point is one of 13 comprehensive universities in the UW System and consistently ranks highly among public midwestern universities by U.S. News and World Report. The UWSP Department of Biology comprises 23 faculty and serves over 700 undergraduate biology majors. The Department takes pride in providing a broad-based biology curriculum with an emphasis on undergraduate research. The Department's success is evidence by its receipt of the UW Regents Award (1996) and ranking of second out of 579 by the Survey of Earned Doctorates (NSF, NIH, USDA, USDE) in the number of graduates (1989-98) that went on to earn a doctorate with an average of seven a year. In particular, the Department has a long history of excellence in undergraduate teaching and research in ichthyology and herpetology due to a decorated history, a broad-based biology curriculum, opportunities for undergraduate research experiences, outstanding teaching and research collections of the UWSP Museum of Natural History, international experiences, collaboration with programs of the College of Natural Resources, active student organizations, internal grant support, and modern infrastructure and facilities. These aspects of ichthyology and herpetology at UWSP will be detailed, and evidence of success in preparing students for a variety of careers, or for graduate study will be presented.

0048 Poster Session I, Friday 8 July 2011; ASIH STORER HERPETOLOGY AWARD

Samantha Rumschlag

Miami University, Oxford, OH, USA

The Interactive Effects of *Batrachochytrium dendrobatidis*, Pesticides, and Temperature on Larval Pacific Treefrogs (*Pseudacris regilla*)

Batrachochytrium dendrobatidis (Bd), pesticides, and temperature variability have been implicated as contributing causes to amphibian declines. Although Bd and pesticides are widespread in their occurrences, they seem to negatively affect populations in certain parts of the world. This variability may suggest that certain environmental conditions, such as temperature, are necessary for enigmatic declines to occur. We propose that multiple stressors interact to create conditions that cause negative effects on populations. The interaction of these factors may be important for understanding patterns of declines in amphibians. Here, we studied the effects of multiple stressors including Bd, pesticides, and variable temperature on a larval species experiencing declines in nature (Pacific treefrogs, *Pseudacris regilla*). We preformed a laboratory

factorial experiment by exposing individual larvae to different treatments of disease, pesticides (carbaryl or malathion), and temperature (15 C, 20 C, 25 C, 15 to 25 C 12:12 hour cycle).

0663 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

Ronald Russell[1], John Gilhen[2]

[1]Saint Mary's University, Halifax, Nova Scotia, Canada, [2]Nova Scotia Museum of Natural History, Halifax, Nova Scotia, Canada

Stable Isotopic Relationships Among Forest Salamanders

Natural communities are structured by a number of biotic and abiotic mechanisms. Analysis of stable isotope ratios of carbon and nitrogen can be used to describe diets and thus ecological relationships among organisms. In this work, we use stable isotope ratios of ^{13}C and ^{15}N to describe the "isotopic niche" in a guild of five caudate amphibian species native to Nova Scotia, Canada. We analyzed terrestrial and aquatic forms of *Ambystoma maculatum* and *Notophthalmus viridescens*, and terrestrial forms of *Hemidactylium scutatum*, *Ambystoma laterale*, and *Plethodon cinereus*. Of the terrestrial caudates, *A. maculatum, P. cinereus,* and *N. viridescens* (red eft) exhibited strongly overlapping $\delta^{13}C$ and $\delta^{15}N$ values indicating similar dietary and habitat preferences. *H. scutatum* showed similar ^{15}N signatures as the above group but depleted ^{13}C signatures, possibly due to the complex habitat requirements of this amphibian. There were significant differences in both $\delta^{13}C$ and $\delta^{15}N$ values between *A. laterale* and *A. maculatum*, consistent with differences in diet and habitat. Movements from the aquatic to terrestrial environment, and converse were accompanied by dramatic shifts in $\delta^{13}C$ and $\delta^{15}N$ isotopic ratios. Extreme disturbance of the forest canopy resulted in changes in ground cover and soil conditions ultimately affecting the isotopic signatures of salamanders.

0028 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Mark Sabaj Pérez[1], José Birindelli[2], Leandro Sousa[3], André Netto-Ferreira[2], Nathan Lujan[4]

[1]The Academy of Natural Sciences, Philadelphia, PA, USA, [2]Museu de Zoologia da Universidade de São Paulo, São Paulo, São Paulo, Brazil, [3]Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil, [4]Texas A&M University, College Station, TX, USA

Piscatorial Travelogue of the 2007 ACSI-PIPE Expedition to Serra do Cachimbo, Brazil

In 2007, with support from the All Catfish Species Inventory (NSF DEB-0315963), a team of three Brazilian and two American ichthyologists conducted a successful expedition to

Serra do Cachimbo, an ancient eroded plateau on the northern Brazilian Shield that rises 600-700 m above sea level to form the major divide between middle stretches of the Tapajós and Xingu watersheds. The effort netted over 15,000 specimens (with 365 tissue samples) in two weeks from 24 sites in the three largest river systems draining the plateau: Curuá (Xingu Dr.), Jamanxim and Teles Pires (Tapajós Dr.). Of the approximately 250 species sampled, nearly half are new with 10 recently described. Highlights included rediscovery of a lebiasinid first reported by Lauro Travassos in 1956 and a new enigmatic cichlid apparently related to *Apistogramma* despite its large size (>11 cm TL). Molecular analyses by Mariangeles Arce (PUCRS) uncovered hidden diversity among doradid catfishes videlicet: an undescribed *Leptodoras* that had eluded previous morphological analyses. Clearwater falls cascade down Cachimbo's escarpment and facilitate vicariant speciation in isolated headwaters alongside opportunities to harness hydroelectricity. One collection coincided with diversion and dry down of the upper Curuá to construct a run-of-river dam, and yielded thousands of rheophilic fishes (mostly heptapterid catfishes). Fish diversity and biogeography will be vested in an image-rich travelogue of the expedition.

0698 Poster Session I, Friday 8 July 2011

Allison Sacerdote

Lincoln Park Zoo, Chicago, IL, USA

Smooth Green Snake (*Opheodrys vernalis*) Head-Starting and Recovery Effort

Opheodrys vernalis is a species in Greatest Need of Conservation in Illinois. Population declines are largely attributed habitat loss. Lincoln Park Zoo and Lake County Forest Preserve District are collaborating on a regional recovery effort pairing habitat restoration and population management. Fourteen sites were surveyed for *O. vernalis*, with intensive search and trapping efforts at four sites with historic records. *Opheodrys vernalis* encounters were low with a detection probability of 0.19. Eight wild-caught adults were transferred to the zoo for a breeding program. Two gravid females produced clutches of seven eggs each. A communal nest of 84 eggs was discovered on a private lot slated for development, and was incorporated into the recovery effort. Hatching success across nests was 96%. As a comparison of head-starting approaches, half of the communal nest neonates were released into in situ field enclosures in one site with extant populations to examine growth and survival rates, and to increase site fidelity post-release. The remaining neonates began ex-situ head-starting, with a subset of neonates remaining active while the remaining snakes were brumated. All snakes survived a 2.5 month brumation period. Brumated snakes increased in mass an average of 182.3% from hatching through brumation. Active snakes increased in mass an average of 351.5% over the same initial 177 days. Comparative releases are planned for June 2011, examining survival, growth, and reproduction of *O. vernalis* using soft release and hard release approaches, and comparing success of brumated head-started snakes versus snakes that were kept active.

0703 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

Allison Sacerdote[1]

[1]Lincoln Park Zoo, Chicago, IL, USA, [2]Northern Illinois University, DeKalb, IL, USA

Assessment of Amphibian Community Structure Following Flatwoods Wetland Restoration

MacArthur Woods, an Illinois State Nature Preserve and Lake County Forest Preserve District (LCFPD) site contains imperiled flatwoods wetland habitat characterized by ephemeral pools. The site was degraded by agricultural drainage tile, severe infestation of European buckthorn, and historic fire suppression. Amphibian richness and diversity were assessed in 1999-2000, prior to restoration, revealing a depauperate community. LCFPD implemented a five-year restoration to restore hydrology, remove invasive plants, and encourage regeneration of native species. I conducted post-restoration inventory and monitoring of amphibians from 2004-2009. Monitoring was coupled with reintroduction efforts for three extirpated species: spotted salamanders (*Ambystoma maculatum*), wood frogs (*Lithobates sylvaticus*), and spring peepers (*Pseudacris crucifer*). Post-reintroduction monitoring began in 2009 and is ongoing. Monitoring data were used to assess effects of restoration efforts on amphibian community structure and to determine if natural recolonization of extirpated species occurred following restoration. Relative densities of amphibians, corrected for detection probability, varied significantly by pond and year. There was an increasing trend in amphibian richness, evenness, and Shannon-Weiner diversity (H') in the post-restoration years, independent of reintroduced species. Amphibian diversity among individual ponds exhibited annual variation. However, overall site diversity steadily increased with time since restoration from 0.5 in 1999 to 1.3 in 2009. Natural colonization of restored habitat and increased amphibian richness and diversity may be considered a measure of restoration success.

0198 Invasive Species, Symphony I & II, Sunday 10 July 2011

Daniel Saenz, Cory Adams

Southern Resrach Station, Us Forest Service, Nacogdoches, TX, USA

Sub-lethal Effects of Chinese Tallow Leaf Litter on Aquatic Amphibians

Recent evidence suggests that invasive Chinese tallow (*Triadica sebifera*) is expanding its range and becoming more abundant where it occurs. This is particularly relevant to amphibian conservation considering that the species tends to invade wetlands and the leaf litter from this tree has been shown to reduce the survival of aquatic amphibians. Recent experiments have demonstrated that, at relatively low concentrations, Chinese tallow leaf litter kills anuran eggs and larvae by reducing the dissolved oxygen and pH of water. The lethal effect of Chinese tallow leaf litter is short lived and concentrated soon after leaf fall, typically December through February in the Gulf Coastal states. We

were interested in determining the sub-lethal effects of Chinese tallow leaf litter on the behavior of overwintering anuran larvae. *Lithobates catesbieanus* and *L. clamitans* are two frog species that commonly overwinter as aquatic larvae and extensively overlap in range with invasive Chinese tallow, which may expose them to the deleterious effects of the leaf litter. We conducted experiments where we exposed tadpoles to four different concentrations of tallow leaf litter and recorded water chemistry and air gulping behavior. As tallow concentration increased, oxygen and pH decreased. The highest concentrations were nearly anoxic. Both anuran species responded similarly, where tadpoles swam to the water's surface to air gulp at a significantly higher rate in the treatments with greater tallow concentration. Such changes in behavior induced by Chinese tallow could have consequences on tadpole foraging efficiency and predator avoidance, ultimately reducing fitness.

0295 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Barbara D. Sanchez, Mark A. Steele

California State University, Northridge, Northridge, CA, USA

A Comparison of Growth and Fecundity of *Paralabrax nebulifer* (Barred Sand Bass) from Polluted and Unpolluted Sites in Southern California

Environmental stressors can have detrimental effects on fish populations by limiting the abilities of individuals to acquire resources for growth, reproduction, and survival. Pollutants such aspolycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and heavy metals can cause physiological stress in fishes, especially in areas of high pollutant concentrations, like harbors. This study evaluated the impacts of pollutants on growth and fecundity of a common coastal marine fish in Southern California. This study was conducted at four sites: two polluted sites within harbors and two relatively unpolluted sites located outside of harbors. Measures of growth and condition (weight-at-age and weight-at-length) did not differ between the polluted and unpolluted sites, implying that concentrations of pollutants in the harbors studied were not high enough to affect growth rates. Hepatosomatic index did not differ between the polluted and unpolluted sites, suggesting that the level of pollutants is not high enough to induce a response. Gonadosomatic index did not differ between sites, but this is a relatively insensitive metric of reproductive potential in multiple batch spawning species. Thus, future work will measure batch fecundity, as well as measure tissue concentrations of pollutants in the fish sampled to further explore the possibility of sub-lethal effects of pollution and to evaluate the extent to which pollutants are accumulated in the tissues of this species in different habitats.

0476 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Michael Sandel

University of Alabama, Tuscaloosa, AL, USA

Comparative Phylogeography of Coastal Plain Fishes and Amphibians

The Gulf-Atlantic Coastal Plain represents one of North America's aquatic biodiversity hotspots. This observation is likely explained by regional geologic stability, cyclic climate change, long annual hydroperiods, and a range of habitats unique to the province. Habitats unique to the GACP have promoted adaptive evolution and maintenance of relictual aquatic lineages. Despite the evolutionary distinction of many coastal plain taxa, population level processes such as speciation, introgression, and adaptation remain relatively poorly understood for this regional fauna. This study assesses mitochondrial DNA variation among four codistributed aquatic vertebrates of the GACP, in order to contribute to a synthesis of a historical biogeography for this region. The Mud Sunfish (*Acantharchus pomotis*), Banded Pygmy Sunfish *(Elassoma zonatum)*, Lesser Siren (*Siren intermedia*), and Tadpole Madtom (*Noturus gyrinus*) are the most widespread species within their respective genera, and are adapted to habitats primarily restricted to the GACP. Intraspecific genealogical concordance is assessed among these lineages using maximum likelihood phylogeny of mitochondrial DNA sequences. The cytochrome *b* gene is sequenced for multiple populations (n= 20-240) sampled throughout each species distribution, in order to compare topologies and divergence times. Species are assigned to a particular distribution "class" based on genealogical concordance with patterns drawn from literature. A historical biogeographic interpretation is offered for each class, and divergence estimates for various nodes are shown to correlate with the presumed geophysical history of the landscape. The limitations of mitochondrial data are discussed, and alternate strategies for incorporating nuclear data are presented.

0744 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Sheri Sanders[2], John Placyk[1]

[1]*University of Texas at Tyler, Tyler, TX, USA,* [2]*University of Notre Dame, Notre Dame, IN, USA*

Re-evaluation of the Pseudogeographica Subgroup of Map Turtles (Genus: *Graptemys*)

Despite repeated attempts, the phylogenetic analysis of certain taxa resist clear prediction of evolutionary relationships. Map turtle (*Graptemys*) taxonomy has seen numerous changes since their original description and many studies conflict in the placement of the western most taxa. Numerous Map Turtles are under state protection,

though the current, often contended, grouping of subspecies leaves some potentially distinct groups vulnerable. In order to elucidate these historically unclear relationships, a multiprong approach was conducted. First, the group was evaluated under the ecological species concept using habitat measures, which was successful in delinating taxa and drawing significant correlations between ecological and morphological measures, identifying characters that may be selectively active and therefore introduce noise in morphological analyses. The effect of the inclusion of these traits was addressed with morphological phylogenetics, which successfully delineated the species and illustrated the effect of including ecologically correlated traits or the highly sexually dimorphic measures traditionally used in morphological analyses. Finally, one nuclear and two mitochondrial genes were used in the genetic analysis of the largest number of individuals in any *Graptemys* molecular study to date. Increased sample size did not fully clarify the molecular relationships, but allowed for population genetic approaches, which shows promise. All analyses support the elevation of the Sabine and Mississippi Map Turtles to species level, possibly allowing these less prolific taxa to garner protection. Using *Graptemys* as a case study, this project demonstrates the importance of taxa specific considerations and the need for sythesis between numerous approaches to define these problematic groups.

0699 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011; NIA BEST STUDENT PAPER AWARD

Vivianne Sant'Anna, Roberto Reis

Pontifícia Universidade Católica, Porto Alegre/ RS, Brazil

Total Evidence Analysis of Needlefishes (Beloniformes: Belonidae)

The Belonidae includes 48 species of fishes that share an elongated body, dorsal and anal fins displaced posteriorly and thin, elongate jaws with large conical teeth. Despite the great morphological homogeneity, molecular techniques have suggested that Belonidae is not monophyletic. In order to test the monophyly of Belonidae, this study was designed to perform a comprehensive, total evidence phylogenetic analysis of the family. To accomplish that, we performed a maximum parsimony analysis, without differential character weighting, based on a matrix of 257 morphological characters and 4808 base pairs from seven DNA fragments encoded for 104 terminal taxa. The ingroup included all valid species of living and fossil Belonidae. The outgroup include almost all genera of Beloniformes and three representatives of the Cyprinodontiformes. The analysis resulted in nine most parsimonious trees with 8465 steps. Our results corroborate the monophyly of the families Exocoetidae, Scomberesocidae, and Zenarchopteridae, and refute the monophyly of the families Belonidae and Hemiramphidae. For this reason we propose a new composition for the family Belonidae, with the inclusion of the genera presently in Scomberesocidae. This new classification restores the monophyly of the Belonidae, which is strongly supported by 20 molecular and 19 morphological synapomorphies. The newly arranged family Belonidae consists of 14 genera distributed in four subfamilies: Beloninae,

Platybeloninae, Potamorrhaphinae, and Strongylurinae. All belonid genera are monophyletic, with the exception of *Strongylura*, which needs to have its species allocated in four genera to be restored monophyletic: *Strongylura*, *Dorybelone*, and two new genera.

0188 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011

Juan Santos[1], David Cannatella[1]

[1]NESCent, Durham, NC, USA, [2]University of Texas at Austin, Austin, TX, USA

Evolution of Aposematism and Scale in Poison Frogs

Aposematism has evolved multiple times in poison frogs (Dendrobatidae). However, other traits are involved in its origin. Most aposematic poison frogs are ant-specialists, from which they sequester defensive alkaloids. To characterize the aposematic phenotypic network, we analyzed trait correlations among its components: conspicuousness, chemical defense, diet specialization, body mass, and metabolic rates. Conspicuous coloration was correlated with all components except resting metabolism. We also found that aposematic species have greater aerobic capacity, also related to diet specialization. Structural equation modeling, based on trait correlations, recovered "aposematism" as one of two latent variables in an integrated phenotypic network, the other being scaling with body mass and physiology ("scale"). Chemical defense and diet specialization were uniquely tied to "aposematism" while conspicuousness was related to "scale." Our results suggest two scenarios for aposematic syndrome evolution in poison frogs: (i) chemical defense and conspicuousness preceded greater aerobic capacity, and (ii) assuming that prey are patchy, diet specialization and metabolic rates evolved in tandem, and both traits subsequently facilitated the evolution of aposematism.

0605 Fish Conservation, Symphony III, Saturday 9 July 2011

Beth Sanzenbacher, Audrey Aronowsky, Mark Westneat, Krystal Villanosa, Johanna Thompson

Field Museum of Natural History, Chicago, IL, USA

WhyReef: A Scientifically Accurate Digital Game Designed to Teach Youth about the Diversity and Ecology of Coral Reefs

WhyReef is a simulated coral reef in the free virtual world of Whyville.net, developed by the Field Museum of Natural History which is targeted at youth aged 8-16. WhyReef is a digital game designed to teach youth about the diversity and ecology of coral reefs and instill in them a desire to steward the environment. WhyReef launched on March 30, 2009 and in its first year had more than 140,000 unique users, all informal players

logging in on their own time. Within WhyReef, players are able to "dive" on two reefs, count and identify 50 different coral reef species (including 25 fish), play food web games to learn who-eats-whom, and test ideas about healthy and degraded reefs using a simulation. Periodically, the simulated reefs were damaged by large disturbances such as overfishing of top predators or coral bleaching. Players were able to participate in a suite activities to identify the cause and rehabilitate the reef. Designs for the physical appearance and behavior of organisms, structure of the reef ecosystem and model for the reef collapse during disturbances came from 1) museum collections, 2) research and observations by museum staff and colleagues, 3) data from government agencies, and 4) the literature. Analysis of game play in WhyReef shows that the game's scientific accuracy allowed players to 1) make realistic scientific observations about reef species, 2) mimic scientific and policy processes to find solutions to real world problems, and 3) provide scientific discovery moments and opportunities for higher-level engagement.

0364 SSAR SIEBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Daniel Scantlebury

University of Rochester, Rochester, NY, USA

Patterns of Adaptive Radiation in West Indian Dwarf Geckos (Sphaerodactylidae: *Sphaerodactylus*)

Adaptive radiation results when natural selection promotes an ancestral lineage to diversify into ecologically adapted descendant species. Many authors consider this process the source of most of Life's diversity, yet only a few of the most spectacular examples of the phenomenon have been scrutinized. West Indian *Anolis* lizards are perhaps the most thoroughly studied radiation, yet it is unclear to what extent the unique geological history and paleogeography of the West Indies has contributed to shaping patterns of anole diversity and ecology, necessitating comparative studies with clades that have radiated simultaneously, in the same regions and habitats as anoles. The West Indian dwarf gecko genus *Sphaerodactylus* is broadly sympatric with *Anolis*, and available evidence (i.e., phylogenies and fossils), suggests they have long cohabited and have experienced similar historical events. These geckos are one of the dominant components of the West Indian herpetofauna, yet essentially nothing is known about their ecologies. Here, I discuss patterns of ecological and morphological diversification in *Sphaerodactylus* as revealed through geometric morphometrics and associated comparative analyses, including a novel, phylogenetic implementation of partial least squares analysis. I address the extent of morphological adaptation to environmental variables and test if patterns of adaptation are replicated among islands, as they are in anoles.

0240 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Jake Schaefer

University of Southern Mississippi, Hattiesburg, MS, USA

Patterns of Variability in Topminnow (*Fundulus*) Developmental Time not Accounted for by Size or Temperature

In ectotherms, temperature and body size are the most influential and well studied variables affecting metabolic rate. Understanding the evolution of metabolic rates is crucial to broader ecological theory. The metabolic cold adaptation (MCA) hypothesis predicts elevated metabolic rates and faster development time in habitats that have shorter growing periods. Debate over the MCA has been spirited. Studies of developmental times for fishes have not supported the MCA and conclude that most, if not all, variability is accounted for by body size and temperature. We tested MCA predictions by quantifying developmental time for multiple populations of *Fundulus* sp. across six temperatures.

0635 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Rachel Scharer[1], William F. Patterson III[1], John K Carlson[2], Gregg Poulakis[3], Michael Cochran[1]

[1]University of West Florida, Pensacola, FL, USA, [2]NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL, USA, [3]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Charlotte Harbor Field, FL, USA

Examination of Smalltooth Sawfish Life History in South Florida via Vertebral Aging and Laser Ablation ICPMS Analysis

Smalltooth sawfish, *Pristis pectinata*, is the first marine fish species listed as endangered, yet basic life history data critical for conservation are lacking for this species. To address this lack of information, we first estimated age of smalltooth sawfish by counting opaque zones in vertebrae of naturally deceased fish (n =12). Transverse sections were made through vertebral centra and read with transmitted light. Opaque and translucent zones were clearly defined in vertebral sections, and each section was read independently by two readers without any prior knowledge of fish size. Age ranged from zero to eight years for fish that ranged in size between 600 mm and 4,327 mm total length. A von Bertalanffy growth function fit to size at age data resulted in parameter estimates of 5.3 m for L_∞ and 0.159 for K when t_0 was fixed at -0.42 y, which corresponds to the estimated gestation period of the fish. Analysis of vertebral sections with laser ablation inductively coupled plasma mass spectrometry also was conducted to estimate freshwater, brackish, and saltwater residency of fish. Patterns observed in Sr:Ca ratios indicate gestation and birth (inferred from natal marks in vertebral sections) most likely

occurred in estuarine waters (i.e., intermediate to high Sr:Ca values). However, neonates likely migrate to lower salinity waters where they remain through their first summer of life. Sr:Ca ratios generally increased for older fish, mostly likely indicating euryhaline to marine residency, but intra-annual patterns indicate some migration in and out of estuaries likely occurs.

0293 Fish Morphology, Symphony I & II, Friday 8 July 2011

Robert Schelly, John Sparks

American Museum of Natural History, New York, NY, USA

A New Species of *Kaupichthys* (Anguilliformes: Chlopsidae), and a Morphological Assessment of Chlopsid Relationships

Chlopsidae is a family of small tropical and subtropical marine eels comprising eight genera and 24 species, which are commonly referred to as false morays. We report on a new species in the genus *Kaupichthys* (Anguilliformes: Chlopsidae) from nearshore reef habitats of Madagascar. An examination of chlopsid intrarelationships is presented based on morphological characters of the new species and representatives of the other chlopsid genera. Chlopsid affiinities within Anguilliformes have been inconsistent across the few phylogenetic studies to date; the family has been aligned variously with muraenids, synaphobranchids, nemichthyids, or even recovered as the sister group to a large assemblage of anguilliform families. Our comparative anatomical survey of chlopsids is expanded across anguilliforms to assess the placement of chlopsids within the order.

0022 Poster Session I, Friday 8 July 2011

Rick Scherer[1], Erin Muths[2], Barry Noon[1], Sara Oyer-McCance[2]

[1]Colorado State University, Fort Collins, CO, USA, [2]U.S. Geological Survey, Fort Collins, CO, USA

Genetic Structure in a Relict Population of Wood Frogs (*Lithobates sylvaticus*)

Habitat fragmentation and the associated reduction in connectivity between habitat patches are cited commonly as causes of genetic differentiation and reduced genetic variation in animal populations. We used eight microsatellite markers to test hypotheses regarding the genetic structure and levels of genetic variation in a relict population of wood frogs (*Lithobates sylvaticus*) in northern Colorado. We also tested for evidence of a recent population bottleneck and for isolation-by-distance. Results from the clustering algorithm in Program STRUCTURE indicated the population is partitioned into two genetic clusters and an estimate of FST provided strong evidence of differentiation between the clusters. Though a pattern of isolation-by-distance was supported, other

processes may also affect genetic differentiation. Genetic variability in the population is low relative to variability reported in other studies of wood frogs, but we found no evidence that a recent bottleneck was responsible for this. Efforts to preserve wood frogs in this area and improve chances of the populations to persist could include increasing the size and spatial distribution of the populations and improving gene flow between the genetic clusters. These actions would be facilitated by the construction or restoration of wetlands in the landscape between clusters.

0765 Poster Session II, Saturday 9 July 2011

Victoria Schneider, Daniel Kashian

Wayne State University, Detroit, MI, USA

The Effects of Emerald Ash Borer-caused Tree Mortality on Desiccation Rates of Juvenile Wood Frogs (*Lithobates clamitans*) in Southeastern Michigan

Exotic insects may have indirect impacts on the population dynamics of sensitive species in animal communities as well as direct effects on their plant hosts. Emerald ash borer (EAB) is a wood-boring insect native to Asia first identified on ash species in the Detroit area in 2002. EAB is now found throughout Michigan as well as fourteen other states. EAB-caused mortality differs from the historical disturbance regime of the region because it creates many canopy gaps synchronized in time that have the potential to alter environmental conditions and thus sensitive animal populations such as amphibians at the forest floor. In particular, terrestrial habitat quality next to breeding ponds is important for juvenile populations because of amphibians' high surface area-to-volume ratio and thus high risk of desiccation. We compared water loss in juvenile wood frogs in ephemeral ponds beneath an open canopy due to EAB and a closed canopy unaffected by EAB. Water loss was significantly higher for juveniles beneath the open canopy, and was significantly higher within the first few hours compared to juveniles in the closed canopy site. Soil moisture was significantly lower in areas of ash mortality. These results are significant because killed ash trees remain standing for 3-5 years after dying, delaying the creation of refugia for amphibians as coarse woody debris. Although desiccation is a mortal risk normally faced by juvenile amphibians, extensive tree mortality exacerbates this risk by quickly creating openings in forest canopy cover that alter the forest floor environment.

0714 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Nalani K. Schnell[1], G. David Johnson[2]

[1] Virginia Institute of Marine Science, Gloucester Point, VA, USA, [2]National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

Development of the Upper Jaw in Squirrelfishes and Soldierfishes (Beryciformes: Holocentridae): A Unique Ontogenetic Trajectory

The Holocentridae are nocturnal fishes inhabiting shallow to deep water coral and rocky reefs in tropical parts of the Indian, Pacific and Atlantic Oceans. Two subfamilies can be distinguished, the squirrelfishes (Holocentrinae) and the soldierfishes (Miripristinae). Unlike the adults, holocentrid larvae are pelagic and are characterized by elaborate head spination, including prominent rostral, supraoccipital and preopercular spines. The rostral spine, formed by ephemeral fusion of the paired nasals, can project far anterior to the mouth. The spine-bearing bones, the lower jaw bones and one set of upper jaw bones (maxillae) are the first to ossify (at SL: 1.4 mm) during early life history. In several cleared and double stained ontogenetic series of Holocentridae (SL: 1.4 mm - 35 mm) we found a unique ontogenetic trajectory of the other set of upper jaw bones (premaxillae). The premaxillae develop late, well after the other jaw bones and head spines are developed and most of the remaining skeleton is ossified (between 5.9 mm and 6.6 mm). Usually in larval fishes both sets of upper jaw bones as well as the lower jaw, the caudal fin and pectoral girdle are the first elements to ossify in order to ensure feeding and swimming mechanics. We address the questions of how feeding is managed without premaxillae, whether the rostral spine has a role in feeding in the absence of premaxillae and whether feeding changes during early life history. Furthermore we compare our results with jaw and rostrum development in other larvae exhibiting a rostral spine, e.g. tilefishes (Malacanthidae).

0120 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Danna Schock

Keyano College, Fort McMurray, Alberta, Canada

Amphibian Ranaviruses in Canada - Historical, Current and Future Research Directions

Ranaviruses have been documented in Canadian amphibian populations from British Columbia to Prince Edward Island, and as far north as Norman Wells in the Northwest Territories. On-going research in Canada falls under four broad categories: 1) field studies that examine host range and geographic range, usually as part of studies that also investigate the prevalence of chytrid fungus infections in provincially or federally listed amphibian species; 2) field + lab studies that seek to identify ecological and environmental correlates with disease outbreaks; 3) validating and improving non-lethal

diagnostic tests; and 4) viral biology including annotating viral genomes and identifying mediators of gene expression. To date, most amphibian ranaviruses documented in Canada have been isolated from ranid frogs and appear to be FV3-like. A smaller number of studies have focussed on ranaviruses from tiger salamanders (Ambystomatidae) in Alberta, Saskatchewan and Manitoba, and thus far, all isolates have been identified as *Ambystoma tigrinum* virus (ATV). Comparatively little work has examined other families of salamanders or anurans. This is an important research need given the multi-host nature of ranaviruses. Studies that are needed for management and conservation purposes include long-term (10+ yr) studies that can address the effects of ranaviruses on long-term host population stability and persistence, the effects of ranaviruses on amphibian communities (not just populations of focal species), and studies that identify immunological and ecological correlates with disease outbreaks and effects of sublethal infections.

0755 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

James Schulte

Clarkson University, Potsdam, NY, USA

Overestimation of Bayesian Credibility Values with Nuclear DNA Data: An Example Using Liolaemini Lizards

Phylogenetic relationships among 134 species of South American Liolaemini lizards are examined using analyses of six nuclear DNA encoded genes. All major lineages within *Liolaemus* and *Phymaturus* are included. Over 10600 base pairs of nuclear DNA are analyzed separately and combined using maximum likelihood and several Bayesian estimation methods including standard MrBayes runs, reversible jump heterotachy models implemented in BayesPhylogenies, and Phycas with and without a polytomy prior assumed. Phylogenetic hypotheses generated from nuclear DNA are generally congruent with trees based on mtDNA data alone as are separate nuclear gene trees compared to the concatenated combined nuclear tree. Combined analyses provide robust support for relationships among most major clades of Liolaemini lizards. However, the use of Phycas assuming a polytomy prior consistently identifies branches in the Liolaemini gene trees that would be incorrectly inferred to be strongly supported using MrBayes or BEAST that do not allow for polytomies in phylogenetic estimation. These results corroborate numerous previous studies indicating Bayesian credibility values can overestimate branch support. The use of maximum likelihood bootstrap values compared with Phycas polytomy prior credibility values both above 95% is recommended to be used for strongly supported branches in phylogenetic inference.

0093 Fish Conservation, Symphony III, Saturday 9 July 2011

Michael R. Schwemm, Anthony A. Echelle, Ron A. Van Den Bussche

Oklahoma State University, Stillwater, OK, USA

Conservation Implications of Fragmentation of the Threatened Leopard Darter, *Percina pantherina*

A history of low abundance and limited distribution has characterized *Percina pantherina*, a percid endemic to the Little River system, SE Oklahoma and SW Arkansas. Concerns of habitat fragmentation by reservoir construction and agricultural/silvicultural perturbations have been apparent since its federal listing in 1978. Here, we compare levels of heterozygosity and population subdivision and estimate genetic effective sizes to evaluate the potential loss of genetic variation. Genetic variation at eight microsatellite loci revealed relatively low levels of allele richness (A_R = 3.74 to 6.60) and heterozygosity (H_e= 0.461-0.636) within populations. Tributary streams (now separated by at least one reservoir) differed significantly in allele frequencies, with 10.2% of the genetic diversity attributable to differences among tributaries. Maximum likelihood (MIGRATE) and Bayesian (MSVAR) coalescence approaches indicate that current effective populations sizes are similar with those from the summary statistic approach of LDNe, and about three orders of magnitude smaller than the ancestral population sizes and one order smaller than the long-term effective sizes. The point estimates of time since the start of the decline (69 to 398 yrs) and the associated 95% support limits are consistent with the hypothesis that low diversity is a result of fragmentation in the last century.

0328 Poster Session II, Saturday 9 July 2011

Arun Sethuraman, Morgan Becker, Fredric Janzen

Iowa State University, Ames, IA, USA

Cryptic Phylogeographic Patterns in Midwestern Populations of Blanding's Turtles (*Emydoidea blandingii*)

As part of a population genetics study of the imperiled Blanding's Turtle, we genotyped 212 turtles sampled across 18 populations in Iowa, Illinois, Nebraska and Minnesota using 8 microsatellite markers. Isolation by Distance analysis captured little of the overall genetic variance (R^2 = 0.04 in a plot of genetic versus geographic distance). Further investigation detected considerable structure among 5 distinct groups of populations, with populations typically structuring into groups that accord with expected patterns of post-glacial re-colonization of the upper Midwest. Unexpectedly, though, populations from Grant County, Nebraska grouped with turtles sampled from the Greater Chicago Metropolitan Area, a pattern detected at all levels of population structure (K=1 through 9) and with multiple statistical inference tools. Divergence and ancestral gene flow estimates reveal a split between *E. blandingii* populations in these

two regions around 50000 years ago (95% CI of 39590-12025 years), with negligible bidirectional migration since. Sequencing of the microsatellite flanking regions and rebuilding the population phylogeny will reveal patterns of ancestral divergence and resolve whether the unexpected pattern resulted from convergent evolution or saturation of microsatellites, or from incomplete lineage sorting from a putative ancestor in the southern Great Plains between these populations.

0475 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

H. Bradley Shaffer[1], Robert Thomson[1], Phillip Spinks[1], Thomas Near[2]

[1]University of California, Davis, Davis, CA, USA, [2]Yale University, New Haven, CT, USA

How Old are the Living Turtles?

Turtle evolution and phylogenetics has benefitted from a large effort in the last decade, and many previously controversial issues are reaching resolution. However, two key issues in the deep evolutionary history of turtles remain unresolved. The first is the position of turtles within Amniota, although the recently completed painted turtle genome project is helping to solve this phylogenetic problem. The second, and the focus of this talk, is the age of the most recent common ancestor (MRCA) of living turtles. Traditionally, the age of fossil taxon *Proterochersis* have been taken as strong evidence that the living turtle MRCA is approximately 210 million years old. However, more recent paleontological and morphological analyses suggest that *Proterochersis* falls outside of the living turtles and therefore provides no evidence on their age. These analyses place a much younger, late Jurassic age on living turtles. Resolving this age is important, both for our basic understanding of the tempo of chelonian diversification and for phylogenetic analyses of key conservation issues. To help resolve the age of turtles, we conducted phylogenetic analyses of a 10-gene, 143 morphological character data set of 28 living and 11 fossil taxa representatives of the major lineages of turtles and estimated the age of the living turtle MRCA. Our estimate was approximately 230 million years, nearly identical to the age based on *Proterochersis*, supporting the original estimate based on this early fossil specimen.

0550 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Amanda Shearin[1], Aram Calhoun[1], Cynthia Loftin[2]

[1]University of Maine, Orono, ME, USA, [2]U.S. Geological Survey, Cooperative Fish and Wildlife Research Unit, Orono, ME, USA

Automated Audio Recording Devices: Implications for Listener-Based Amphibian Surveys in Maine (USA)

Volunteer-based audio surveys are valuable tools for documenting trends in amphibian communities. Current sampling protocols are not region or species-specific, however, and they may not be suitable for detecting rare or audibly cryptic species. We used automated audio recording systems (ARS) to record calling amphibians at 12 lakes and four vernal pools in Maine, USA, during 2006-2009. These systems were programmed to record a 2-3 minute audio clip every hour from 30 minutes past sunset until sunrise. Individual audio clips selected from the sampling time period (30 minutes past sunset to 0100 h) described in the North American Amphibian Monitoring Program (NAAMP) detected fewer species than were detected during recordings for the entire night. Individual audio clips from the NAAMP sampling period underestimated the Calling Index for *Lithobates septentrionalis* and *L. clamitans* during 33 and 24%, respectively, of sampling nights. Time of maximum detection and full chorusing of *L. septentrionalis*, *L. clamitans*, and *L. palustris* occurred after the 0100 h NAAMP sampling end time. Julian date was the best predictor of calling occurrence for *Hyla versicolor*, *L. catesbeiana*, *L. pipiens*, *L. septentrionalis*, and *L. sylvatica*, however, additional environmental variables were needed to predict calling occurrence by *Pseudacris crucifer*, *L. clamitans*, and *L. palustris*. The sampling period described in the NAAMP protocol may result in omissions and misclassifications of chorus sizes for certain species. These potential errors should be considered when interpreting trends generated from generalized amphibian audio surveys.

0169 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Christopher Sheil, Sean Harrington

John Carroll University, University Heights, OH, USA

A Comprehensive Study of Heterochrony Among Amphbians Using PARSIMOV

Studies of relative timing of formation and ossification of skeletal elements have shed light on the developmental and evolutionary origins of various aspects of the tetrapod skeleton. Recently, software has been developed that automates the process of inferring ancestral sequences of developmental events, thereby facilitating the study of heterochrony in these data. PARSIMOV is one such program. Ossification sequence data were collected from representatives of families within Anura, Gymnophiona, and

Caudata to reconstruct ossification sequences of internal nodes within the phylogenetic hypothesis of Frost et al. (2006) to identify instances of heterochrony in various structural units of the skeleton of these amphibians.

0357 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

Donald Shepard[1], Frank Burbrink[2]

[1]University of Minnesota, Saint Paul, MN, USA, [2]College of Staten Island-CUNY, Staten Island, NY, USA

Local-scale Environmental Variation Generates Highly Divergent Lineages Associated with Stream Drainages in a Terrestrial Salamander, *Plethodon caddoensis*

Spatial and temporal environmental heterogeneity can have profound effects on species that are tightly linked to their environments. The Caddo Mountain Salamander (*Plethodon caddoensis*) inhabits a unique physiographic section of the Ouachita Mountains of Arkansas, a region in which Pleistocene climatic fluctuations have been implicated in driving lineage diversification in two other closely related salamanders. We examined *P. caddoensis* to determine whether it was similarly impacted by historic climatic changes and to test whether physiographic features unique to the area influenced its pattern of diversification. Using mtDNA, we found that *P. caddoensis* is composed of four highly divergent, geographically distinct lineages that abut one another along an east-west axis (8.3 - 10.9% mean uncorrected sequence divergence). Phylogeographic structure was significantly related to both geographic distance and stream drainage basins, indicating that connectivity of streams and stream-associated habitats influence patterns of interpopulation gene flow. Lineages originated during the Middle Miocene (9 - 11 mya) and population size decreased in all lineages during the Pleistocene. Surface geology and precipitation were the most important variables predicting the species distribution. Our results show that the unique physiographic features of the region coupled with species response to climatic factors have driven lineage diversification and phylogeographic structure in *P. caddoensis*. Variation in responses to historic climatic fluctuations among salamander species in this region underscore the importance of integrating species ecology with other factors such as geology and hydrology in order to better understand the effects of climate change on species with close associations to their environments.

0033 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

David Shiffman[1], Bryan Frazier[2], John Kucklick[3], Tracey Sutton[4], Kristene Parsons[4], Gorka Sancho[1]

[1]College of Charleston, Charleston, SC, USA, [2]South Carolina Department of Natural Resources, Charleston, SC, USA, [3]National Institute of Standards and Technology, Charleston, SC, USA, [4]Virginia Institute of Marine Sciences, Gloucester Point, VA, USA

Detection of an Ontogenetic Shift in the Diet of the Sandbar Shark (*Carcharhinus plumbeus*, Nardo 1827) Using Minimally Invasive d13C and d15N Stable Isotope Analysis.

The sandbar shark, *Carcharhinus plumbeus*, is a common and economically important species in the western North Atlantic. Additional diet and trophic level information would facilitate the creation of an ecosystem-based management plan. Diet analyses using stomach contents in other regions have revealed an ontogenetic shift in the diet of sandbar sharks in two different areas, but whether this shift takes place throughout their range is unknown. $\Delta^{13}C$ and $\Delta^{15}N$ stable isotope analysis is a minimally invasive and non-lethal method for determining diet and trophic level. Significant differences in $\Delta^{13}C$ signatures were found between young-of-year and juveniles, suggesting that South Carolina sandbar sharks have a similar ontogenetic shift as sandbar sharks in other regions. Differences in total occupied niche area and $\Delta^{15}N$ range indicated that young-of-year sharks have more diverse diets than juveniles. Data from suspected prey species is also described.

0019 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Natalia Shishova[1], Victor Uteshev[1], Svetlana Kaurova[1], Ludmila Kramarova[2], Robert Browne[3], Edit Gakhova[1]

[1]Institute of Cell Biophysics, Russian Academy of Sciences, Pushchino, Moscow Region, Russia, [2]Institute of Theoretical and Experimental Biophysics, Russian Academy of Sciences, Pushchino, Moscow Region, Russia, [3]Centre for Research and Conservation, Royal Zoological Society of Antwerp, Antwerp, Belgium

Cryopreservation of Sperm for Conservation of Threatened Amphibians

At present, cryopreservation is unique and reliable technique for the long-term conservation of amphibian germplasm. In 1996 at the Institute of Cell Biophysics, Russian Academy of Sciences, we cryopreserved spermatozoa from the macerated testis of *Rana temporaria* and *Bufo bufo* using a cryodiluent of 15% DMSO, 10% sucrose, and 1% BSA, which proved both motile and fertile in producing substantial numbers of metamorphosis. Recently, protocols were developed for the cryopreservation of

hormonally induced sperm (HIS) sampled through spermic urine. We induced spermiation in *R. temporaria* through the intraperitoneal administration of 50 µg LHRH and sampled HIS. We diluted spermic urine to a final concentration of $1x10^8$ cell/ml in four cryodiluents to give a final concentration in cryosuspensions of: 1. DMSO, (½ ringer's solution (RS) with 10% sucrose and 12% DMSO); 2. DMSO/egg yolk, (cryodiluent 1. with 10% egg yolk); 3. dimethylformamide (DMFA), (½ RS, 10% sucrose, 12% DMFA); or 4. MIS (motility inhibiting saline)/glycerol, (MIS, 5% glycerol, 2.5% sucrose, 5% egg yolk). The cryosuspensions were then frozen in a simple apparatus over LN_2 vapour, then thawed and osmotically equilibrated. After thawing and equilibration the DMFA protocol produced significantly higher motility and membrane integrity. Egg yolk did not improve recovery and MIS/glycerol provided very low recovery. Although hatching rates were the same between cryodiluents, DMFA produced significantly higher survival of larvae 7 days post hatch. In conclusion, we developed reliable protocols for production and cryopreservation of HIS from *R. temporaria*, which may be transferable to many threatened Ranid species.

0280 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011

Brian Sidlauskas, Douglas F. Markle

Oregon State University, Corvallis, OR, USA

How We Learned to Stop Worrying and Love the Fire Marshal: A Practical Guide to Saving an Ichthyology Collection

Changing institutional priorities, high cost and a troublesome flammable preservative often threaten the stability and support of ichthyology collections despite their scientific importance. The Oregon State University Ichthyology Collection (OSUIC) has represented a major center of research and education since 1935, but nevertheless came under substantial threat in 2009 when its building entered renovation and was found to be massively out-of-compliance with fire and seismic safety regulations. Initial proposed solutions, such as moving the collection to an off-campus warehouse, would have destroyed much of the collection's scientific and educational potential. This talk will detail the successful negotiation and good fortune that helped the OSUIC avoid that grim fate and parlay the crisis into substantial new growth. As a result of the trial by fire-suppression, the collection has secured funding for a renovated on-campus facility from OSU and the NSF. Post-renovation, the OSUIC will comply with all fire and seismic safety codes, enjoy a 43% increase in shelf space due to a new compact shelving system, and house its largest specimens in over 90 archival stainless-steel tanks. Imminent upgrades also include complete computerization of the catalog, the development of a digital teaching collection and online course on the Systematics of Fishes, and renewed growth resulting from expeditions to Guyana and the Oregon outback. With luck, other collections undergoing similar tribulations will be able to recapitulate the steps that led to the salvation of the OSUIC, for each collection that is deaccessioned or warehoused represents a major loss for biodiversity science.

0013 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Dustin Siegel[1], Kevin Gribbins[2], Robert Aldridge[1]

[1]Saint Louis University, St. Louis, MO, USA, [2]Wittenberg University, Springfield, OH, USA

The Function of the Sexual Collecting Ducts in *Notophthalmus viridescens*

Kidneys with sexual function are rare in vertebrates and restricted to stickleback fishes, squamates (lizards and snakes), and salamanders. Little data exist on all aspects of sexual kidneys in salamanders. Recently we have reported the presence of sexual segments in at least Ambystomatidae, Plethodontidae, Rhyacotritonidae, and Salamandridae, described the morphology of the sexual segment in *Ambystoma maculatum*, and assessed the seasonal secretory activity of the sexual segment in comparison to other sexual glands in *Notophthalmus viridescens*. Here we present data indicating that the secretions from the sexual collecting ducts elicit undulations of the axial filament of sperm from *N. viridescens*. However, hypoosmotic shock of the spermatozoa is required for axial filament activation. Furthermore, hypoosomtic shock elicits vibration of the spermatozoa by activation of the marginal filament and subsequent motility of the undulating membrane. The axial filaments of "mature sperm" from the testis could not be activated indicating that sperm must complete the maturation process in either the extratesticular or Wolffian ducts to respond to the sexual segment secretions.

0018 Amphiban Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Aimee Silla

University of Western Australia, Perth, Western Australia, Australia

Effect of Multiple Priming Injections of Luteinizing Hormone-releasing Hormone on Spermiation and Ovulation in Guenther's Toadlet, *Pseudophryne guentheri*

In most vertebrates, gametogenesis and gamete-release depend on the pulsatile secretion of luteinizing hormone-releasing hormone (LHRH). Studies attempting to artificially stimulate ovulation and spermiation in frogs may benefit from mimicking the naturally episodic secretion of LHRH by administering multiple priming injections of a synthetic analogue. This study investigated the impact of multiple priming injections of LHRHa on gamete-release in the Australian toadlet *Pseudophryne guentheri*. Toadlets were administered a single dose of 2µg/g LHRHa without a priming injection (no priming), or preceded by one (one priming) or two (two priming) injections of 0.4µg/g LHRHa. No priming induced the release of the highest number of spermatozoa, with a step-wise

decrease in the number of spermatozoa released in the one and two priming treatments respectively. No significant difference in sperm viability was detected among treatments. Control females failed to released oocytes, while those administered an ovulatory dose without priming exhibited a poor ovulatory response. The remaining two priming treatments (one and two priming) successfully induced 100% of females to expel an entire clutch. Oocytes obtained from the no, or two priming treatments all failed to fertilise, however oocytes obtained from the one priming treatment displayed an average fertilisation success of 97%. In conclusion, results from this study show that ovulation is most effectively induced in female *P. guentheri* by administering a single priming injection prior to a higher dose of LHRHa. In contrast, spermiation was most effectively induced by the administration of a single LHRHa injection in the absence of priming.

0330 Poster Session I, Friday 8 July 2011

Colin Simpfendorfer[1], Beau Yeiser[2], Tonya Wiley[3], Gregg Poulakis[4], Philip Stevens[4], Michelle Heupel[5]

[1]James Cook University, Fishing and Fisheries Research Centre, Townsville, Australia, [2]Florida Fish and Wildlife Conservation Commission, Tequesta Field Laboratory, Tequesta, FL, USA, [3]Haven Worth Consulting, League City, TX, USA, [4]Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA, [5]James Cook University, School of Earth and Environmental Sciences, Townsville, Australia

Environmental Influences on the Spatial Ecology of Juvenile Smalltooth Sawfish (*Pristis pectinata*): Results from Acoustic Monitoring.

To aid recovery efforts of smalltooth sawfish (*Pristis pectinata*) populations in U.S. waters a research project was developed to assess how changes in environmental conditions within estuarine areas affected the presence, movements, and activity space of this endangered species. Forty juvenile *P. pectinata* were fitted with acoustic tags and monitored within the lower 27 km of the Caloosahatchee River estuary, Florida, between 2005 and 2007. Sawfish were monitored within the study site from 1 to 473 days, and the number of consecutive days present ranged from 1 to 125. Residency index values for individuals varied considerably, with annual means highest in 2005 (0.95) and lowest in 2007 (0.73) when several *P. pectinata* moved upriver beyond detection range during drier conditions. Mean daily activity space was 1.42 km of river distance. The distance between 30-minute centers of activity was typically <0.1 km, suggesting limited movement over short time scales. Salinity electivity analysis demonstrated an affinity for salinities between 18 and at least 24 psu, suggesting movements are likely made in part, to remain within this range. Thus, freshwater flow from Lake Okeechobee (and its effect on salinity) affects the location of individuals within the estuary, although it remains unclear whether or not these movements are threatening recovery.

0234 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Phillip Skipwith, Aaron Bauer, Todd Jackman

Villanova University, Villanova, PA, USA

Multilocus Systematics and Divergence Times of New Caledonian Diplodactylids

Diplodactylid geckos represent one of two squamate lineages to have undergone a major radiation on New Caledonia. We used mitochondrial DNA (ND2 + 5 tRNAs) and five independent nuclear exons (KIF24, KIAA1549, RAG1, MXRA5, PDC) to re-examine the placement of the New Caledonian radiation within the Diplodactylidae as well as estimate times of divergence. Both mtDNA and nucDNA suggest that there is significant species-level diversification within Bavayia and Dierogekko despite both genera being morphologically conservative. Additionally, all datasets agree that *Rhacodactylus* is non-monophyletic and is composed of several unrelated lineages. Despite the inclusion of more than 5,000 bp of molecular data, the base of the New Caledonian tree consists of relatively short branches and remains poorly resolved. The concatenation of nuclear genes results in improved support for certain nodes also recovered in the mtDNA phylogeny, but not seen in individual nuclear gene trees. Dating analyses suggest that this clade underwent a rapid diversification early in its divergence. Coalescent dating methods (both concatenation and species tree analyses) suggest that the New Caledonian radiation is younger than implied solely based upon suspect cladogenic geological events.

0278 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Gregory Skomal, John Chisholm, Steven Correia

MA Marine Fisheries, New Bedford, MA, USA

Implications of Increasing Pinniped Populations on the Diet and Abundance of White Sharks off the Coast of Massachuestts

Although the occurrence of the white shark, *Carcharodon carcharias*, is well documented in the North Atlantic, the species is relatively rare and much of what is known about its distribution and movements is based on historical sightings data. The advent of new tagging technology coupled with the existence of white shark "hotspots" near pinniped colonies have allowed researchers to investigate the ecology of this species in the Pacific and Indian Oceans, but its elusive nature in the Atlantic has hampered such studies in this region. However, the numbers of white shark sightings and white shark-pinniped predation events have been rising off the coast of Massachusetts in recent years and, in particular, near Monomoy Island on Cape Cod, which hosts a large growing population

of gray seals (*Halichoerus grypus*). While the perceived increase in shark predation on gray seals can be attributed to several factors, it is feasible that white sharks, which were thought to primarily scavenge cetaceans in the Atlantic, are expanding their diet in response to regional changes in seal abundance. Based on documented changes in white shark populations exhibited in other parts of the world, we anticipate that the number of white shark sightings and seal interactions will continue to rise off the coast of Massachusetts.

0285 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Christopher E. Smith[1], Erica P. Hoaglund[2], Jeffrey B. LeClere[3], Jim Scharosch[4], Tony Gamble[5]

[1]University of Minnesota, Saint Paul, MN, USA, [2]Minnesota Department of Natural Resources, Division of Ecological and Water Resources - Nongame Program, Saint Paul, MN, USA, [3]878 Galtier Street, Saint Paul, MN, USA, [4]811 Boulder Drive, Center Point, IA, USA, [5]University of Minnesota, Minneapolis, MN, USA

Two Naturally Occurring Intergeneric Hybrids from the Snake Tribe Lampropeltini (Squamata: Colubridae) from the Midwestern United States

Intergeneric hybridization in nature appears to be uncommon among squamates, with only one case (*Conolophus subcristatus* x *Amblyrhynchus cristatus*) confirmed using genetic data. This study describes two intergeneric hybrid snake specimens (both *Pituophis catenifer sayi* x *Pantherophis vulpinus*). The two specimens appear morphologically intermediate between the putative parental species, *Pituophis c. sayi* and *Pantherophis vulpinus*. Both originated from the midwestern United States, with one specimen collected from southeastern Minnesota and the other from southern Iowa. Hybrid status was verified by comparing DNA sequence data from each specimen with sequences from the likely parental species. Both hybrid specimens were found to posses *Pituophis c. sayi* mitochondrial DNA haplotypes. Further support for the specimen's hybrid status was obtained by the examination of a nuclear gene fragment (Vimentin intron 5), which showed that the hybrid specimens were heterozygous at most variable sites. We also collected and analyzed morphometric and meristic data from 12 *P. vulpinus*, 12 *P. c. sayi*, and the two hybrid specimens. Principal component analysis revealed the hybrid specimens to be morphologically intermediate between the parental species. These two individuals represent only the second and third confirmed specimens of naturally occurring intergeneric hybrids among squamate reptile species.

0700 Poster Session II, Saturday 9 July 2011

Gerald Smith[1], Thomas Dowling[1]

[1]University of Michigan, Ann Arbor, MI, USA, [2]Arizona State University, Tempe, AZ, USA

Effect of Stream Captures on Evolution in Western United States Freshwater Fishes

Fish diversity is lower in the geologically unstable landscapes of western US compared to the stable east because of high extinction rates in the west. We test the hypothesis that captures of neighboring river drainages have consequences for genetic structure of populations. Many western drainages such as the Columbia and Colorado are composites of smaller drainages that existed before late Pliocene climate changes; the faunas may be larger depending on the duration of isolation prior to the connection. Stream captures and lake spillovers between drainage basins in extensional terrains such as the Basin and Range may bring whole populations of previously isolated relatives into genetic contact. The prediction is that populations brought together in unequal numbers may merge genetically, with loss or gain of apomorphic traits, whereas sudden sympatry of equally large populations of relatives may result in ecological divergence. Where genetic contact consists of occasional immigrants from allopatric sister populations isolated by distance, as in stable drainages of the eastern US, divergence may be enhanced slowly by mate choice selection and behavioral isolating mechanisms. These lineages experience lower rates of introgressive losses of populations. Ecological divergence of sister species sometimes occurs as a consequence of stream capture and large-scale genetic contact, according to evidence from fossils and molecular cladistics.

0546 Poster Session I, Friday 8 July 2011

Kelcee Smith, John Carlson

National Marine Fisheries Service, Panama City, FL, USA

Status and Population Viability of the Alabama shad (*Alosa alabamae*)

Historically, Alabama shad have been recorded as far north as the Ohio River in West Virginia and were commonly found in other Mississippi River tributaries including the Red, Arkansas, Missouri, and Tennessee Rivers. Over the last several decades, habitat fragmentation as a result of locks and dams blocking access to spawning areas and altering hydrology and river substrates has resulted in declines in the range of Alabama shad. The habitat fragmentation and reduction in range caused the National Marine Fisheries Service to list this species as Species of Concern in 2004. We evaluated new sources of data to provide an update as to whether Alabama shad should be retained or removed from the Species of Concern list. Surveys from scientists at Universities, state and federal facilities, and non-profit organizations suggest that the population has undergone severe fragmentation, but spawning populations persist in the Suwannee,

Choctawhatchee, Escambia, and Pascagoula Rivers, with the largest spawning population of Alabama shad in the Apalachicola River in Florida. Population Viability Analysis indicates populations could increase if favorable environmental conditions are restored throughout its range. Scenarios exploring increases in habitat availability and survivorship all resulted in increases in the number of spawners. Positive results such as these provide incentives to advance research and develop management plans to enable the species to increase in abundance and re-occupy historic systems.

0673 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Leo Smith

The Field Museum, Chicago, IL, USA

Approaching the Percomorph Problem

Steps toward resolving relationships among the diversity of percomorph fishes remain highly contentious. Previous morphological attempts to resolve the percomorph bush have often failed to include sufficient taxon and/or character sampling to allow for substantive revisions to percomorph taxonomy. Recent molecular studies have addressed these problems with some success, but they have highlighted new issues regarding homoplasy and gene concordance. The bottom line is that progress will not be made without morphological and molecular studies testing each others hypotheses in an attempt to refine previous homology statements and propose new relationships based eventually on combined analyses. This talk will outline a first pass at molecular approaches to resolving the percomorph bush, including an example from one of the novel molecular groupings.

0589 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Matthew Smith

University of Arkansas, Fayetteville, AR, USA

Is the Trophic Morphology of Snakes Inducible by Variation in Prey Size and Abundance?

The trophic morphology of snakes is a complex mosaic of structures that interact and articulate to function as spectacular unit capable of ingesting large prey items. Each of the disparate parts may vary in size, shape, and/or ontogenetic development; influencing the overall performance of an individual. I tested the hypothesis that trophic morphology of rattlesnakes is inducible by prey size and/or abundance. Juvenile prairie rattlesnakes (*Crotalus viridis viridis*) were manipulated to control for resource level, prey 'size', snake population of origin, and litter. Neonate rattlesnakes were fed a diet of

thawed rodents or force-fed rodent homogenate for 15 months, while geometric morphometrics were employed to quantify shape and size of integrated components of trophic morphology. ANCOVA and MANCOVA procedures were used to test for differences in size and shape respectively. The ontogenetic relationship between body size (SVL) and trophic morphology was examined using Procrustes Trajectory Analysis (PTA). Results suggest that the litter effect, whether through maternal effects or genetic differences, far outweighs the influence of prey size and resource level. The relative contributions of all three factors can be examined in the context of previously documented patterns of geographic variation in morphology to provide insights into the ecology and population structure of these organisms. My results have improved on past research through the use of geometric morphometrics and the careful control of both genetic and environmental factors. My study has revealed a more complete understanding of the relationships between trophic morphology and the factors that influence it.

0679 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Wade D. Smith, Jessica A. Miller

Department of Fisheries and Wildlife, Coastal Oregon Marine Experiment Station, Hatfield Marine Science Center, Oregon State University, Newport, OR, USA

The Effects of Temperature, Growth, and Water Concentration on the Elemental Composition of Elasmobranch Vertebrae

Otolith elemental signatures have proven to be valuable natural markers, providing insight into migratory patterns, population structure, and natal origin of many species. Sharks and rays lack the calcium carbonate otoliths of teleosts but possess mineralized vertebral cartilage that is typically deposited in an annual banding pattern and continues to grow throughout an individual's life. If the incorporation of elements in vertebrae is related to environmental conditions, the geochemical composition of cartilaginous vertebrae may also serve as natural tags and records of environmental history in elasmobranch populations. To determine the relationship between water and vertebral elemental concentrations, we conducted two controlled laboratory studies using round stingrays, *Urobatis halleri*, as a model species. First, we determined the extent of partitioning and quantified the effects of temperature (16°C, 18°C, 24°C) and growth rate on vertebral elemental composition (Li:Ca, Mg:Ca, Mn:Ca, Zn:Ca, Sr:Ca, Ba:Ca). Second, we further evaluated the relationship between water and vertebral elemental composition by manipulating the dissolved concentrations of barium in each tank. In the first experiment, vertebral elemental concentrations were significantly influenced by temperature. Temperature negatively affected the incorporation of Mg:Ca, Sr:Ca, and Ba:Ca. In the second experiment, vertebral Ba:Ca was positively correlated with water Ba:Ca. Elemental incorporation was not found to be effected by variable growth rates. This study represents the first validation experiment on elemental incorporation in elasmobranch cartilage, provides support for the assumption that

vertebral composition reflects environmental variation, and highlights the potential use of elemental signatures in the vertebrae of elasmobranchs as natural markers.

0529 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Julie Sommer[1], Chenhong Li[1], Jeremy Brozek[1], Michael Bessert[1], Guillermo Orti[1], Tim Berra[2]

[1]University of Nebraska, Lincoln, NE, USA, [2]The Ohio State University, Mansfield, OH, USA

Low Genetic Diversity in Nurseryfish, *Kurtus gulliveri* (Perciformes: Kurtidae), and an Appraisal of its Breeding System using Microsatellite Loci

The Nurseryfish, *Kurtus gulliveri,* is a freshwater fish distributed in northern Australia and southern New Guinea that exhibits forehead brooding, a unique form of male parental care. Microsatellite markers were developed for paternity analysis to study its reproductive life history in a population from the Adelaide River, Northern Territory, Australia. In 20 microsatellite loci tested, only two polymorphic markers were found. The microsatellite data are mostly consistent with the hypotheses that the putative egg-carrying male sired the egg mass and no multiple paternity occurred in the population examined. However, caution should be taken in interpreting the results, given the low genetic diversity and limited analytic power. The extremely low genetic diversity was also corroborated by control region sequences, the most variable fragment in the piscine mitogenome. Eighteen individuals from the Adelaide River were sequenced, revealing four polymorphic sites in the control region and five haplotypes in total, with an average p-distance of 0.001. Additional individuals from three other isolated populations in the Northern Territory (Daly River, the South Alligator River, and East Alligator River) were sequenced and found to be identical to one of the common haplotypes from the Adelaide River. Four samples collected from New Guinea represent a single haplotype that had 24.5 substitutions on average relative to the Australian populations.

0609 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Laurie Sorenson

University of California, Los Angeles, Los Angeles, CA, USA

Accomodating Incomplete Sampling in Shark Macroevolution

The extant Neoselachii are a relatively diverse group of chondricthyans that form a well-supported monophyletic group. Extant sharks are of an ancient lineage and rapid diversification of these fishes during the Jurassic and Cretaceous is suggested based on fossil evidence, and the timing is in agreement with phylogenetic hypotheses. Several

longstanding hypotheses have been suggested to explain shark diversity, including but not limited to ecological opportunity, reproductive strategy and body size. Testing macroevolutionary hypotheses is difficult in part due to incomplete sampling of trees. Here I use recently developed comparative phylogenetic methods that accommodate missing taxa to explicitly test evolutionary scenarios of shark lineage diversification and body size evolution in an incomplete phylogenetic framework. I used MEDUSA in conjunction with a backbone phylogeny generated from DNA sequences for five loci (four mitochondrial and one nuclear) currently available in Genbank for 230 taxa, complemented with newly sequenced species. The inferred phylogeny was dated using a relaxed molecular clock approach and 15 fossil calibration points. The program MECCA, a new method based upon approximate Bayesian computation (ABC), was used to examine the role of phenotypic diversification (i.e. body size) in the evolution of shark lineages, and to quantify the tempo of body size evolution in sharks.

0690 Poster Session I, Friday 8 July 2011

Stephen Spear[1], Joshua Parker[2], Mark Anderson[3], Douglas Keineth[3], Charles Peterson[4], Lisette Waits[1]

[1]The Orianne Society, Clayton, GA, USA, [2]Clayton State University, Morrow, GA, USA, [3]Wyoming Natural Diversity Database, Laramie, WY, USA, [4]Idaho State University, Pocatello, ID, USA, [5]University of Idaho, Moscow, ID, USA

Integrating Genetics and Habitat Modeling to Inform Conservation of Midget Faded Rattlesnakes (*Crotalus oreganus concolor*)

Fragmentation of habitat due to energy development is increasingly becoming a concern for the persistence of reptile populations, particularly in shrub or desert habitats. We used distribution models and genetic analyses to predict important habitat areas and assess connectivity in the midget faded rattlesnake (*Crotalus oreganus concolor*) in Wyoming. Known denning sites were used to develop a den model and radio-telemetry points from foraging snakes were used to model foraging sites. Model selection based on AIC indicated only two variables predicted denning areas: distance to rock outcrops and temperature range between warmest and coldest months. We conducted field surveys to validate predicted denning areas and found support for the two-variable model chosen by AIC. The foraging model also contained only two variables: distance to rock outcrops and mean temperature during the wettest quarter. Both models suggest climate change could impact location of suitable habitat. We also used 19 microsatellite loci to assess the genetic diversity and connectivity of 680 individuals across the study area. While expected heterozygosity across the entire study area was similar to other rattlesnake studies (H_e = 0.65), observed heterozygosity was much lower (H_o = 0.45), suggesting genetic fragmentation and loss of diversity due to drift across the Wyoming range. Genetic clustering also supported genetic differentiation, as we estimated 4-5 distinct genetic clusters. Examining spatial patterns of genetic structure suggested that recent anthropogenic barriers (reservoirs, roads) have

recently disrupted formerly connected areas, and thus the snakes are susceptible to additional isolation if further development occurs.

0641 Poster Session III, Sunday 10 July 2011

Carol Spencer[1], Michelle Koo[1], David Bloom[1], Carla Cicero[1], John Wieczorek[1], Robert Guralnick[2], Town Peterson[3], Laura Russell[3], David Vieglais[3], Nelson Rios[4], Hank Bart[4]

[1]University of California, Berkeley, CA, USA, [2]University of Colorado, Boulder, CO, USA, [3]University of Kansas, Lawrence, KS, USA, [4]Tulane University, New Orleans, LA, USA

VertNet: Distributed Databases with Backbone

Alarm over global climate change and associated loss of biodiversity has resulted in international demand for quick, reliable access to high quality data on the spatio-temporal occurrence of species and their relation to environment. Responses to this demand have led to the development of four NSF-funded distributed database vertebrate networks (FishNet2, MaNIS, HerpNET, ORNIS), which currently include 171 collections from 12 countries and 52 additional collections (20 countries) committed to participation. Collectively, these networks have successfully demonstrated community data sharing and cooperative data management. Participation in each of these networks has far exceeded expectations, resulting in growing problems of scalability, performance, sustainability, and ability to incorporate new members. The proposed creation of VertNet will address these problems by using a cloud-based computing strategy to create a fast, cost-effective, and scalable data platform. This new platform will have capabilities and applications for data discovery, data quality improvement, and visualization that go beyond those of the current networks. Specifically, VertNet will (1) have new user interfaces with expanded search capabilities (keyword and full text, synonyms for search terms, phylogenetic browsing), (2) incorporate new kinds of data (paleontological), (3) provide improved, open methods for accessing data (via application programming interfaces that connect web browsers, mobile devices, and integrated applications), (4) enable customized change notifications, and (5) create novel annotation and user feedback services. This strategic combination of open access to data, new capabilities, and integration with other applications will transform the use of vertebrate biodiversity data for cross-disciplinary research and for conservation.

0754 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Christopher St. Andre, Stephen Richter

Eastern Kentucky University, Richmond, KY, USA

Annual Variation of Orientation and Timing of Amphibian Movements in South Central Kentucky

The upland habitat use of amphibian movements is poorly understood. To further our understanding of these processes for pond-breeding amphibians, an ephemeral pond was monitored at the Central Kentucky Wildlife Management Area, Madison County, Kentucky. The study pond was completely enclosed using a circular drift fence and pitfall trap array, which was checked continually from January 2009 to March 2011 during peak periods of amphibian movement. Many species of amphibians used the pond for reproduction, including *Rana clamitans* (green frogs), *R. catesbeiana* (American bullfrogs), and *Ambystoma opacum* (marbled salamanders). However, two species of salamander *Ambystoma jeffersonianum* (Jefferson salamander) and *A. maculatum* (spotted salamander) were the primary species reproduced in the pond. Movements into and out of the pond by *A. jeffersonianum*, and *A. maculatum* varied among species, sex, age and year. Males of both species exhibited non-random movements exiting the pond (Jefferson $p= 0.008$, Spotted $p=0.009$). Only female Spotted salamanders exited the pond in a non-random pattern ($p<0.001$). Although there was variation among the orientation of movements both species did show an affinity to move from or toward the connected forest, and closely isolated forest patches. Our data exemplify how amphibian movements can vary based on surrounding habitat and vary annually. Our research increases understanding of when amphibians move to and from breeding locations as well as the habitat they utilize to reach their destination. Understanding movement patterns through the environment will guide conservationists and land managers to structure and build more suitable upland habitat for amphibians around wetlands.

0440 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

Katie Staab[1], Roi Holzman[2], Peter Wainwright[3], L. Patricia Hernandez[1]

[1]The George Washington University, Washington, DC, USA, [2]Tel Aviv University, Eilat, Israel, [3]UC Davis, Davis, CA, USA

Do Convergent Means of Premaxillary Protrusion Produce Similar Flow Regimes during Suction Feeding?

Elucidating functional consequences of convergent morphologies allows construction of evolutionary hypotheses on how selection may independently generate similar forms. A protrusible upper jaw evolved multiple times across teleosts and is implicated in the success of the groups that possess this morphology. We use digital particle image velocimetry (DPIV) to evaluate suction flow dynamics in goldfish, a cyprinid, and compare our findings to bluegill, a centrarchid. These species represent independent

evolutionary origins of jaw protrusion. Bluegill protrude the upper jaws via linkages to the opercular apparatus and lower jaw. Goldfish protrude the upper jaws via a novel sesamoid bone, the kinethmoid, a synapomorphy of Cypriniformes. Using DPIV, we contrast 1) the spatial pattern of flow in the two species, 2) the temporal relationship between flow and head kinematics with particular focus on the timing of flow with jaw protrusion, and 3) the contribution of jaw protrusion to forces exerted on prey. We find that the spatial pattern of flow is the same in the two species. However, we find that the timing of kinematics and suction flow is quite different; goldfish are slower to reach maximal excursions, but are able to sustain maximal flow longer than bluegill. Despite the differences in kinematic timings, jaw protrusion in these two distantly related species has a fundamental performance advantage: to augment the hydrodynamic forces exerted on prey.

0294 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

Ralph Stearley[1], Gerald Smith[2]

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Neogene Fossil *Oncorhynchus* of Western Nevada and the Paleobiogeography of Cutthroat Trouts

During middle Miocene time, between 18 and 9 ma, what is now western Nevada was a high-altitude plateau undergoing transtensional faulting and incision by surrounding drainages. Numerous short-lived lakes occupied faulted basins with intermittent drainage connections, forming a N-S dispersal corridor presumably connected to SE Oregon and the western Snake River Plain. To the east, in eastern Nevada and western Utah, a rugged highland served as a drainage divide. Geologic data indicate probable drainage connections between western Nevada and the Pacific Ocean, which occupied what is now the Great Valley of California. Three plesiomorphic species of *Oncorhynchus*, similar to present-day cutthroat trouts, occupied these western Nevadan lakes, including a fossil trout from the Truckee formation discovered by Michael Bell. This trout shares derived anatomical features of *Oncorhynchus*, including dermethmoid and metapterygoid shapes, reduced lower limb of preopercle with rounded anterior margin, deep subopercle, and 3 epurals. It possesses mandibles with high coronary processes and straight maxillae. It differs from other Nevada Miocene *Oncorhynchus*, *O. esmeralda* and *O. cyniclope* , as well as recent *O. clarki* in the possession of a short, broad, heavily ornamented frontal, as well as other features.

0646 Fish Conservation, Symphony III, Saturday 9 July 2011

Mark Steele[1], Mia Adreani[1], Stephen Schroeter[2], Dan Reed[2]

[1]California State University, Northridge, Northridge, CA, USA, [2]Marine Science Institute, University of California, Santa Barbara, Santa Barbara, CA, USA

A Comparison of Growth, Reproduction, and Tissue Production of Temperate Reef Fishes on Artificial and Natural Reefs

Artificial reefs are commonly used to mitigate damage to natural reefs, yet how well these artificial reefs function is still widely debated. One major question yet to be resolved is whether artificial reefs produce fishes at rates equivalent to those on natural reefs. We tested whether rates of reef fish growth, reproduction, and total tissue production on a large artificial reef (Wheeler North Reef) were comparable to those on two nearby natural reefs. Adults from five of the most common rocky reef fishes in the Southern California Bight (California sheephead, kelp bass, barred sand bass, señorita, and blacksmith) were collected during the spawning season. Rates of growth, reproduction, and tissue production of each species were generally similar on the artificial and natural reefs, with rates on the artificial reef being most like those on the natural reef nearest to it. These generally similar rates of tissue production (somatic and reproductive) are congruent with similar foraging success (based on gut fullness) of fishes on the three reefs. The similar performance of fishes living on the artificial and natural reefs implies that well-designed artificial reefs can mitigate damage to natural reefs by enhancing production of reef fishes.

0662 Poster Session I, Friday 8 July 2011; SSAR POSTER AWARD

Anne Stengle[1], Maureen Murray[2], Tom Tyning[3], Al Richmond[1], Paul Sievert[1]

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Observations of Secondary Disease Agents in Timber Rattlesnake (*Crotalus horridus*) Populations in the Northeast

Isolated populations at the edge of their species' range are subject to many stressors, including reduced genetic variation, anthropogenic changes, habitat fragmentation and stochastic climate effects. Recent work has suggested a relationship between secondary disease signs, such as external fungal lesions, and a synergistic effect of these stressors in timber rattlesnake at the northern range limit. Results from four biopsied rattlesnakes captured during the 2009 and 2010 field seasons from separate northeastern populations displayed various fungal and bacterial agents, supporting the suggestion of a secondary disease problem and not a single infectious pathogen. These agents are primarily common soil species, and these lesions may be a normal stressor in timber rattlesnake populations. Observation of disease incidence has been primarily anecdotal, making it difficult to determine if numbers of affected individuals is increasing. Two biopsied

snakes were from a metapopulation undergoing a radiotelemetry study assessing subpopulation connectivity and genetics. During the 2010 field season both snakes improved greatly after receiving little to no treatment, suggesting snakes are capable of overcoming the infection. Of thirty-six marked individuals from the metapopulation only those two showed lesions. These and other observations in the northeast will lead to future collaboration to launch a state and region-wide health survey. If there were a correlation between multiple stressors and increased secondary infections it would pose a serious problem to isolated, fragmented and possibly declining populations in the Northeast.

0524 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Jeffrey Stephens[1], Keith Berven[1], Dean McCurdy[2]

[1]Oakland University, Rochester, MI, USA, [2]Albion College, Albion, MI, USA

Phenotypic Responses of Amphibian Larvae to Prolonged Predatory Cues are Associated with Chronically Elevated Levels of Stress Hormone

The ability of an organism to undergo morphological and behavioral changes in response to predation (stress) may be important in determining future survival and fitness of larval amphibians. However, any changes might be accompanied by fitness trade-offs that appear during the stressful time or later in life. We present evidence of a physiological change in larvae of *Rana sylvatica* frogs that is concomitant with the morphological and behavioral changes of frog larvae chronically exposed to the chemical cues of a dragonfly predator (*Aeshna* sp.). Tadpoles exposed to caged dragonfly larvae that were fed conspecific tadpoles experienced a 2.5-fold increase in endogenous corticosterone (CORT), altered morphology (increased tail depth and length, decreased body length), and suppressed behavior (less active and visible) compared with no-predator control tadpoles. We also found that there was a positive relationship between the level of endogenous CORT and the degree of tail depth, and a negative relationship between endogenous CORT and body length. While elevated glucocorticoids may be responsible for creating and maintaining anti-predator morphology in tadpoles, this phenotypic response may come at the cost of immunosuppression and result in carry-over effects during their terrestrial phase.

0741 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Nathan Stephens, Stan Trauth, Carole Cramer, Maureen Dolan

Arkansas State University, Jonesboro, AR, USA

Molecular Ecology of Western Slimy Salamanders in the Spillway Mine, Garland Co., AR

Ten polymorphic microsatellite loci were developed for the western slimy salamander (*Plethodon albagula*). Nine tetranucleotide loci and one trinucleotide locus were optimized for PCR and identified in 20 salamanders from the Spillway Mine in Garland Co., AR. The trinucleotide locus displayed a confounding level of stutter and was excluded from analyses of polymorphism, heterozygosity, Hardy/Weinberg equilibrium (HWE) and the presence of null alleles. The other loci conformed to HWE and were without null alleles. These microsatellite markers were developed for the purpose of resolving the familial relationships of brooding females at specific nest-sites in ongoing research of salamander reproductive ecology in the mine. They will also be useful in population genetic analyses of this species including effective population size and genetic structure within and among populations. A minimally-invasive sampling technique was also developed to be used in conjunction with PCR-based molecular analyses of these animals. Additionally, these loci were tested for cross-species transference to five other closely-related congeners endemic to the Ouachita Mountains of Arkansas and Oklahoma.

0385 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

Duane Stevenson[1], Christopher Kenaley[2]

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A Revision of the Caristiidae

The perciform family Caristiidae includes several species of mesopelagic fishes found throughout the tropical, temperate, and subarctic oceans of the world. Commonly known as manefishes or veilfins, these fishes are characterized by large sail-like dorsal and anal fins, each of which can be retracted into a fleshy sheath on the dorsal or ventral surface of the body. There has been a great deal of taxonomic confusion surrounding these fishes since the early 20th century, and virtually every recent author dealing with caristiids has noted the desperate need for a taxonomic revision of the family. Here we present preliminary results of a worldwide revision of the Caristiidae based on examination of over 250 specimens. We recognize four genera, including two "small-mouth" genera and two "large-mouth" genera. The small-mouth forms have an upper jaw that extends approximately to midorbit and is almost completely covered by the thin bones of the suborbital series, a broad suborbital space, and lack palatine teeth,

while the two large-mouth genera have a relatively long upper jaw extending to the posterior margin of the orbit, a narrow space between the orbit and the mouth, and both palatine and vomerine teeth. The small-mouth group contains a new genus and three new species, as well as two previously described forms, while the large-mouth group includes two previously recognized genera, three previously described species, and several new forms. We will present all recognized forms along with their distinguishing characteristics and geographic ranges.

0458 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Donald Stewart

SUNY Coll. Envir. Sci. & For., Syacuse, NY, USA

A New Species of *Arapaima* (Pisces, Osteoglossidae) from the Solimoes River, Amazonas State, Brazil

A new species of *Arapaima* has been discovered from the central Amazon of Brazil. This new taxon is readily distinguished from the syntype of *Arapaima arapaima* as well as reference population samples from Mamiraua Reserve (n = 29) and from Guyana (n=40) by its relatively slender body, short dorsal fin base, low pre-orbital depth, and elongate fourth infraorbital bone. It is distinguished from the holotypes of *A. gigas*, *A. mapae* and *A. agassizii* by having over 30 total caudal fin rays (vs. less than 17 in the other species). It is further distinguished from the holotype of *A. gigas* by having a single row of mandibular teeth (vs. 2+ irregular rows) and a rounded posterior margin on pelvic fins (vs. retrose shaped pelvic fins). From *A. mapae* and *A. agassizii*, it is further distinguished by a relatively deep caudal peduncle. This new taxon also has the dorsal fin base encased in a distinctive fleshy sheath such that anterior dorsal rays are largely hidden. This species was collected near the confluence of the Solimoes and Purus Rivers in Amazonas State.

0090 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

James R. Stewart[1], Tom W. Ecay[1], Benoit Heulin[2], Santiago P. Fregoso[1]

[1]East Tennessee State University, Johnson City, TN, USA, [2]Station Biologique de Paimpont, Paimpont, France

Ontogeny of Calcium Transport by Chorioallantoic Membranes of Oviparous and Viviparous Embryos of the Lizard, *Zootoca vivipara*

The eggshell of oviparous lizards is a significant source of calcium for embryos, but when present, the eggshell of viviparous lizards contains little calcium. In view of the potential cost to embryonic nutrition occasioned by the loss of eggshell calcium, the

large number of independent origins of viviparity among lizards is surprising. Concomitant evolution of viviparity and calcium placentotrophy would ameliorate loss of eggshell calcium, but a mechanism for this concurrence has not been discovered. *Zootoca vivipara*, a lizard with geographic variation in mode of parity, is an excellent model to study mechanisms of calcium transport to oviparous and viviparous embryos because each is highly dependent on calcium secreted by the uterus (eggshell or placenta) and ontogenetic patterns of embryonic calcium mobilization are similar. Embryonic uptake of calcium is mediated by the chorioallantoic membrane, which expresses the calcium transport proteins (calbindin-D_{28K} and plasma membrane calcium ATPase, PMCA). We compared developmental expression (immunoblotting) of calbindin-D_{28K} and PMCA in chorioallantoic membranes of oviparous and viviparous embryos to test the hypothesis that the mechanism of calcium transport does not differ between modes of parity. We found that the ontogenetic pattern of expression of both proteins is similar between reproductive modes and that expression of calbindin-D_{28K} is correlated with calcium uptake from the eggshell or placenta. This finding, which suggests that functional continuity is maintained in the transition between reproductive modes by conservation of structure and function of the chorioallantoic membrane, has implications for understanding independently derived similarity in the evolution of placentation.

0372 Poster Session III, Sunday 10 July 2011

Haley K. Stinnett[1], James R. Stewart[1], Tom W. Ecay[1], Rebecca A. Pyles[1], Michael B. Thompson[2]

[1]East Tennessee State University, Johnson City, TN, USA, [2]The University of Sydney, New South Wales, Australia

Developmental Expression and Localization of Calcium Transporting Proteins in the Chorioallantoic Membrane of a Placentotrophic Lizard

Pseudemoia pagenstecheri is a viviparous Australian scincid lizard with extensive placental transfer of nutrients; 90% of calcium in neonates is received via the placenta. This species has a regionally differentiated chorioallantoic placenta characterized by an elliptical-shaped region, the placentome, with hypertrophied uterine and embryonic epithelial cells supported by dense vascular networks. The remainder of the chorioallantoic placenta is also highly vascularized but epithelia are thin. The structural and functional characteristics of the placenta provide a remarkable opportunity to study mechanisms of nutrient transfer in a placentotrophic squamate. We used immunohistochemistry and immunoblotting to test the hypothesis that the chorioallantoic placenta has discrete specializations for calcium transport. Calcium uptake by extraembryonic membranes of squamates is correlated with expression of the intracellular calcium binding protein, calbindin-D28K. Immunohistochemistry was used to localize calbindin-D28K expressing cells in the chorioallantois. Immunoblotting for calbindin-D28K and plasma membrane calcium ATPase (PMCA, an additional marker for active calcium transport) was used to assess changes in protein expression levels

through development. We found support for our hypothesis because calbindin-D28K was expressed in the chorionic epithelium of the placentome, but not in the remainder of the chorioallantoic placenta. Calbindin-D28K and PMCA were expressed at low levels in early development and increased significantly prior to birth, when embryonic calcium demand peaks. These data suggest that placental calcium secretion occurs over an extended interval of gestation, with increasing activity as embryonic demand escalates in late development. Our results support the hypothesis that the structurally elaborate placentome is functionally specialized for calcium transport.

0268 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Ashley Stoehr[1], Cheryl Wilga[2], Rebecca Allen[3]

[1]University of Massachusetts Dartmouth, Dartmouth, MA, USA, [2]University of Rhode Island, Kingston, RI, USA, [3]Ross University, Roseau, Dominica

Hyoid and Pharyngeal Arch Mechanics during Prey Processing in Elasmobranchs

The position of the hyomandibulae is related to prey capture in elasmobranchs; yet it is little understood how hyoid and pharyngeal arch morphology relate to prey processing mechanics. The kinematics of the jaws, hyoid, and 2nd pharyngeal arches were quantified by sonomicrometry and pressure transducers during prey processing in bamboo sharks, *Chiloscyllium plagiosum*, spiny dogfish, *Squalus acanthias*, and little skates, *Leucoraja erinacea*. These species possess different cranial morphologies with short lateral, longer lateral, and anterior hyomandibular orientations, respectively. Similar to prey capture, in all species oropharyngeal expansions generated subambient pressures during suction processing, while compressions created superambient pressures during bite processing. Bamboo sharks generated the strongest subambient and superambient pressures during prey processing. The mechanism of cavity expansion and compression differed between species and behaviors, with hyoid and pharyngeal widths increasing or decreasing. In dogfish the hyoid distance expanded vertically and horizontally during suction and decreased during bite, differing from prey capture. Contrastly, in bamboo sharks and little skates the hyoid distance increased vertically and decreased horizontally during suction, which was similar to prey capture. Bamboo sharks continued to decrease hyoid width during bite, but hyoid width movement either increased or decreased in skates. Pharyngeal width movements were more variable in the three species. Bamboo sharks are mechanistic specialists and more stereotyped in behavior compared to dogfish and skates, which are generalist predators. It appears differences during prey processing may reflect different degrees of morphological constraint among the elasmobranchs.

0366 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Andrew Storfer, Karen Chojnacki, Jonathan Eastman

Washington State University, Pullman, WA, USA

Ranavirus-salamander Evolution: From Genes to Landscapes

Emerging infectious diseases threaten wildlife, livestock and humans, and are recognized as a leading scientific challenge for the 21st Century. Emerging infectious diseases are implicated in the global die-offs of amphibians, threatening many populations and species with extinction. Two critical questions arise when pathogens emerge. First - is the pathogen new or old? Second - what is the likelihood of spread? I will discuss the past 10 years of a multifaceted research program on coevolution of tiger salamanders and an emerging ranavirus throughout western North America to address these two questions. Using comparative phylogenetic methods, we show that tiger salamanders and viruses are coevolved, but human introductions of infected salamanders as fishing bait disrupts coevolutionary patterns. Due to increased densities of captive populations, increased virulence is observed in a virus strain isolated from a bait salamander population. Next, we show geographic variation in putative viral virulence genes. Using a cross-infection experimental design to test for local adaptation, we show that apparent viral adaptation is correlated with molecular evolutionary rates and particular amino acid changes in these genes. We also show that pathogen local adaptation is multi-faceted and requires estimates of infectivity, within-host growth, transmission and virulence, as opposed to the commonly used single measure of infectivity. Future studies will focus on genomic interactions of host and virus to better understand the mechanisms underlying host resistance and pathogen evasion of host defenses.

0584 Poster Session I, Friday 8 July 2011

Joe Strande[1], Merlin Caldwell[1], Aimee Finley[1], Kiel Tietz[1], Gerrick Meyer[1], Chenhong Li[2], Mike Bessert[1]

[1]UW-Stout, Menomonie, WI, USA, [2]University of Nebraska, Lincon, NE, USA

Conservation Genetics of *Fundulus sciadicus* (Fundulidae): A New Approach with Microsatellites

The plains topminnow (*Fundulus sciadicus*) is a freshwater killifish endemic to the Great Plains of North America. Rising concerns for future viability of this species have prompted recent changes in its conservation status. In a previous rangewide study, extremely low variation was detected at the mtDNA control region, a locus that is generally variable within populations. Despite low variation, it revealed distinct population structure. In order to extend this work, ascertain conservation target areas of greatest genetic diversity, and estimate gene flow among disjunct areas, we developed additional hypervariable nuclear (STR) loci. These markers have provided greater

resolution in re-examining population structure among the previously collected sites plus four recently collected sites that filled sampling gaps (Minnesota and Colorado). Resulting measures of allelic richness and heterozygosity are particularly valuable as we study populations previously suggested for conservation (those with highest gene diversity). In addition, Bayesian techniques place previously undocumented disjunct populations (MN and CO) in an appropriate phylogeographic context and allow for estimation of recent and historical demography in the species.

0419 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Jeffrey Streicher, Eric Smith

The University of Texas at Arlington, Arlington, TX, USA

Systematics of Polymorphic Direct-Developing Frogs (Anura: Craugastoridae) from Mexico and Northern Central America

The *Craugastor rhodopis* species series contains two species of leaf litter frog that occur in a variety of tropical habitats from central Mexico southward to El Salvador. These direct-developing frogs are known to display substantial levels of phenotypic polymorphism at the population level. Previous investigations in this group have recovered high levels of genetic variability between populations indicative of much more diversity than is recognized by the current taxonomy. In the present study we investigated relationships in the species *C. loki* and *C. rhodopis* across the majority of each species geographic distribution. Using a fragment of mitochondrial DNA derived from 61 frogs sampled from 30 localities throughout three countries (Mexico, Guatemala and El Salvador) we attempted to characterize the evolutionary history of this group. Phylogenetic analyses revealed, as previously hypothesized, high levels of diversity across our sampling including a hitherto unrecognized group of *C. rhodopis* species series frogs inhabiting western Mexico. Within the populations currently referred to *C. loki* and *C. rhodopis* there appear to be two major mitochondrial lineages. One of these lineages is a widely distributed lowland group occurring at elevations below 1400 m and the other is a highland group occurring above 1400 m in the Sierra Madre Oriental of eastern Mexico. Since these clades are not consistent with the existing taxonomy we discuss the potential nomenclatural implications of our findings. Additionally, we discuss levels of color pattern polymorphism across this group and the putative ecological and phylogenetic factors associated with this phenomenon.

0775 Poster Session III, Sunday 10 July 2011

Masayuki Sumida, Naoki Satou, Shohei Oumi, Atsushi Kurabayashi and Mitsuru Kuramoto

Institute for Amphibian Biology, Graduate School of Science, Hiroshima University, Hiroshima, Japan, Section of Agriculture and Forest, Amami City Government, Amami, Kagoshima, Japan

Inter- and intra-island Divergence in *Odorrana ishikawae* (Anura, Ranidae) of the Ryukyu Archipelago of Japan, with Description of a New Species

The endangered frog, *Odorrana ishikawae* (Anura, Ranidae), is a species endemic to the Amami and Okinawa Islands of the Ryukyu Archipelago, Japan. Vicariance of these islands has been considered to occur middle or upper Pleistocene. Our morphometric analyses revealed obvious differences between the Amami and Okinawa populations. Two distinct morphotypes were also recognized from the Amami population (Amami common and Amami large types). Furthermore, the Amami and Okinawa populations could be distinguished clearly by coloration and dorsal tuberculation. Based on 16S rRNA gene data, the Okinawa and Amami populations were phylogenetically separated but the genetic divergence (1.44 – 2.16%) was lower than the value suggested as species threshold in anurans (> 3% in *16S*). Individuals of the Amami common and large types were nested within a single clade. Artificial hybridization experiments revealed normal hybrid viability between the two Amami types, with one exception. By contrast, between Okinawa females and two Amami type males, complete hybrid inviability was observed at early embryonic stages in the hybrids contrary to expectations from their low divergence in *16S*. The reciprocal hybrids between two Amami type females and Okinawa males were viable, but spermatogenesis in the hybrid males showed some degree of abnormality. These results strongly indicate specific separation of the Amami population from the Okinawa population of *O. ishikawae*. Thus, we describe the Amami population as a new species, which is readily distinguishable from *O. ishikawae* by smaller ruggedly edged dorsal spots and an immaculate ventral surface.

0178 SSAR SEIBERT CONSERVATION AWARD, Session II, Conrad B & C, Friday 8 July 2011

Yik-Hei Sung, Nancy Karraker, Billy Hau

The University of Hong Kong, Hong Kong, Hong Kong

Impacts of Illegal Trapping on Endangered Big-headed Turtles (*Platysternon megacephalum*) in Hong Kong

Big-headed Turtles (*Platysternon megacephalum*) inhabit fast flowing streams at high altitudes in South-east Asia and is regularly recorded in the wildlife trade in China and Hong Kong. Its populations are experiencing drastic declines and this species is listed as

Endangered in the IUCN Red List of Threatened Species. Given existing pressures on its populations and the rarity of this species in mainland China, there is an urgent need to understand the ecology and population status of this poorly-known species. In Hong Kong, where populations still exist, we used mark-recapture methods to investigate the impacts of illegal trapping on this species by comparing demographic characteristics between sites with trapping history and one site in a fully protected area. In addition, we conducted radio-telemetry to study their home range, movements and habitat use. Our results revealed that large adults were underrepresented in sites where traps were found in the past and this was likely caused by overharvesting. Long-term monitoring of populations of this species is essential to track immediate and long-term effects of illegal collection. The information obtained through this study will allow us to develop a plan that will aid local conservation efforts for this species in Hong Kong.

0225 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

William Sutton[1], Sumio Okada[2], Zachary Felix[3]

[1]University of Tennessee, Knoxville, TN, USA, [2]Tottori University, Tottori, Japan, [3]Reinhardt University, Waleska, GA, USA

Differences in Microhabitat Use among Life Stages of the Japanese Giant Salamander

Understanding habitat use differences among organismal life stages is essential for longterm species conservation. In this study we used radiotelemetry to evaluate habitat use differences among larval, juvenile, and adult Japanese Giant Salamanders (*Andrias japonicus*). Our study was centered in two study sites within Hiroshima (Ikuritani River) and Tottori (Tsuchia River) prefectures, Japan. Salamanders were captured by turning over rocks during day and evening searches, and radiotransmitters were attached externally to the tail of each individual by passing a small piece of monofilament fishing line through the tail and securing each end of the fishing line with small plastic disks and aluminum clamps. As salamanders radiotracked, we recorded location data and completed a maximum of three habitat plots per individual through a use-availability approach. During the three month study period, we were able to successfully monitor 25 total salamanders (5 larvae, 9 juveniles, and 11 adults) at both sites and were able to obtain approximately 300 locations and complete nearly 100 habitat plots at "used" and "random" locations. Overall, adult *A. japonicus* tended to use microsites that possessed large rocks (> 100 cm), deep pools (> 30 cm), and very little stream flow, whereas larval and juvenile *A. japonicus* used microsites with relatively small rocks (~ 40 cm), shallow water (10-20 cm), and distances closer to the stream bank compared to random sites. These short-term data provide considerable insight into habitat requirements of this fully aquatic salamander.

0224 Poster Session I, Friday 8 July 2011

William Sutton[1], Yong Wang[2], Callie Schweitzer[3]

[1]University of Tennessee, Knoxville, TN, USA, [2]Alabama A&M University, Normal, AL, USA, [3]USDA Forest Service Southern Research Station, Normal, AL, USA

Amphibian and Reptile Responses to Prescribed Burning and Thinning in Pine-Hardwood Forests of Northwestern Alabama

Habitat disturbances such as forest management practices can have varied impacts on organismal population parameters. We evaluated herpetofaunal responses to forest management using a variety of techniques, including drift-fences, coverboards, and radiotelemetry. This experiment consisted of a 2 X 3 complete block design with three replications. Forest treatments consisted of three thinning levels (no thin, 11 m^2/ha residual basal area [BA], and 17 m^2/ha residual BA) and two burning levels (no burn and burn) resulting in 18 total treatments. Pre- and post-treatment data were collected for one year and two years, respectively. We captured 2,643 individual amphibians and reptiles representing 47 species (20 amphibians and 27 reptiles) during 3,180 trap nights using drift-fence arrays and 1,074 individual amphibians and reptiles representing 14 species (10 reptiles and 4 amphibians) during 173 sampling days (i.e., 73,664 board days) using coverboards. Overall, reptiles responded positively to thin and thin and burn forest treatments, whereas amphibians were not impacted by the disturbances implemented during this study. Lizards demonstrated species-specific responses, whereas larger snake species had greater captures in thinned plots during the second year post-treatment. Litter-dwelling snake captures increased in thin with burn plots during second year post-treatment surveys. Radiotelemetry of Copperheads (*Agkistrodon contortrix*) revealed that male snakes selected micro- and macrohabitat features different from random and tended to select sites that possessed an abundance of downed woody debris and deep litter. The cumulative results of this study demonstrate the need for multiple techniques to evaluate overall herpetofaunal community responses to landscape disturbances.

0263 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Christopher Swarth[1], Mike Quinlan[1], Joel Snodgrass[2]

[1]Jug Bay Wetlands Sanctuary, Lothian, MD, USA, [2]Towson University, Towson, MD, USA

Sex and Age Differences in Home Range and Habitat Use of Eastern Box Turtles (*Terrapene carolina carolina)*

The size and shape of an animal's home range are determined in part by the distribution and abundance of resources needed for survival. To understand eastern box turtle

(*Terrapene carolina carolina)* preference for various habitats, we used radio telemetry from 2001 to 2007 to follow the movements of 38 female, 15 male and 8 juvenile turtles along a freshwater tidal wetland on the Patuxent River in Maryland. Forty-six turtles were tracked for one season and 15 were followed for 2-3 years. Turtles were located an average of 33 times between May and November. 95% kernel home ranges (mean ±SD) for females were variable (8.3 ± 8.7 ha), but were significantly larger than those for males (1.5 + 0.6 ha) and juveniles (1.0 ± 0.9 ha). Females used tidal and non-tidal wetlands (foraging areas) and fields (nesting sites) much more than did males or juveniles. Gravid females traveled long distances from mixed hardwood forests and wetlands to reach a limited number of suitable nesting sites; this accounts for the largest home ranges. Stable isotope analysis of turtle tissue, along with animal and plant diet items, revealed that females derived considerable nutrition from the tidal wetland ecosystem. Males and juveniles spent most of each season in the forest and most juveniles did not visit permanent water sources for at least three years. This study illustrates how the arrangement of habitats in the local landscape can be an important determinant of home range size and shape.

0463 Poster Session I, Friday 8 July 2011

Joshua Sweet, Christopher Beachy

Minot State University, Minot, ND, USA

Educational and Conservation Outreach Provided by the Amphibian Growth Project Website

The Amphibian Growth Project (AGP) website (http://www.amphibiangrowthproject.org) has two objectives: outreach and online data collection. For outreach, the site is structured to appeal to and inform four audiences including children, parents, researchers and institutions. For children and parents, specific pages present amphibian facts and husbandry information in an easy to understand format with applicable citations clearly stated on each page. For potential researchers and institutions looking to become AGP partners, specific pages maintain links to current research projects and research archives. The archives contain files of previous talks and poster presentations. These give inquiring parties a good idea of the basic type of AGP research to which they can contribute. Online data collection is the second major objective. Online data collection is a critical aspect of amphibian tracking. Through online databases, AGP partners and independent enthusiasts separated by geographic location can compile and access standardized amphibian data in one place online. Geography is no longer a limitation in effective amphibian tracking. AGP standardized databases provide the ability to monitor and record crucial information including but not limited to relative and absolute species densities, individual and average sizes at specific locations, and migration patterns. This website supplement ongoing touring museum visits to rural K-12 school groups. In the past 24 months, members of the AGP have conducted 53 school visits that have included approximately 2000 students, and covered an 85 mile radius from Minot State University.

0671 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

John Szczepanski, Christina Lemnotis

University of Rhode Island, Kingston, RI, USA

Feeding Ecology of the Bullnose Ray, *Myliobatis freminvillii*, in Delaware Bay

Feeding habits of many batoid elasmobranchs (skates and rays) have been recorded but diets, prey selection, and resource partitioning within specific populations are not fully understood. Few studies compare diets of a species throughout its life history. During my research, I was able to collect a higher abundance of neonate and juvenile rays than expected allowing for a more comprehensive diet characterization than in past studies. Through gut content analysis, my research examines the feeding habits of the bullnose ray, *Myliobatis freminvillii*, to understand the diet and trophic role of this species in the estuarine ecosystem at various life stages. Specimens were collected over the course of two years through fisheries-independent trawl surveys. Prey items were identified to lowest taxonomic level, counted and weighed. Various diet metrics, importance indices, and multivariate analyses were used to incorporate the data from different sexes and size groups to identify important prey species and elucidate ontogenetic shifts. In addition to the feeding data, the increasing proportional abundance of smaller (and therefore younger) size classes through the summer months provides some evidence indicating that Delaware Bay may serve as a nursery area for the bullnose ray. Though recently proposed criteria characterizing shark nursery areas cannot fully be fulfilled by my data alone, the calculated trends along with the diet data shown can provide new information for future efforts in conservation, ecosystem-based management and modeling.

0368 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Milton Tan

Auburn University, Auburn, AL, USA

Molecular Phylogenetics of *Hypancistrus* (Loricariidae: Siluriformes)

Hypancistrus is a genus of loricariid catfishes, including six described and many undescribed species distributed in tributaries of the Amazon and Orinoco rivers of South America. Apart from variation in color patterns, species of *Hypancistrus* are morphologically conserved. A published phylogeny of *H. zebra* and three Venezuelan species found *H. zebra* to be the sister of the Venezuelan species, but the Venezuelan species were identical in their skeletal anatomy. A molecular phylogeny is inferred for Venezuelan species of *Hypancistrus* (*Hypancistrus contradens*, *H. debilittera*, *H. furunculus*, *H. inspector*, *H. lunaorum*) from mitochondrial cytB and nuclear S7 genes. In addition, aquarium specimens were added to increase the number of species, including the type

of the genus (*H. zebra*), and various undescribed, putatively Brazilian forms. Monophyly of the genus is tested and species relationships are documented.

0567 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Kevin Tang[1], Henry Bart[2], Masaki Miya[3], Kenji Saitoh[4], Andrew Simons[5], Robert Wood[1], Wei-Jen Chen[6], Tetsuya Sado[3], Mary Agnew[1], Michael Doosey[2], M. Vincent Hirt[5], Lei Yang[1], Richard Mayden[1]

[1]Saint Louis University, St. Louis, MO, USA, [2]Tulane University, New Orleans, LA, USA, [3]Natural History Museum and Institute, Chiba, Chuo-ku, Chiba, Japan, [4]National Research Institute of Fisheries Science, Kanazawa, Yokohama, Japan, [5]University of Minnesota, St. Paul, MN, USA, [6]National Taiwan University, Taipei, Taiwan

Phylogenetic Relationships of the Cyprinid Subfamily Cultrinae (Teleostei: Cypriniformes)

The subfamily Cultrinae is a diverse group of cyprinid fishes, distributed across eastern Asia. The taxonomic composition of the subfamily and the relationships within it are still poorly understood. Recent phylogenetic studies have provided new insights into the relationships of Cultrinae, while also contradicting some earlier classifications. In an effort to better grasp the extent of this subfamily, sequence data from more than 120 cyprinid taxa were collected. Representative species were drawn from all major cyprinid lineages. Particular emphasis was placed on including taxa with historically uncertain phylogenetic affinities that may be putative cultrines, based on previous literature. Our analyses were conducted on sequences from two mitochondrial loci (COI, cyt *b*) and two nuclear loci (RAG1, rhodopsin), which were then evaluated using maximum likelihood and parsimony methods. Our results reveal interesting relationships, which will require revisions in classification to accommodate a monophyletic Cultrinae, changes that will also affect other subfamilies of Cyprinidae. The relationships within the Cultrinae and its relationship to other cyprinid subfamilies will be discussed.

0565 Poster Session I, Friday 8 July 2011

David Taylor[1], William Crampton[2], Judith Szamosi[1], Nathan Lovejoy[1]

[1]University of Toronto Scarborough, Toronto, ON, Canada, [2]University of Central Florida, Orlando, FL, USA

Molecular Systematics of the Neotropical Electric Fish Genus *Brachyhypopomus*

The electric "bluntnose knifefish" genus *Brachyhypopomus* (Ostariophysi, Gymnotiformes, Hypopomidae) is distributed in continental lowland tropical and subtropical

freshwaters from as far north as Costa Rica to as far south as Uruguay. *Brachyhypopomus* are nocturnal predators of small aquatic invertebrates and typically mature at less than 200 mm total length (TL). Like all gymnotiforms, *Brachyhypopopus* species possess a dual electrogenic and electrosensory system (ESS) which permits active electrolocation and also electrocommunication. Ongoing field studies indicate that *Brachyhypopomus* diversity is considerably higher than the currently recognized 11 species, and final diversity is expected to reach 30-40 species. Here we present a molecular phylogenetic analysis of 25 *Brachyhypopomus* species based on nuclear and mitochondrial genes (rag2 and cytochrome *b*). We compare our topology to reconstructions based on morphology, and evaluate biogeographic implications of the molecular tree.

0257 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Rory Telemeco

Iowa State University, Ames, IA, USA

Effects of Incubation Temperature on Offspring Phenotype in the Southern Alligator Lizard (*Elgaria multicarinata*: Anguidae)

Developmental environment greatly affects offspring survivorship and phenotype. Temperature in particular has profound fitness-relevant effects in diverse organisms. Because most reptiles deposit their eggs in nests without further parental care, ambient thermal conditions within the nest greatly impact many reptiles. Understanding these effects illuminates important aspects of the ecology and evolution of these species, and is important for determining the likely effects of impending climate change. To date, no study has examined the effects of thermal variation during embryogenesis on any member of the Anguidae, a diverse and conspicuous family of lizards found throughout the northern hemisphere. To begin bridging this knowledge gap, I incubated southern alligator lizard (*Elgaria multicarinata*) eggs at three temperatures (26°C, 28°C, and 30°C). Hatchling size and performance were measured repeatedly over 6 months. In general, temperature had a negative effect on offspring fitness, with lizards incubated at 26°C being larger, faster, and having greater survivorship than those incubated at warmer temperatures. My results suggest that 28°C is above the optimum temperature for incubation in *E. multicarinata* and that 30°C is near the critical thermal maximum for successful embryogenesis. Finally, *E. multicarinata* appear to be adapted to cooler incubation conditions than many lizards with which they are sympatric and therefore may be at increased risk of decline induced by ongoing climate change.

0254 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Rory Telemeco, Karen Abbott, Fredric Janzen

Iowa State University, Ames, IA, USA

Modelling the Effects of Climate-change Induced Shifts in Nesting Date on Sex Ratios in Species with Temperature-dependent Sex Determination: A Case Study Using Painted Turtles (*Chrysemys picta*)

Species with temperature-dependent sex determination (TSD) may be particularly susceptible to climate change induced decline because warming environments could skew sex ratios. Plasticity in nesting phenology may be a natural mechanism that buffers populations with TSD from climate change. However, shifting nesting date only allows direct maternal control of oviposition conditions, not temperatures later in development when sex is actually determined (thermo-sensitive period, TSP). Early nesting will only buffer progeny from sex-ratio shifts if temperature at the time of oviposition consistently predicts temperature during the TSP. Such constant predictive ability is unlikely in seasonal areas because the rate of seasonal warming is higher in spring than it is in summer. We developed a modified constant temperature equivalent (CTE) model that explicitly accounts for the interaction of oviposition date and seasonal thermal pattern on temperature during the TSP to examine whether advances in nesting date are likely to buffer populations with TSD from altered sex ratios induced by climate change. We then applied this model to a well-studied population of painted turtles (*Chrysemys picta*). Our results suggest that shifts in nesting date may buffer populations from skewed sex ratios despite warmer TSPs. The model also suggests that many nests should fail prior to sexes becoming significantly skewed if females track temperatures at oviposition. Therefore, the greatest threat of climate change on many species with TSD might be reduced survivorship and reproduction rather than skewed sex ratios.

0044 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Marisa Tellez

University of California, Los Angeles, Los Angeles, CA, USA

The Interaction of *Alligator mississippiensis* and Its Helminth Parasites

As one of the surviving reptilian archosaurs of an ancient phylogenetic lineage, it is probable that the interaction between *Alligator mississippiensis* and its parasites has developed into a near-commensal, and possibly mutualistic association. Yet, anthropogenic and environmental factors are perturbing this interaction, increasing alligators' susceptibility to parasite virulence. This may have serious consequences because the disruption of a potentially coevolved relationship between hosts and parasites can lead to disease dispersal, host population fluctuations, and host epidemic mortality. I am studying these intestinal helminths over a three year period to assess

host-parasite distribution patterns in populations of *A. mississippiensis* in Louisiana in response to environmental and anthropogenic impacts. Intestinal tracts of alligators that vary in size, gender and geographic location have been collected during the Louisiana wild alligator harvest with the assistance of Louisiana Department Fisheries and Wildlife (LDFW). To date, specimens from two harvests have been collected and analyzed. Helminth prevalence, intensity, and abundance is found to be significantly higher in alligators of Eastern Louisiana wetlands, as well as in males. Parasitism is shown to have decreased from year one to year two, indicating an external factor is affecting parasite transmission, which can have a direct effect on alligator fitness. The alteration of normal parasitic alligator fauna can result in the invasion of novel pathogens, resulting in host morbidity and/or mortality. Continued data collection and assessment will be vital for wildlife and wetland management agencies as they deal with wetland restoration from past hurricane activity, and urbanization management.

0310 Poster Session II, Saturday 9 July 2011; STORER ICHTHYOLOGY AWARD

Kimberly Tenggardjaja

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

Comparative Phylogeography of Two Endemic and Two Widespread Damselfish Species across the Hawaiian Archipelago

A widely accepted paradigm in the study of marine populations has been that populations are "open" to the dispersal of larvae from remote sources. However, results from an increasing number of studies challenge this belief, suggesting that limits to marine dispersal exist. To shed light on larval dispersal and the extent of connectivity between marine populations, this study utilizes mitochondrial cytochrome *b* sequences to analyze levels of gene flow in populations of endemic (*Abudefduf abdominalis* and *Chromis ovalis*) and widespread (*A. vaigiensis* and *C. vanderbilti*) damselfishes across the Hawaiian Archipelago. Endemic species with their limited geographic ranges represent "closed" systems that persist through self-recruitment. To address whether there is a trend for endemic species to exhibit more restricted dispersal, patterns of gene flow first will be compared between endemic and widespread species within each congeneric pair and then between congeneric pairs. A better understanding of dispersal in marine populations is important for the execution and evaluation of conservation efforts in marine protected areas. Knowledge about the extent of larval dispersal is critical in designing reserves that can be self-sustaining while allowing for additional transport of larvae into non-protected areas. This research will assess the degree of connectivity between the main Hawaiian Islands and the Northwestern Hawaiian Islands, which constitute the Papahānaumokuākea Marine National Monument. Recent studies indicate limited gene flow between the two regions. Knowledge on the extent of larval dispersal in endemic and widespread species will elucidate how conservation efforts within each region of the HA should be fine-tuned.

0509 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Shara Teter[1], Bradley Wetherbee[2], Dewayne Fox[3], Chi Lam[4], Dale Kiefer[4], Paul Howey[5], Mahmood Shivji[1]

[1]Guy Harvey Research Institute, Nova Southeastern University, Dania Beach, FL, USA, [2]University of Rhode Island, Kingston, RI, USA, [3]Delaware State University, Dover, DE, USA, [4]University of Southern California, Los Angeles, CA, USA, [5]Microwave Telemetry, Columbia, MD, USA

Migratory Patterns and Habitat Use of Sand Tiger Sharks (*Carcharias taurus*) in the Northwest Atlantic

Though there is concern over declines in sand tigers (*Carcharias taurus)* in the Northwest Atlantic Ocean, details of their habitat use and movement patterns in the open ocean are limited. We report on the vertical and horizontal movements of sand tigers off the US east coast using archival pop-up satellite transmitters. Transmitters were deployed on 13 sand tigers (168 - 232 cm TL) in Delaware Bay in late summer 2008. Duration of tracks ranged from 12-154 days ($\bar{x}$=105), allowing reconstruction of 12 horizontal tracks using light-level data and a Kalman filter state-space model. Seven of the males exhibited directed movements south along the US east coast to waters off North Carolina, whereas all three females initially moved eastward into deeper offshore waters and remained largely in waters off New Jersey to Virginia. While in Delaware Bay, sand tigers spent the majority of their time at depths of less than 10 m and at 19-22^{o}C. During their migration south, males occupied deeper water, primarily 20-80 m (max depth 188 m), and upon arrival in North Carolina waters in late 2008 or early 2009, some males moved into shallower water. Female sharks generally inhabited shallower water during their migrations, remaining predominantly at depths < 50 m (maximum depth 92 m). Water temperatures occupied by sharks ranged from 13-26^{o}C, with females averaging 21-23^{o}C and males 19-24.5^{o}C. These initial results suggest possible differences in the movement behavior of male and female sand tigers, but need confirmation by tracking more animals of each gender.

0483 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Christopher Thawley[1], Ariel Rodriguez[2], Leslie Rissler[1]

[1]University of Alabama, Tuscaloosa, AL, USA, [2]Instituto de Ecología y Sistemática, Havana, Havana, Cuba

Phylogeography and Invasive Spread of Two Cuban Anurans in the Southeastern United States

Invasive species are a major cause of extinctions in the U.S., and predicting the spread of invasions is a major conservation priority. The Cuban treefrog (*Osteopilus septentrionalis*) and the greenhouse frog (*Eleutherodactylus planirostris*) are two anurans native to Cuba and invasive in the southeastern U.S. We use a combination of phylogeography and ecological niche modeling to determine sources of invasive populations, analyze patterns of invasion and differences in genetic diversity between the native and invasive ranges. Portions of cytochrome b were sequenced for genetic analyses. Ecological niche models (ENMs) were constructed in Maxent using climatic data and point localities from natural history collections and field observations. In Cuban treefrog populations, two haplotypes are fairly evenly mixed across the southeastern U.S.; these haplotypes show high levels (approx. 4%) of pairwise divergence and correspond to distinct areas in western and central Cuba, suggesting at least two independent invasions. Mixing of these haplotypes in the invasive range results in higher average genetic diversity in invasive populations. Similarly two haplotypes have been identified in invasive greenhouse frog populations corresponding to areas in western central Cuba. Preliminary data suggests extremely low diversity at most sites in the southeastern U.S compared to native populations. For both species, habitat suitability scores from ENMs constructed using invasive range data highlight areas in Cuba containing haplotypes corresponding to those in invasive populations. Our results suggest that using phylogeographic and ENM-based approaches in combination can aid in identification of source populations and refinement of predictions of invasive spread.

0726 Poster Session III, Sunday 10 July 2011

Benjamin D. Thesing, David E. Starkey

The University of Central Arkansas, Conway, AR, USA

Population Genetic Analyses of the Southern Redback salamander (*Plethodon serratus*) in the Ouachita Mountains

Recent studies on habitat fragmentation have centered on terrestrial amphibians due to their limited dispersal capabilities. The resulting restriction of gene flow is thought to cause a reduction in genetic diversity and a decrease in population health through genetic drift or inbreeding. In order to further address this issue, we examined the genetic variation of the Southern Redback salamander (*Plethodon serratus*) in the

Ouachita Mountains. This study was initiated to determine if there is gene flow between localized populations across our study area. Our populations were defined as areas of 500 meters or less of continuous forested area, without any apparent barriers to gene flow. We selected 7 populations across the center of the Ouachita Mountains for analyses. Sample locations were between 7 and 56 kilometers apart. At each localized population between 10 and 20 samples were collected by overturning rocks or logs. Whole animals were collected or approximately 1 centimeter of tail was removed and stored in 95% ethanol for DNA analysis. Six of 13 dinucleotide microsatellites, previously developed for the Redback salamander (*Plethodon cinereus*), will be examined to investigate genetic diversity and gene flow between and within populations of *P. serratus*.

0613 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Richard Thomas

University of Puerto Rico, San Juan, Puerto Rico, Puerto Rico

Blindsnake Evolution: The Blindsnakes of Hispaniola (Typhlopidae and Leptotyphlopidae)

The species of Hispaniolan blindsnakes, their distribution, relationships and biogeography, are discussed, including newly discovered and cryptic species.

0378 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Alfred Thomson

Florida Museum of Natural History, Gainesville, FL, USA

Molecular Phylogenetics of the African Catfish Family Amphiliidae (Teleostei: Siluriformes).

Catfishes of the family Amphiliidae are small to moderate-sized fishes native to small streams throughout sub-Saharan Africa. The phylogenetic relationships, monophyly, and limits of Amphiliidae have been the subject of considerable debate. The family was erected by Regan (1911), who divided it into two major groups. The genera *Amphilius* and *Paramphilius* were placed in the subfamily Amphiliinae, and the genera *Andersonia*, *Belonoglanis*, *Doumea*, *Paraphractura*, *Phractura* and *Trachyglanis* were placed in the subfamily Doumeinae. David and Poll (1937) proposed that the bagrid genus *Leptoglanis* was more closely related to species of Amphiliidae and included it in the family. Harry (1953) rejected the inclusion of *Leptoglanis* in the family, but Bailey and Stewart (1984) transferred *Leptoglanis* back to Amphiliidae and included *Zaireichthys*, a genus described by Roberts (1967) and thought to be closely related to Leptoglanis. The inclusion of

Leptoglanis and *Zaireichthys* in Amphiliidae has been strongly supported by subsequent phylogenetic analyses, and three subfamiles are currently recognized in the family: the Amphiliinae, the Doumeinae, and the Leptoglanidinae. In the present study, mitochondrial and nuclear sequence data are used to test the monophyly of these three subfamilies, examine the relationships among the subfamilies, and test the monophyly of many of the amphiliid genera. Taxon sampling is especially strong for the genus *Amphilius*, and analyses recover several well supported clades consistent with morphology within *Amphilius*.

0720 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Alexander Tilley, Marie Smedley, John Turner

Bangor University, Wales, UK

Functional Ecology of the Southern Stingray (*Dasyatis americana*) in a Tropical Shallow Reef System

The Southern Stingray (*Dasyatis americana*) is one of the most common elasmobranch species in the Caribbean, found in shallow sand and seagrass habitats, yet its functional ecology within these systems is poorly understood. This study aimed to understand aspects of mesopredator ecology, and provide insight into the dynamics of top down control by working in an isolated reef, where the shark population is quantified. Movement patterns of *Dasyatis americana* were investigated at Glovers Reef Marine Reserve, Belize, using manual acoustic tracking & in-water follows, between June 2009 and August 2010. 15 rays (27-86cm DW) were tagged and manually tracked for 13-32 hours. Additionally, 45 hours of in-water follows for 86 rays for 1hr periods were analyzed for fine-scale foraging behaviour. Analyses show that as with other elasmobranch species, southern stingrays exhibit ontogenic expansion of activity space, and that foraging patterns increased in organisation with age. Stingray movements and habitat use showed diel periodicity, with rate and linearity of movement of tagged animals correlating with night and day. Tagged animals remained in a very precise depth (0.5-7m) and habitat band (accumulated algae fields at the base of a sand slope), foraging only occasionally in shallower sandflat habitat, and avoiding deeper lagoon areas entirely. Understanding of the ecological role of this mesopredator is important in enhancing MPA and fisheries management systems in Belize and the wider Caribbean.

0291 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Jessica Tingle

Cornell University, Ithaca, NY, USA

Field Observations on the Behaviour and Ecology of *Langaha madagascariensis*

The purpose of this project was to study the behavior and ecology of the vine snake *Langaha madagascariensis* in the wild. The locations of the study were the littoral forest fragments of Mandena and Petriky in the southeast of Madagascar, but the snakes were observed only at Petriky. Snakes were found by walking through the littoral forest, both on and off trails. When an individual was found, it was observed for as long as possible and every behavior was recorded with its frequency and duration, and notes were taken on microhabitat. Behaviors observed included stalking, capturing, and consuming prey, flight, and resting. Times spent performing specific activities were quantified, as was the amount of time spent in each microhabitat. All 6 individuals found were males, and a total of 52.5 hours of observations were made. One male captured and consumed the terrestrial lizard *Chalarodon madagascariensis*, and another male captured and consumed the arboreal day gecko *Phelsuma modesta*. All individuals preferred between 0 and 2 m above the ground except for one male, and he spent most of his time above 4 m.

0190 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Michelle Tipton

Wesleyan University, Middletown, CT, USA

Phylogeography of the Eastern Blacknose Dace, *Rhinichthys atratulus*

During the last ice age, much of North America as far south as 40° north was covered by glaciers (Hewitt 2000). About 20,000 years ago, as the glaciers retreated, the hydrologic landscape changed dramatically creating waterways for fish dispersal. The number of populations responsible for recolonization and the regions from which they recolonized are unknown for many freshwater fishes living in New England and southeastern Canada. The Blacknose Dace, *Rhinichthys atratulus*, is an obligate freshwater fish species that recolonized this region. With over 500 individuals analyzed, phylogenetic analyses have begun to elucidate the recolonization routes and identify the glacial refugia for this species. For example, one identified likely route of recolonization for Connecticut's population is the temporary freshwater river that existed in Long Island sound ~17,000 years before present (Stone et al. 2005). From dates (calibrated with radiocarbon dating, paleomagnetism and varve chronology) of biogeographic events such as this and the chronology of New England's deglaciation, I have also calculated rates of divergence of >5% per my within the post-glacial populations. While this is higher than the commonly accepted rate of 2% for mitochondrial DNA, these results join a growing list of

publications finding high rates of divergence for various taxa (Peterson & Masel 2009). For the greater New England region, our data suggests that it was recolonized by multiple genetically distinct populations that diverged prior to/during the last ice age. The high genetic similarities suggest that they came from different refugia in the south.

0075 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Stanley Trauth[1], David Sever[2]

[1]*Arkansas State University, State University, AR, USA,* [2]*Southeastern Louisiana University, Hammond, LA, USA*

Proximal Genital Ducts and Their Ultrastructural Characteristics in Male Flathead Snakes (*Tantilla gracilis*)

We examined the proximal genital ducts of non-reproductive and reproductively-active male Flathead Snakes, *Tantilla gracilis*, using light microscopy (LM) and transmission electron microscopy (TEM). Snakes were collected from the Interior Highlands ecoregion of Arkansas between early April 2007 and mid-January 2011. Specimens were returned to the lab and sacrificed using sodium pentobarbital. The proximal genital ducts were excised and prepared for LM and TEM using routine histological and ultrastructural techniques, respectively. We focused this study on four distinct regions of the anterior genital duct system: the rete testis, the ductuli efferentes, the ductus epididymis, and the ductus deferens. More posterior genital segments of the system, known as the ampulla ductus deferentis, and the most caudal portion, the ampulla urogenital papilla, were previously examined by us. All of these ducts are involved in secretion and absorption, and secretory activity varies from merocrine to an apocrine discharge. Epithelial cells in the rete testis are low cuboidal cells and in the ductuli efferentes range from cuboidal to columnar. The ductuli efferentes is the only portion of the duct system that has ciliated cells. The ductus epididymis and ductus deferens are pseudostratified with non-ciliated, columnar principal cells and scattered basal cells. Sperm aggregates associate closely with the epithelial surfaces in all ductal regions. The functional significance of secretory products released by the epithelia within this duct system remains unresolved.

0214 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Vance L. Trudeau[1], Gustavo M. Somoza[2], Guillermo S Natale[3]

[1]University of Ottawa, Ottawa, Ontario, Canada, [2]Instituto de Investigaciones Biotecnológicas-Instituto Tecnológico de Chascomús, Provincia de Buenos Aires, Argentina, [3]CIMA, Facultad de Ciencias Exactas, Universidad Nacional La Plata, Argentina

Induction of Spawning in Anura by the AMPHIPLEX Method

Amphibian declines and the need for captive bred frogs for physiological and toxicological studies motivated us to develop the AMPHIPLEX method for spawning induction in mature anura. The method is based on the injection of a combination of a gonadotropin-releasing hormone (GnRH) agonist and a dopamine antagonist in order to stimulate luteinzing hormone surges in both sexes. We have named this formulation AMPHIPLEX, which is derived from the combination of the words amphibian and amplexus. The main experiments to estabish the method used *Lithobates pipiens*. It was used in-season, after short-term captivity and in frogs artificially hibernated under laboratory conditions. The AMPHIPLEX method was also effective in 3 Argentinian frogs, *Ceratophrys ornata*, *Ceratophrys cranwelli* and *Odontophrynus americanus*. Thsi requires the combined injection of des-Gly10, D-Ala[6], Pro-LHRH (0.4 micrograms/g body weight) and metoclopramide (10 micrograms/g BWt. MET). These results wil be reviewed, and an outline for future use and improvement of the method will be presented.

0753 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Michael Tuma[1], Emily Kochert[2]

[1]University of Southern California, Los Angeles, CA, USA, [2]SWCA Environmental Consultants, Pasadena, CA, USA

Modeling Habitat for Desert Tortoises in the Northeastern Mojave Desert

We developed and tested a habitat model for desert tortoise populations inhabiting the Gold Butte-Pakoon Critical Habitat Unit in the northeastern Mojave Desert. We developed the model using a series of ecological parameters that describe components of desert tortoise habitat, as determined through existing knowledge of desert tortoise habitat preferences. We compiled existing spatial datasets for occurrence of these ecological parameters, including geomorphological, geological, pedological, climatological, and botanical data within the mapped study area. We scored the variability within each dataset and mapped the ranked scores for each ecological parameter at scales appropriate for our modeled landscape, which allowed us to predict areas of relative habitat suitability. We tested the model using occurrence data; plot

surveys that sampled a range of habitats; and long-term radio-telemetric field data collection. Appropriate desert tortoise habitat was modeled over most of the study area, and we determined areas of relative suitability. Desert tortoise occurrence data confirmed that our habitat model was useful in predicting suitable habitat. Plot surveys and radio-telemetric observations confirmed that certain modeled ecological parameters, particularly the occurrence of geological landforms and soils that contribute to the formation of exposed caliche (CaCO3) deposits, provided areas of enhanced habitat suitability. We developed this habitat model as part of a larger effort to develop a spatially-explicit population model that will simulate and rank the effects of anthropogenic threats within the modeled landscape, allowing us to prioritize tortoise conservation and land management recommendations at a site-specific level.

0309 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

John A. Tupy

Western Carolina University, Cullowhee, NC, USA

Terrestrial Habitat Choice Of The Endangered Dusky Gopher Frog

Prescribed fire can result in a mosaic of habitat patches having different characteristics. Animals that have a small home range may select patches with particular characteristics within a fire maintained area because the animals require a specific microhabitat. We examined terrestrial habitat choice of dusky gopher frogs (*Rana sevosa*) in a longleaf pine forest managed with winter and early spring fires. We tracked 13 adult and 4 juvenile gopher frogs from a breeding/metamorphosing site to terrestrial burrows using radio telemetry. Average distance traveled, measured from the center of the pond, was 158.22m (std. dev. = 52.02, min = 94.3m, max = 239.6m). Habitat data were recorded in nested 1m x 1m and 15m x 15m plots centered on the burrows individual gopher frogs (n=17) were tracked to, or randomly selected points (n=20). Nonmetric multidimensional scaling of the nine 1m x 1m plot variables and % canopy openness revealed that the gopher frog homesites grouped together when plotted (Stress=14.141). Compared to random sites, gopher frog homesites had a higher percent cover of grass and bare ground and a lower percent cover of shrubs and leaf litter within 1m x 1m plots, more underground refuges available within 15m x 15m plots, and a more open canopy (all $P<0.03$). The habitat characteristics found at gopher frog homesites are associated with the effects of fire. The selection of characteristics influenced by fire suggests that more frequent or intense fires, or applying fire during the growing season, may increase the availability of preferred microhabitats.

0123 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Sharon Turk, Christopher A. Sheil

John Carroll, University Heights, OH, USA

Patterns of Formation, Chondrification, and Ossification of the Cranial and Postcranial Skeleton of *Graptemys kohnii* (Emydidae)

Patterns of ossification and chondrification are well-described for many species of turtles, but none exist for *Graptemys kohnii.* Using cleared and double-stained specimens, we describe the sequence of formation, chondrification, and ossification of the entire skeleton of *Graptemys kohnii,* the Mississippi Map Turtle. The chondrocranium of late-developmental stages of embryonic specimens will be described and and compared with those of other species of turtles. Furthermore, a comparative approach will be used to examine sequences of ossification in the cranial and postcranial skeleton of *G. kohnii* to other species of *Graptemys,* emydids, and turtles in general. Patterns of formation of elements of the fore- and hind limb autopodium will be discussed.

0704 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Thomas Turner, Trevor Krabbenhoft, Corey Love

Museum of SW Biology, Univ New Mexico, Albuquerque, NM, USA

New Insights from Old Specimens: Effects of Intensive River Regulation in the Rio Grande Revealed from Stable Isotopes of Preserved Material

Stable Isotopes of naturally-occuring elements offer a new way to interpret specimens held in natural history collections. We examined trophic structure of the fish community in the Rio Grande, New Mexico by evaluating stable isotopes of carbon and nitrogen at four locations and over a time span of 80 years. At present, the Rio Grande is heavily regulated for irrigation and flood control. Prior to regulation, the Rio Grande had extensive overbank flooding and increased connectance to adjacent floodplain habitats. We predicted that energy source heterogeneity and trophic structure would be diminished as river habitats were homogenized through channelization. We tested this prediction using a new analytical framework that characterizes and tests for differences in dispersion, central tendencies, and trajectories of $\delta^{13}C$ and $\delta^{15}N$ values across space and time. Our analyses revealed that instream carbon sources predominately fueled both historical and contemporary fish food webs, but energy sources to the food web were less heterogeneous over time. There was concomitant reduction in dispersion in $\delta^{15}N$, suggesting homogenization of trophic structure in the fish community. Isotopic analysis of museum specimens indicates that the Rio Grande has suffered losses in ecological diversity and ecosystem function that coincide with habitat homogenization and loss of species diversity.

0723 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

John Tyminski[1], Robert Hueter[1], Rafael de la Parra[2]

[1]Mote Marine Laboratory, Sarasota, FL, USA, [2]Proyecto Domino, CONANP, Cancun, Quintana Roo, Mexico

Patterns in Diving Behavior of Whale Sharks Identified through Pop-up Satellite Archival Tagging in the Gulf of Mexico

Pop-up satellite archival transmitting (PSAT) tags were attached to 33 whale sharks (*Rhincodon typus*) off Mexico's northeast Yucatan Peninsula 2003-2010, to examine these sharks' long-term movement patterns and gain insight into the underlying factors influencing their habitat selection. Archived data were received from 26 PSATs on immature and mature sharks of both sexes (9 males, 17 females) with total lengths of 5.5-8.5 m. Seven of these tags were physically recovered facilitating their direct download and a detailed view into the sharks' vertical movements (range of 2-180 days). Analyses using the fast Fourier transform revealed a distinct diel pattern in diving behavior that can be explained by regular and conspicuous depth-change events often coinciding with sunrise or sunset. Whale sharks feeding primarily on fish eggs off Isla Mujeres initiated an extended period of surface swimming at sunrise that abruptly changed to a pattern of regular vertical oscillations in the mid-afternoon. When in oceanic waters, *R. typus* often demonstrated a pattern of repetitive epipelagic dives that were punctuated by very deep dives followed by ascents initiated almost immediately after reaching maximum depth. Analysis of these extreme dives (those exceeding 500 m; max 1,888 m) revealed a mean descent rate (36.6 m/min) that was significantly faster than the mean ascent rate (25.7 m/min). An additional 7m male whale shark tagged off the southwest Florida Gulf coast in 2010 displayed the deepest dive we have yet recorded, to 1,928 m in the northern Gulf.

0037 Poster Session II, Saturday 9 July 2011

Franz Uiblein

South African Institute of Aquatic Biodiversity, Grahamstown, South Africa

The Diversity of Goatfishes: a Comparative Phenotypic Approach

The diversity of goatfishes is still insufficiently explored. For instance, in the Western Indian Ocean (WIO) the number of reported species has increased from 21 species in 1984 to 41 known today. Eleven of the 20 WIO species added since have been described only during the last three years. The genera *Upeneus* and *Mulloidichthys* deserve enhanced attention in particular, as they show considerable intraspecific variation in colour and body form that needs to be disentangled from characters allowing robust species diagnosis. Detailed studies of meristic, morphometric and colour characters

provide also important information about adaptive traits involved in diversification and evolution of goatfishes. Good examples are the tail-fin markings and lateral body stripes in *Upeneus* that should facilitate the co-existence of otherwise ecologically rather similar species. Colour patterns alone however do not always warrant reliable species distinction. For instance, the characteristic dark lateral spot of *Mulloidichthys flavolineatus* can be switched "on" or "off" depending on context. To overcome taxonomic challenges deriving from a rather high variability in colour and a rather low variability in meristic characters, a large set of morphometric characters has been used successfully in inter- and intraspecific comparisons of both genera. This comparative phenotypic approach has the added advantages of being applicable to formalin-fixated samples and permitting simple field-identification keys to be prepared; however, this approach aims also at integrating molecular studies towards a deeper understanding of evolutionary processes and patterns.

0106 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

Franz Uiblein[1], Jørgen G. Nielsen[2], Peter R. Møller[2], Werner Schwarzhans[3]

[1]Institute of Marine Research, Bergen, Norway, [2]Zoological Museum, University of Copenhagen, Copenhagen, Denmark, [3]Ahrensburger Weg, Hamburg, Germany

On the Evolution of Colour Patterns in the Ophidiid Genus *Neobythites*

Neobythites is the species-richest genus of the entire order Ophidiiformes with 51 currently known species. Many *Neobythites* species have conspicuous colour markings like vertical bars across the body and dark spots and/or margins on unpaired fins. In several species eye-spots or ocelli occur on the dorsal fin which consist of a black spot surrounded by a contrasting white ring. A recent comparative study of ocellus variation in *Neobythites* indicated adaptive significance of this character in predator avoidance and social communication. Here we examine the question which role colour patterns have played in the evolution of *Neobythites* using a phenotypic phylogenetic approach. A total of 62 external and internal characters including various otolith measurements were obtained from a large number of individuals representing the 51 *Neobythites* species and eight out-group species from seven ophidiid genera. Based on both qualitative and quantitative coding methods a data matrix was prepared. Parsimony analysis using Paup software resulted in 54 equally parsimonious trees with most branches fully resolved on the strict consensus tree. When mapping the different colour characters on the branches, we noted repeated occurrence with a tendency towards more frequent appearance of spots, ocelli and bars in species positioned at more distant branches, whereas dark fin margins do not reveal such a trend. From these data we conclude that, while all colour patterns seem to reflect some degree of homoplasy, spots, bars, and in particular the ocelli may have contributed to the high level of diversification in this deeper-shelf and upper-slope dwelling genus.

0760 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Yumi Une

Azabu University, Sagamihara,Kanagawa, Japan

Emergence of Ranaviruses in Japan

Ranavirus was discovered in *Rana catesbeiana* (Rc) larvae in a mass die-off in October 2008 in Japan. By 2010, five outbreaks in wild *R. catesbeiana* were discovered within a 35-km radius. Mortality events involving Rc occurred between the end of September and the beginning of October, and continued for several weeks. Fish mortality was documented at 2 sites and ranavirus was detected in one of these cases. Additionally, an outbreak occurred in a protected colony of 80 *Hynobius nebulosus* after the introduction of newly collected animals; the entire colony was annihilated in two weeks. These ranaviruses were registered as Rc ranavirus (RCV-JP) and *H. nebulosus* ranavirus (HNV) based on sequences of the MCP gene. Subsequent surveillance of 1200 wild amphibians revealed RCV-JP infections in Rc (larva), *Cynops ensicauda* (adult), *Hyla japonica* (adult), and *Rhacophorus arboreus* (larva). A third ranavirus TFV was found in *Fejervarya limnocharis* (adult). All infected animals appeared healthy except for *H. japonica*. In ranavirus challenge experiments using 13 native species (8 salamanders and 5 frogs, *n* = 486 individuals), the mortality rates of RCV-JP were 100% in salamanders and 33 - 100 % in frogs. The mortality rate of HNV was 0-100 %, with high mortality in all salamander species except *H. nigrescens.* Additionally, mortality was greatest at elevated temperatures. The two ranaviruses reported here could pose a threat to native amphibian species in Japan. More studies are needed investigating the threat of these isolates to other Japanese species and the prevalence of ranaviruses in wild populations.

0410 Herp Population Genetics/Herp Coloration, Symphony I & II, Monday 11 July 2011

Shem Unger, Rod Williams

Purdue University, West Lafayette, IN, USA

Population Genetics of the Eastern Hellbender (*Cryptobanchus alleganiensis alleganiensis*) at Multiple Spatial Scales

The eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) is a large paedamorphic salamander experiencing population declines throughout its geographic range. Causes for declines include habitat destruction, degradation, and illegal harvesting. The genetic ramifications of these population declines are currently unknown. To this end, we developed a suite of 12 hyper-variable genetic markers (microsatellites) to examine levels of gene flow, genetic variation, and genetic structure at both local and regional scales. We collected 812 individuals from 47 rivers throughout 11 states from June 2008 to September 2010. Levels of genetic diversity were relatively high among all sampling locations. The number of alleles per locus ranged from 4 to 32 (mean of 8.79), while

observed heterozygosity and expected heterozygosity averaged 0.812 and 0.831, respectively among populations. We detected significant genetic structure across populations (F_{st} values ranged from 0.0009 between rivers within a single watershed to 0.2182 between states across their range). Understanding range-wide levels of genetic variation and differentiation will enable natural resource managers to make more informed decisions and plan conservation strategies for this cryptic, protected species.

0616 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Peter Unmack

NESCent, Durham, NC, USA

Using GIS to Predict Population Connectivity in Southwestern USA Rivers Based on Continental Shelf Width

The phylogeography of coastal rivers is an important topic that so far largely remains under exploited in terms of its full research potential. Salt water acts as a strong barrier to obligate freshwater species. Salt water barriers are highly dynamic in that they are controlled by sea level changes and coastal geomorphology. As sea levels fall, barriers are removed as formerly isolated rivers may coalesce together and allow dispersal. Therefore, when sea level is lowered, there is greater potential for dispersal to occur. As sea level rises again, barriers reform, isolating the fauna of each now separate river basin. Changes in sea levels occur in cycles, and at least throughout Pleistocene have occurred every 100,000-150,000 years and are thought to be strongly influenced by Milankovitch Cycles. Here I use GIS to map continental shelf width and low sea level drainage patterns to establish some hypotheses that can be tested by phylogeographic data. Broad continental shelves should allow greater opportunities for populations to mix than narrow continental shelves, as there is more opportunity for rivers to coalesce and for fishes to move between coastal floodplains. From this we can predict that fish populations present in coastal rivers that are separated by similar continental shelf widths should have similar genetic divergences, and that those divergences should be greater in narrow shelves and lower in broader widths. By using GIS to quantify potential limitations to gene flow, specific regions and species can be targeted to allow these hypotheses to be broadly tested.

0617 Poster Session II, Saturday 9 July 2011

Peter Unmack

NESCent, Durham, NC, USA

Using GIS to Predict How Do Changes in Sea Level Potentially Influence Phylogeographic Patterns in Freshwater and Coastal Marine Fishes

Most research within phylogeography has concentrated on first identifying a biogeographic pattern from their phylogenetic results and then explaining this pattern due to some earth history event. My goal is to shift the focus in the opposite direction. That is, to map relevant aspects of earth history across the landscape and then see how consistent these earth history patterns are relative to the phylogenetic data. If these aspects of earth history are important in determining biogeographic patterns then phylogeographic patterns should be fairly consistent with them. If the patterns are not consistent then it suggests that we need to find alternative explanations for the observed phylogeographic patterns and that the earth history factors are not strong forces with broad impact. Here I present two examples using different aspects of continental shelf width to predict phylogeographic patterns. The first quantifies the relative degree and difficulty of movement of obligate freshwater organisms between drainage basins via low sea level connections. The second aspect of this research is to quantify potential habitat for coastal marine fishes at different sea level heights to contrast potential changes in population size since the last low sea level stand. Using GIS I have developed datasets that allow researchers to visualize and quantify continental shelf width for any region of the world. I provide some examples that demonstrate the utility of this approach.

0561 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

James Van Tassell[1], Luke Tornabene[1]

[1]*American Museum of Natural History, New York, NY, USA,* [2]*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*

A New Deep-reef Goby from the Caribbean: a New Genus or Bizarre Basal *Bollmannia* (Gobiidae: Gobiosomatini)?

A new species of American seven-spined goby (tribe Gobiosomatini) is described. This species has been referred to as the "sabre goby" and the "filamentous goby" since it was first recorded in 1974, yet it has remained undescribed for over three decades. It is abundant on rocky reefs and talus slopes at depths of 90-200m in several locations through the Caribbean, where it occurs in groups ranging from 4-10 individuals to large schools consisting of dozens of gobies. Several past molecular analyses have suggested that this species belongs within the *Microgobius* group of the Gobiosomatini, perhaps as the basal member of a clade containing all other *Bollmannia* species. We discuss the

systematics of this species in light of previous molecular analyses and recent osteological examination.

0212 Poster Session III, Sunday 10 July 2011

Carrie Vance[1], Andrew Kouba[2], Scott Willard[1]

[1]Mississippi State University, Mississippi State, MS, USA, [2]Conservation and Research Department, 2000 Prentiss Place, Memphis, TN, USA

Use of Near Infrared Reflectance Spectroscopy (NIRS) for Gender Determination in Amphibians: Applications for Sexing Monomorphic Species and Juvenile Animals

Many amphibians exhibit clear sexual dimorphism via color variation, physiological morphology, or calling behaviors; however, monomorphic species and juveniles may not. Evidence exists that some anurans exhibit sexually dimorphic chemical profiles in skin peptides, such as the Australian frog *Litoria splendida* where specialized peptides are present only in the skin secretions of the male. Our purpose is to develop a Near Infrared Reflectance (NIRS) spectroscopic approach towards distinguishing gender in amphibians with specific application to monomorphic species and juveniles in which traditional dimorphic physical and behavioral characteristics are not readily apparent. Gender discrimination by NIRS was tested with (20.37) *Bufo boreas* and (24.24) *Bufo fowleri* housed at the Memphis Zoo and Mississippi State breeding research colonies. Full Vis-IR spectrum scans, ranging from 350-2500 nm, were obtained from live animals using a surface contact probe placed on the abdomen of the individual, and VisIR light reflectance captured using an ASD FieldSpec3® NIR Spectrophotometer. Chemometric analysis of spectra using GRAMS9.0© software utilized a 2-block PLS1 discriminant calibration after data processing for scattering inhomogeneity. Calibration and validation spectral sets were developed at an 80/20 ratio, and validation unknowns tested against the spectral libraries. For *B. fowleri* and *B. boreas,* 93% and 95% of individual animals were correctly classified by gender against the spectral calibration libraries, respectively. Thus, NIRS has great potential for non-invasive gender discrimination of amphibians, with over 90% reliability. Furthermore, the portable NIRS system would be applicable to field studies for *in situ* gender determination.

0540 Herp Behavior, Symphony I & II, Monday 11 July 2011

Terry VanDeWalle, Joshua Otten, Bob Doherty

Stantec Consulting, Independence, IA, USA

Homing Behavior of *Graptemys geographica* and *Chrysemys picta* in Michigan

Following an oil spill in the Kalamazoo River, over 2700 turtles, from eight species, were captured in a 48 km stretch of the river as part of a wildlife rescue and recovery effort. Oiled turtles were cleaned of oil, rehabilitated and released at several locations inside and outside of the spill zone. Prior to release, turtles greater than 100 g were PIT-tagged for identification. A total of 293 *Graptemys geographica* and eight *Chrysemys picta* were recaptured, including multiple recaptures of some individuals. Members of both species exhibited homing behavior. Distances moved by individual recaptured turtles ranged from no movement to more than 16 km.

0747 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Alejandro Vélez, Mark Bee

University of Minnesota, St. Paul, MN, USA

Finding a Mate at a Cocktail Party: Dip-listening Improves Acoustic Mate Recognition in Cope's Gray Treefrogs

Dip-listening refers to our ability to catch brief "glimpses" of speech when the background noise momentarily dips to low levels. This mechanism allows us to solve the "cocktail-party problem," which describes the difficulty we have following one conversation in noisy, multi-talker social environments. Nonhuman animals that communicate in dense social aggregations also face cocktail-party-like problems. We currently know relatively little about how nonhuman animals may be adapted to exploit various acoustic features of signals and noise to facilitate signal recognition in noisy environments. In this study of Cope's gray treefrogs (*Hyla chrysoscelis*), we asked whether female frogs listen in the dips of background noise to recognize male mating calls. In female phonotaxis experiments, we tested the hypothesis that temporal amplitude fluctuations in chorus-like noise influence thresholds for recognizing male mating signals. Compared to an unmodulated control, signal recognition thresholds were ~4dB lower when noise dips were long enough to include "glimpses" of nine or more consecutive pulses of the mating call. We did not find evidence for dip-listening when noise dips included five or less consecutive pulses. In quiet conditions, calls comprising six to nine pulses were necessary to elicit female response. These results suggest that the ability of female frogs to listen in the dips may be constrained by neural mechanisms underlying temporal pattern recognition. Because the sounds of frog choruses are often modulated at slow rates, female frogs might benefit from dips in the background noise to recognize signals in natural social environments.

0256 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Matthew D. Venesky[1], Richard J. Wassersug[2], Matthew J. Parris[1]

[1]The University of Memphis, Memphis, TN, USA, [2]Dalhousie University, Halifax, NS, Canada

Missing Teeth Alters Feeding Kinematics in Pond-dwelling Tadpoles

The keratinized mouthparts of tadpoles play an integral role in feeding; yet, few data exist on how tadpoles feed when these structures are damaged and/or missing. We conducted a series of experiments using high-speed videography to explore how missing labial teeth alters the feeding kinematics and foraging performance of pond-dwelling tadpoles. We examined: (1) tadpoles with a high degree of tooth loss from *Batrachochytrium dendrobatidis* infection, (2) overwintered tadpoles with similar patterns of natural tooth loss, and (3) a controlled pattern of tooth loss by surgically removing one row of teeth from otherwise normal larvae. In each experiment, we measured two kinematic variables associated with feeding: the duration of: (1) the entire gape cycle and (2) time the teeth were in contact with an algal covered substratum. We observed similar effects on tadpole feeding kinematics despite different causes and patterns of tooth loss across experiments—the mouths of tadpoles with missing teeth slipped off the surfaces on which tadpoles grazed and were in contact with the substratum for a shorter duration in each gape cycle. In a follow-up experiment, we found that tadpoles with a row of surgically removed teeth obtained similar amounts of food as tadpoles with intact mouthparts. However, tadpoles with missing teeth completed approximately 25% more foraging bouts per unit time, suggesting that they needed to expend more energy to consume similar amounts of food. Collectively, our data indicate that tadpoles missing labial teeth forage less effectively than tadpoles with undamaged dentition and tadpoles.

0367 Poster Session II, Saturday 9 July 2011

Maria das Neves Silva Viana[1], Luciana Santos Viana[1], Tomas Hrbek[1], Paulo Cesar Machado Andrade[2], Richard Carl Vogt[3], Izeni Pires Farias[1]

[1]Universidade Federal do Amazonas - ICB, Manaus, Amazonas, Brazil, [2]Universidade Federal do Amazonas - ICA, Manaus, Amazonas, Brazil, [3]Instituto de Pesquisas da Amazonia, Manaus, Amazonas, Brazil

Genetic Diversity of *Podocnemis sextuberculata* (Chelonia; Podocnemididae) Populations in the Brazilian Amazon

Podocnemis sextuberculata has a geographic distribution in the Amazon basin of Brazil, Peru and Colombia. Currently, it is classified as vulnerable by the IUCN Red List, with the principal threat being human consumption of eggs and meat. Exploitation of this species has caused changes in densities and structure of populations, as well as changes

in sex ratio. In this study, we analyzed the genetic diversity of *P. sextuberculata* utilizing the control region of the mitochondrial DNA and five nuclear DNA microsatellite loci, characterizing ten and five localities along the Amazon River, respectively. Results both from control region and microsatellite loci showed lack of differentiation among all sampled localities with the exception of comparisons involving individuals from the Nhamundá River. For this locality, the data also showed limited gene flow (Nm). Considering that the differentiation of the Nhamundá River from other localities in both data sets does not have an obvious biological or geographic explanation, and considering the low genetic diversity within the Nhamundá River locality which could be the results of sampling of related individuals, the result of the differentiation of the Nhamundá River should be interpreted cautiously. In both data sets, genetic divergence between localities is not correlated with geographic distance between them. Results are also concordant in revealing heterogeneity in genetic diversity among localities that is not correlated with anthropogenic actions. Given the existence of panmixia within *P. sextuberculata*, it may be possible to augment genetic diversity in depaupered populations via introduction of animals from selected appropriate localities.

0421 Poster Session II, Saturday 9 July 2011; STORER ICHTHYOLOGY AWARD

Kirill Vinnikov

University of Hawaii at Manoa, Honolulu, HI, USA

How Many Species Are Within the Genus *Pseudopleuronectes* (Teleostei: Pleuronectidae)?

According to the last revision of pleuronectids made by Cooper and Chapleau (1998), genus *Pseudopleuronectes* Bleeker, 1862 includes the following species: *P. americanus*, *P. herzensteini*, *P. obscurus*, *P. schrenki* and *P. yokohamae*. Most inferences about their relationships were obtained from the cladistic analysis of the osteological characters and ecological data. Specimens of *P. obscurus* were not analyzed, but the authors have suggested inclusion of this species based on the literature data. The last four species are endemics for the Sea of Japan and only *P. americanus* is the usual flounder for the US North Atlantic coast. I made comparison for both type and field collected specimens by the standard metric and meristic morphological characters with the addition of osteological information and molecular data from the mitochondrial COI and CytB gene sequences and over 300 RAPD-PCR markers for nuclear DNA. Both morphological and RAPD-PCR traits represented closer position of *P. obscurus* to *Pseudopleuronectes* than to its previous genus *Liopsetta*. Bayesian tree reconstructions based on mtDNA gene sequences showed close relationship of this species to *P. americanus*. All comparisons revealed intraspecific similarity between *P. yokohamae* and *P. schrenki*. Also no robust differences by the morphological characters, which are provided in the literature for these species, were found in type specimens and in field samples. On the contrary, distinct sexual dimorphism and size-related differences were observed. Therefore, I

propose synonymy of these species and *P. yokohamae* (Gunther, 1879) as senior synonym. Identification key for all *Pseudopleuronectes* species and close related taxa is provided.

0244 Poster Session I, Friday 8 July 2011

Richard Vogt, Camila Ferrara, Rafael Bernard, Virginia Diniz-Bernardes, Fernanda Rodriques, Adriana Terra, Fabiano Waldez, Romildo Sousa

Instituto Nacional de Pesquisas da Amazonia, Manaus, Amazonas, Brazil

Bottom Up -Top Down, a New Strategy in the Battle for the Conservation of Giant Amazon River Turtles in Brazil

Conservation efforts aimed at preserving populations of Giant Amazon River Turtles, *Podocnemis expansa*, have centered around police state actions against the riverine people who sell turtles to the middle men and environmental education programs with these same people aimed at changing their way of livelihood. Through the program of Petrobras Ambiental we are working from both ends of the food chain, from the turtle poacher (bottom up) to the city dweller buyer (top down). If the city dweller can be convinced to only buy legally raised turtles then the lucrative black market should recede. Simultaneously we will be giving classes on conservation and environmental awareness to school children and adults in the riverine communities on the Trombetas River. At the same time we will be hosting alternative production work shops, helping these people to change their life styles to gain income from sustainable use of the forest products available to them. School children and adults in Manaus will be given environmental awareness courses in hopes of changing their life styles of turtle consumption. In order to succeed we are constructing a turtle conservation and research center, which in addition to a class room and research facilities will also have all the species of Amazon turtles on display in large aquaria. Student guides will lecture people about conservation efforts as they are observing the turtles. With an active program at both ends of the food chain it may be possible to reap success.

0171 Invasive Species, Symphony I & II, Sunday 10 July 2011

Hardin Waddle

U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, USA

Brown Anole Presence Reduces Occupancy of Green Anoles in Southern Florida Natural Areas

Since the introduction of Brown Anoles (*Anolis sagrei*) into Florida, numerous authors have noted the high densities that Brown Anoles achieve, especially in disturbed or in dry, sparsely vegetated habitats. The colonizing success of Brown Anoles has appeared to coincide with a decline in the occurrence of Green Anoles (*A. carolinensis*). The high

density of Brown Anoles along with evidence of asymmetrical interspecific interactions is presumed to account for an apparent replacement of Green Anoles with Brown Anoles in some areas. I analyzed data from herpetofaunal surveys conducted at 180 sites in national parks and other protected areas in southern Florida from 2000 to 2008. The effects of habitat and distance from the nearest road on occurrence were investigated for both anole species. Both species were found to have habitat specific occurrence probabilities; Brown Anoles were more likely to occur in forested habitat and Green Anoles were more likely to occur in open and wetter habitats. Considerable evidence was found that Brown Anole occurrence is negatively associated with distance from roads. Models of species interaction including both anole species indicated that the presence of Brown Anoles at a site has a negative effect on the occurrence of Green Anoles. These results indicate that Brown Anoles have invaded natural areas in south Florida, but are still most abundant near roads. Although Green Anoles do co-occur with Brown Anoles, there is now evidence from the field to support anecdotal observations that Brown Anole presences reduces the probability of occurrence of Green Anoles.

0719 Poster Session I, Friday 8 July 2011

Hardin Waddle, Brad Glorioso

U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, USA

Estimating the Power to Detect a Trend in Occupancy Monitoring Studies: Comparison of VES and Vocalization Surveys

The goal of most wildlife monitoring programs, often implied, is to determine if there is a trend in the population (i.e. is it declining?). Amphibian monitoring is difficult because detection of individuals is often imperfect and population abundance can fluctuate. Occupancy modeling provides a methodology suitable for monitoring amphibians that compensates for both imperfect detection and fluctuations in abundance, but determining the power to detect a trend in occupancy is a problem that has largely been overlooked. We used computer-simulated monitoring based on detection probabilities estimated from field data of four species from southern Louisiana to estimate the power to detect a trend using two standard methodologies: visual encounter surveys (VES) and vocalization surveys. We simulated 10,000 observation matrices for each species and analyzed the data using a standard occupancy model. We used model selection based on AIC to determine if the true model (the one with the decline) would be selected as the best model. Probability of detecting a 33% decline in site occupancy based on vocalization surveys was <25% for all four species, but power to detect the same trend using VES ranged from 80-100%. Detection probabilities were generally lower for vocalization surveys compared to VES which accounts for lower power to detect a trend and higher degree of uncertainty in occupancy estimates. Monitoring programs that sample species with low detection probabilities should be aware of decreased power to detect trends. Increasing the number of samples or altering methods to increase detection are possible solutions to this problem.

0365 Poster Session I, Friday 8 July 2011

Robert Wagner[1], Josh Pierce[2], Craig Rudolph[2], Richard Schaefer[2], Dwayne Hightower[1]

[1]*Quantitative Ecological Services, Rosepine, LA, USA,* [2]*USDA Forest Service, Southern Research Station, Nacogdoches, TX, USA*

A Landscape-scale Model of Potential Louisiana Pine Snake (*Pituophis ruthveni*) Habitat

Ongoing surveys suggest that the Louisiana Pine Snake (*Pituophis ruthveni*) is declining; and currently occupied habitat is limited to a few small, isolated blocks of degraded and fragmented habitat. Research suggests that the species requires frequently burned sites with a well developed herbaceous understory capable of supporting populations of its primary prey, Baird's Pocket Gopher (*Geomys breviceps*). Baird's Pocket Gophers are associated primarily with sandy, well-drained soils. However, past attempts to identify the relationship between soil attributes and Louisiana Pine Snake occurrence at local and landscape scales were marginally successful. To develop a landscape-scale model of potential habitat, which is required for species management and recovery, we developed a resource selection function to predict suitability across the species range based on soil characteristics. We evaluated 26 *a priori* models consisting of different combinations of candidate SSURGO soil variables to explain the distribution of used and available resources at 162 individual historic snake locations. Of the models considered, the model consisting of hydrologic group (hydgrp) alone best fit the data. Hydrologic group is a categorical measure of runoff potential, incorporating water table depth and soil permeability. We used a dataset of 22 radio-tagged snakes to validate the model, both within and across individuals. Recently this model was used to rank potential sites for an ongoing reintroduction effort, to select potential conservation areas on private lands, and to identify suitable acres on federal lands.

0298 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Peter Wainwright[1], Jose Tavera[2], Samantha Price[1]

[1]*University of California, Davis, Davis, CA, USA,* [2]*CIBNOR, La Paz, Mexico*

Living on Reefs Promotes Faster Evolution of Feeding and Locomotor Traits in Haemulid Fishes

Reefs are known to harbor exceptional biodiversity but it is unclear what processes produce this pattern. We studied the impact of reefs on rates of morphological evolution in 50 New World species of Haemulidae, a group of shallow water marine fishes that have successfully radiated into many soft-bottom and reef niches. In each species, we

measured 11 functional traits associated with the feeding mechanism and 13 traits that characterized body and fin shape and are thought to affect locomotor performance. Using an ultrametric phylogeny of haemulids and a Brownian motion model of trait evolution we compared rates of evolution in the 24 traits between haemulid lineages that live on reefs and those that live in soft-bottom habitats. Rates of evolution were significantly faster in reef haemulids in 9 of 11 trophic characters and 5 of 13 body shape and locomotor traits. Rates were never faster in soft-bottom lineages. Overall, rates of evolution on reefs was 5.2 times faster in trophic traits and 2.1 times faster in body shape and locomotor characters. Reef lineages have also invaded novel regions of morphospace and adopted feeding niches not founding soft-bottom taxa. The causes of these results are not certain, but the biological richness found on reefs may provide a more complex adaptive landscape for haemulids than soft-bottom habitats, while the high species richness found on reefs may increase opportunities for character displacement. Both of these factors could result in faster trait diversification.

0371 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Christina J. Walker[1], James J. Gelsleichter[1], J. Marcus Drymon[2]

[1]University of North Florida, Jacksonville, FL, USA, [2]Dauphin Island Sea Lab, Dauphin Island, AL, USA

Assessing the Impacts of the Deepwater Horizon Oil Spill on Sharks Caught off the Coast of Alabama

The Deepwater Horizon oil spill (DHOS) is considered to be the largest offshore oil spill in U.S. history and the resulting contamination of the Gulf of Mexico (GOM) has posed health threats to many pelagic species that live in these waters. Studies on wildlife following past oil spills (i.e., Exxon Valdez oil spill) have provided evidence of population-level effects in some species following exposure to the toxic constituents, including polycyclic aromatic hydrocarbons (PAHs), of oil. However, these assessments are often difficult to perform based on the lack of baseline data on oil exposure in wildlife. Therefore, in response to the DHOS, this study will employ a biomarker approach in order to compare levels of PAH exposure in fifteen species of elasmobranchs caught both before and after the GOM oil spill from various locations off the coast of Alabama. Cytochrome P4501A1 (CYP1A1) activity, a reliable biomarker for PAH exposure, will be measured in the livers of these sharks (n≈700). It is expected that baseline levels of PAH exposure (CYP1A1 activity) in sharks collected prior to the oil spill, or prior to coming in contact with oil, will be lower than sharks collected near areas contaminated with oil from the spill.

0717 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Cathy Walsh, Carl Luer, Stephanie Leggett, Theresa Cantu, Jodi Miedema, Jennifer Yordy

Mote Marine Laboratory, Sarasota, FL, USA

Shark Immune Cell-derived Factors Induce Apoptosis (Programmed Cell Death) in T-cell Leukemia Cells

Research in our laboratory has demonstrated that protein factors secreted into the surrounding medium by short-term cultures of shark epigonal cells (epigonal conditioned medium, ECM) will kill human tumor cells *in vitro* by inducing apoptosis (programmed cell death). Studies presented here were designed to contribute to our understanding of the molecular mechanism through which ECM destroys tumor cells. Using a T-cell leukemia cell line (Jurkat) as the target cells, key enzymes in the apoptotic pathway are activated in Jurkat cells treated with ECM for 24 h compared with untreated control Jurkat cells. Both an initiator caspase (caspase-9) and an effector caspase (caspase- 3) are converted from precursor forms to active enzyme forms as visualized using Western blots. These conversions are accompanied by several-fold increases in enzymatic activity for both caspase-9 and caspase-3. Enzymatic activity of another initiator caspase (caspase-8) is also increased in ECM treated Jurkat cells. In addition, Western blots confirmed that lysates of ECM treated Jurkat cells contain fragments of PARP (poly ADP-ribose polymerase), a nuclear enzyme responsible for DNA repair. Inactivation of PARP by caspase-3 cleavage in a specific domain of the enzyme allows DNA damage to go unrepaired and apoptosis to proceed. Molecular sizes of PARP fragments are consistent with caspase-3 cleavage and further support induction of apoptosis in Jurkat cells by ECM.

0582 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Thomas Waltzek[1], Bruce Drecktrah[2], Jeff Briggler[3], Beth MacConnell[4], Crystal Hudson[5], Lacey Hopper[5], Susan Yun[1], Kirsten Malm[1], Scott Weber[1], Ronald Hedrick[1]

[1]University of California at Davis, Davis, CA, USA, [2]Blind Pony State Fish Hatchery, Missouri Department of Conservation, Sweet Springs, MO, USA, [3]Missouri Department of Conservation, Jefferson City, MO, USA, [4]Headwaters Fish Pathology, Bozeman, MT, USA, [5]Bozeman Fish Health Center, Bozeman, MT, USA

Isolation of Frog Virus 3 from Pallid Sturgeon Suggests an Interclass Host Shift

During July – September 2009, juvenile pallid sturgeon (*Scaphirhynchus albus*) at the Blind Pony State Fish Hatchery (BPSFH) in Sweet Springs, Missouri experienced mortalities of over 500 individuals/day at water temperatures between 16 – 26 C.

Histological exams revealed necrosis of the hematopoietic tissues. A viral replicating agent was observed in cell culture and confirmed by electron microscopy. Experimental infection studies revealed the virus is pathogenic to pallid sturgeon – a federally endangered species. Analysis of the major capsid protein revealed that it was identical to the type species of ranavirus, *Frog Virus 3* (FV-3), and to a previous BPSFH isolate. This suggests that recurring infections or carryover of the virus from prior groups of sturgeon may have maintained the virus at this facility. Inasmuch as the BPSFH draws water directly from nearby Blind Pony Lake without disinfection, entry of ranavirus-contaminated water into the facility cannot be ruled out. However, liver samples collected from adult and larval American bullfrogs (*Lithobates catesbeianus*) and plains leopard frogs (*Lithobates blairi*) during the fall of 2009 and 2010 in nearby wetlands were negative for FV-3. The potential for reciprocal FV-3 infections (i.e. amphibian to fish and vice versa) has only been reported in sympatric populations of threespine stickleback (*Gasterosteus aculeatus*) and red-legged frog tadpoles (*Rana aurora*). Future research will focus on discovering the source of the virus at the facility (e.g. contaminated water supply, broodstock, etc…) as well as testing the host specificity and pathogenicity of the virus across a suite of poikilothermic vertebrates.

0599 Poster Session I, Friday 8 July 2011

Emily Warchol, John Waters, Johanna Imhoff, George Burgess

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

An Investigation of Internet Based Sale of Sawfish (Pristidae) Rostra

The worldwide decline in populations of critically endangered sawfish species is of considerable concern. Bycatch mortality is the predominant threat to sawfishes, but there is also a market for their fins and rostra. Rostra are sold as curios and trophies, used as religious offerings, in traditional medicine, in cockfights, as clothing pins, and made into tools. Fishers seldom target sawfish solely for rostra, but removal of the rostra is commonplace when removing bycaught sawfishes from nets. These rostra and fins provide supplemental income to fishers. While CITES listings make it illegal to trade in pristid fins and rostra, there are few data available concerning the internet-based sale of sawfish rostra. Records were collected from July 2010 to date using an internet alert for the sale of sawfish rostra and closely related products. In a few cases, individuals provided information on origin and/or ownership history of rostra. Information was gathered on individual rostra including origin of sale (website), seller country, sale price (USD), reported origin location (if provided), length of rostrum, etc. If photos were provided, the identification of species was made and number of rostral teeth counted. Relationships between price and length, between price and species, species composition, and points of origin will be discussed. Over 100 documented records indicate the sale of rostra is still an active trade. It is vital for sawfish rostra sales to be documented and efforts made to halt internet sales of this globally threatened group.

0124 Poster Session II, Saturday 9 July 2011

Daniel Warner, Timothy Mitchell, Fredric Janzen

Iowa State University, Ames, IA, USA

Sex-Specific Effects of Incubation Temperature on Hatchling Phenotypes of the Painted Turtle

Nest temperature determines offspring sex in many reptiles, but its sex-specific effects on offspring fitness are poorly understood, particularly in long-lived species. Models for the adaptive significance of temperature-dependent sex determination posit that egg incubation temperature differentially affects the fitness of male versus female offspring, thereby enabling each sex to develop under their own optimal thermal conditions. To address this hypothesis in a long-lived organism, we studied the sex-specific effects of incubation temperature during early life-history stages in the painted turtle (*Chrysemys picta*). By using hormonal manipulations, our experimental design enabled us to produce both sexes across a range of incubation temperatures (26°C, 28°C, and 30°C). Both sex and temperature contributed to morphological variation of hatchlings. Male hatchlings were smaller than females and were notably small when incubated under a female-producing temperature. Cool incubation temperatures (male-producing) induced relatively rapid growth rates after hatching, but this effect did not result in treatment differences in body size at one and two years of age. Hatchling turtles were also released into outdoor arenas to measure performance during simulated terrestrial dispersal from nests to water. Cool-incubated turtles reached arena perimeters more quickly than those from the other incubation treatments, but males and females did not differ. These results provide evidence that incubation temperature affects fitness-relevant traits of hatchlings independent of intrinsic differences between sexes. Our ongoing research will address the sex-specific effects of incubation temperature on other aspects of fitness (survival and reproduction) during adult stages.

0545 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Jason R. Warner, Robert E. Espinoza

California State University, Northridge, Northridge, CA, USA

Getting High and Chillin': Cold Hardiness of Liolaemid Lizards Living along an Elevational Gradient

Despite the thermal challenges imposed by cold environments, reptiles have evolved a diversity of behavioral and physiological strategies to cope with subzero temperatures. These include freeze avoidance, supercooling, and freeze tolerance. Freeze avoidance is a behavioral strategy usually involving taking refuge below the frost line. By supercooling, reptiles physiologically maintain body fluids in their liquid state at

temperatures below the freezing point of water. Freeze tolerance allows some reptiles to recover after a significant portion of their tissues have frozen. We hypothesize that species of liolaemid lizards that have invaded cold habitats (>3000 m elevation) will have either retained or evolved greater capacities to supercool and tolerate freezing while low-elevation species will have never evolved, or if ancestral, lost cold-hardiness abilities. To test my hypotheses, we are characterizing the thermal environments experienced by a diversity of liolaemid species with operative temperature models. We will test physiological responses to cold by determining crystallization points (minimum body temperature attained before body fluids freeze) accomplished via supercooling, freeze tolerance abilities, and cryoprotectant concentrations in body tissues of each species. In sum, this study will use an explicit phylogenetic framework to test whether the cold-coping strategies of several species of *Liolaemus* vary as a function of the ecological pressures imposed by the high-elevation regions the lizards inhabit or are the result of phylogenetic conservatism. Habitat data confirms the lizards' need to survive extreme temperature fluctuations but preliminary data suggest no difference between the points of crystallization of low- and high-elevation species.

0338 Poster Session III, Sunday 10 July 2011

Mel Warren[1], Brooks Burr[1]

[1]USDA Forest Service, Oxford, MS, USA, [2]Southern Illinois University, Carbondale, IL, USA

North American Freshwater Fishes: Natural History, Ecology, and Conservation

Over 1,200 native freshwater fish species occur on the North American continent, comprising the largest temperate, freshwater fish fauna on Earth. The importance of North American freshwater fishes in ecosystem function, their value economically and as providers of ecological services, and the increasing need and means to conserve this fauna cannot be emphasized enough. In the last 30 years, major advances have occurred for these fishes in disciplines of systematics, genetics, physiology, behavior, autecology, community ecology, and conservation. These advances, however, are marked by increased specialization and resulting fragmentation of knowledge about the diverse North American fish fauna. Our book will be the first-ever published, fully-illustrated multi-volume work synthesizing all that is known about the diversity, natural history, ecology, and biology of 52 families of North American freshwater fishes (including several marine families with species occurring in fresh water). The coverage includes Canada, the coterminous United States, and Mexico (south to about the Isthmus of Tehuantepec). Chapter authors will synthesize information on a set of standard topic areas for each family with emphasis on the generic level. We are striving for a near-comprehensive synthesis of existing information on North American freshwater fishes. The book also will have non-taxonomic chapters including syntheses on evolution and ecology of fish communities, mating behavior, status and effects of foreign fishes, and conservation. Currently, we have 71 authors engaged in the book. Volume 1 is

anticipated to go to Johns Hopkins University Press in August 2011 followed by Volumes 2 and 3 at one-year intervals.

0552 Poster Session I, Friday 8 July 2011

John Waters[1], George Burgess[1], Felipe Carvalho[2], Gregg Poulakis[3], Tonya Wiley-Lescher[4]

[1] Florida Museum of Natural History, University of Florida, Gainesville, FL, USA, [2]School of Forest Resources and Conservation, University of Florida, Gainesville, FL, USA, [3]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA, [4]Haven Worth Consulting, League City, TX, USA

Spatiotemporal Distribution of Smalltooth Sawfish, *Pristis pectinata*, in Florida Waters

The National Sawfish Encounter Database (NSED) documents all known encounters of the federally endangered smalltooth sawfish (*Pristis pectinata*), and the equally threatened largetooth sawfish (*Pristis perotteti*). Encounters, sightings and captures, are reported to the NSED from researchers and the general public. Data generated include the length of the fish, location based on a qualitative confidence scale, date, and water depth. Distance from shore was acquired by sampling encounter locations using ArcGIS. A Generalized Additive Model (GAM) was used to identify potentially important biological and environmental factors that could influence sawfish distribution and habitat use. A subsequent GAM using penalized regression splines was fitted to Florida encounters having confident locations assigned using the *mgcv* package in R statistics, optimizing the degree of smoothing estimated by the generalized cross-validation criterion. Model predictions of sawfish distribution with regard to maturity, season, and recovery region were then mapped in ArcGIS to visualize trends in spatial distribution. Hypotheses were tested to determine if there are spatial trends among sawfish maturity stages, seasonal distribution patterns, and determine the environmental variables that influence sawfish habitat use.

0276 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Linet Cynthia Watson, Donald Stewart

SUNY-College of Environmental Science and Forestry, Syracuse, NY, USA

Population Genetics of the Giant *Arapaima* in South Western Guyana: Implications for its Management

The *Arapaima* is one of the most heavily exploited and threatened freshwater fishes in Guyana. Unregulated harvesting over the past 30 years has reduced the population to

about 800 individuals over 1-m in length, but more recently, the number has increased to about 3,000. The population genetic structure of *Arapaima* was inferred with 11 microsatellite loci using samples collected from five locations in the Essequibo and Branco River basins in Guyana. Population structure was detected at different spatial scales. Using a Bayesian approach that does not define the populations a priori three clusters were observed: (1) Rio Branco, (2) Apoteri, Iwokrama, Rewa, and (3) Karanambu. At the smallest scale, significant genetic differentiation was detected between most sampled locations through pairwise differentiation index (F_{ST}). Genetic variation was low with average heterozygosity of each sampling location ranging from 0.08 (Iwokrama) to 0.20 (Karanambu) and the overall average was 0.15. Intense harvesting over the past 30 years may explain the low genetic diversity observed. The results can be used to delineate management units. The Rio Branco population is most distinct, yet it is nearly extirpated and, presently, is receiving the least management attention.

0648 Herp Behavior, Symphony I & II, Monday 11 July 2011

Robert Weaver

Central Washington University, Ellensburg, WA, USA

Ants as Competitors for Refugia Sites with Pacific Northwest Dipsadine Snakes

Among the many abiotic factors that affect the lives of snakes is the presence (or absence) or suitable refugia. In the case of small, cryptic species, such refugia are small scattered rocks, downed limbs, or may be artificial in the form of discarded sheets of wood or metal. Rocks utilized by these snakes may be thick and deeply embedded into the substrate, multi-layered, or thin with just a portion embedded. Rocks provide protection, sites for thermoregulation, egg laying sites and in many cases, ambush sites for actively hunting snakes. The importance of these microhabitat types has been documented for all three species of dipsadine snakes native to the Pacific Northwest, the Desert Nightsnake (*Hypsiglena chlorophaea*), Ring-necked Snake (*Diadophis punctatus*), and the Sharp-tailed Snake (*Contia tenuis*). In this talk I present experimental data that shows ant of the genera *Pogonomyrmex*, *Formica*, and to a lesser extent *Camptonotus* can prevent these small snakes from selecting otherwise suitable refugia. During experimental trials the presence of live ants and odor of adult/larvae prevented both adult and juveniles of all three species from occupying a site. I also discuss how this may impact the laying of artificial cover when surveying for these species, as well how it may impact survey efforts and the ability to detect these species in areas with an abundance of these ant genera.

0647 Poster Session III, Sunday 10 July 2011

Robert Weaver[1], Daniel McEwen[2], William Clark[3]

[1]Central Washington University, Ellensburg, WA, USA, [2]Minnesota State University Moorhead, Moorehead, MN, USA, [3]Western Wyoming Community College, Rock Springs, WY, USA

Odor Cues Allow the Desert Nightsnake, *Hypsiglena chlorophaea* (Colubridae: Dipsadinae) to Assess Prey Size

We tested to see if desert nightsnakes (*Hypsiglena chlorophaea*) can chemically discriminate between two prey size classes (small and large). Twenty-one adult individuals of *H. chlorophaea* (mean snout-vent length = 364 ± 14.3 SD) were collected in 2008 from a site in Washington State, U.S.A. We obtained odors assays of a known prey item, the western terrestrial gartersnake (*Thamnophis elegans*) collected at the same site as *H. chlorophaea*. The two size classes were a small *T. elegans* (164 mm snout-vent length, SVL) and a large *T. elegans* (640 SVL). We presented odors on pre-moistened 15-cm cotton swabs held 2.5 cm in front of snake's snout. For each trial we recorded the number of tongue flicks in 60 seconds, and the latency to first tongue flick. We compared these responses to each size class, as well as to separate odor controls (water and cologne). Analysis showed no statistically significant difference in latency times when comparing cologne to water, or small snake odor to these controls. In terms of tongue flicks, snakes responded the strongest to the small snake odor. Our study is the first to show that a species of snake can chemically discriminate between sizes of prey.

0515 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Denita M. Weeks, Robert E. Espinoza

California State University, Northridge, Northridge, CA, USA

When Warmer Isn't Better: Subzero Tolerances and Performance Eurythermy for the World's Southernmost Gecko

The biological consequences of predicted warming can be modeled if we know how species respond to temperature over their geographic range. Reptiles that rely on the availability of favorable temperatures to function may be particularly sensitive to warming. *Homonota darwinii*-the world's southernmost gecko-is broadly distributed from central to southern Argentina where cold climates likely pose a thermal challenge for this nocturnal species. We tested the null hypothesis that thermally dependent processes of this widespread species match its thermal environment over its broad latitudinal range. We predicted that the species would exhibit the greatest thermal mismatch to local thermal conditions in the coolest environments that *H. darwinii* occupies. We measured thermal tolerances (critical thermal minimum, CT_{min} and panting threshold, *PT*) and temperature-dependent sprint performance, resting metabolic rate (RMR), and evaporative water loss (EWL) at 10, 15, 25, 35, and 40 °C for four populations of *H.*

darwinii spanning most of the latitudinal range of the species. CT_{min} differed across populations, but not latitudinally as anticipated. Remarkably, some populations had subzero CT_{min} indicating supercooling-the first time this phenomenon has been reported for any gecko. Annual operative temperature data indicate gecko retreats play a crucial role in surviving harsh surface temperatures (<0 or >50 °C). Our sprint, RMR, and EWL data suggest *H. darwinii* is eurythermic, yet differences in physiological performance exist throughout the range. Ultimately, these data will be incorporated into biophysical and climate models to predict the future distribution of this lizard following predicted changes in regional temperature.

0612 Fish Physiology, Minneapolis Ballroom G, Monday 11 July 2011

Nicholas Wegner[1], Chugey Sepulveda[2], Scott Aalbers[2], Jeffrey Graham[1]

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Adaptations for Fast Swimming and Ram Ventilation: Gill Fusions in Scombrids and Billfishes

For ram-gill ventilators such as tunas and mackerels (family Scombridae) and billfishes (families Istiophoridae, Xiphiidae), fusions binding the gill lamellae and filaments are used to prevent gill deformation by a fast and continuous ventilatory stream. For scombrids, a progressive increase within the family for reliance upon ram ventilation correlates with the elaboration of gill fusions. This ranges from mackerels (tribe Scombrini), which only utilize ram ventilation at fast cruising speeds and lack gill fusions, to the most derived tunas (Tribe Thunnini) of the genus, *Thunnus*, which are obligate ram ventilators and have two distinct fusion types (one binding the gill lamellae and a second connecting the gill filaments). The billfishes appear to have independently evolved gill fusions that rival those of tunas in terms of structural complexity. Examination of a large body-size range of some scombrid and billfish species shows that gill fusions begin to develop as small as 2.0 cm fork length, perhaps indicating the use of ram ventilation at the small juvenile stage. Materials testing of gill filaments with and without gill fusions suggests that these structures do not increase gill stiffness. Rather, gill fusions are likely used to maintain the spatial configuration of the gill sieve and may also increase branchial resistance to slow and streamline ventilatory flow produced by fast and continuous swimming to create optimal flow conditions past the respiratory exchange surfaces.

0503 Poster Session III, Sunday 10 July 2011; ASIH STORER HERPETOLOGY AWARD

Beck A. Wehrle

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Eat Poop and Thrive: Testing the Role of the Lizard Lounge for Transferring Digestive Microbes

Researchers first attempted to identify the sources of the gut microbes harbored by herbivorous reptiles >30 years ago. These endosymbionts are needed to digest plant fiber (primarily cellulose and hemicellulose) and contribute substantially to their host's energy budget. *Iguana iguana* are herbivorous throughout life, yet emerge from their eggs with sterile guts. How do they acquire their gut microflora? Although rare in lizards, social interactions are a hypothesized route of microbe transfer via direct contact and/or eating feces of conspecifics. Early attempts to characterize this microbial community in hatchling iguanas provided crude assessments of turnover. Our study will be the first to characterize the spatial and temporal variation of these vital communities using modern genomic techniques. Over two hatching seasons we observed juvenile iguanas in social lounges on Barro Colorado Island, Panamá. Of the 128 focal observations of hatchlings, 41% were of social aggregations (mean group size = 2.9). Grouping hatchlings averaged 1 m from their nearest neighbor (range = 0–6 m), although densities varied among sites. We also collected microbe samples from iguanas over the first 60 d post-hatching. Microbial DNA will be isolated from samples and pyrosequenced to characterize the microbe communities of iguanas over space and time. We expect microbe communities to be most similar among proximate hatchlings and to increase in diversity over time.

0316 Fish Conservation, Symphony III, Saturday 9 July 2011

Stuart Welsh[1], Melissa Braham[3], Dave Smith[2], Mary Mandt[2]

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Migration and Dam Passage of Yellow-Phase American Eels in the Shenandoah River of the Potomac River Drainage, USA

Information on migration and dam passage is important for the conservation and management of American eels. Size, age, and upstream migration of American eels were examined at an eel ladder, Millville Dam, Shenandoah River, from 2003 to 2011. About 15,000 eels were counted at the Millville Dam eel ladder since 2003. Eels using the ladder ranged primarily from 200 to 550 mm in length, and 3 to 10 years in age. Upstream movements of eels during spring, summer, and fall were associated with an increase in river flow and darker nights on or near the new moon. Monitoring of the eel ladder at

Millville Dam will continue, with plans for additional ladders at dams farther upstream allowing a more comprehensive study on eel movements within the Shenandoah River watershed.

0659 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Kevin Weng[1], Chris Lowe[1], Oscar Sosa-Nishizaki[1], John O'Sullivan[1]

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Connectivity of US and Mexican White Shark Populations in the Eastern Pacific

In the eastern Pacific, aggregations of adult and subadult white sharks are known from the Farallones and Ano Nuevo in California, USA, and at Isla Guadalupe, Mexico. Interchange between these apparent population centers by adult sharks appears to be very low, with mixing occurring only in offshore waters. Genetic studies indicate a single population of white sharks in the eastern Pacific. One explanation of these apparently contradictory findings is that mating occurs in the offshore area, maintaining genetic panmixia. Another, related possibility is that both 'US' and 'Mexican' white sharks share a common, mixed nursery region. Parturition is thought to occur in the Southern California Bight and in Pacific waters of Baja California. Movement patterns of early juvenile life stages reveal consistent migrations from the Southern California Bight into Mexican waters of Baja California and the Gulf of California. Therefore, young-of-the-year and juvenile white sharks born in separate pupping grounds appear to share the same large nursery region. The recruitment into separate adult population centers may therefore be based not on ancestry, but instead on stochastic, environmentally mediated, density dependent, or facultative processes. Once an animal becomes associated with an aggregation, it shows fidelity through its lifetime, thereby maintaining two separate, but genetically homogenous groups.

0672 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Bradley Wetherbee[1], Guy Harvey[2], Neil Burney[3], Choy Aming[3], Shara Teter[2], Mahmood Shivji[2]

[1]University of Rhode Island, Kingston, RI, USA, [2]Guy Harvey Research Institute Nova Southeastern University, Ft. Lauderdale, FL, USA, [3]Bermuda Shark Project, Bermuda, Bermuda

Are Tiger Sharks Reef Sharks or Pelagic Sharks? Movements of Tiger Sharks in the Western North Atlantic

The tiger shark (*Galeocerdo cuvier*) is a large, far-ranging species that exhibits a variety of movement patterns depending on location and season. These sharks are managed by NMFS as part of the "large coastal" species complex under the Atlantic Highly Migratory Species Fishery Management Plan, but are occasionally observed far at sea and caught in pelagic fisheries. To investigate movements of tiger sharks, we tagged 26 individuals in Bermuda in late summer of 2009 and 2010 with fin-mounted "spot" satellite transmitters. Although a number of sharks made fairly rapid (~2 weeks) and straight-line moves from Bermuda to the Bahamas, other sharks followed meandering paths eventually reaching the Bahamas after several months. Several smaller individuals remained in Bermuda over the winter. Some sharks spent the winter months moving within relatively small, near shore areas within the Bahamas, and subsequently moved north into pelagic waters where they remained during summer months. Other sharks left the Bahamas a short time after arrival, moving into pelagic waters during winter months. Several individuals tracked over consecutive winters (>19 months) occupied similar wintering areas within the Bahamas. North-south seasonal movements for many sharks appeared to be related to water temperature, with the majority of time spent at 24-28^{o}C. Most sharks demonstrated the ability to seamlessly shift between pelagic and insular habitats spending approximately equal time in both environments. Although movements vary substantially among individuals, tiger sharks demonstrate high mobility trophically connecting widespread and disparate marine ecosystems in the Western North Atlantic.

0432 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Matthew White, Greg Scott

Ohio University, Athens, OH, USA

Mitochondrial DNA Variation in the American Brook Lamprey

The American Brook lamprey (ABL) is a non-parasitic species with a broad distribution in eastern North America. It has a three to four year larval phase. Sequencing of the mitochondrial control region (Non-coding I) was performed on 35 individuals from 14 localities. Included in these samples were individuals of the so-called giant phenotype. Additional sequences were obtained from likely sister taxa. Our data identified almost

no variation in either gene region throughout the range of the ABL. In addition, the giants did not demonstrate any sequence divergence with normal phenotype ABL. This suggests that the giants may constitute a population that has retained a parasitic lifestyle or has reverted to a parasitic lifestyle. Our data suggest that the ABL colonized eastern North America since the retreat of the Wisconsinan glacier approximately 10KYA. Our data also identify Alaskan Brook lamprey as the most likely sister-taxon.

0674 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Steven Whitfield[1], Kelsey Reider[1], Jacob Kerby[2], Lydia Gentry[3], Sasha Greenspan[5], Sonia Ghose[4], Maureen Donnelly[1]

[1]Florida International University, Miami, FL, USA, [2]University of South Dakota, Vermillion, SD, USA, [3]Washington State University, Pullman, WA, USA, [4]Occidental College, Los Angeles, CA, USA, [5]University of Maine, Orono, ME, USA

Pattern and Process in Amphibian and Reptile Declines at La Selva Biological Station, Costa Rica

Amphibian populations are declining even in pristine areas in many parts of the world, and in the Neotropics most such enigmatic amphibian declines have occurred in mid- to high-elevation sites. However, amphibian populations have also declined at La Selva Biological Station in the lowlands of Costa Rica, and similar declines in populations of lizards have occurred at the site as well. Herein, we assess the impacts of multiple, non-exclusive hypotheses that may explain these declines. We illustrate that climate- or mesomammal-related changes to dynamics of leaf litter, a critical resource for both frogs and lizards, strongly regulates population densities of frogs and lizards with the highest decline rate. Although lowland forests are generally believed to be too warm for presence or adverse population effects of chytridiomycosis, we present evidence for seasonal patterns in infection prevalence with highest prevalence in the coolest parts of the year. We evaluate toxicity of major current-use pesticides in Costa Rica to amphibians to illustrate that pesticide contamination within the La Selva reserve resulting from aerial transport from nearby agricultural zones is unlikely to directly affect amphibian survival. Our work illustrates that sites that are assumed to be pristine are likely impacted by a variety of stressors and we discuss links between faunal declines at La Selva and more typical amphibian decline events in the region.

0470 Poster Session I, Friday 8 July 2011

Benjamin Whitmore[1], Nicholas Whitney[1], Harold Pratt[1], Adrian Gleiss[2]

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Design and Performance of a Release and Recovery System for Data-Logging Tags on Sharks.

The rapidly expanding use of high-resolution data-loggers to study marine vertebrates presents a wealth of new opportunities for understanding the behavior, physiology, and ecology of these animals *in situ*. It also presents a number of new logistical challenges, one of the biggest of which is the need to physically recover the tag in order to download data. We designed and tested a logger release and recovery package consisting of a microsphere-resin float, VHF transmitter, and galvanic timed release that allowed loggers to remain on animals for several days before being released. Upon release, tags would float to the surface and be located using a VHF receiver. Galvanic timed release duration was found to be correlated with water temperature, which meant that the tag packages of animals that swam in deeper (cooler) water stayed attached longer than those of animals that stayed in shallow, warmer water. This method produced recovery rates of 86% in nurse sharks (*Ginglymostoma cirratum*) over periods of 1-5 days and distances up to 7 km, and has been recovered at distances of 16 -27 km in other shark species. This represents a cost-effective method for recovering data-loggers from sharks. Logistics of float design and counter-weighting are also presented.

0465 Poster Session I, Friday 8 July 2011

Nicholas Whitney[1], Kristen Hart[2], Michael Cherkiss[3], Michael Rochford[3], Frank Mazzotti[3]

[1]*Mote Marine Laboratory, Sarasota, FL, USA,* [2]*US Geological Survey, Davie, FL, USA,* [3]*University of Florida, Davie, FL, USA*

Activity and Putative Feeding Behavior of Invasive Burmese Pythons (*Python molurus bivittatus*) from Acceleration Data-Loggers

The establishment of a population of Burmese pythons (*Python molurus bivittatus)* in Everglades National Park has been a considerable cause for concern due to their impact on the ecosystem via consumption of native birds, mammals, and reptiles. Efforts to control this population are underway but are hampered by a lack of information about the activity cycles and behavior of snakes in the wild. We conducted a pilot study using acceleration data loggers (ADLs) to continuously record the movements and body posture of captive and free-living pythons in Everglades National Park. Captive trials indicated that acceleration data could be used to easily distinguish between moving and resting, as well as different types of locomotion (e.g. concertina, rectilinear, etc.). Results from a free-living snake showed the animal to be most active at night, typically starting to move just after sunset. Sudden rolling behavior was detected on one morning shortly

after sunrise and continued for several minutes, after which the animal did not move significantly for the next six days, suggesting a successful feeding event followed by digestion. Deployment of an ADL in conjunction with a GPS data logger showed that animal movement did not coincide with periods of high variance in GPS fixes, illustrating the potential pitfalls of inferring fine-scale movement from GPS data alone.

0691 Poster Session III, Sunday 10 July 2011

Kellie Whittaker[1], Michelle Koo[1], Carol Spencer[1], Joyce Gross[1], Vance Vredenburg[2], David Bloom[1], David Blackburn[3], David Cannatella[4], David Wake[1]

[1]University of California, Berkeley, CA, USA, [2]San Francisco State University, San Francisco, CA, USA, [3]University of Kansas, Lawrence, KS, USA, [4]University of Texas, Austin, TX, USA

AmphibiaWeb: On the Cutting Edge of Herpetological Biodiversity Informatics

Amphibians comprise the most endangered group of vertebrates, with nearly one-third of the world's amphibian species under threat of extinction. Hence there is a particularly urgent need to facilitate research into amphibian biodiversity, and for distributional data to be widely available. AmphibiaWeb provides access to information on the natural history, conservation, declines, and taxonomy of amphibians, contributed by herpetologists from around the world. AmphibiaWeb partners with HerpNET and VertNET to provide a dynamic mapping tool by retrieving individual vouchered, georeferenced specimen records from 55 institutions, and overlaying these data as markers onto IUCN's expert range estimations, with satellite or USGS topoquad base maps. In addition, AmphibiaWeb uniquely reports new published species and maps their holotype localities to produce valuable metrics on amphibian discovery. IUCN has re-partnered with AmphibiaWeb, and IUCN summary accounts are again available for species where there is not yet an AmphibiaWeb account. Site usage has grown tremendously, to an average of 19,730 specific queries/day for 2010. AmphibiaWeb is always interested in collaborating with university research projects and other educational institutions to make more information and photographs available on amphibians and the global amphibian crisis. Herpetologists may want to be aware that in some cases, data contributions to AmphibiaWeb can also help fulfill the "broader impact" requirements of NSF grants.

0127 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

E O Wiley, Michael Doosey

University of Kansas, Lawrence, KS, USA

Teleost Epurals and Homology

Epurals have traditionally been counted sequentially from anterior to posterior. Teleosts typically have three epurals; however, epurals can vary from zero to five depending on the group and intraspecific variation. In basal teleosts, the typically three epurals are associated with the caudal skeleton proper, i.e. with specific ural centra. However, Arratia and Schultze have demonstrated that epurals may be associated with ural or preural centra. Their observations indicate that simple numbering can cause category mistakes in phylogenetic homology assignment. Work on model organisms (e.g. *Danio* and *Oryzias*) indicates that there is a decoupling of epural, notochordal, and hypural segmentation. A survey of epural variation including larvae of several euteleost species suggests that the plesiomorphic pattern of three epurals associated with the caudal skeleton has been variously modified. These variations may be useful as a source of new phylogenetic characters.

0059 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Michelle Wilkes-Martin[1], Judy Cole[1], Jennifer Germano[2], Andy Kouba[2]

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

Frequency of Exogenous Hormone Administration Affects Sperm Characteristics in the Fowler Toad (*Bufo fowleri*): Implications for Captive Breeding

Amphibian populations have been rapidly declining across the globe due to habitat loss, the spread of chytrid fungus, and environmental stressors. To prevent many species from going extinct captive assurance colonies have been established for conservation management. Zoo and university scientists have been examining different reproductive technologies in order to maintain the genetic diversity of these founder populations. It is critical that we determine the optimal frequency for hormone administration and sperm collections to improve current protocols for assisted breeding so that the number of males can be used to produce large numbers of offspring for reintroductions. To our knowledge, no studies have assessed the effect of numerous hormone treatments on the quality of sperm. Therefore, the purpose of this study was to assess sperm motility, forward progression, and concentration as a function of the frequency of hCG injections in Fowler's toads (*Bufo fowleri*). Four experimental groups of toads received 300 IU of hCG injections either twice a week, once a week, every other week, or every three weeks. This study showed a significant decline in the percentage of motile sperm and in sperm concentration in toads that received hormone treatments twice a week. Toads

that received injections given every two or three weeks appear to have no detrimental effect on their sperm quality. Overall, these results allow for future improvement in breeding programs in endangered *Bufo* species.

0766 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Jim Williams

Florida Museum of Natural History, Gainesville, FL, USA

Pleistocene River Drainages of Florida: Evidence from Fossil Fish and Mussels

During the Pleistocene, a span of 2.6 million years, the four glacial and three interglacial cycles drastically altered the landscape of Florida. During the most recent glacial maximum, about 18,000 years ago, the approximately 300-m drop in sea level exposed a vast land area off the west coast increasing the peninsular region to about twice its present width. The expanse of land off the east coast was far more limited especially in the southern portion of the peninsula. Examination of Pleistocene fossil freshwater fishes and mussels reveals the presence of a river drainage that connected Florida streams, as far west as the Apalachicola and Ochlockonee drainages, with the southern end of the peninsula. The presence of a large interconnected river drainage in peninsular Florida provided a dispersal route for aquatic organisms extending from the Panhandle to the southern tip of the peninsula during the Pleistocene.

0350 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

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An Assessment of Seasonal and Individual Variation in Reproductive Hormones from a Captive Population of Female Little Skates

In order to successfully manage an elasmobranch species it is essential to understand the reproductive biology. Previous studies suggest that the little skate, *Leucoraja erinacea*, exhibits a continuous reproductive cycle however, discrepancies exist surrounding the timing and quantity of reproductive peak(s). An effective non-lethal technique which has been used to describe the reproductive cycle in elasmobranch species is the analysis of circulating steroid hormones. Although an accurate technique, the ability to clearly interpret correlations between steroid hormones and the reproductive cycle has been limited in some continuously reproducing species due to high variability amongst individuals. Thus, the goal of this study was to address problematic aspects of previous

studies by using circulating steroid hormones to define both the reproductive cycle and degree of individual variability in the little skate. Weekly blood samples were collected from 2008-2009 in a captive breeding population of little skates and analyzed for circulating levels of E_2 and P_4, by radioimmunoassay. Circulating levels of E_2 and P_4 ranged between 93.85 to 8,857.85 pg/ml and 12.5 to 12,817.96 pg/ml and varied greatly within individual skates, E_2 (i.e. 3196.85 ± 2073.89 SD) and P_4 (i.e. 689.59 ± 1864.51 SD). Similarly, variability in hormone levels between skates within each sampling week (i.e. E_2 304 vs. 5,986 pg/ml) and month (i.e. E_2 157 vs. 8,858 pg/ml) remained high suggesting an asynchrony in ovulation amongst females. The results from this study suggest that the little skate continuously reproduces throughout the year and lacks a reproductive peak in hormone concentrations.

0342 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

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From Individual-level Effects to Population-level Responses: The Missing Link in Amphibian Ecotoxicology

Widespread concern about the role of environmental contaminants in global amphibian declines has prompted extensive experimental evaluation of contaminant effects in a variety of amphibian taxa. However, most ecotoxicological studies focus on effects on pre-metamorphic life stages, and few studies have attempted to translate these effects to the population level. We use our research on the effects of mercury (Hg) on *Bufo americanus* as a model for bridging the gap between individual-level contaminant effects and amphibian population dynamics. We synthesize the results of field surveys, and laboratory, mesocosm, and terrestrial enclosure experiments examining the effects of maternal and dietary Hg throughout the life cycle of *B. americanus* and use a demographic population model to mechanistically evaluate the population-dynamic consequences of Hg effects in the context of important amphibian population drivers such as larval density-dependence and environmental stochasticity. We demonstrate that embryonic effects and sublethal effects that delay maturation have minor effects on adult population size or extinction probability, whereas contaminant effects that reduce late-larval or post-metamorphic survival have important population-level consequences. We then parameterize the model to comprehensively incorporate Hg-effects, demonstrating that excessive Hg exposure through maternal transfer or larval diet, alone, has minor effects on *B. americanus* populations, whereas simultaneous maternal and dietary exposure results in reduced population size and a dramatic increase in extinction probability. Our results suggest that environmental contaminants can influence amphibian population viability, but that highly integrative approaches are needed to interpret the population-level consequences of individual-level effects observed in experimental studies.

0099 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Anthony Wilmes[1], Jan Crowley[2], David Gruenewald[1], Parth Shah[1], Robert Aldridge[1]

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Identification of the Female Sex Pheromone in the African Brown House Snake, *Lamprophis fuliginosus*

Sex pheromones are chemical compounds emitted by animals that elicit sexual behavior among conspecifics. In squamates, these chemical cues are often secreted through the skin of females and picked up by male conspecifics using olfactory and vomeronasal senses. Identifying the chemical makeup of a snake sex pheromone has only been performed once in which the non-volatile pheromone of the red-sided garter snake, *Thamnophis sirtalis parietalis*, was identified as a combination of many different long chain methyl ketones. In this study we used the African Brown House Snake, *Lamprophis fuliginosus*, as our model. Using male courtship behavior as the bioassay for presence of sex pheromones, earlier work in our lab established that female sex pheromones were non-volatile. Females secrete this non-volatile sex pheromone through their skin, which is then transferred to the substrate when the female moves. Male snakes then use this pheromone trail to track and locate the female. Using high performance liquid chromatography and mass spectrometry we compared skin secretions of attractive females, non-attractive females and male snakes in order to identify chemicals specific to attractive females. Lathosterol, a steroid similar to cholesterol, was present only in attractive female skin secretions. Behavioral experiments were performed using artificially manufactured lathosterol (5a-Cholest-7-en-3b-ol) to determine if this steroid was indeed the female sex pheromone. Lathosterol induced male courtship behavior toward unattractive females in 6 of 10 trials.

0346 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Robert Winokur

Univeersity of Nevada,Las Vegas, Las Vegas, NV, USA

The Chelonian Skin - More Variable than You Thought

Although features of the skin of turtles and tortoises are familiar, detailed discussion of chelonian skin is largely lacking in comparative anatomy texts, and it's the turtle shell and its scutes that have captured the attention of vertebrate morphologists. Although the skin of reptiles exhibits significant topographic variation (such as that between the dorsal and ventral surfaces of lizards and snakes), turtles exhibit more extreme topographic variation in skin structure than usually acknowledged. Functionally the

skin can be a simple barrier that protects against mechanical intrusions and evaporative water loss, or it may be a surface for respiratory gas exchange, (reminiscent of amphibians). It may produce pheromones or defensive foul smelling secretions from specialized holocrine glands. In some respects chelonian skin can be more mammalian-like than any non-mammal and non-hairy mammalian skin and smooth scale-less skin in chelonians can appear similar. Chelonian skin exhibits a variety of sensory receptors including tubercles, barbels, and keratinized pores. Too often the skin is discussed in texts as an "organ", but it is better considered an organ system containing an array of organs. Chelonian skin demonstrates convergent evolution, especially between Asian and North American freshwater turtles. Convergences in texture, scalation and rather specific color patterns can be readily discerned. Other skin convergences include plastral hinges, and perhaps barbels. The existences of these convergences point to the diverse importance of the skin to chelonians. Future investigations of turtle integument should reveal more about basic chelonian biology, behavior, ecology, and evolution.

0260 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Megan Winton[1], Enric Cortés[2], David Ebert[1], Gregor Cailliet[1]

[1]Moss Landing Marine Laboratories, Moss Landing, CA, USA, [2]NOAA Southeast Fisheries Science Center, Panama City, FL, USA

Comparative Demography of Two Populations of the Roughtail Skate, *Bathyraja trachura* (Gilbert, 1892), in the Eastern North Pacific

The roughtail skate, *Bathyraja trachura*, is among the longest-lived, latest maturing, and slowest growing skate species reported to date. Results of life history studies may indicate a latitudinal pattern in size and growth of the species, with individuals from the eastern Bering Sea (EBS) growing more slowly and reaching higher maximum ages than previously reported for the species off the United States west coast from the California Current ecosystem (CC). Age-structured demographic models were constructed based on empirical estimates of longevity and maturity from both ecosystems to investigate how observed differences in life history parameters affect population growth rates, to identify portions of the population most important from a management perspective, and to estimate the species' relative vulnerability to exploitation. Monte Carlo simulations were used to incorporate uncertainty in vital rates and generate mean estimates of demographic parameters and elasticities for each scenario. Mean annual population growth rates were higher for *B. trachura* from the CC ($\lambda = 1.184$ yr^{-1}) than from the EBS ($\lambda = 1.003 - 1.072$ yr^{-1}), with corresponding population doubling times ranging from 7.3 to 38.9 years. Elasticity analyses indicated that population growth rates of *B. trachura* are more influenced by juvenile and adult survival than either egg case survival or fecundity. The results of this study suggest that *B. trachura* is relatively unproductive with a limited harvest potential compared to other elasmobranchs.

0061 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Lynea R. Witczak, Jackie C. Guzy, Steven J. Price, J. Whitfield Gibbons, Michael E. Dorcas

Davidson College, Davidson, NC, USA

Variation in Survivorship and Recruitment of *Malaclemys terrapin* Over Three Decades

Diamondback terrapins (*Malaclemys terrapin*) are a species of conservation concern and throughout their range populations have experienced noticeable declines. Threats include crab trapping, roads and human-subsidized predators. Mark-recapture studies have been conducted on terrapins at Kiawah Island, SC since 1983. All terrapins captured are measured and individually marked. Since the early 1990's, populations have declined and indications are that crab trapping plays a role in this decline. Continued evaluation of spatial and temporal variation in survivorship and recruitment is necessary to fully understand factors causing the decline and its impacts on the population. In this study, we used data from this long-term study to test four hypotheses related to survivorship and recruitment in terrapins: 1) population decline as a result of crab-trapping will cause a decline in male survivorship over time while female survivorship remains relatively constant; 2) population decline as a result of road mortality will result in a decline in female survivorship and constant male survivorship; 3) nest predators will lead to low recruitment while adult survivorship remains relatively constant; and 4) creek-specific population declines will be reflected in different levels of survivorship among the creeks. Using program MARK, survivorship was estimated using open-population models and recruitment was estimated using Pradel models. Variation in survivorship and recruitment was examined both spatially and collectively over three decades. Results from this study are essential for understanding terrapin population status and conservation needs and can act as a reference for turtle conservation and coastal ecosystem management.

0062 Poster Session II, Saturday 9 July 2011

Lynea R. Witczak, Courun J. Williams, Steven J. Price, Michael E. Dorcas

Davidson College, Davidson, NC, USA

Population Densities of Semi-Aquatic Turtles in Rural, Urban and Golf Course Ponds

Landscape composition varies among urban, rural and golf course ponds and such variation may affect population densities of semi-aquatic turtles inhabiting these ponds. Greater population densities may indicate higher quality habitats, therefore indicating which pond types are most suitable for maintenance of populations. Our objectives were 1) estimate turtle population sizes at 20 study sites, 2) determine population

densities at each site, and 3) evaluate variation in densities among urban, rural and golf course ponds. Species examined in this study included *Chrysemys picta, Trachemys scripta, Kinosternon subrubrum*, *Chelydra serpentina*, *Pseudemys concinna* and *Sternotherus odoratus.* We set 10 hoop traps at 5 rural, 5 urban and 10 golf course ponds which were checked every other day for 10 days. All turtles were given an individual code and measured. Population sizes were estimated using closed population capture-mark-recapture methods. Population sizes and densities varied among the pond types, with rural ponds having the highest densities. No correlation was found between pond size and population densities. To support greater turtle population densities, those managing ponds should have open nesting space around ponds, shallow areas with emergent vegetation suitable for young turtles and minimal anthropogenic disturbance.

0376 Poster Session III, Sunday 10 July 2011; ASIH STORER ICHTHYOLOGY AWARD

Jeremy Wright

University of Michigan, Ann Arbor, MI, USA

Adaptive Significance of Venom Glands in the Tadpole Madtom (*Noturus gyrinus*)

Studies of piscine venom glands have implicitly assumed them to be anti-predatory adaptations, but direct examinations of the potential fitness benefits provided by these structures have historically been lacking. The only previous experiments attempting to address this question in catfishes did not present alternative phenotypes to ecologically relevant predators, and their results are potentially confounded by the presence of sharp, bony fin spines in these species, which are also likely to represent significant deterrents to predation in addition to any benefit provided by venom glands. I presented an ecologically relevant predator (*Micropterus salmoides*) with Tadpole Madtoms (*Noturus gyrinus*) having one of several fin spine phenotypes (intact, stripped, absent), in order to demonstrate that the venom glands of this species do provide a significant fitness benefit, relative to individuals having fin spines lacking venom glands, or no spines at all. Intact madtoms were forcefully rejected by the predatory species, and were almost never consumed, while alternative phenotypes were always consumed, although those with stripped fin spines showed increases in predator handling time relative to spineless madtoms and control minnows (*Pimephales vigilax*). Experiments were also performed using a less venomous catfish species (*Ameiurus natalis*), which was demonstrated by toxicological and compositional examinations to possess an alternate venom phenotype to *N. gyrinus*. These results allow for the examination of adaptation at multiple levels of biological organization, and indicate that a single protein present in the venom of *N. gyrinus* may be responsible for providing the significant selective advantage conferred by the venom glands of this species.

0409 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Jeremy Wright, Reeve Bailey

University of Michigan, Ann Arbor, MI, USA

Systematic Revision of the Formerly Monotypic Genus *Tanganikallabes* (Siluriformes: Clariidae)

The monotypic genus *Tanganikallabes*, endemic to Lake Tanganyika, is a poorly known member of the family Clariidae. Examination of 142 specimens housed in museum collections has revealed the presence of at least two additional species in this genus. *Tanganikallabes* sp. 1 is distinguished from all congeners by the length of its pelvic fins, the presence of a depigmented vertical bar on the opercular margin, and a combination of additional morphometric (pectoral spine length, preanal length, body depth at anus) and meristic (dorsal and anal-fin ray counts) characters. *Tanganikallabes* sp. 2 is distinguished from all other *Tanganikallabes* species by having a relatively shorter, incomplete lateral line, and shallow body depth at the anus, as well as shorter prepelvic and preanal lengths and a longer anal fin with a higher number of fin rays. A combination of several morphological characters, as well as cytochrome *b* and 18S-ITS1-5.8S-ITS2-28S rDNA sequence data indicate that *Tanganikallabes* constitutes a monophyletic group within the Clariidae and supports the recognition of additional species diversity. The monophyly of *Tanganikallabes*, coupled with the geographical isolation of this group to a single lake, satisfy the requirements for its classification as a true species flock, the latest to be described from Lake Tanganyika.

0026 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Yunke Wu, James Hanken

Harvard University, Cambridge, MA, USA

Pre-Quaternary Climate Changes Promote Lineage Diversification and Extinction in Chinese Stout Newts (Salamandridae: *Pachytriton*)

Montane amphibians are ideal models to study lineage diversification at both spatial and temporal scales. We present a phylogeographic study of the stout newts, a genus of salamanders endemic to southeastern China. They live and reproduce in small montane streams at elevations from 50-1800 m. We use molecular and geographic data to understand the formation and distribution of genetic lineages under the influence of paleoclimatic changes. A mitochondrial genealogy was obtained for 24 populations that include all three described species and the taxonomically unnamed *Pachytriton* B. Based on molecular dating estimates, incipient speciations within *Pachytriton* occurred in the late Miocene, which coincides with a substantial intensification of the East Asian summer monsoon 7-10 Ma (million years ago). Subsequent lineage diversifications occurred mostly after 3.6 Ma, along with further strengthening of the summer monsoon.

Heavy summer precipitation cause overflows of montane streams and may promote dispersal into adjacent mountains followed by isolation and divergence. Contrasting phylogeographic patterns are found among species with hypotheses of directional expansion and/or local extinction. Using distribution data as a proxy for physiological tolerance of high temperatures in these cold-adapted salamanders, we build a temperature buffer-zone model that suggests large scale population decline or even extinction as a consequence of early Pliocene warming. Supported by NSF (EF-0334846, AmphibiaTree) to JH.

0693 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Amy Yahnke[1], Alexandra Troiano[1], Christian Grue[1], Marc Hayes[2], Julie Tyson[2]

[1]University of Washington, WACFWRU, Seattle, WA, USA, [2]Washington Department of Fish and Wildlife -- Habitat Program, Olympia, WA, USA

Amphibian Phenology and Aquatic Weed Management in the Pacific Northwest United States

Timing of amphibian development and habitat use is critical to determining the potential effects of pesticide application in aquatic environments. Current restrictions on aquatic applications are based on salmonid life histories, but little is known about amphibians. We investigated amphibian species and life stages in wetland habitats invaded by reed canarygrass (*Phalaris arundinacea*) to determine the potential for exposure to herbicides used to control this invasive. Weekly surveys were conducted on two sites supporting Oregon Spotted Frog (*Rana pretiosa*) breeding populations encompassing the weed control season: May-September. One of the sites included plots that were mowed the previous year. Amphibians were generally more frequently observed in mowed plots, but the basis of this difference is unclear as treatment-specific detectability is unknown. Amphibian presence for all life stages was correlated with water depth in each of the habitats. Tadpoles of Oregon Spotted Frogs, Northern Red-Legged Frogs (*Rana aurora*), and Pacific Treefrogs (*Pseudacris regilla*) were found in all habitats, the last tadpole was detected on 24 August. The first metamorphic frogs were observed on 8 June and the metamorphic interval for all anurans lasted until 9 September. Northwestern Salamander (*Ambystoma gracile*) larvae were the most frequently observed salamander species and life stage. Salamander larvae were present throughout the sampling period. Metamorphic Northwestern Salamanders were found between 1 July and 9 September and metamorphic Rough-Skinned Newts (*Taricha granulosa*) were found until mid-August. Amphibians were present during the entire weed management season. Information on sensitive life stages may be useful in guiding management timing.

0301 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Atsuko Yamaguchi, Keisuke Furumitsu, Takeshi Ito, Shigeki Fujiwara, Yuki Minei, Gen Kume

Nagasaki University, Nagasaki, Japan

Reproductive Biology of Shortspine Spurdog, *Squalus mitsukurii*, around Ishigaki Island, Okinawa, Japan

Size at sexual maturity, reproductive cycle, and fecundity of the shortspine spurdog, *Squalus mitsukurii* (Jordan and Snyder, 1903), were examined based on specimens collected around Ishigaki Island, Okinawa, Japan from November 2006 until October 2010. Size [total length (TL)] ranged from 435 mm to 702 mm for males and from 430 mm to 945 mm for females, respectively. Females reached sexual maturity at a larger size than males (TL at 50% sexual maturity: males, 560 mm; females, 727 mm). Monthly gonadosomatic indices of males decreased from February to September. Nearterm embryos were observed in females with preovulatory ova from February to August. Uterine eggs, which were recognized as recently fertilized, were observed around the same time. Accordingly, parturition period is lengthy, which occurred from February to August, immediately followed by mating, ovulation, and fertilization. Based on monthly variations of size frequencies of embryos and ovarian ova, the gestation period was estimated to be approximately 1 year although previous studies suggested that it would take two years. Fecundity increased with TL and ranged from 1 to 5 (mean, 3.1) embryos per litter.

0386 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Bruce Young, Jessica Dumais

University of Massachusetts Lowell, Lowell, MA, USA

Propulsive Mechanics during Swimming in Water Monitors (*Varanus salvator*)

Monitor lizards swim similar to (the better studied) crocodilians and snakes, though with a functional complex that is distinct from both clades. This study attempted to generate a reasonably complete mechanical analysis of aquatic thrust production in *Varanus*. Electromyography was performed in the epaxial muscles at four levels of the vertebral column (two anterior and two posterior to the pelvis), the hypaxial muscles at two different vertebral levels within the tail, and from the caudofemoralis. All emg recordings were taken from semi-adult specimens freely swimming within a flow tank and were synchronized to high-speed videographic records. Water monitors trail their limbs passively while swimming, so the kinematic analysis involved quantification of the lateral undulations (wavelength, amplitude, etc.) of the trunk and tail. A morphological data set (projected area, mass, muscle cross-sectional area, etc.) of the

trunk and tail segments was determined through dissection, photography, and MRIs. Combination of the electromyographic, kinematic, and morphological data enabled an exploration of the mechanistic basis and efficiency of aquatic propulsion in *V. salvator*. Our analysis revealed that propulsive force was generated almost exclusively by the tail, and that there were marked regional differences in thrust production along the length of the tail. The mechanics of swimming in monitor lizards offer insights into analyses of the evolutionary radiation and hydrodynamic specialization of mosasaurs.

0161 Poster Session II, Saturday 9 July 2011; STORER HERPETOLOGY AWARD

Melissa Youngquist

Miami University, Oxford, OH, USA

The Curious Case of Blanchard's Cricket Frogs: Population Structure in a Fragmented Landscape

Dispersal between populations is vital for species persistence because it allows for colonization of new areas and for the rescue of populations on the brink of extinction. The probability of a population being rescued depends on the habitat matrix and how permeable different habitats are to dispersing individuals. In areas with high levels of fragmentation, individuals may encounter a variety of habitats which differentially affect successful dispersal and colonization. Southwest Ohio, historically deciduous forest, has a landscape composed primarily of farmland (row-crop, pasture land, hay fields) dotted with towns and small forest patches. Blanchard's cricket frog (*Acris blanchardi*), once one of the most abundant species in the eastern U.S., is experiencing enigmatic declines. Cricket frogs have an average life span of 4 months with complete turnover in about 16 months; thus this species is highly susceptible to local extirpation and may be reliant on successful dispersal events for population persistence. To determine how a landscape fragmented by anthropogenic land uses affects cricket frog dispersal, I surveyed 28 ponds in Butler and Preble counties, OH for presence of this species. Where observed, I collected tissue samples for genetic analysis using microsatellite markers. Utilizing tools afforded by population genetics and global information systems (GIS), I examined how the habitat and landscape matrix correlate with genetic diversity and population structure.

0122 Poster Session III, Sunday 10 July 2011

Krista Zaharewicz, Christopher Sheil

John Carroll University, University Heights, OH, USA

Anatomy of the Fully Formed Chondrocranium of *Podocnemis unifilis* (Pelomedusidae), a Pleurodiran Turtle

The chondrocranium is a cartilaginous structure that forms around and protects the brain and sensory organs of the head. Through ontogeny, the chondrocranium may become more elaborate, remodeled and reabsorbed, and/or ossified. Though considerable attention has been given to the formation of the chondrocranium, and a great amount of data has been gathered on the development of this structure among many craniate groups, the anatomy of this structure in turtles often is neglected. We describe the mature chondrocranium of the pleurodiran turtle, *Podocnemis unifilis* (Pelomedusidae), and compare it to those of previously-described cryptodiran turtles (*Apalone spinifera, Pelodiscus sinensis, Chelydra serpentina, Macrochelys temminckii, Trachemys scripta, Chrysemys picta,* and *Eretmochelys imbricata*) to identify possible differences in anatomy observed among these taxa. Anatomy of the chondrocranium was described by examination of cleared and double-stained specimens.

0398 Poster Session I, Friday 8 July 2011

Anabela Zavatteri[1], Natalia Hozbor[1], Mauro Belleggia[1]

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Age and Growth of Yellownose, *Dipturus chilensis* (Guichenot, 1848), in the Southwestern Atlantic (34°- 55°S)

The yellownose *Dipturus chilensis* inhabits the southeastern Pacific and southwestern Atlantic Ocean. It is extensively exploited in both targeted fisheries and as by catch in the southwestern Atlantic. This study contributes to the knowledge of the age and growth of *D. chilensis* providing biological information that is essential for developing sustainable fisheries management strategies. Age and growth was studied based on vertebral analysis of 415 specimens collected on the Argentinean continental shelf (34oS - 55o S). Males specimens ranged from 24 to110 cm (n=203), while females specimens ranged from 24 to 115 (n=211). Sectioned vertebrates were stained with cobalt chloride. The marginal increment analysis (MIA) supported the hypothesis that *D. chilensis* produces one growth band pair each year, which ends during autumn. Maximum estimated age was 21 and 25 years for males and females, respectively. The von Bertalanffy growth function was selected based on the best fit to the age-length data to males ($L\infty$=114.32 cm; k=0.10 years-1; t0=4.95 years) and females ($L\infty$= 149.05 cm; k=0.07 years1; t0=-8.11 years). Significant difference was detected between male and females growth parameters. Females reach larger size than males. These results indicate that *D.*

chilensis is a long-lived and slow growing species. Therefore, it is particularly vulnerable to over-exploitation by fisheries.

0692 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Mingna Zhuang, Robert Dudley

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Comparative Gliding Performance of *Anolis carolinensis* and *Anolis sagrei*

The *Anolis* genus is composed of over 400 species, partitioned traditionally into six ecomorphs distributed from the ground to the tree crown. Because controlled aerial behaviors is suspected for many arboreal lizard species that either jump or fall from the tree canopy, vertical division of the arboreal niche among *Anolis species* makes them a prime subject for study of gliding abilities. Additionally, most members of the *Anolis* genus has little to no obvious morphological adaptations for controlled descent. I evaluated gliding performance of a trunk-crown species, *Anolis carolinensis*, following initial observations by Oliver (1951), and compared its performance to that of *Anolis sagrei*, a trunk-ground species. Parameters used to compare gliding performancewere horizontal distance covered, translational speeds and accelerations. *Anolis carolinensis* adopts a far more flattened posture than *Anolis sagrei,* and its posture is reminiscent of the *Ptychozoon* geckoes and other known gliding species. In comparison to *A. sagrei*, *Anolis carolinensis* also has shallower glide angles. These results substantiate the existence of gliding and controlled falling in arboreal lizards with few or no obvious adaptations for aerial performance, and indicates that body posture plays an important role in gliding capacity.

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