

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

Amanda Ackiss<sup>1</sup>, Shinta Pardede<sup>2</sup>, Eric Crandall<sup>3</sup>, Paul Barber<sup>4</sup>, Kent Carpenter<sup>1</sup>

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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 ( $\Phi_{CT}=0.4596$ ,  $p<0.0031$ ). 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.

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## 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 sphenoccephalus*), 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. sphenoccephalus* 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.

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**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 biogeographic patterns are properly assigned.

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## **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.

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## **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.

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### **0233 Poster Session III, Sunday 10 July 2011**

Windsor Aguirre<sup>1</sup>, Virginia Shervette<sup>2</sup>, Ronald Navarrete<sup>3</sup>, Paola Calle<sup>4</sup>, Stergiani Agorastos<sup>5</sup>

<sup>1</sup>DePaul University, Chicago, IL, USA, <sup>2</sup>University of South Carolina, Columbia, SC, USA, <sup>3</sup>Universidad Agraria del Ecuador, Guayaquil, Ecuador, <sup>4</sup>Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador, <sup>5</sup>Stony Brook University, Stony Brook, NY, USA

#### **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.

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## **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.

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## **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.

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

Mohammad Shafiqul Alam<sup>1</sup>, Mohammed Mafizul Islam<sup>1</sup>, Md. Mukhlesur Rahman Khan<sup>1</sup>, Masayuki Sumida<sup>1</sup>

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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.

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

Laura Alberici da Barbiano<sup>1</sup>, Zach Gompert<sup>2</sup>, Caitlin Gabor<sup>1</sup>, Andrea Aspbury<sup>1</sup>, Alex Buerkle<sup>2</sup>, Chris Nice<sup>1</sup>

<sup>1</sup>Texas State University - San Marcos, San Marcos, TX, USA, <sup>2</sup>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*.

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**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.

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### **0100 Poster Session II, Saturday 9 July 2011**

Robert Aldridge<sup>1</sup>, Dustin Siegel<sup>1</sup>, Chad Montgomery<sup>2</sup>, Matthew Graves<sup>3</sup>,  
Lynnette McGuire<sup>4</sup>

<sup>1</sup>*Saint Louis University, St Louis, MO, USA*, <sup>2</sup>*Truman University, Kirksville, MO, USA*, <sup>3</sup>*Bowling Greene High School, Bowling Greene MO, USA*, <sup>4</sup>*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.

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### **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.

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

Matt Allender

*University of Illinois, 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.

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**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 <sup>99m</sup>Tc 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.

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

John Anderson

*Rice University, 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.

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

Matthew Anderson<sup>1</sup>, Cybil Cavalieri<sup>1</sup>, Stanley Fox<sup>1</sup>, Felipe Rodríguez-Romero<sup>2</sup>

<sup>1</sup>Oklahoma State University, Stillwater, OK, USA, <sup>2</sup>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.

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**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.

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**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.

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#### **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.

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#### **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.

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

Robin Andrews<sup>1</sup>, Lin Schwarzkopf<sup>2</sup>

<sup>1</sup>*Virginia Tech, Blacksburg, VA, USA*, <sup>2</sup>*James Cook University, Townsville, QLD, Australia*

### **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.

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### 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.

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

Whitney Anthonysamy<sup>1</sup>, Michael Dreslik<sup>2</sup>, Marlis Douglas<sup>2</sup>, Natalie Marioni<sup>2</sup>, Christopher Phillips<sup>2</sup>

*<sup>1</sup>University of Illinois Urbana Champaign, Urbana, IL, USA, <sup>2</sup>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*.

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### **0377 Poster Session III, Sunday 10 July 2011**

Whitney Anthonysamy<sup>1</sup>, David Mauger<sup>2</sup>, Michael Dreslik<sup>3</sup>, Marlis Douglas<sup>3</sup>, Christopher Phillips<sup>3</sup>

<sup>1</sup>University of Illinois Urbana Champaign, Urbana, IL, USA, <sup>2</sup>Forest Preserve District of Will County, Joliet, IL, USA, <sup>3</sup>IL Natural History Survey, Champaign, IL, USA

#### **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.

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## **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.

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

Lucía Arregui<sup>1</sup>, Jennifer Germano<sup>2</sup>, Andy Kouba<sup>2</sup>

<sup>1</sup>*Universidad Autonoma de Madrid, Madrid, Madrid, Spain*, <sup>2</sup>*Memphis Zoo, Memphis, TN, USA*

### **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 ( $81\% \pm 13$ ) to 8-day old sperm ( $48\% \pm 9$ ). 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.

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

Jairo Arroyave<sup>1</sup>, Melanie Stiassny<sup>1</sup>

<sup>1</sup>American Museum of Natural History, Department of Ichthyology, New York, NY, USA, <sup>2</sup>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.

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

Helena Aryafar<sup>1</sup>, Rachel Berquist<sup>2</sup>, Lawrence R. Frank<sup>2</sup>, Kathryn A. Dickson<sup>1</sup>

<sup>1</sup>California State University Fullerton, Fullerton, CA, USA, <sup>2</sup>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.

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## 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 largely 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.

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

Jimiane Ashe<sup>1</sup>, Kevin Feldheim<sup>3</sup>, Samuel Gruber<sup>2</sup>, Demian Chapman<sup>1</sup>

<sup>1</sup>*Stony Brook University, Stony Brook, NY, USA*, <sup>2</sup>*University of Miami, Bimini Biological Field Station, Miami, FL, USA*, <sup>3</sup>*Field Museum of Chicago, Chicago, IL, USA*, <sup>4</sup>*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  $\Phi_{ST}=0.35$ ,  $p<0.000001$ ). In Florida and the western Bahamas we found that nursery collections separated by as little as 300 km were genetically distinct ( $\Phi_{ST}=0.165$ ,  $p<0.0000001$ ), whereas subadult/adult collections were more homogeneous across a similar range ( $\Phi_{ST}=0.001$ , 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.

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#### **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.

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#### **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 *Carpophis 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.

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**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.

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**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,  $3.64 \pm 0.26$ , CRP,  $3.42 \pm 0.36$ , grass,  $3.11 \pm 0.35$ ). 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.

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## **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.

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### **0499 Poster Session III, Sunday 10 July 2011**

Justin Baker<sup>1</sup>, Brian Wagner<sup>2</sup>, Robert Wood<sup>1</sup>

<sup>1</sup>*Saint Louis University, Saint Louis, MO, USA*, <sup>2</sup>*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.

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

Jordan Balaban<sup>1</sup>, Joseph Bizzarro<sup>2</sup>, Adam Summers<sup>2</sup>

<sup>1</sup>*University of Rhode Island, Kingston, RI, USA*, <sup>2</sup>*University of Washington, Seattle, WA, USA*

#### **Burrowing 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.

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

Carole Baldwin<sup>1</sup>, Ross Robertson<sup>1</sup>

<sup>1</sup>*National Museum of Natural History, Smithsonian Institution, Washington, DC, USA,*

<sup>2</sup>*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.

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**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 project 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.

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

Margaret (Cissy) Ballen<sup>1</sup>, Mark Wilson<sup>2</sup>, Mo Healey<sup>2</sup>, Michael Tobler<sup>1</sup>, Erik Wapstra<sup>3</sup>, Mats Olsson<sup>1</sup>

<sup>1</sup>*University of Sydney, Sydney, NSW, Australia*, <sup>2</sup>*University of Wollongong, Wollongong, NSW, Australia*, <sup>3</sup>*University of Tasmania, Hobart, TAS, Australia*

**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.

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## **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.

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

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

<sup>1</sup>National Veterinary Institute, Aarhus, Denmark, <sup>2</sup>National Institute of Public Health, Copenhagen, Denmark, <sup>3</sup>Norwegian Veterinary Institute, Oslo, Norway, <sup>4</sup>Centre for Environment, Fisheries and Aquaculture Science, Weymouth, UK, <sup>5</sup>Friedrich-Loeffler Institute, Insel Reims, Germany, <sup>6</sup>Istituto Zooprofilattico Sperimentale delle Venezie, Padova, Italy, <sup>7</sup>Veterinary Research Institute, Brno, Czech Republic, <sup>8</sup>Finnish Food Safety Authority Evira, Helsinki, Finland

### **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.

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**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.

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

Brittany Barker<sup>1</sup>, Javier Rodriguez-Robles<sup>2</sup>, Joseph Cook<sup>1</sup>, Robert Waide<sup>1</sup>

<sup>1</sup>*University of New Mexico, Albuquerque, NM, USA*, <sup>2</sup>*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, *Eleutherodactylus 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.

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## **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.

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

Paul Bartelt<sup>1</sup>, Robert Klaver<sup>1</sup>

<sup>1</sup>Waldorf College, Forest City, IA, USA, <sup>2</sup>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.

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## **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.

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### **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 rupicolous 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 substrate 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).

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### **0334 Poster Session III, Sunday 10 July 2011**

Collin Beachum, Matt Michel, Jason Knouft

*Saint Louis University, 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.

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### **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.

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

Mark Belk<sup>1</sup>, Eric Billman<sup>1</sup>, Josh Rasmussen<sup>2</sup>, Karen Mock<sup>3</sup>, Jerry Johnson<sup>1</sup>

<sup>1</sup>Brigham Young University, Provo, UT, USA, <sup>2</sup>US Fish and Wildlife Service, Klamath Lakes, OR, USA, <sup>3</sup>Utah State University, Logan, UT, USA

### **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.

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

Mauro Belleggia<sup>2</sup>, Daniel Enrique Figueroa<sup>3</sup>, Claudia Bremec<sup>2</sup>, Felisa Sánchez<sup>1</sup>, Anabela Zavatteri<sup>1</sup>

<sup>1</sup>INIDEP (Instituto Nacional de Investigacion y Desarrollo Pesquero), Mar del Plata, Argentina, <sup>2</sup>CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas), Buenos Aires, Argentina, <sup>3</sup>UNMdP (Universidad Nacional de Mar del Plata), Mar del Plata, Argentina

### **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.

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### **0732 Poster Session III, Sunday 10 July 2011**

Jordan Benjamin<sup>1</sup>, Kate Jackson<sup>1</sup>, Sanda Ashe<sup>2</sup>

<sup>1</sup>Whitman College, Walla Walla, WA, USA, <sup>2</sup>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.

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### **0430 Poster Session II, Saturday 9 July 2011**

Torsten Berg<sup>2</sup>, Ralph Saporito<sup>1</sup>

<sup>1</sup>John Carroll University, University Heights, OH, USA, <sup>2</sup>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.

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### 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*.

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

Moises Bernal<sup>1</sup>, William Ludt<sup>1</sup>, Matthew Craig<sup>3</sup>, Brian Bowen<sup>2</sup>, Luiz Rocha<sup>1</sup>

<sup>1</sup>*University of Texas Marine Science Institute, Port Aransas, TX, USA*, <sup>2</sup>*Hawaii Institute of Marine Biology, Honolulu, HI, USA*, <sup>3</sup>*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.

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#### **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  $210 \pm 14,02$  mm (163-262) and females mean of  $251 \pm 17,75$  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.

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#### **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.

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### **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.

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### **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 beso* and *Labeobarbus gananensis* were examined. RAxML analysis based on cytochrome *b* and cytochrome oxidase 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.

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## **0628 Poster Session II, Saturday 9 July 2011**

Michael Bessert<sup>1</sup>, Guillermo Orti<sup>1</sup>

<sup>1</sup>University of Wisconsin - Stout, Menomonie, WI, USA, <sup>2</sup>George Washington University, Washington, D.C., USA

### **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.

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## **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 °C; whereas, temperatures in other years are generally above 23 °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.

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## **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.

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

Phil Bishop<sup>1</sup>, Jaime Garcia-Moreno<sup>2</sup>, Simon Stuart<sup>3</sup>, George Rabb<sup>4</sup>, Jonathan Baillie<sup>2</sup>

<sup>1</sup>*Department of Zoology, University of Otago, Dunedin, New Zealand*, <sup>2</sup>*Zoological Society of London, London, UK*, <sup>3</sup>*The Innovation Centre, University of Bath, Bath, UK*, <sup>4</sup>*Chicago Zoological Society, Chicago, IL, USA*

### **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.

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## **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.

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

Flávio Bockmann<sup>1</sup>, Roberto Reis<sup>2</sup>

<sup>1</sup>Laboratório de Ictiologia de Ribeirão Preto (LIRP), Departamento de Biologia, FFCLRP, Universidade de São Paulo, Ribeirão Preto, SP, Brazil, <sup>2</sup>Laboratório de Sistemática de Vertebrados, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, RS, Brazil

### **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.

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**0387 Poster Session II, Saturday 9 July 2011**

Benjamin Bond<sup>1</sup>, Susan Lyons<sup>1</sup>, Peter Braun<sup>2</sup>, Angela Horner<sup>2</sup>, Molly Morris<sup>1</sup>

<sup>1</sup>Ohio University, Athens, OH, USA, <sup>2</sup>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.

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

Michelle Boone<sup>1</sup>, Caren Helbing<sup>2</sup>, Nik Veldhoen<sup>2</sup>, Melissa Youngquist<sup>1</sup>

<sup>1</sup>Miami University, Oxford, OH, USA, <sup>2</sup>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 thyroid 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.

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

Cal Borden<sup>1</sup>, Terry Grande<sup>1</sup>, Wm. Leo Smith<sup>2</sup>

<sup>1</sup>Loyola University Chicago, Chicago, IL, USA, <sup>2</sup>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 (E 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.

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**0402 Poster Session II, Saturday 9 July 2011**

Cal Borden<sup>1</sup>, Guillermo Ortí<sup>1</sup>

<sup>1</sup>University of Nebraska-Lincoln, Lincoln, NE, USA, <sup>2</sup>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 *Ichthyocephalus*. *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.

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### 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.

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### **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.

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### **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.

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

Krista A. Boysen<sup>1</sup>, Casey B. Dillman<sup>2</sup>, Robert M. Wood<sup>1</sup>

<sup>1</sup>*Saint Louis University, St. Louis, MO, USA*, <sup>2</sup>*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. platyrhynchus* 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.

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## **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 be influential in shaping the history of these tortoises.

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

Camrin Braun<sup>1</sup>, Gregory Skomal<sup>2</sup>, Michael Berumen<sup>3</sup>, Simon Thorrold<sup>2</sup>

<sup>1</sup>*The College of Idaho, Caldwell, ID, USA*, <sup>2</sup>*Woods Hole Oceanographic Institution, Woods Hole, MA, USA*, <sup>3</sup>*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.

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## **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.

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

Ralf Britz<sup>1</sup>, Kevin Conway<sup>2</sup>, Lukas Rüber<sup>1</sup>

<sup>1</sup>The Natural History Museum, London, UK, <sup>2</sup>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.

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**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 chechchiai* 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.

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

Kristen Brochu<sup>1</sup>, William G. R. Crampton<sup>2</sup>, Javier A. Maldonado Ocampo<sup>3</sup>,  
Nathan R. Lovejoy<sup>1</sup>

<sup>1</sup>University of Toronto, Toronto, ON, Canada, <sup>2</sup>University of Central Florida, Orlando, FL, USA, <sup>3</sup>Universidade 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.

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## **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.

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## **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.

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## 0074 Poster Session III, Sunday 10 July 2011

Mary Brown<sup>1</sup>, Susan Walls<sup>2</sup>

<sup>1</sup>Jacobs Technology, Gainesville, FL, USA, <sup>2</sup>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.

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## 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.

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**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.

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**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.

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#### **0415 Poster Session III, Sunday 10 July 2011**

Gary Bucciarelli<sup>1</sup>, Lee Kats<sup>2</sup>, David Schlais<sup>2</sup>, Barbara Han<sup>3</sup>, Andrew Blaustein<sup>4</sup>

<sup>1</sup>University of California, Los Angeles, CA, USA, <sup>2</sup>Pepperdine University, Malibu, CA, USA, <sup>3</sup>University of Georgia, Athens, GA, USA, <sup>4</sup>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.

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## **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 conspecificity 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 basin, 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, which is shared among headwaters of the Iriri river (Xingu basin) and the rio do Braço drainage (Tapajós basin). (Financial support: CNPq)

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## **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.

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

George H. Burgess<sup>1</sup>, Galal Nasser<sup>1</sup>

<sup>1</sup>Florida Program for Shark Research, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA, <sup>2</sup>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.

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

Gordon Burghardt<sup>1</sup>, Masahiro Shibasaki<sup>2</sup>, Nobuyuki Kawai<sup>4</sup>, Akira Mori<sup>3</sup>, Nobuo Masataka<sup>1</sup>

<sup>1</sup>University of Tennessee, Knoxville, TN, USA, <sup>2</sup>Kyoto University Primate Research Institute, Inuyama, Japan, <sup>3</sup>Kyoto University, Kyoto, Japan, <sup>4</sup>Nagoya University, Nagoya, Japan

### **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.

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#### **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 controlling 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 following 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.

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**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 Gobiiformes) 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*.

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**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 arctic, 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 Hemitriptera. 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](http://www.FishTree.org)).

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

Kenneth Cabarle<sup>2</sup>, Christopher Beachy<sup>1</sup>, Robert Page<sup>3</sup>, Randal Voss<sup>3</sup>

<sup>1</sup>Minot State University, Minot, ND, USA, <sup>2</sup>University of North Dakota, Grand Forks, ND, USA, <sup>3</sup>University of Kentucky, Lexington, KY, USA

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

Cd<sup>2+</sup> 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<sup>2+</sup> 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).

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## 0131 Poster Session III, Sunday 10 July 2011

Natalie Calatayud<sup>1</sup>, Cecilia Langhorne<sup>1</sup>, Tricia Rowlinson<sup>1</sup>, Kevin Thompson<sup>3</sup>, Carrie Vance<sup>2</sup>, Jennifer Germano<sup>2</sup>, Scott Willard<sup>1</sup>, Andrew Kouba<sup>2</sup>

<sup>1</sup>Mississippi State University, Starkville, MS, USA, <sup>2</sup>Memphis Zoo, Memphis, TN, USA, <sup>3</sup>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.

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## 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.

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## **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 catalogued 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.

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## 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. passionis*). 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.

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

Gerardo Carfagno<sup>1</sup>, Patrick Weatherhead<sup>2</sup>

<sup>1</sup>*Gettysburg College, Gettysburg, PA, USA*, <sup>2</sup>*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.

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

Aaron Carlisle<sup>1</sup>, Daniel Madigan<sup>1</sup>, Kenneth Goldman<sup>2</sup>, Thomas Kline<sup>3</sup>, Barbara Block<sup>1</sup>

<sup>1</sup>Hopkins Marine Station of Stanford University, Pacific Grove, CA, USA, <sup>2</sup>Alaska Department of Fish and Game, Division of Commercial Fisheries, Homer, AK, USA, <sup>3</sup>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 (<sup>13</sup>C/<sup>12</sup>C) and nitrogen (<sup>15</sup>N/<sup>14</sup>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.

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**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.

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**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.

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**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.

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## 0602 Poster Session II, Saturday 9 July 2011

Abel J. Castaneda<sup>1</sup>, Robert B. Gillespie<sup>1</sup>, Peter C. Smiley<sup>2</sup>, Mark A. Jordan<sup>1</sup>

<sup>1</sup>Indiana University - Purdue University, Fort Wayne, IN, USA, <sup>2</sup>Agricultural Research Service, USDA, Columbus, OH, USA

### **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.

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## 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.

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### **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.

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

Ryan Chabarría, 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.

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**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.

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**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

southern 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.

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

Prosanta Chakrabarty<sup>1</sup>, Larry Page<sup>2</sup>

<sup>1</sup>Museum of Natural Science, Louisiana State University, Baton Rouge, LA, USA,

<sup>2</sup>Florida Museum of Natural History, Gainesville, FL, USA

### **Genotypes: 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 “genotype” 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 “hologenotype” (from: **holotype** and **genotype**), sequences from a topotype will be a “topogenotype,” 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 genotypes approach will promote all forms of taxonomic research as molecular phylogenetics becomes integrated with taxonomy and as technology improves in molecular biology.

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## 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.

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## 0500 Poster Session I, Friday 8 July 2011

Guangchun Chen<sup>1</sup>, Brian Ward<sup>1</sup>, Gregory Chinchar<sup>2</sup>, Jacques Robert<sup>1</sup>

<sup>1</sup>*University of Rochester Medical Center, Rochester, NY, USA*, <sup>2</sup>*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-2 $\alpha$  gene); and (3) FV3-18K-KO (replacement of the 18K gene). Each recombinant was purified by successive rounds of puromycin and GFP<sup>+</sup> 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.

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

Megan Chesser<sup>1</sup>, John Kim<sup>2</sup>, Kevin McGarigal<sup>3</sup>

<sup>1</sup>University of Massachusetts, Amherst, MA, USA, <sup>2</sup>San Diego State University, San Diego, CA, USA, <sup>3</sup>University of Massachusetts, Amherst, MA, USA

**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.

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

V. Gregory Chinchar<sup>1</sup>, Dexter S. Whitley<sup>1</sup>, Elizabeth Kwang Yu<sup>1</sup>, Jacques Robert<sup>2</sup>

<sup>1</sup>*U. Mississippi Medical Ctr., Jackson, MS, USA*, <sup>2</sup>*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.

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## **0186 Poster Session I, Friday 8 July 2011**

James Christiansen<sup>1</sup>, Neil Bernstein<sup>2</sup>, Christopher Phillips<sup>4</sup>, Jeffrey Briggler<sup>3</sup>, Don Kangas<sup>5</sup>

<sup>1</sup>*Drake University, Des Moines, IA, USA*, <sup>2</sup>*Mount Mercy University, Cedar Rapids, IA, USA*, <sup>3</sup>*Missouri Department of Conservation, Jefferson City, MO, USA*, <sup>4</sup>*Illinois Natural History Survey, Champaign, IL, USA*, <sup>5</sup>*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.

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### **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 TJJ. 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.

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**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.

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

Angela Cicia<sup>1</sup>, Lela Schlenker<sup>2</sup>, James Sulikowski<sup>3</sup>, John Mandelman<sup>1</sup>

<sup>1</sup>*University of New England, Biddeford, ME, USA*, <sup>2</sup>*Dauphin Island Sea Lab, Dauphin Island, AL, USA*, <sup>3</sup>*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 obtained 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,  $p\text{CO}_2$ ), whole-blood lactate, and  $\text{K}^+$  became progressively more disturbed the longer skates were exposed to air in both the winter and summer studies. In addition, glucose,  $\text{Na}^+$ ,  $\text{Cl}^-$ ,  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  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.

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**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 pricklebaks, 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.

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

Eugenie Clark<sup>1</sup>, Diane Nelson<sup>2</sup>

<sup>1</sup>Mote Marine Laboratory, Sarasota, FL, USA, <sup>2</sup>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, *Mulloidops vanicolensis*, 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.

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## **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.

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

Nat Clarke<sup>1</sup>, Richard Tinder<sup>2</sup>, Kate Jackson<sup>1</sup>

<sup>1</sup>Whitman College, WA, USA, <sup>2</sup>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.

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### **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.

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

John Clulow<sup>1</sup>, Helen Robertson<sup>3</sup>, Stephen Donnellan<sup>2</sup>, Michael Mahony<sup>1</sup>

<sup>1</sup>*University of Newcastle, Newcastle, NSW, Australia*, <sup>2</sup>*South Australian Museum, Adelaide, South Australia, Australia*, <sup>3</sup>*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.

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## **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.

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## **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.

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**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.

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

Patrick Colombo<sup>1</sup>, Taran Grant<sup>1</sup>, Laura Verrastro<sup>2</sup>, Ralph Saporito<sup>3</sup>

<sup>1</sup>*Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil*, <sup>2</sup>*Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil*, <sup>3</sup>*John Carroll University, Cleveland, OH, USA*

**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.

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

Robert Colombo<sup>1</sup>, John West<sup>1</sup>, Trent Thomas<sup>2</sup>

<sup>1</sup>Eastern Illinois University, Charleston, IL, USA, <sup>2</sup>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.

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

Justin Congdon<sup>1</sup>, Whitfield Gibbons<sup>1</sup>, Ronald Brooks<sup>1</sup>, Njal Rollinson<sup>1</sup>, Ria Tsaliagos<sup>1</sup>

<sup>1</sup>*Savannah River Ecology Lab, Aiken, SC, USA*, <sup>2</sup>*Savannah River Ecology Lab, Aiken, SC, USA*, <sup>3</sup>*University of Guelph, Guelph, Ontario, Canada*, <sup>4</sup>*Dalhousie University, Halifax, Nova Scotia, Canada*, <sup>5</sup>*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.

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## **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.

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### **0373 Poster Session II, Saturday 9 July 2011**

Kevin W. Conway<sup>1</sup>, Lukas Rüber<sup>2</sup>, Héctor Espinosa Pérez<sup>3</sup>, Phil Hastings<sup>4</sup>

<sup>1</sup>Texas A&M University, College Station, TX, USA, <sup>2</sup>Natural History Museum, London, UK, <sup>3</sup>Instituto de Biología, UNAM, Mexico, <sup>4</sup>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.

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## 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.

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

Aur lie Cosandey-Godin<sup>1</sup>, John K. Carlson<sup>2</sup>, Val rie Burgener

*Department of Biology, Dalhousie University, Halifax, Nova Scotia, Canada, <sup>2</sup>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.

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**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.

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**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.

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### **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 (*Cryptobranchus 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.

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## **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.

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## **0737 Poster Session III, Sunday 10 July 2011**

Brian Crnobra

*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.

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

Brian Crnobra, 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.

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**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.

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### **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.

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### **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 Kāneʻohe 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 (MO<sub>2</sub>) 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 MO<sub>2</sub> ranged from 53.06 mg O<sub>2</sub> kg<sup>-1</sup> h<sup>-1</sup> for a 9.85 kg

individual at 23 °C to 115.99 mg O<sub>2</sub> kg<sup>-1</sup> h<sup>-1</sup> 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 MO<sub>2</sub>. Both mass and temperature had significant effects on MO<sub>2</sub> (P < 0.001) and explained 98% of the variance in MO<sub>2</sub> values. Standard metabolic rates increased with temperature at a Q<sub>10</sub> (22-27 °C) of 1.82 and increased with mass following the allometric equation: MO<sub>2</sub> (mg O<sub>2</sub> h<sup>-1</sup>) = 107 × M<sup>0.78</sup>. 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.

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## **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.

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## 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.

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## 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 conservatism 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.

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

Mark Davis<sup>1</sup>, Michael Collyer<sup>2</sup>, Marlis Douglas<sup>1</sup>, Michael Douglas<sup>3</sup>

<sup>1</sup>Illinois Natural History Survey, University of Illinois, Champaign, IL, USA, <sup>2</sup>Stephen F. Austin State University, Nacogdoches, TX, USA, <sup>3</sup>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 20<sup>th</sup> 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.

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

Matthew Davis<sup>1</sup>, Prosanta Chakrabarty<sup>1</sup>, Wm. Leo Smith<sup>2</sup>, Zach Baldwin<sup>3</sup>, John Sparks<sup>3</sup>

<sup>1</sup>Louisiana State University, Baton Rouge, LA, USA, <sup>2</sup>The Field Museum, Chicago, IL, USA, <sup>3</sup>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.

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**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.

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**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 sphaerodactylid 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 Sphaerodactylidae and provide diagnostic features for its major suclades.

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**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]

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#### **0645 Poster Session I, Friday 8 July 2011**

Mason Dean<sup>1</sup>, Justin Schaefer<sup>2</sup>, Dominique Adriaens<sup>3</sup>, Adam Summers<sup>4</sup>

<sup>1</sup>Max Planck Institute, Potsdam, Germany, <sup>2</sup>Univ. of California, Los Angeles, CA, USA,

<sup>3</sup>Ghent University, Ghent, Belgium, <sup>4</sup>Friday Harbor Labs, Univ. of Washington, Friday Harbor, WA, USA

#### **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 ( $\mu$ CT, SR- $\mu$ CT) 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.

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## **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.

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**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.

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

Andrea Dell'Apa<sup>1</sup>, Simona Clò<sup>1</sup>

<sup>1</sup>ECU, Greenville, NC, USA, <sup>2</sup>CTS, Rome, Italy

**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.

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

Gina Della Togna<sup>2</sup>, Pierre Comizzoli<sup>1</sup>, Brian Gratwicke<sup>1</sup>

<sup>1</sup>Smithsonian Conservation Biology Institute, Washington, DC, USA, <sup>2</sup>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.

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

Naomi Delventhal<sup>1</sup>, Ainhoa Agorreta<sup>2</sup>, Lukas Ruber<sup>2</sup>

<sup>1</sup>University of Manitoba, Winnipeg, MB, Canada, <sup>2</sup>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?

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**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.

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**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.

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

Lesley deSouza<sup>1</sup>, Geoffrey Sorrell<sup>2</sup>, Michael Gangloff<sup>3</sup>, Craig Guyer<sup>1</sup>

<sup>1</sup>*Auburn University, Auburn, AL, USA*, <sup>2</sup>*The Nature Conservancy, Ft. Benning, GA, USA*, <sup>3</sup>*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 endemism. 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.

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**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 Crocodylian Immunology and Select Wisconsin Snake Species.**

Previous studies have demonstrated the broad spectrum antibacterial properties of crocodylian immune systems in the wild. Despite developing interest in reptilian immunology, little data has been reported regarding the antibacterial properties of entirely captive raised crocodylians. Secondly, despite the broad resistance representative in crocodylians, 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.

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**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.

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**0246 Poster Session I, Friday 8 July 2011**

Valentina Di Santo<sup>1</sup>, Bruce Cooper<sup>2</sup>, Wayne Bennett<sup>2</sup>

<sup>1</sup>*Boston University, Boston, MA, USA*, <sup>2</sup>*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 brachipomus*) 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<sup>2</sup> 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.

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

Joseph DiBattista<sup>1</sup>, Matthew Craig<sup>2</sup>, Luiz Rocha<sup>3</sup>, Kevin Feldheim<sup>4</sup>, Brian Bowen<sup>1</sup>

<sup>1</sup>Hawaii Institute of Marine Biology, Honolulu, HI, USA, <sup>2</sup>University of Puerto Rico, Mayagüez, Puerto Rico, <sup>3</sup>University of Texas at Austin, Port Aransas, TX, USA, <sup>4</sup>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.

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**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.

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**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.

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## **0306 Fish Conservation, Symphony III, Saturday 9 July 2011**

Lynda Dirk<sup>1</sup>, Lawrence Glenn<sup>2</sup>

<sup>1</sup>Florida Atlantic University, Boca Raton, FL, USA, <sup>2</sup>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.

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

Laura Dixon<sup>1</sup>, Charles Dieter<sup>2</sup>

<sup>1</sup>USFWS, Bismarck, ND, USA, <sup>2</sup>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  $15 \pm 0.553$  (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  $61.27 \text{ m} + 7.123$  (SE) and the mean straight-line distance from water to nest for *G. pseudogeographica* was  $54.24 \text{ m} + 8.768$  (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.

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### **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, endemism, and herpetological sampling patterns will be discussed.

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## **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.

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## **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.

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## **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.

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

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

<sup>1</sup>*Davidson College, Davidson, NC, USA*, <sup>2</sup>*Virginia Tech, Blacksburg, VA, USA*, <sup>3</sup>*Everglades National Park, Homestead, FL, USA*, <sup>4</sup>*University of Florida FLREC, Davie, FL, USA*, <sup>5</sup>*Auburn University, Auburn, AL, USA*, <sup>6</sup>*State Museum of Pennsylvania, Harrisburg, PA, USA*, <sup>7</sup>*US Geological Survey, Fort Collins, CO, USA*, <sup>8</sup>*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.

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**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.

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**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.

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### **0304 Poster Session III, Sunday 10 July 2011**

Dana Drake<sup>1</sup>, Stanley Trauth<sup>1</sup>

<sup>1</sup>University of Missouri, Columbia, MO, USA, <sup>2</sup>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.

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**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.

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

Joshua Drew<sup>1</sup>, Beth Sanzenbacher<sup>1</sup>, Johanna Thompson<sup>1</sup>, Stacy Jupiter<sup>2</sup>, Ron Vave<sup>3</sup>

*<sup>1</sup>Field Museum of Natural History, Chicago, IL, USA, <sup>2</sup>Wildlife Conservation Society, Suva, Fiji, <sup>3</sup>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.

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## **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.

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

Marcus Drymon<sup>1</sup>, Matthew Ajemian<sup>2</sup>, Sean Powers<sup>2</sup>

<sup>1</sup>Dauphin Island Sea Lab, Dauphin Island, AL, USA, <sup>2</sup>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.

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**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.

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### **0352 Poster Session I, Friday 8 July 2011**

Amanda Duffus<sup>1</sup>, Richard Nichols<sup>2</sup>, Trent Garner<sup>3</sup>

<sup>1</sup>Gordon College, Barnesville, GA, USA, <sup>2</sup>Queen Mary, University of London, London, England, UK, <sup>3</sup>Institute 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.

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**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 theoretical 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.

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**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.

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**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.

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**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.

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**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.

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## 0213 Poster Session I, Friday 8 July 2011

David A. Ebert<sup>1</sup>, Heidi Dewar<sup>2</sup>, Suzanne Kohin<sup>2</sup>, Joseph J. Bizzarro<sup>3</sup>, Russ Vetter<sup>2</sup>, Erin K. Loury<sup>1</sup>, Jennifer S. Bigman<sup>1</sup>

<sup>1</sup>Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, USA, <sup>2</sup>Southwest Fisheries Science Center, La Jolla, CA, USA, <sup>3</sup>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.

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## 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*), chuckwalla (*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.

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**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.

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

Corey Eddy<sup>1</sup>, Diego Bernal<sup>1</sup>, Greg Skomal<sup>2</sup>, Lisa Natanson<sup>3</sup>, Nancy Kohler<sup>3</sup>

<sup>1</sup>University of Massachusetts, Dartmouth, MA, USA, <sup>2</sup>Massachusetts Division of Marine Fisheries, New Bedford, MA, USA, <sup>3</sup>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.

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

Corey Eddy<sup>1</sup>, Nancy Kohler<sup>2</sup>, Patricia Turner<sup>2</sup>

<sup>1</sup>University of Massachusetts, Dartmouth, MA, USA, <sup>2</sup>National Marine Fisheries Service, Narragansett, RI, USA

**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.

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## **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 Bluntnose 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.

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## 0730 Poster Session I, Friday 8 July 2011

Jennifer Eichelberger<sup>1</sup>, Timothy King<sup>2</sup>, Edward Heist<sup>1</sup>

<sup>1</sup>*Southern Illinois University, Carbondale, IL, USA*, <sup>2</sup>*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.

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## 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.

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## **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.

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**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*.

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**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 cyprinidae; 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 redbfin 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.