

**Abstracts for the 2010**

**Joint Meeting of Ichthyologists & Herpetologists**

**AES - American Elasmobranch Society**

**ASIH - American Society of Ichthyologists &  
Herpetologists**

**HL - Herpetologists' League**

**NIA - Neotropical Ichthyological Association**

**SSAR - Society for the Study of Amphibians & Reptiles**

**Providence, Rhode Island**

**7-11 July 2010**

**Edited by**

**Martha L. Crump & Maureen A. Donnelly**

**2 May 2010**

**0705 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010**

Maria Abate, Melonie Lontoh, Magdalena Buttlar, Les Kaufman

*Boston University, Boston, MA, United States*

**The Effect of Conspecific Alarm Cue on the Swimming Performance of Juvenile Nicaragua Cichlids (*Hypsophrys nicaraguensis*)**

Karel Liem catalyzed the study of adaptive plasticity in fish behavior, morphology, and their interplay. Predator-induced defenses include changes in activity and body form in response to alarm cues. The response entails a trade-off between crypsis and sustained swimming to evade pursuit. We exposed four-month- and six-month-old sibling Nicaragua cichlids from two different broods to alarm cue (conspecific skin extract) to test for a change in swimming performance. Distilled water was the control for cue delivery, and green swordtail (*Xiphophorus hellerii*) skin extract was the control for a response to any injured fish. Depth, standard length, and total length of siblings in all groups were equal prior to treatment. After at least four weeks of odorant treatment, individual fish were subjected to stepwise increases in current velocity in a flume until they fatigued (maximum trial time = 14 minutes). The time and velocity at fatigue was used to calculate critical swimming speed, a measure of swimming performance. The critical swimming speed of fish exposed to conspecific alarm cue was lower than those exposed to distilled water (Mann Whitney  $U_s$ ,  $P < 0.05$ ). The critical swimming speed in green swordtail and distilled water treatments did not differ ( $P > 0.05$ ). The perceived threat of predation conveyed by alarm cue is sufficient to affect fish stamina. The question is: was the response adaptive or merely a reflection of stress induced by the threat of predation?

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**0326 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556 AB, Friday 9 July 2010**

Megan Acord, Carl Anthony, Cari-Ann Hickerson

*John Carroll University, Geneva, Ohio, United States*

**Assortative Mating in the Polymorphic Salamander, *Plethodon cinereus***

Reproductive isolation due to divergent selection is thought to be one of the means that promote speciation in sympatry. A key element of isolation is assortative mating. When studying speciation in sympatry, polymorphic taxa provide important model systems by focusing on reproductive isolation. We examined a polymorphic population of the red-backed salamander (*Plethodon cinereus*) for evidence of reproductive isolation through assortative mating. Our study population consists of two common color morphs, striped and unstriped. In the field, we turned over natural cover objects to find male-female pairs of *P. cinereus* during peak mating season. We recorded sex, color morphology, and

snout-vent length (SVL) for each of the 100 pairs of salamanders found. Salamanders tended to mate assortatively in the field, but some intermorph pairings were observed. Such pairings interfere with the potential for divergence. Laboratory experiments were conducted to assess the ability of females of each color morph to distinguish between males of the same, and of different color morphs, through fecal squashing and scent. Results of the fecal pellet experiment were inconclusive, however in the scent experiment females tended to have a higher frequency of nose taps when exposed to males of the same color phase.

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### **0216 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Andrew Adams, Nathan Landry, Michael Savaria, Whitney Hable, Ken Oliveira

*University of Massachusetts Dartmouth, Dartmouth, MA, United States*

#### **A Comparison of Artificial Maturation of American Eels in Freshwater and Seawater**

Artificial maturation of male and female American eels, *Anguilla rostrata*, is becoming of greater importance as some evidence suggests the species is in decline. Preliminary research has shown male American eels can be matured in freshwater and that their sperm is capable of fertilization. Studies using the European eel, *Anguilla anguilla*, which are similar in their catadromous reproductive behavior, have shown that a higher sperm quality can be achieved from males if the eels are matured in seawater as opposed to freshwater. This study was designed to evaluate the role of maturation environment on sperm. Twenty silver phase male eels were divided, 10 per treatment, into freshwater and seawater groups. The freshwater group was maintained in a 450L recirculating freshwater tank while the seawater group was kept in a 500L flow through seawater system. All males were being artificially matured by weekly intraperitoneal injections of human chorionic gonadotropin (HCG). After 5 weeks of injections sperm was collected and measured for cell count, motility, and viability assays. These results will provide data that will enhance the understanding of artificial propagation of this species.

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## 0289 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Andrew Adams, Nathan Landry, Michael Savaria, Ken Oliveira, Whitney Hable

*University of Massachusetts Dartmouth, Dartmouth, MA, United States*

### **Polychlorinated Biphenyls Cause Sperm Deformities in the American Eel**

The American Eel is considered to be in a state of population decline. Contamination has been hypothesized to be one of several possible causes that may be contributing to the reduction in recruitment to continental waters. Polychlorinated biphenyls (PCBs) are a common pollutant that accumulates to high levels in the American eel. Eels do not feed during their extensive migration to the spawning area and thus metabolize stored lipids as an energy source. These lipids are also the primary location for sequestered PCBs, and the migration likely releases PCBs into the eels' circulation during gametogenesis. Evidence from avian and mammalian systems indicates that PCBs can affect the structure of sperm heads and flagella. Moreover, a recent study has shown that American eels treated with PCBs yield sperm with decreased motility. The current study was designed to determine if low levels of circulating PCBs disrupt spermatogenesis in the American eel. Eels were injected weekly with 1.0 or 10.0 µg of a mixture of Aroclors 1221, 1242, and 1254 while being artificially matured with injections of human chorionic gonadotropin. After 5 weeks, milt was examined for cell count, sperm motility, viability, and microtubule structure within the flagella. Preliminary results show that eels treated with high concentrations of PCBs produce sperm with deformed sperm heads, often lacking microtubules within the flagella. These results will provide insight into the often overlooked effect of contamination on the male contribution to reproduction.

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## 0208 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Cory Adams, Daniel Saenz

*Southern Research Station, Forest Service, U.S. Department of Agriculture, Nacogdoches, Texas, United States*

### **The Effects of Chinese Tallow (*Triadica sebifera*) on *Lithobates sphenoccephalus* Hatching**

Chinese tallow (*Triadica sebifera*) is a subtropical deciduous tree native to China and Japan. It was first introduced into the United States in the late 1700s and in Texas in the early 1900s. Chinese tallow is extremely abundant in parts of eastern Texas and has the capability of producing monocultures which can be in or near wetlands that are utilized by breeding amphibians. The impact Chinese tallow has on most amphibians is currently unknown. We determined if Chinese tallow has an effect on the hatching of a

common anuran, *Lithobates sphenoccephalus*. We found that Chinese tallow leaf litter significantly affects dissolved oxygen, pH, and turbidity. At low concentrations, Chinese tallow can be lethal to *L. sphenoccephalus* eggs. We determined that by controlling dissolved oxygen, eggs exposed to low concentrations of Chinese tallow hatched, but died in higher concentrations. We also found that at low concentrations Chinese tallow significantly reduced the time to hatching, and had similar effects as red maple (*Acer rubrum*), a native tree species. Since Chinese tallow appears to negatively affect water chemistry, this non-native species could be a significant threat to amphibians.

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### **0577 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Dominique Adriaens<sup>1</sup>, Renaud Boistel<sup>2</sup>, Barbara De Kegel<sup>1</sup>, Joachim Christiaens<sup>1</sup>, Manuel Dierick<sup>3</sup>, Luc Van Hoorebeke<sup>3</sup>

<sup>1</sup>*Ghent University, Gent, Belgium*, <sup>2</sup>*CNRS/Université de Poitiers, Poitiers, France*, <sup>3</sup>*Ghent University, Gent, Belgium*

### **On How to Reconcile Flexibility with Rigidity during Evolution: The Caudal System in Seahorses**

Within teleosts, seahorses and pipefish are unique fishes that are capable of using their caudal tail as a prehensile organ. An unusual level of flexibility for such a system in teleosts, paradoxically, evolved within a lineage in which the body is covered with bony plates. This provides at least in pipefish an increased level of rigidity, as well as protection against predators. It thus seems that evolutionary transformations of the caudal system within syngnathid fishes resulted in a system that avoids extensive trade-offs between rigidity and flexibility. Additionally, considering the use of this prehensile organ, it suggests that also at the muscular level, modifications have occurred to allow fine motor control of this system. In order to get to a better understanding of how the body armour in seahorses got modified from an ancestral condition, as found in pipefish, a comparative study is performed on a pipefish and seahorse species. To allow a full comprehension of the detailed 3D-anatomy of the musculoskeletal system in the caudal system, including the structural interaction between elements, both non-invasive (synchrotron X-ray scanning and micro-CT scanning) and invasive (histological sectioning) are used and combined with graphical 3D-reconstructing and modelling. Results show that the structural organisation and interaction between modified skeletal plates in seahorses can explain how rigidity and flexibility can be combined. The muscular system also shows that apparent complex movements for prehension may be achieved by a limited set of muscles.

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## 0572 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Dominique Adriaens<sup>1</sup>, Anthony Herrel<sup>1</sup>

<sup>1</sup>*Ghent University, Gent, Belgium, <sup>2</sup>C.N.R.S/M.N.H.N., Paris, France*

### **Aquisition of Extreme Performance: Adaptive Mechanisms and Evolutionary Patterns**

One of the aspects of biology that intrigued Karl Liem was that of energy transfer in biological systems, where evolutionary transformations mould existing designs into efficient machines with highly specialised feeding structures. The core function of these structures is to obtain nutritional mass to generate that energy with minimal energy expenditure. It is thus not a surprise that evolution of heterotrophe lineages is largely characterised by changes in the cranial system (for food uptake) and postcranial system (for catching food or avoiding to becoming food). One of the paradoxes studied by Karl Liem was that of evolutionary specialisations which allow the occupation of unoccupied niches, but which at the same time may constrain ecological versatility (and hence make organisms vulnerable to extinction). That this does not necessarily constrain functional and hence ecological versatility had been demonstrated in cichlid fishes by Liem (and more recently other biologists). However, one aspect that remains intriguing is that of extreme morphologies. The cranial system in vertebrates seems to be susceptible to far reaching morphological transformations, assumed to be related to extreme but constrained functional performances. In this presentation, this hypothesis, and some associated ones, is tested using some examples derived from the recent literature. What becomes clear is that the favourite topic of Karl Liem, i.e. the craniate trophic system, is a very suitable system to test hypotheses related to extreme performance. Yet, the relation with extreme morphologies is not as clear as might be assumed a priori.

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## 0552 Fish Life History, 551 AB, Friday 9 July 2010

Andrew Adrian, Bruce Stallsmith

*University of Alabama in Huntsville, Huntsville, AL, United States*

### **Seasonality and Reproductive Impact of *Dactylogyrus* Gill Parasites Upon the Telescope Shiner, *Notropis telescopus***

*Dactylogyrus* is a holarctic genus of trematode flatworms that infect the gills of cyprinid fishes. *Dactylogyrus* species are usually highly host specific, and little is known about their life history in North America. The purpose of this study was twofold: to determine whether *Dactylogyrus* exhibits seasonality in its life cycle, and if there is any effect upon reproductive effort of the host as a result of *Dactylogyrus* infection. We examined 383 Telescope Shiners, *Notropis telescopus*, collected from Hurricane Creek and Estill Fork in

the upper Paint Rock River system in Jackson County, northeastern Alabama, USA, from February to September, 2007, and October, 2008 to January, 2009. A total of 967 flatworms, *Dactylogyrus spatulus*, were found on the gill arches of fish collected. Parasite counts yielded a peak in the average number of parasites present per fish in May, a significant relationship between host length and infection, and a negative correlation between higher parasite load and gonadosomatic index (GSI). Parasites per fish averaged about 1.5 from August to February, with an average high of just under 6 per fish in May. An ANOVA with Tukey's HSD post-hoc test groups together the months of March through July as a prevalence peak for *Dactylogyrus* infection. These months are the time of gonadal development and reproduction in Telescope Shiners. Female fish with higher parasite infections had significantly lower GSI ( $P < 0.01$ ). A previously unknown species of trematode flatworm, *Octomacrum lamiaruthis* sp. nov., was also found on Telescope Shiners.

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## **0654 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010**

Matthew Ajemian<sup>1</sup>, Sean Powers<sup>1</sup>

<sup>1</sup>University of South Alabama / Dauphin Island Sea Lab, Dauphin Island, AL, United States, <sup>2</sup>Dauphin Island Sea Lab, Dauphin Island, AL, United States

### **Feeding Ecology of Cownose Rays (*Rhinoptera bonasus*) from the Northern Gulf of Mexico: Further Evidence of Opportunism?**

Increases in the abundance of myliobatid rays may pose problems for fisheries management due to their consumption of exploitable shellfish species. The cownose ray (*Rhinoptera bonasus*) is a myliobatid ray common to the northern Gulf of Mexico (NGOM) known to reach shoal densities of tens of thousands of individuals. Despite their abundance, there are no published studies on the diet of *R. bonasus* from this region, and thus their impact to shellfisheries is currently unknown. To assess the impact of cownose rays to the NGOM, we collected gut contents from 182 individuals inhabiting Mississippi Sound, Mobile Bay, and Perdido Bay between 2007 and 2009. Prey items were analyzed for frequency of occurrence and percent composition by weight. These data were then used to develop an index of importance (IOI) for each prey group. Our data indicate minimal impact of cownose rays on exploitable shellfish species of the NGOM. Furthermore, cownose rays exhibited significant spatial and ontogenetic variability in diet; adult diets were dominated by crustaceans and echinoderms along barrier islands while juveniles and young-of-the-year (YOY) individuals almost exclusively consumed bivalves in estuarine and riverine areas. Thus, dietary differences among maturity stages were explained by differential habitat partitioning. Overall, cownose ray diet appears to reflect the benthic prey in greatest density at each locale. These findings support previous evidence of cownose ray opportunistic foraging behavior in other regions of the Atlantic.

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## 0307 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Timothy J. Alberg<sup>1</sup>, Douglas Moore<sup>2</sup>, Jacqueline F. Webb<sup>1</sup>

<sup>1</sup>University of Rhode Island, Kingston, RI, United States, <sup>2</sup>Brown University/Rhode Island Hospital, Providence, RI, United States

### **μCT Imaging of the Cranial Lateral Line Canal System of Teleost Fishes**

The cranial canals of the mechanosensory lateral line system are embedded in a conserved set of dermal bones in the skull and may have a narrow, wide, branched or reduced morphology. The lateral line canals have traditionally been described using dry skeletons, cleared and stained specimens, and histological material, all of which introduce preparation artifact. In this study we generated high-resolution images (8, 16 and 32 μm isometric voxel size) of the cranial skeletons of species with widened canals (*Aulonocara baenschi*, Cichlidae; *Gymnocephalus cernuus*, Percidae), both widened and narrow canals (*Ericymba buccata*, Cyprinidae), and reduced canals (*Apollonia melanostomus*, Gobiidae) using micro-computed tomography (μCT 40, Scanco Medical, Brütisellen, CH). 2-D slice images and 3-D volume and surface renderings were generated using OsiriX (v. 3.1.6, 64-bit; [www.osirix-viewer.com/](http://www.osirix-viewer.com/)), as were interactive rotation and cutaway movie sequences. Our results confirm that this powerful imaging technology is an invaluable tool for resolving details of lateral line canal morphology, including canal lumen diameter, canal pore location and size, and placement of nerve foramina, and allow quantification of these morphological parameters for comparative, developmental and genetic analyses. Supported by NSF grant IOS-0843307 to JFW.

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## 0021 NIA II, 551 AB, Monday 12 July 2010

James Albert<sup>1</sup>, Paulo Petry<sup>2</sup>, Roberto Reis<sup>3</sup>

<sup>1</sup>University of Louisiana at Lafayette, Lafayette, LA, United States, <sup>2</sup>Museum of Comparative Zoology, Cambridge, MA, United States, <sup>3</sup>Pontifícia Universidade do Rio Grande do Sul, Porto Alegre, RS, Brazil

### **Why Are There So Many Species? The Case of the Neotropical Ichthyofauna**

The Neotropical ichthyofauna is among the richest on Earth, with > 5,600 species representing ~ 10% all living vertebrate species in a similar proportion of the world's total land surface area. How have so many species lineages come to inhabit this region? Many patterns of biodiversity and biogeography in this fauna are general (latitudinal species gradient, species-area relationship), others typical of continental taxa (high species richness in the core, high endemism in the periphery), and yet others distinct for fishes (lineages constrained to individual basins; maximum diversity at lowest elevations). Certain patterns emerge from the unique geographic history (Western

Amazon with highest diversity). Most species have small geographic ranges (> 50% restricted to one ecoregion), and there is high species turnover (gamma diversity) between adjacent ecoregions. Phylogenetic studies indicate that most speciation occurred in allopatry, with vicariations attributed to epeirogenic uplifts, headwater stream captures, and marine transgressions. Vicariant speciation and (geo)dispersal across semi-permeable watersheds contributed to the accumulation of species-rich faunas over geological time scales. Most species assemblages are polyphyletic suggesting diversification through many rounds of divergence in allopatry, followed by range expansions and coexistence or extinction in sympatry. There is little evidence for adaptive radiations, and Amazonian species richness did not arise recently, nor rapidly, nor under geographically restricted conditions. The Neotropical region is unique in retaining the high diversity of the Cretaceous-Paleogene global greenhouse. The fauna is therefore, at least in part, relictual, having persisted through a fortuitous combination of geological, climatological and especially, biogeographic processes.

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### **0156 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010**

R. Craig Albertson<sup>1</sup>, W. James Cooper<sup>1</sup>, James Wernle<sup>2</sup>, Sarah Collines<sup>1</sup>, Kenneth Mann<sup>2</sup>

<sup>1</sup>*Syracuse University, Syracuse, NY, United States*, <sup>2</sup>*SUNY Upstate Medical University, Syracuse, NY, United States*

### **Morphological Integration Shapes Patterns of Craniofacial Divergence among Lake Malawi Cichlid Fishes**

Morphological integration refers to the degree of covariation among traits and has important implications for the potential for evolutionary change. East African cichlid fishes are a paramount example of adaptive morphological radiation, offering a unique opportunity to study integration in the context of rapid evolutionary change. Here we combine a comprehensive morphometric analysis of cichlid craniofacial shape with both finite-element analysis (FEA) of bite force transmission and quantitative genetic analyses to examine the effects of morphological integration on the adaptive radiation of cichlid feeding architecture. We show that the primary axis of variation among Lake Malawi cichlids involves relatively simple, coordinated shifts in jaw length and craniofacial profile. Using FEA we show further that the profile of the cranium affects the ability of this structure to resist forces transmitted from the jaws during biting, revealing a novel role for skull shape in fish feeding mechanics. Finally, quantitative genetic analyses reveal a strong association between these two traits, supporting the hypothesis that the co-evolution of these functionally related phenotypes is due to their shared genetic control. These data shed new light on how genetic architecture has influenced patterns of trophic divergence in this remarkable evolutionary radiation.

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**0766 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Robert Aldridge

*Saint Louis University, St Louis, MO, United States*

**The Costs and Benefits of Pre-Ovulatory and Post-Ovulatory Spermatogenesis in Squamates**

Within the Squamata, sperm production may occur prior to mating (pre-ovulatory spermatogenesis) or following mating (post-ovulatory spermatogenesis). In species with pre-ovulatory spermatogenesis, males are constantly producing sperm; thus, individual males are unlikely to deplete sperm reserves during the mating season. However with this pattern, males may incur significant costs including: 1) If multiple individual females come into estrus early in the spring mating season, some males may not have produced enough sperm to fertilize these females in rapid-succession; 2) Cool temperatures may slow the production of sperm in the spring thus limiting the males fertilization ability; and, 3) If sperm production is energetically costly this may affect the amount of energy available for SSK development and male courtship, territorial, and male searching behaviors. In species with post-ovulatory spermatogenesis, males benefit in several ways: 1) Cool temperatures in the early spring do not affect sperm number; 2) With adequate numbers of sperm stored in the vas deferens, males can use all their available energy for developing the SSK, moving to locate receptive females, growth and maintenance, and (potentially) fighting rival males in intrasexual agonistic encounters; 3) For species that also exhibit a Summer/Fall mating season, males that continue to produce sperm are not likely to deplete the sperm reserves whereas males that exhibit post-ovulatory spermatogenesis might. We examined the frequency of pre- and post-ovulatory spermatogenesis in various families of squamates to determine if the frequency of pre- and post spermatogenesis is related to phylogeny.

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**0767 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Robert Aldridge

*Saint Louis University, St Louis MO, United States*

**Pond Use by Amphibians and Watersnakes**

The goal of this research is to determine if amphibians choose to lay eggs in ponds that have fewer competitors and 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 (*Lithobates catesbeiana*), three were stocked with 25 goldfish (*Carassius auratus*) and (later) bluegill sunfish (*Lepomis macrochirus*), and three served as controls. 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. In mid-June American toad and gray treefrog (*Hyla versicolor* complex) tadpoles were present. In mid-July, the vast majority of the tadpoles were treefrogs of the *Hyla versicolor* complex and cricket frogs (*Acris crepitans*). 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 each year of the study, first year northern watersnakes (*Nerodia sipedon*) were present at the ponds feeding on tadpoles.

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**0673 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD**

Dom Alioto-Jurado

*WVC, Saratoga, CA, United States*

**A Review of the Systematics of the Genus *Squatina* in the Eastern Pacific Ocean**

The systematics of the genus *Squatina* occurring in the Eastern Pacific have been poorly understood and historically the subject of debate. Currently there exist two valid described species *Squatina californica* and *Squatina armata* which are both harvested in fisheries in some parts of their ranges. Effective conservation and management strategies for these species require a fundamental understanding of their population structures. If their geographic ranges contain genetically distinct sub-populations, management guidelines based on large geographic areas could be inappropriate and lead to the permanent loss of small regional populations and any endemic alleles the sub-population may have contained. Observations in previous studies have suggested that a *S. californica* sub-population in the Gulf of California may even constitute a third distinct species. This study's objective is to clearly define how many distinct species occur in the Eastern Pacific and further identify the intra- and interspecific population structures by utilizing classical morphometrics and a suite of polymorphic microsatellite markers. Several specimens from both preserved collections and field expeditions were morphologically measured using a newly modified protocol specifically designed for the body shape of angel sharks and also sampled for genomic DNA fragments. Classical morphometric results will be presented with up to the date completed genetic analysis.

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## **0130 Fish Conservation, Ballroom B, Friday 9 July 2010**

Larry G. Allen<sup>1</sup>, Brad E. Erisman<sup>2</sup>

<sup>1</sup>*California State University, Northridge, Northridge, CA, United States*, <sup>2</sup>*Scripps Institution of Oceanography, La Jolla, CA, United States*

### **The Existence, Importance, and Contribution of Fish Spawning Aggregations to the Ecosystems and Fisheries of the Temperate Waters off Southern California**

Fish spawning aggregations (FSAs), the large and temporary gatherings of fishes for the sole purpose of reproduction, represent one of the most incredible biological phenomena of the marine realm. Spawning aggregations are important biological events crucial to the life history of many reef fishes. They are also very important to commercial and sport fisheries worldwide, because they often involve species of high market value and high-quality meat. We know that tropical FSAs are declining and disappearing worldwide due to overfishing and poor management. However, little attention has been paid to the existence, importance, or contribution of FSAs to the ecosystems and fisheries of temperate zones. This is unfortunate, since this same phenomenon occurs in the vicinity of kelp forests, rocky reefs, and sand flats of temperate zones. The fisheries which target aggregating species in these ecosystems face many of the same conservation and management challenges and require many of the same management strategies that have been identified for tropical species. Moreover, such information is very important to the direction in which fisheries management in California is headed (i.e., ecosystem-based management). The purpose of this talk is to: 1) review some important biological and fishery characteristics of four reef associated fishes (kelp bass, barred sand bass, white seabass, and giant sea bass) that form spawning aggregations off southern California, 2) discuss the interaction between fishing, spawning and the effects of overfishing aggregations, and 3) propose options for management of aggregations based on the success of a recent policy.

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## **0397 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD**

Christine Ambrosino, Timothy Tricas

*University of Hawaii at Manoa, Honolulu, HI, United States*

### **Differential Function Among the Ampullary Subgroups of the Scalloped Hammerhead Shark, *Sphyrna lewini***

Elasmobranchs use their electrosensory system to detect the electrical fields produced by hidden prey or potential mates. The electrosensory system of elasmobranchs consists of

discrete networks of gel-filled canals that connect to specific subgroups of ampullae, which are subcutaneous structures that contain the receptor cells. The purpose of this project is to test the functional subgroup hypothesis that predicts functional differences among the ampullary subgroups. Gross dissection of the ampullary system in the scalloped hammerhead shark, *Sphyrna lewini*, provided an accurate map of the pore fields and their neuroanatomical relationship to each ampullary subgroup. The orientation behavior of sharks to electrical dipoles was digitally recorded on video. The ampullary pores of these same sharks were then inactivated with non-conductive gel and again exposed to the same dipoles to observe potential changes in orientation behavior. The majority of sharks oriented to the dipole less than 10cm away and at an angle of more than 60 degrees from the dipole axis. Spiraling was the most frequent orientation behavior exhibited, followed by turning. The non-conductive gel was sufficient to inhibit the electroreceptor system and affected the shark's ability to orient to an electric field. Orientation frequency decreased after subgroup inactivation. The accuracy of sharks orienting to the active dipole also decreased. These responses to ablation of specific ampullary subgroups demonstrate that partial inactivation of electroreceptor fields decreases the reaction of an elasmobranch to bioelectric fields and loss of subgroup function affects foraging accuracy.

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#### **0585 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010**

Maria Clara P. Amorim<sup>1</sup>, José Miguel Simões<sup>1</sup>, Andreia Ramos<sup>2</sup>, Paulo J. Fonseca<sup>2</sup>

<sup>1</sup>*Instituto Superior de Psicologia Aplicada, Unidade de Investigação em Eco-Etologia, Lisbon, Portugal*, <sup>2</sup>*Faculdade de Ciências da Universidade de Lisboa, Centro de Biologia Ambiental, Lisbon, Portugal*

#### **Variability in the Mating Call of the Lusitanian Toadfish, *Halobatrachus didactylus*: Propagation Constraints for Mate Attraction and Choice**

During the reproductive season, Lusitanian toadfish males establish nests in shallow water and emit an advertisement call (the boatwhistle) to attract females for breeding. Previous studies suggest that the boatwhistles are individually distinct. We studied boatwhistle variability in short (minutes) and longer time (days) scales and related boatwhistle acoustic features with male physical characteristics. We also broadcast the boatwhistles of different males and measured propagation loss at different water depths to estimate the distance over which a female can distinguish an individual male's call. We recorded 22 males during the breeding season that spontaneously occupied artificial intertidal nests in Tagus River estuary (Portugal). Boatwhistles showed individuality in short periods of time. Pulse period, sound duration and amplitude modulation were the acoustic feature that most contributed to discriminate among males. Intra-male signal variability increased when considering a longer time scale but significant differences could still be found among males. Calling rate and calling tenure (% of time spent calling) strongly reflected male condition (lipid content of somatic muscles) and also larger sonic muscles and gonads. Males in better condition (body lipid and liver mass)

contracted the sonic muscles at a faster rate (shorter pulse periods). Males with heavier sonic muscles also produced boatwhistles with higher amplitude modulation. These results suggest that calling activity, pulse period and amplitude modulation could be important for mate choice. The propagation of boatwhistles is under analysis. The potential acoustic communication range of breeding males will be discussed.

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**0496 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Christopher Anderson

*University of Texas at El Paso, El Paso, TX, United States*

**Phylogeography of the Black-Tailed Rattlesnake (*Crotalus molossus* Baird and Girard, 1853) in the Northern Chihuahuan Desert**

The northern black-tailed rattlesnake (*Crotalus molossus molossus*) is the nominate member of a species complex currently represented by four subspecies occurring through central Mexico and the southwestern United States. Recently, a phylogenetic study of the Neotropical rattlesnake complex (*C. durissus* and *C. simus*) based on three mtDNA genes provided evidence that *C. molossus* is polyphyletic. The Mexican west-coast rattlesnake (*C. basiliscus*) and the Totonacan rattlesnake (*C. totonacus*) were recovered as sister to western and eastern clades of *C. m. molossus* respectively. Herein, I use maximum-likelihood (ML) and Bayesian inference (BI) analyses of four mitochondrial genes (cyt b, ND4, ATPase 6 and 8) to: (1) identify phylogeographic patterns within eastern populations of *C. m. molossus*; (2) investigate the relationship between eastern and western *C. m. molossus* clades; and (3) elucidate the relationship between *C. molossus* and *C. totonacus*. Preliminary ML and BI analyses of a 730 bp section of cytochrome b suggest: (1) *C. totonacus* is sister to eastern populations of *C. m. molossus*; (2) *C. m. molossus* is polyphyletic; and (3) two well-supported clades of *C. m. molossus* are represented in the northern Chihuahuan desert. Principal components analyses will be implemented to discern patterns of morphological variation that correspond to the geographic clade boundaries identified by my molecular analyses.

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0752 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Corey Anderson<sup>1</sup>, Dennis Jorgensen<sup>1</sup>

<sup>1</sup>Arizona State University, Tempe, Arizona, United States, <sup>2</sup>World Wildlife Fund, Zortman, Montana, United States

### **Microsatellite DNA Loci Suggest High Levels of Gene flow Among Distantly Spaced Overwintering Hibernacula of the Prairie Rattlesnake in Alberta, Canada**

We used eight microsatellite DNA loci to examine patterns of genetic variation and gene flow among two sets of overwintering hibernacula of the Prairie Rattlesnake, located approximately 28 km apart, near Medicine Hat, Alberta. All loci were polymorphic, with the number of alleles per locus ranging between 3 and 11. Extreme heterozygote deficiencies that might be indicative of null alleles were detected at three of eight loci (which were not included in further population genetic analyses). For the five loci that met our criteria for analysis, allelic richness ranged between 4.71 and 5.26; private allelic richness ranged between 0.16 and 0.49. When hibernacula were grouped based on geographic proximity, allelic richness measured 5.78 for Group 1 and 5.53 for Group 2; private allelic richness measured 0.93 for Group 1 and 0.68 for Group 2. The proportion of genetic variance in the total population due to variation among hibernacula ( $q \approx F_{ST}$ ) measured 0.026 (95% CI: 0.002 to 0.049), but Bayesian K-means clustering algorithms based on individuals and groups of individuals failed to detect any real structure in the data set. Interestingly, patterns of genetic variation did not differ substantially between males and females, a result consistent with behavioral data from the same sample population, indicating extreme long distance movements by some females. In general, results do not support the hypothesis that gene flow is restricted among proximal overwintering hibernacula, even for populations near the extreme northern latitudes, where hibernacula tend to be large and distantly spaced.

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## 0240 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Paul Anderson<sup>1</sup>, Paul Anderson<sup>2</sup>, Erin Adams<sup>1</sup>, Erin Adams<sup>2</sup>, William Lindberg<sup>1</sup>, David Mann<sup>3</sup>

<sup>1</sup>University of Florida IFAS Program in Fisheries and Aquatic Sciences, Gainesville, FL, United States, <sup>2</sup>The Florida Aquarium Center for Conservation, Tampa, FL, United States, <sup>3</sup>University of South Florida College of Marine Sciences, St. Petersburg, FL, United States

### **Hearing and Acoustic Communication in the Lined Seahorse (*Hippocampus erectus*)**

Seahorses produce a click; a stridulation of the posterior process of the supraoccipital against the coronet. We characterized the acoustic nature of 78 clicks recorded from 10 lined seahorses (*Hippocampus erectus*). In terms of pressure, peak frequency averaged  $210 \pm 23$  Hz at an average peak amplitude of  $95.9 \pm 0.8$  dB (re:  $1 \mu\text{Pa}$ ) in the frequency domain. In terms of particle acceleration, peak frequency averaged  $265 \pm 22$  (mean  $\pm$  SE) Hz at an average peak amplitude of  $1.52 \times 10^{-3} \pm 1.87 \times 10^{-4}$  m s<sup>-1</sup>. Broadband hearing thresholds estimated from auditory evoked potentials (AEPs) of 11 *H. erectus* are  $92.0 \pm 1.5$  dB (re:  $1 \mu\text{Pa}$ ) and  $1.73 \times 10^{-4} \pm 3.8 \times 10^{-5}$  m s<sup>-1</sup> at 200 Hz; suggesting conspecific audition, particularly in terms of particle acceleration. Also, feeding and courtship behaviors of surgically muted seahorses were compared against controls. Muted seahorses did not suffer reduced proficiency when preying on live *Mysidopsis bahia*, discounting the click's role in prey capture. One-hour observations of male-female pairs over five days revealed an increase in clicking among males over time, concomitant with other documented courtship behaviors. Courtship of muted pairs was affected as characterized by cessation of pointing, a late courtship behavior, in females during the latter days of courtship, and no increase among males in the number of approaches to females over time. These results suggest that the click may be an acoustic signal in a behavioral repertoire displayed to synchronize reproductive states in preparation for copulation.

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## 0243 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Paul Anderson<sup>1</sup>, Erin Tate<sup>1</sup>, Daniel Huber<sup>2</sup>, Danielle Noaker<sup>2</sup>, Ilze Berzins<sup>3</sup>

<sup>1</sup>The Florida Aquarium Center for Conservation, Tampa, FL, United States, <sup>2</sup>The University of Tampa, Tampa, FL, United States, <sup>3</sup>John G. Shedd Aquarium, Chicago, IL, United States

### **Potential Etiologies of Spinal Deformity in Captive Sandtiger Sharks (*Carcharias taurus*)**

Seventeen U.S. public aquaria participated in a study of their resident sandtiger sharks (*Carcharias taurus*) to evaluate etiologies of spinal deformity, a prevalent disease in captive specimens of this species. Data and/or tissue samples from up to 59 healthy and 21 afflicted specimens were submitted (prevalence: 26%). Sharks caught off Rhode Island and/or by pound net demonstrated a higher prevalence of deformity than sharks caught from other areas or with hook and line, meriting further investigation into different collectors' methods. Sharks became afflicted by a median of 4 years in captivity, while healthy sharks persisted in captivity for a median of 10 years. Aquaria with smaller lengths (or diameters) had populations with higher disease prevalence. Behaviorally, all captive sharks spent a median of 98.8% of time swimming and only 0.6% gliding, lacking parity between swimming and gliding that other species naturally demonstrate. Furthermore, afflicted sharks spent less time gliding than healthy sharks. All captive sharks swam in one asymmetrical direction (either clockwise or counter-clockwise) a median of 99.7% of the time. Also, afflicted sharks carried more body mass per unit length. Biomechanical analyses revealed that healthy animals demonstrated greater flexural stiffness of intact vertebral columns, and greater compressive stiffness, yield strength, yield strain, and ultimate strength of individual vertebrae. However, the compressive stiffness and ultimate strength of vertebrae from healthy specimens were still lower than those of other shark species for which data is available.

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## 0041 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

W. Gary Anderson

*University of Manitoba, Winnipeg, Canada*

### **Probing the Depths: What Can the Endocrine Stress Response in Teleost Fishes Tell Us about Stress in Elasmobranch Fishes**

There have been numerous review articles published on various aspects of the endocrine stress response in fish. Topics have ranged from discussing the stressor, be it air exposure, contaminants, or temperature to specific endocrine pathways, be they the sympathetic chromaffin axis or the much studied hypothalamic pituitary interrenal axis.

Corticotropin releasing hormone, urotensin, cortisol, growth hormone, catecholamines and deoxycorticosterone are just some of the hormones known to be involved in the stress response in fish. In the last decade the advancement of molecular tools has significantly expanded our understanding and now genomic and proteomic tools are commonly used to examine receptor and enzyme expression and activity. Despite these advances the word fish in many of the titles of these review articles is a misnomer. There is one taxon that lags way behind in our understating of the endocrine stress response. The presence of 1 $\alpha$  hydroxycorticosterone in elasmobranchs and our apparent inability to synthesise the steroid based on published techniques has significantly hindered the examination of the stress response in elasmobranch fish. A comparison or perhaps more appropriately, lack thereof, of the endocrine stress response between elasmobranchs and other fish taxon will be discussed.

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### **0440 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Wesley Anderson, Emily Henry, Gad Perry

*Texas Tech University, Lubbock, TX, United States*

### **Ecology of the Texas Horned Lizard in Two Previously Understudied Parts of Its Range**

The Texas horned lizard (*Phrynosoma cornutum*) is considered threatened in Texas and has declined over much of its range. Significant potential geographical variation suggests that local data may be essential for elucidating possible causes for the decline and determining evolutionary influences on life history. From 2007-2009, we monitored two populations of horned lizards in Central Texas on a Texas Army National Guard facility near Brownwood and a private ranch near Mason, TX. Disregarding hatchlings, a total of 70 lizards were encountered and 22 were radio-tracked. Average snout-vent length (SVL) for the Brownwood population supports the existence of a latitudinal sex gradient, whereas the average SVL for the Mason population is significantly smaller than expected. Average SVL of identified females (80.5 mm, 75.6 mm) is significantly larger than that of males (72.33 mm, 63.4 mm) for the Brownwood and Mason populations, respectively. Growth rate is significantly correlated with SVL, with smaller lizards having much higher growth rates. Eggs were laid from mid May into the middle of July, and mortality directly associated with egg deposition was recorded. Aspects of the ecology in these two populations are compared to a reference population studied from 2005-2008 in the Rolling Plains ecoregion near Post, TX where data on 389 lizards were collected. Although various life history aspects among these populations are similar, densities at both sites in Central Texas appear much lower.

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## **0438 SSAR SEIBERT CONSERVATION AWARD, 555 AB, Friday 9 July 2010**

Wesley Anderson, Gad Perry, Christopher Salice

*Texas Tech University, Lubbock, TX, United States*

### **Vital Rate Sensitivity Analysis of the Texas Horned Lizard (*Phrynosoma cornutum*)**

The Texas horned lizard, *Phrynosoma cornutum*, has undergone precipitous range-wide population declines over the last several decades - particularly in Eastern and Central Texas. Various hypotheses have been posited for these declines including habitat loss, collection for the pet trade, exposure to pesticides, and the effects of red imported fire ants. At the present all these hypotheses remain largely untested. We conducted a population viability analysis to better understand how some of the abovementioned factors could impact populations of *P. cornutum*. Life history data were obtained from the literature and unpublished data from an ongoing study in Central Texas. We constructed an age-structured matrix model to estimate population growth rate and conducted an elasticity analysis to determine which ages are particularly important for population growth. Our preliminary results show that *P. cornutum* populations are particularly impacted by survival of juvenile lizards and that populations do not likely have a high capacity for growth. Although results of this study do not necessarily suggest we reject any of the aforementioned hypotheses outright, they do highlight our incomplete understanding of this species' biology. Researchers should make a concerted effort to better understand the habits of young lizards - particularly dietary composition and cause-specific mortality - to gain further insight into the decline of this species.

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## **0319 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Paul Andreadis<sup>1</sup>, Maulik Patel<sup>2</sup>

<sup>1</sup>*Stetson University, Biology Dept., DeLand, FL 32723, United States*, <sup>2</sup>*Collier-Seminole State Park, 20200 E. Tamiami Trail, Naples, FL 34114, United States*

### **A Noteworthy Episode of Python Activity in Southwest Florida**

If the factors affecting Burmese Python (*Python molurus bivittatus*) surface activity were better understood, control/management activities could be more effectively implemented. Southern Florida experienced a prolonged period of cold weather in January 2010. The minimum air temperature at Collier-Seminole State Park [CSSP] dropped below 5.0 °C on 03 January, and nightly minima stayed below this level till 14 January (lowest minimum -2.8 °C). In all of 2009, a total of 8 python sightings was recorded in or near CSSP. But from 16-31 January 2010, 6 python sightings were recorded. Size estimates for four of these snakes ranged from 2.4-3.7 m in total length; a fifth was large enough to have been hit by a car but able to crawl off the road. Thus,

most of the sighted snakes were of adult size. There are multiple explanations for this apparent increase in activity. Snakes may have been injured by or become sick because of the cold, e.g. developed respiratory infections. After the weather warmed, many may have been seeking optimal basking sites in order to recover. Alternatively, the activity may reflect typical reproductive behavior. The combination of short days and cold temperatures may normally trigger winter reproductive movements, e.g. mate seeking. But the duration, severity, and timing of the cold period may have synchronized winter movements to a greater extent than in previous years. In southern Florida, it may be especially effective to conduct python surveys or control activities right after a winter cold spell breaks.

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### **0330 Fish Life History, 551 AB, Friday 9 July 2010**

Allen H. Andrews, Robert L. Humphreys, Edward E. DeMartini, Ryan S. Nichols

*NOAA Fisheries - Pacific Islands Fisheries Science Center, Aiea, Hawaii, United States*

### **A Long-Lived Life History for Opakapaka (*Pristipomoides filamentosus*) Based on Lead-Radium and Bomb Radiocarbon Dating**

Age determination for the Hawaiian snapper or opakapaka (*Pristipomoides filamentosus*) from the Hawaiian Archipelago has been an ongoing problem because otoliths lack well developed annual growth zones. Early growth was well documented and validated otolith growth rates were successful for the first few years of growth using daily increments, but the determination of age for the largest and oldest adults was still in question. Ralston and Miyamoto (1983) developed a relationship called numerical integration of daily increment widths as a model for age prediction from otolith dimensions, which led to a maximum reported age of 18 years; however, the largest fish in that study were less than the maximum length for this species in the region. This age has been reported as the maximum age for this species, but the 18-year estimate was based on clearly stated assumptions about otolith growth during adult stages and caution was suggested for age determined in this manner for the largest fish. Lead-radium and bomb radiocarbon dating are two methods that can provide an independent estimate of age for adult otoliths. In this study, application of these methods indicated the longevity of opakapaka was greater and exceeded to 40 years, with support for a long-lived age and growth interpretation that lends credence to the cautionary statements of Ralston and Miyamoto (1983). Other life history aspects will be discussed in light of the revised age and growth structure of opakapaka.

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## 0148 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Kimberly M. Andrews<sup>1</sup>, Priya Nanjappa<sup>2</sup>

<sup>1</sup>*UGA Savannah River Ecology Lab, Aiken, SC, United States*, <sup>2</sup>*Association of Fish and Wildlife Agencies, Washington, DC, United States*

### **Guiding the Way: Enhancing Ecosystem Connectivity through Transportation Planning**

Roads are the most common manifestation of urbanization, providing connectivity within and between rural and heavily populated areas. Ecologists, engineers, government officials, and the general public are increasingly aware that roads create various ecological disturbances and barriers. Further, as natural habitat continues to be developed for homes and businesses, and as transportation agencies consider climate change planning strategies, opportunities exist to preserve and to restore connectivity for animals that are forced to move to seek suitable habitat or food resources. Proactive transportation planning to enhance habitat connectivity, public education, and communication among professional sectors of society are the most cost-effective means to find ways to minimize, mitigate, and even prevent road impacts. Much research exists on wildlife-crossing structures and related needs with respect to large vertebrates. However, transportation professionals are increasing their focus on road ecology research involving small vertebrates, such as amphibians, reptiles, fish, and small mammals due to these organisms' unique biological characteristics that warrant revised planning considerations. The physiological, ecological, and behavioral traits that characterize amphibians and reptiles, in particular, enhance their susceptibility to the habitat and environmental alterations associated with road development. Thus, herpetofauna can serve as models for protocols to resolve wildlife-transportation conflicts, and has broad applications at several scales that can be extended to other small vertebrate taxa, such as fish and small mammals. I will present an overview of the state of our knowledge in road ecology, and briefly address the challenges and emerging considerations to guide transportation planning and to ensure connectivity.

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## 0152 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Kimberly M. Andrews<sup>1</sup>, Tracey D. Tuberville<sup>1</sup>, James D. Westervelt<sup>2</sup>, John Macey<sup>3</sup>, Larry Carlile<sup>3</sup>

<sup>1</sup>UGA Savannah River Ecology Lab, Aiken, SC, United States, <sup>2</sup>US Army ERDC, Champaign, IL, United States, <sup>3</sup>Fort Stewart Army Installation, Ft. Stewart, GA, United States

### **Using Individual-Based Modeling to Investigate the Influence of Landscape Variables on Persistence of Gopher Tortoise Populations**

Population viability analysis (PVA) is often used to predict the effects of proposed management actions or of future landscape changes on target species. Unfortunately, PVA requires detailed life history data, which are often lacking for rare species, particularly long-lived species such as the gopher tortoise (*Gopherus polyphemus*). In some cases, however, the natural history and individual behavior of the target species is well-characterized. Using data published in the literature, we have developed a spatially explicit individual behavior model (IBM) for gopher tortoises using the program NetLogo®, and we illustrate how we apply it in a theoretical landscape. By tracking the behavior of many individuals over time, population-level dynamics can emerge. We conducted model simulations under a range of landscape conditions that varied in patch size, distance between patches, and patch quality to examine the effects of these landscape variables on persistence of gopher tortoise populations. Our results from the individual-based modeling will be used to make management recommendations and will be compared to minimum reserve requirements developed using other analytical techniques and from field data reported in the literature.

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## 0697 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Maria Lúcia Araújo<sup>1</sup>, Rosângela Lessa<sup>2</sup>, Sara Melo<sup>3</sup>, Luiz Alberto Monjeló<sup>4</sup>

<sup>1</sup>Universidade do Estado do Amazonas, Manaus, Amazonas, Brazil, <sup>2</sup>Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brazil, <sup>3</sup>Secretaria de Meio Ambiente, Rio Branco, Acre, Brazil, <sup>4</sup>Universidade Federal do Amazonas, Manaus, Amazonas, Brazil

### **Age and Growth of the Freshwater Stingray *Paratrygon aiereba* (Müller and Henle, 1841) in Rio Negro Basin, Amazonas, Brazil**

Age and growth estimates were determined for the freshwater stingray *Paratrygon aiereba* from Rio Negro Basin, Brazil. Age estimates were obtained through vertebral centra analysis of 113 stingrays. We verified age estimates through marginal increment analysis of centra. Sizes of sampled stingrays ranged from 15.3 to 93.0 cm disc width. Six

models were fitted to disc width-at-age data: von Bertalanffy growth model (VBGM), generalized VBGM, VBGM using disc width-at-birth, Gompertz growth model, Richards growth model, and Schnute growth model. The best model was selected by small-sample bias-corrected form of Akaike information criterion (AICc). The Akaike weight  $w_i$  of each model was calculated to quantify the plausibility of each model. The average model was estimated based on  $w_i$ . Using multi-model inference (MMI) approach, the model-averaged asymptotic length  $DW_\infty$  and unconditional standard error were determined. The Gompertz model ( $w_i=51.7\%$ ;  $DW_\infty=97.3$ ;  $k=0.146$ ) and the Richard model ( $w_i=46.6\%$ ,  $DW_\infty=99.1$ ;  $k=0.15$ ) were found to be the best models according  $w_i$ . The generalized VBGM was least supported among the set of candidate models with  $w_i=1.15\%$  ( $DW_\infty=96.38$ ;  $k=0.124$ ). VBGM ( $w_i=0.35\%$ ,  $DW_\infty=129.4$ ;  $k=0.053$ ), VBGM using known disc width-at-birth ( $w_i=0.15\%$ ,  $DW_\infty=124.2$ ;  $k=0.056$ ), were very weakly supported, and Schnute growth model had no support. The model average  $DW_\infty$  was 96.53 ( $\pm CI 95\%=13.04$ ).  $DW_\infty$  values in both best models are similar to highest DW in sample. There were no observed differences in growth of males and females. Male and female *P. aiereba* mature at approximately 6 and 7 years of age, respectively. These estimates form the basis of work for management of this species.

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## **0265 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010; ASIH STOYE AWARD GENETICS, DEVELOPMENT & MORPHOLOGY**

Jessica Arbour

*University of Toronto, Toronto, Ontario, Canada*

### **Comparative Functional Morphology of Neotropical Geophagine Cichlids**

Geophagines are a species rich clade of Neotropical cichlids with high morphological, behavioural and trophic diversity. Recent phylogenetic studies suggest that this group diversified through adaptive radiation. We examined how the evolution of feeding morphology may be associated with the diversification of Geophagine cichlids. We analyzed functional features related to prey capture, suction feeding and post-capture prey processing. We measured biomechanical and morphometric variables linked with the ability of the feeding apparatus to produce force, transmit force and motion, and distribute or resist these forces. Principal component analyses were carried out on these variables to examine major axes of diversification in geophagine morphospace. We found a gradient of variation between high velocity transmission, high jaw muscle mass and a vice-like bite characteristic of piscivores, and high force transmission, low jaw muscle mass and a scissor-like bite characteristic of fishes with more benthic diets. Substrate-sifting genera (*Geophagus*, *Satanoperca* and *Retroculus*) varied significantly in functional traits despite their frequently specialized diet. Development of novel functional attributes is especially noticeable within the predatory genus *Crenicichla* and these novelties may have influenced the diversification of this species rich group (80+ species). The relatively low overlap between monophyletic groups of geophagines within the observed morphospace suggests that different clades have become

biomechanically specialized for the use of different portions of niche space. The evolution of these specialized functional traits may have characterized the early divergence of the major lineages of geophagine cichlids, a pattern consistent with the hypothesized Late Cretaceous adaptive radiation of this tribe.

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### **0343 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010**

Victoria Arch<sup>1</sup>, Dwayne Simmons<sup>1</sup>, Bryan Stuart<sup>2</sup>, Patricia Quinones<sup>1</sup>, Peter Narins<sup>1</sup>

<sup>1</sup>UCLA, Los Angeles, CA, United States, <sup>2</sup>North Carolina Museum of Natural Sciences, Raleigh, NC, United States

### **Morphological Correlates of High-Frequency Hearing Sensitivity in Frogs Inhabiting Noisy Environments**

Environmental noise is ubiquitous in the habitats of sonically communicating organisms, and can mask intraspecific vocalizations. The risk of masking is contingent on the frequency overlap between the signal and the ambient noise. The frogs *Odorrana tormota* and *Huia cavitympanum* call adjacent to rushing streams that produce high-intensity noise spanning the human audible spectrum (ca. 20 Hz - 20 kHz). Both species communicate ultrasonically, making them the first non-mammalian vertebrates known to do so. We hypothesize that these unrelated species converged on ultrasonic communication to increase the signal-to-noise ratio of their calls. We used immunohistochemistry and confocal microscopy to compare the morphology of the auditory inner ears of *H. cavitympanum* with that of *Rana pipiens*, a species with an upper detection limit of ca. 3 kHz. Our data suggest that small-scale functional modifications of the *H. cavitympanum* ear subserve high-frequency detection. We also examined the inner-ear morphology of three sympatric species of Lao torrent frogs - *O. chloronota*, *O. nasica*, and *Amolops daorum* - that live in an acoustic environment resembling those of the "ultrasonic" frogs. Our data show that the *O. chloronota* auditory organs resemble those of *H. cavitympanum* in every morphological feature measured, suggesting that this species also detects high-frequencies. Further exploration of the Lao species' communication systems will be necessary to determine whether high-frequency hearing can be predicted from morphological properties. These data present the intriguing possibility of convergence in the communication behavior and auditory physiology of species that evolved in environments characterized by broadband background noise.

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## 0287 General Ichthyology, Ballroom B, Friday 9 July 2010

Nichole Ares, David Taylor

*Roger Williams University, Bristol, RI, United States*

### **Mercury Accumulation in Brain and Muscle Tissues of Bluefish (*Pomatomus saltatrix*) and Tautog (*Tautoga onitis*)**

Mercury (Hg) is a toxic environmental contaminant that negatively affects human health, and exposure occurs mainly through fish consumption. Previous research has been dedicated to measuring Hg levels in muscle filets of edible fish, including the bluefish (*Pomatomus saltatrix*) and tautog (*Tautoga onitis*). While Hg contamination in the muscle tissue of these species has been reported, there is little information on Hg concentrations in other tissues, e.g., brain and liver. The objectives of this investigation were to: (1) examine Hg bioaccumulation in brain and muscle of bluefish and tautog, and (2) evaluate the relationship between Hg levels in the two tissue types. From June to August 2007-2009, target fish were collected from the Narragansett Bay (RI, USA), and total Hg was measured in excised muscle and brain tissue using combustion atomic-absorption spectroscopy (ppm dry wt). For both species, muscle and brain Hg concentrations were positively correlated with fish length (Blue:  $R^2=0.110$ ,  $n=7$ ; Taut:  $R^2=0.256$ ,  $n=17$ ), indicating that the Hg bioaccumulates in both tissues. There was also a positive correlation between muscle and brain Hg concentrations for both target fish (Blue:  $R^2=0.868$ ,  $n=7$ ; Taut:  $R^2=0.468$ ,  $n=17$ ). Among these relationships, tautog experienced elevated brain Hg concentrations relative to bluefish, which can be attributed to this species greater age-at-catch; hence tautog had a protracted period in which they accumulated Hg. Future research will include the analysis of target fish livers, as well as the possible role of selenium in mitigating the toxic effects of Hg.

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## 0324 Fish Evolution, 555 AB, Saturday 10 July 2010

Jonathan Armbruster

*Auburn University, Auburn, AL, United States*

### **Linear Thinking and its Perils in Understanding the Evolution of Amblyopsid Cavfishes (Teleostei: Percopsiformes)**

The Amblyopsidae is a small family of fishes, most of which are confined to caves in the United States. Amblyopsids appear to show a continuing progression from surface to subterranean life: *Chologaster cornuta* is epigean, *Forbesichthys agassizii* is troglomorphic, spending time in caves, but leaving the caves to feed at night, and *Typhlichthys subterraneus*, *Amblyopsis rosae*, *A. spelaea*, and *Speoplatyrhinus poulsoni* are troglitic, showing progressive adaptation for caves. Several hypotheses of cavefish evolution have been published, but have not been explored phylogenetically. These include

beliefs that cavefishes progressively became more troglobitic and that the more derived cavefishes have been in caves longer. These hypotheses provide testable models of cavefish evolution. To test these hypotheses, morphological phylogenies were elucidated using skeletal characters that do not seem to be associated with life in caves alone and together with three cave adaptations. The two analyses differed only in the placement of *Amblyopsis spelaea*: sister to other troglobitic species when cave adaptations were included and sister to all other amblyopsids when they were excluded. *Amblyopsis roseae*, *Typhlichthys*, and *Speoplatyrhinus* formed a trichotomy and *Forbesichthys* and *Chologaster* were sister taxa in both analyses. Wilcoxon signed rank tests rejected all previous models of cavefish phylogeny except the time in caves model if cave adaptations were excluded. The belief in progressive adaptation to life in caves may not be correct for the Amblyopsidae as a whole, and, when cave adaptations were excluded, the phylogeny suggests that the primitive condition for the Amblyopsidae is troglobitic.

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### **0325 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010**

Lilianne Arsenault, Tom Herman, Steve Mockford, Mike Lawton, Jennifer McNeil

*Acadia University, Wolfville, Nova Scotia, Canada*

### **Post-release Survival, Growth, and Movement Patterns of Blanding's Turtle (*Emydoidea blandingii*) Headstarts in Nova Scotia**

Nova Scotia supports a small population complex of Blanding's turtle at the northeastern periphery of the species range. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has listed this turtle as Endangered in Nova Scotia. Ongoing efforts to conserve this population have included species, habitat and nest protection, public stewardship, and headstarting. Despite past and ongoing conservation efforts, recruitment of juveniles to the breeding population remains low. A recent population viability analysis indicates that without further intervention the population will continue to decline. In response, a management strategy involving nest protection, artificial egg incubation, and a two year captive rearing regime was undertaken to bolster juvenile recruitment. The present study investigates the ability of headstarted turtles to adapt to their new environment following release. Post-release survival, growth, movement, behavior, and habitat use were examined in headstarts and wild juvenile turtles. Preliminary results suggest that headstarts released to their natural habitats have similar survival, growth, and movement patterns to those of wild juvenile turtles. While these findings indicate short-term success, replicated releases and sustained monitoring are required to measure the long-term effectiveness of the headstart program.

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**0282 Fish Evolution, 555 AB, Saturday 10 July 2010; ASIH STOYE AWARD  
GENERAL ICHTHYOLOGY**

Neil Aschliman

*Florida State University, Tallahassee, Florida, United States*

**A New Framework for Interpreting the Evolution of Skates and Rays  
(Chondrichthyes: Batoidea)**

Chondrichthyan fishes are 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 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. We describe a conservative batoid phylogeny recovered using DNA and protein sequence data. Previous molecular phylogenies of batoids were hindered by very limited taxon sampling and few sequence data. We addressed these issues by assembling large sequence datasets including two independent nuclear markers and the complete protein-coding complement of the mitochondrial genome, sampling densely and evenly across batoid families. Trees were recovered using various phylogenetic methods including custom Bayesian Dirichlet priors. We accommodated systematic biases in the data, estimated divergence times and evaluated the prevailing signal against morphology and the fossil record. A number of well-supported clades were recovered. Some are novel, while others are anticipated by morphology.

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**0356 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010**

Henry Astley<sup>1</sup>, Emily Abbott<sup>1</sup>, Richard Marsh<sup>2</sup>, Emanuel Azizi<sup>1</sup>, Thomas Roberts<sup>1</sup>

<sup>1</sup>*Brown University, Providence, RI, United States*, <sup>2</sup>*Northeastern University, Boston, MA, United States*

**The Celebrated Jumping Frogs of Calaveras County: Determining Maximal Jumping Performance in Frogs**

Maximal performance is an essential metric for understanding many aspects of an organism's biology, including physiology, biomechanics, ecology, life history, and evolution. Unfortunately, sub-optimal laboratory conditions, stimuli, and animal motivation can all lead to underestimation of maximal performance. Maximal jump

distance of frogs offers an ideal system for linking muscle physiology and biomechanics to ecologically relevant organismal performance, but there is wide variation in “maximal” jump distances reported in the literature, as well as exceptional records from frog-jumping contests. To gain insight into maximal animal performance, we recorded 3449 bullfrog (*Rana catesbeiana*) jumps over three days at the 82<sup>nd</sup> Calaveras County Jumping Frog Jubilee, using an HD camcorder, a large calibration grid and a perspective transformation algorithm to achieve high measurement accuracy (95% CI =  $\pm 1.6$  cm). A total of 54% of recorded jumps surpassed the maximum jump distance in the literature (1.295 meters, Zug 1978), and the longest jump was 2.2 meters, requiring a peak power output of over 1000 Watts per kg muscle mass. Such high power output could only be achieved by storage of muscular energy in elastic elements such as tendons. Using resampling, we estimated sample sizes necessary to capture jumps of varying proportions of maximal observed performance. This new data suggests both a re-evaluation of our methods of determining maximal performance, particularly sample size, and caution in the use of maximal performance measurements in our understanding of the physiology and biology of organisms. Supported by NSF grant 642428 to TJR.

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### **0355 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Henry Astley, Thomas Roberts

*Brown University, Providence, RI, United States*

#### **Decoupling of Muscle Shortening and Joint Kinematics During Frog Jumping**

Elastic tendons can decouple changes in muscle length from changes in joint angle, allowing the muscle to function at closer to optimal conditions for force production and allowing elastic energy storage in the tendon. While elastic tendons have been well-studied in steady-speed locomotion, their role in acceleration is not well understood. The remarkable jumping ability of anurans is an excellent system for addressing this issue due to well-characterized muscle physiology, extensive prior work, static pre-jump posture, and recent data suggesting that elastic energy storage in tendons may occur. In order to test the hypothesis that elastic tendons decouple muscle contraction from joint movement during accelerations, we quantified simultaneous joint movement and muscle contraction in the ankle of *Rana pipiens* using X-ray Reconstruction Of Moving Morphology (XROMM), a high-speed biplanar X-ray cinefluoroscopy system, with radiopaque markers implanted into the muscle and bones to simultaneously track muscle strain and joint movement. Preliminary data from 7 jumps shows 7.7% ( $\pm 0.8\%$ ) shortening strain of the muscle fascicle preceding any substantial joint movement, followed by a 38.7° ( $\pm 3.4^\circ$ ) joint extension with minimal muscle fascicle length change, after which both joint and muscle display rapid change. During the period of minimal fascicle velocity, joint angular acceleration was very high. These data indicate a decoupling of muscle strain from joint angle as well as the storage of strain energy in the tendon. Funded by NSF Grant 064242.

## **0008 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010**

Peter Auster<sup>1</sup>, Laura Kracker<sup>2</sup>, Greg McFall<sup>3</sup>

<sup>1</sup>*University of Connecticut, Groton, CT, United States*, <sup>2</sup>*NOAA/NOS, Charleston, SC, United States*, <sup>3</sup>*NOAA/GRNMS, Savannah, GA, United States*

### **Behavior Webs Linking Mid-water and Demersal Piscivores at a Subtropical Reef**

Pelagic and demersal guilds of piscivorous fishes are linked by a variety of biological and physical processes that mediate interactions with common prey species. Understanding the behaviors of predators and prey can provide insight into the conditions that make such linkages possible. Here we report on the behaviors of mid-water piscivorous fishes and the responses of prey that produce feeding opportunities for demersal piscivorous reef fishes off the coast of Georgia (northwest Atlantic Ocean). Prey taxa reduced nearest neighbor distances and retreated towards the seafloor during predatory attacks by mid-water fishes. Demersal fishes subsequently attacked and consumed prey in these ephemeral high density patches. In addition, large schools and aggregations of fishes unassociated with predation events channeled movements of prey fishes and provided cover for ambush by predators. Direct underwater observations by divers as well as active hydroacoustic approaches provided insights into such interactions. If the predator-prey interactions of demersal piscivorous fishes are commonly mediated by the predatory behavior of midwater piscivorous fishes and their prey, such indirect facilitative behaviors may be important in terms of the population processes (e.g., prey consumption and growth rates) of these demersal fishes.

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## **0027 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Peter Auster<sup>1</sup>, Jon Moore<sup>2</sup>, Ken Sulak<sup>3</sup>

<sup>1</sup>*University of Connecticut, Groton, Connecticut, United States*, <sup>2</sup>*Florida Atlantic University, Jupiter, Florida, United States*, <sup>3</sup>*U.S. Geological Survey, Gainesville, Florida, United States*

### **Patterns of Diversity of Deep Canyon and Seamount Fishes in the Western North Atlantic**

Submarine canyons and seamounts are characterized by abrupt topographies, patchy seafloor habitats, and complex flow patterns (with direct and indirect effects on distribution of prey). The composition of fish assemblages in these landscapes is poorly known due to problems related to sampling using traditional towed nets. Video surveys with submersible vehicles were used to sample the deep sea fish fauna at 1000 - 2500 m depth from multiple sites across a latitudinal gradient. Species-individual plots revealed

unique geographic patterns. The fish fauna in submarine canyons off the northeast United States as well as from the western New England Seamounts chain had relatively fewer individuals per species than assemblages at the Corner Rise Seamount Complex in the central North Atlantic. The deep fish assemblage at the Outer Bahamas Platform had the highest diversity but fewest individuals per species. This pattern is consistent with latitudinal and productivity correlates of fish diversity and abundance. These results suggest that small-scale geographic variation across similar landscape types in the deep ocean could be used as an aid for conservation planning.

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### **0800 Herp Systematics, 551 AB, Monday 12 July 2010**

Christopher Austin<sup>1</sup>, Marc Spataro<sup>2</sup>, Stacy Peterson<sup>1</sup>, Joshua Jordan<sup>1</sup>, John McVay<sup>1</sup>

<sup>1</sup>Louisiana State University, Baton Rouge, Louisiana, United States, <sup>2</sup>The Boelen's Python Group, , Glen Arm, Maryland, United States

### **Conservation Genetics of Boelen's Python (*Morelia boeleni*) from New Guinea: Reduced Genetic Diversity and Divergence of Captive and Wild Animals**

Boelen's python (*Morelia boeleni*) is a montane New Guinea endemic found in highlands above 1000 m and below the tree line. The ecology, natural history, distribution, population size, and conservation status of this species are largely unknown. It has a protected status in Papua New Guinea but not in Indonesian Papua and several US and European zoos have active captive breeding programs that have been largely unsuccessful. To understand the degree of genetic diversity in wild and captive animals we undertook a genetic analysis of 90 *M. boeleni* for which we sequenced two mtDNA loci and one nuclear locus for a total of 1,418 bp of sequences data per individual.

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## 0174 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

Cynthia Awruch<sup>1</sup>, Colin Simpfendorfer<sup>1</sup>, Sue Jones<sup>2</sup>

<sup>1</sup>*Fishing and Fisheries Research Centre, James Cook University, Townsville, Queensland, Australia,* <sup>2</sup>*School of Zoology, University of Tasmania, Hobart, Tasmania, Australia*

### **The Physiology of Deepwater Sharks: Can Biochemical Methods be Used to Develop Stress Profiles?**

Deepwater sharks are among the most vulnerable of marine species, increasing on the world's endangered and threatened species lists. Currently, there is no information available on the fate of released or discarded deepwater sharks to help inform managers. Thus there is a need to quantify the level of stress and post-release mortality of these species. During March 2008, blood samples were obtained from four species of deepwater shark species including 60 individuals of deepwater draughtboard shark (*Cephaloscyllium albiginum*), 43 individuals of Australian sawtail catshark (*Figaro boardmani*), 150 individuals of the endangered greeneye spurdog (*Squalus chloroculus*) and 23 individuals of the critically endangered southern dogfish (*Centrophorus zeehaani*). Levels of the stress hormone corticosterone were measured by radioimmunoassay (RIA), and lactate concentrations were determined by spectrophotometry. During capture and release, the condition of these sharks was recorded. We determined if measurable levels of corticosterone are present in four species of deepwater sharks including the variability in hormone levels between species and between individuals within a species. Secondly, we correlated corticosterone levels with lactate levels and with ancillary data on condition of the shark during capture and release to determine the degree of variability in this stress hormone and the relationship being found between this hormone and different levels of stress.

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## 0064 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

Cynthia Awruch<sup>1</sup>, Colin Simpfendorfer<sup>1</sup>, Ned Pankhurst<sup>2</sup>

<sup>1</sup>*James Cook University, Townsville, Queensland, Australia,* <sup>2</sup>*Griffith University, Gold Coast, Queensland, Australia*

### **Are Steroid Hormones Useful to Evaluate Stress in Sharks?**

Understanding the stress physiology of sharks that are caught and released is recognised as an important criterion for assessment and effective management of sustainable fisheries. Sharks are important components of Australian's Inshore Finfish Fishery where there is already a high level of release of sharks by recreational fishers. Despite increasing rates of release of sharks there is no information on their fate after release. To assess the post-release mortality, this study examined the responses of

whitespotted spurdog *Squalus acanthias* and the Australian sharpnose *Rhizoprionodon taylori* to capture stress by angling. Sharks were captured in a hook line, over a period of two hours, eight blood samples were taken from each animal at: 0, 3, 10, 30, 45, 60, 90 and 120 min post-capture. After initial blood sampling, each shark was placed on a hook line, where it remained freely swimming around the boat until the next blood sampling. During capture and release, the condition of these sharks was recorded. Lactate and glucose concentrations were determined. Plasma samples were chromatographed on a Thin Layer Chromatography (TLC) using corticosterone and cortisone as standards. Subsequently, each TLC track was separated into 1 cm fractions and each fraction analysed by radioimmunoassay. Serum levels of circulating steroid hormones in corticosterone units were quantified. Secondly, steroid hormone levels were correlated with lactate and glucose values of the shark during capture and release to determine the degree of variability in the steroid hormones and the relationship being found between the hormones and different levels of stress.

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### **0702 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Lyndell M. Bade, Rebecca A. Deehr, Kevin J. Hart, Joseph J. Luczkovich

*East Carolina University, Greenville NC, United States*

### **Ecosystem Impacts of Cownose Rays, *Rhinoptera bonasus*: Seasonal Abundance and Feeding Behavior in North Carolina Estuaries**

Cownose rays, *Rhinoptera bonasus*, undertake cyclic migrations in the spring and fall, with migratory groups numbering as many as 10,000 individuals. The population size of cownose rays in the Eastern seaboard has increased to as many as 40 million individuals from 1970 to 2007. This increase may be due to a reduction of predation by large sharks. In North Carolina, cownose rays migrate through coastal and estuarine waters in the spring and fall, consuming commercially important shellfish and crustaceans along the way. During foraging and feeding behaviors, they create excavation pits, thereby damaging seagrass beds. Previous work in Core Sound, North Carolina, indicated that cownose rays are important mesopredators (Ecopath Model trophic level 3.57) and have negative impacts on hard clams (mixed trophic impact analysis -0.09), bay scallops, and crustaceans. Research will be conducted to describe the seasonal abundance, biomass, and diet composition of cownose rays in order to further parameterize the Core Sound Ecopath Model. Through the use of side-scan sonar, visual, and experimental techniques, cownose ray habitat usage and feeding impacts on seagrass, shellfish, and oyster beds will be investigated and quantified.

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## 0105 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

MSc Clarianna Baicere-Silva<sup>1</sup>, MSc Fernando Carvalho<sup>2</sup>, Luiz Malabarba<sup>2</sup>, Irani Quagio-Grassiotto<sup>3</sup>

<sup>1</sup>Universidade de Campinas/UNICAMP, Campinas, SP, Brazil, <sup>2</sup>Universidade Federal do Rio Grande do Sul/UFRGS, Porto Alegre, RS, Brazil, <sup>3</sup>Universidade Estadual Paulista/UNESP, Botucatu, SP, Brazil

### **Sperm Diversity Within the Genus *Hyphessobrycon* (Teleostei: Characiformes) and Possible Phylogenetic Implications**

*Hyphessobrycon*, the most speciose genus within Characidae, is possibly not monophyletic. Besides the traditional data, reproductive characters have shown to be useful in cladistics analyses. In order to make available the spermiotic characteristics that can be applied to the phylogenetic studies, testes from sexually mature males of *Hyphessobrycon anisitsi*, *H. bentosi*, *H. bifasciatus*, *H. columbianus*, *H. erythrostigma*, *H. herbertaxelrodi*, *H. megalopterus*, *H. meridionalis*, *H. socolofi*, and *H. pyrrhonotus* were prepared and analyzed under TEM. Testes of the specimens were obtained from fresh specimens and mainly from zoological collections. The species analyzed showed a variation of the Type I spermiogenesis, with nuclear rotation ranging from 20° to 80°. The sperm nucleus is spherical, and the nuclear fossa is more eccentric depending of the nuclear rotation. Both centrioles are partially inside the nuclear fossa, the proximal centriole is anterior and oblique to the distal, except by *H. anisitsi* in which the proximal centriole is anterior and parallel to the distal. Considering the nuclear rotation and the midpiece there are five patterns of sperm: one shared by *H. bentosi*, *H. erythrostigma*, *H. megalopterus*, *H. pyrrhonotus*, and *H. socolofi*; the second share by *H. bifasciatus* and *H. meridionalis*, and the last three patterns exclusive of *H. anisitsi*, *H. herbertaxelrodi* and *H. columbianus*, respectively. The complexity of the group is reflected in the sperm diversity. However, the first pattern, shared only by five species of the "rosy tetras clade" defined by Weitzman and Palmer, may further support its monophyly and the close relationships among included species.

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## **0659 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010**

John Baker<sup>1</sup>, Matthew Wund<sup>2</sup>, Susan Foster<sup>1</sup>

<sup>1</sup>*Clark University, Worcester, MA, United States*, <sup>2</sup>*The College of New Jersey, Ewing, NJ, United States*

### **Armor Diversification Across Populations of Freshwater Threespine Stickleback**

Oceanic threespine stickleback are well protected against predators, possessing long dorsal and pelvic spines, a robust set of dermal bones supporting the spines, and many, large lateral plates. The numerous freshwater populations derived from the oceanic ancestor exhibit generally reduced armoring, but armor development displays considerable variation across populations. We scored 12 armor traits in 26 lacustrine populations from the Cook Inlet region of Alaska, to investigate whether the correlation structure of armor traits changes during adaptation to freshwater, and secondly to explore how variation in armoring might relate to the type of freshwater environment invaded. A variant of PCA (hierarchical analysis of oblique factors) indicated that 10 of the traits loaded strongly on a general axis comprised of two aspects - one interpreted as variation in the distance between the tips of the spines, and the other as variation in the structural integrity of the spine support elements. Three more specific axes were also significant, one indicative of variation in the lateral plates, and two others indicative of unique components of variance within some of the 10 traits loading on the general axis. Nested ANOVAs clearly distinguished fish living in different environments, with higher armor scores and more lateral plates favored when predatory fish were present. Interestingly, limnetic and benthic stickleback achieved high scores on the general axis in different ways: limnetics via a slender body but long spines; and benthics via a deep body but shorter spines.

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## **0578 Fish Systematics II, Ballroom D, Monday 12 July 2010**

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

<sup>1</sup>*Saint Louis University, Saint Louis, MO, United States*, <sup>2</sup>*Arkansas Game & Fish Commission, Benton, AR, United States*

### **Molecular Systematics of the Darter Subgenera *Ozarka* and *Psychromaster* (Teleostei: Percidae)**

The darter subgenus *Ozarka* has been hypothesized to consist of *Etheostoma boschungii*, *E. cragini*, *E. pallidorsum*, *E. punctulatum*, and *E. trisella*. Subgenus *Psychromaster* is monotypic, containing only *E. tuscumbia*. These subgenera share a number of morphological and ecological similarities and have an intertwined taxonomic history.

Previous analyses of morphological characters have hypothesized different phylogenetic relationships among the members of *Ozarka*. In addition, the relationships of *Psychromaster* and *Ozarka* to other members of *Etheostoma* have not been well established. Here we investigate relationships within *Ozarka*, as well as the possible affinity of *Ozarka* and *Psychromaster* using DNA sequence data from mtDNA and several nuclear loci. The points of concordance and conflict between the nuclear and mtDNA will be presented and the relationships of *Ozarka* and *Psychromaster* to other subgenera will be discussed.

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**0503 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Carole Baldwin, Cristina Castillo, Lee Weigt

*Smithsonian Institution, Washington, DC, United States*

**A New Look at Species Diversity of Western Atlantic *Starksia* (Teleostei: Labrisomidae) Using a Molecular/Morphological Approach**

Specimens of *Starksia* were collected throughout the western Atlantic region, and a 650-bp portion of the mitochondrial gene cytochrome oxidase-c subunit I (COI) was sequenced as part of a re-analysis of species diversity of Caribbean reef-fish species. A neighbor-joining tree constructed from the sequence data suggests the existence of several cryptic species. Voucher specimens from each genetically distinct lineage and color photographs of vouchers taken prior to dissection and preservation were examined for diagnostic morphological characters. The results suggest new species in the *S. atlantica*, *S. lepicoelia*, and *S. sluiteri* complexes. In most cases, morphological features were found that support the genetic data, but there are two genetic lineages of *S. atlantica* in Belize and two lineages of *S. lepicoelia* in the Bahamas that we cannot distinguish based on morphology. Genetic lineages within western Atlantic *Starksia* generally correspond to geographical locations, such that within each species complex each species has a very restricted geographical distribution. To date we have analyzed COI in specimens from Belize, the Bahamas, Curacao, Florida, Saba Bank, and Tobago, and we predict that adding new sampling locations will further increase the number of *Starksia* species recognized in the western Atlantic. As with previous and ongoing studies of *Coryphopterus* and *Bathgobius* gobies, combining molecular and morphological investigations in this study is bringing clarity to the taxonomy of a group of morphologically similar fishes and increasing the number of currently recognized species.

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**0494 Herp Development, 556 AB, Sunday 11 July 2010**

Brandon Ballengée<sup>1</sup>, Stanley Sessions<sup>2</sup>, David Green<sup>3</sup>

<sup>1</sup>*University of Plymouth, Plymouth, United Kingdom*, <sup>2</sup>*Hartwick College, Oneonta, United States*, <sup>3</sup>*McGill University, Montréal, Canada*

**Predation-Induced Limb Deformities in Southern Quebec Amphibians**

Hind-limb deformities (sometimes called “malformations”) in natural populations of amphibians have been an important environmental issue for more than a decade. The most commonly reported abnormalities in Quebec and the rest of North America are those featuring missing, partial or truncated hind limbs, yet specific causes for this phenomenon have remained unclear. Only recently have aquatic predators such as dragonfly nymphs (Odonata) and some fishes (and even tadpoles themselves) been linked to tadpole injuries resulting in these types of limb abnormalities. Here we present evidence from both field and laboratory studies demonstrating that selective predation by Odonate nymphs plays a significant role in inducing limb deformities in natural populations of anuran amphibians in Southern Quebec.

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**0615 NIA I, 556 AB, Saturday 10 July 2010**

Heidi Banford

*University of West Georgia, Carrollton, GA, United States*

**An Assessment of the Characin Genus *Hyphessobrycon* from Panama, with the Description of a New Species**

Species of the genus *Hyphessobrycon* (Characidae) were previously known only from the Atlantic slope of Panama. In 1996 we made a cross cordillera trek from the Rio Playon Chico of the Atlantic slope of the Comarca Kuna Yala to the upper reaches of the Pacific Rio Bayano drainage. Fishes were collected from the tributaries of the upper Rio Bayano. Eight specimens of *Hyphessobrycon* were included in these collections. Morphological and molecular genetic comparisons to other populations of *Hyphessobrycon* have indicated that these eight specimens represent a new species. The species is easily distinguished by distinct chevrons along the lateral midline and a deep body depth. Genetic distances for mtDNA ATPase 6/8 between the new species and other *Hyphessobrycon* from Panama average 0.16.

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**0764 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Charles Bangley, Roger Rulifson

*East Carolina University, Greenville, NC, United States*

**Feeding Habits and Effects on the Marine Community of Spiny Dogfish (*Squalus acanthias*) Overwintering off the Coast of North Carolina**

The spiny dogfish *Squalus acanthias*, a common shark that is considered a pest among fishermen, overwinters in large numbers off the coast of North Carolina. Recently the role of spiny dogfish as predators upon commercially-important species has become controversial. Spiny dogfish can have significant predatory impact during short-term feeding events. This research will focus on the feeding habits of spiny dogfish overwintering off the coast of North Carolina. Dogfish will be sampled opportunistically during research trawls conducted in North Carolina waters from January to March. Abundance data will be taken on all other species, both in trawls containing dogfish and those without, and species composition will be compared. Dogfish stomach contents will be removed by gastric lavage. Preliminary trials of the lavage method show a mean efficiency of 85%. Contents will be analyzed to determine prey selectivity and consumption rate. This will be compared with the abundance data for the prey species collected during the trawl and with available data on stock assessment and commercial landings. The results will be used to determine which species are most affected by spiny dogfish predation and whether it is a significant source of mortality among species of concern for commercial and recreational fisheries.

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**0636 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Crista Bank<sup>1</sup>, Steve Cadrin<sup>2</sup>, Ken Oliveira<sup>3</sup>

<sup>1</sup>UMASS Dartmouth's School for Marine Science and Technology, New Bedford, MA, United States, <sup>2</sup>NOAA Cooperative Marine Education & Research, Woods Hole, MA, United States, <sup>3</sup>UMASS Dartmouth, North Dartmouth, MA, United States

**Age Validation of Monkfish Using Oxytetracycline in Field Experiments and Laboratory Trials**

Monkfish, *Lophius americanus*, remains an obscure species both to the public and scientists despite its importance in the commercial fishing industry. One of the uncertainties in understanding population dynamics of monkfish is age determination, which plays a crucial role in understanding the health of the stock. The purpose of this study is to determine that a chemical marker, oxytetracycline, can be used to validate the age of monkfish in laboratory trials and a mark-recapture experiment. For laboratory trials, monkfish were caught by commercial fishermen, brought to the SMAST sea water

lab, and held in circular, 450 gallon tanks. After a one-week acclimation, they were injected with a 75 mg/kg dose of oxytetracycline to mark the annuli of the age structures (otolith, vertebrae, illicium). For the mark-recapture experiment, monkfish were caught at sea on commercial gillnet vessels, a Star-Oddi data storage tag was surgically implanted in the fish, each fish was injected with the same dose of oxytetracycline and released. The holding study has proven challenging, from monkfish health issues to feeding difficulties. The longest lived specimen survived 95 days, exhibited no somatic growth, and the oxytetracycline mark on the age structures could not be confirmed. For the field studies, 150 fish have been released between January and December 2009, with no recaptures to date. Results from these studies are expected to improve stock assessment of the monkfish resource and the scientific basis of fishery management.

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## **0250 AES Conservation & Management, 552 AB, Friday 9 July 2010**

Ivy Baremore, Lori Hale

*NOAA Fisheries Service, Panama City, FL, United States*

### **Reproductive Patterns and Maturity Estimates of the Sandbar Shark *Carcharhinus plumbeus* in the US Atlantic Ocean and Gulf of Mexico**

Sandbar sharks *Carcharhinus plumbeus* were sampled for age, growth, and reproduction from January 2007 - February 2010. Samples were collected by fisheries observers aboard commercial longline fishing vessels, and age and reproductive parameters were assessed by biologists at the NOAA Fisheries Service Panama City Laboratory. All sandbar sharks examined for reproductive analysis were directly aged using vertebral band counts (n=1100). Size and age at 50% maturity were determined for females and males using logistic regression analysis, and size at which 50% of females were in maternal condition was also calculated. Seasonality of reproduction was determined from monthly plotting of measurements of the reproductive tract (gonads, oocytes, etc.) from mature animals. Mature females and males were staged according to reproductive condition to further elucidate seasonality and periodicity. Embryo length was plotted by month to determine the length of gestation and time of parturition. Sex ratio of embryos from all females was tested for significant difference from a 1:1 ratio with a  $\chi^2$  test. Finally, a regression of female length was plotted against number of embryos per female to assess whether fecundity increased with increasing maternal length.

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**0536 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Brenna Barger<sup>1</sup>, David Blackburn<sup>1</sup>, Allison Fuiten<sup>1</sup>, Arvin Diesmos<sup>1</sup>, Rafe Brown<sup>1</sup>

<sup>1</sup>University of Kansas Biodiversity Institute, Lawrence, Kansas, United States, <sup>2</sup>National Museum of the Philippines, Manila, Luzon, Philippines

**Phylogeny, Species Boundaries, and Hidden Diversity in the *Rana everetti* Complex of Philippine Stream Frogs**

We used analyses of continuous morphological variation, discrete morphological characters, and approximately 2000 base pairs of mitochondrial DNA to investigate species boundaries in the endemic Philippine clade of stream frogs related to *Rana everetti*. Our robust geographical sampling (145 samples from throughout the archipelago) and phylogenetic analyses of the 12S–16S rDNA demonstrates the presence of numerous highly divergent lineages, several of which correspond to described species. Previously considered five distinct species, our new data plus inferences from biogeography suggest that this radiation minimally consists of nine evolutionary lineages that should be recognized as full species. In addition to aiding in our estimation of species diversity, the phylogeny reveals biogeographic patterns that allow us to confidently reject predictions derived from a prevailing, 25-year paradigm of Philippine biogeography.

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**0506 Lundberg Symposium, Ballroom D, Sunday 11 July 2010**

Jonathan Baskin<sup>1</sup>, Brian Diep<sup>1</sup>

<sup>1</sup>California State Polytechnic University Pomona, Pomona, CA, United States, <sup>2</sup>San Gabriel High School, San Gabriel, CA, United States

**Evolutionary Trends in the Digestive Tract of the South American Parasitic Catfishes and Their Relatives (Telostei, Trichomycteridae)**

Many species of the widespread Neotropical catfish family Trichomycteridae are known for their parasitic habits of feeding on blood, scales and mucus of other fishes, while other species are more generalized predators, feeding mainly on insects. We define specific anatomical and histological characteristics of the parasite digestive tract, and find that the digestive tract of the parasites has become reduced, with the stomach lacking and the intestine simplified to a straight tube with a reduced wall (muscularis layer) and reduced internal surface area (few or no villi). The intestine of the parasites appears to have lost most of its digestive/absorptive function and serves mainly as a holding area. However the parasites have developed a distinct rectal segment, which appears to be a major site of digestive product absorption in most of the parasitic species. One species of the parasitic group, *Pareiodon microps* from the Amazon, has

developed a predatory habit of feeding on fish flesh. *P. microps* is found to have a basic parasite digestive tract but redeveloped a strong intestinal wall, as well as intestinal villi, and further developed an enlarged rectal segment. The internal structure of the *P. microps* gut is more complex compared to other members of the family. A related trichomycterid of unknown feeding habits, *Ituglanis amazonica*, has some digestive tract features characteristic of parasitic.

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## **0161 Herp Systematics, 551 AB, Monday 12 July 2010**

Aaron Bauer<sup>1</sup>, Todd Jackman<sup>1</sup>, Eli Greenbaum<sup>2</sup>

<sup>1</sup>Villanova University, Villanova, PA, United States, <sup>2</sup>University of Texas, El Paso, TX, United States

### **Phylogeny and Taxonomy of Tropical Asian *Hemidactylus* (Squamata: Gekkota: Gekkonidae)**

*Hemidactylus* geckos are a species-rich component of many tropical lizard assemblages. We sampled deeply among tropical Asian, and especially south Asian, taxa and used a multi-gene approach to establish the affinities of Indian and Sri Lankan *Hemidactylus* and evaluate the monophyly of previously proposed clades within the genus. There is only weak support for the monophyly of tropical Asian *Hemidactylus* as a whole, but two strongly supported subclades were retrieved: the bowringii group is a predominantly East Asian clade that only reaches South Asia peripherally; the brookii group is a morphologically diverse clade that represents a previously unrecognized, species-rich (25 species), chiefly South Asian radiation. Unlike several other vertebrate groups, Sri Lankan *Hemidactylus* do not represent a single insular radiation. Rather, each of six Sri Lankan species represents an independently-derived insular lineage. The widespread *H. brookii* includes minimally two species-level subclades, the nominate form, widespread in tropical Asia, and *H. parvimaaculatus*, found in Sri Lanka and the islands of the Indian Ocean. *Hemidactylus brookii* sensu stricto has probably spread from south to southeast Asia (including to the type locality in Borneo) in the relatively recent past. Species boundaries of *H. brookii*-like geckos in northern India and Pakistan remain poorly understood and will require thorough revisionary and phylogenetic studies.

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**0534 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Kyle Baumgartner, Stephen Mullin, Lorin Neuman-Lee

*Eastern Illinois University, Charleston, IL, United States*

**The Effect of Atrazine on Scale-row Symmetry During the Development of Neonate Watersnakes (Colubridae: *Nerodia*)**

Fluctuating asymmetry is used as a metric to examine phenotypic variation resulting from the environmental conditions that an organism experiences during its development. Atrazine, an endocrine disruptor, has been shown to cause a variety of developmental abnormalities, many of which can correlate with decreased reproductive output and survival. We examined the effects of in utero atrazine exposure on the development of Northern Watersnakes (*Nerodia sipedon*). We caught adult watersnakes and allowed them to breed in the lab. For the duration of their gestation, we then fed the female subjects with fish that had been injected with one of four concentrations of atrazine. Following their birth, we examined the scale symmetry of neonate subjects by counting the number of scale rows on each side of the mid-dorsal scale at intervals of 25%, 50% and 75% of the individual's snout-vent length. We also visually identified other scale deformities, such as the abnormal dividing of abdominal scutes. Our data indicate that female watersnakes exposed to atrazine produced neonates that had a greater incidence of scale row asymmetries. We suggest that the frequency of occurrence of these phenotypic anomalies in the neonate snakes resulted from the ingestion of contaminated fish by their mothers. Although we have yet to correlate these anomalies to long-term decreases in fitness, atrazine might pose similar and indirect problems to other non-target species, especially if they practice some form of viviparity.

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**0365 Fish Conservation, Ballroom B, Friday 9 July 2010**

Collin Beachum<sup>1</sup>, Jason Knouft<sup>1</sup>, Donovan Henry<sup>2</sup>, Lennie Pitcher<sup>3</sup>

*<sup>1</sup>Saint Louis University, Saint Louis, MO, United States, <sup>2</sup>USACOE, Saint Louis, MO, United States, <sup>3</sup>Third Rock Consulting LLC, Lexington, KY, United States*

**Use of Landsat Imagery to Assess Temporal Changes in a Stream Fish Assemblage Associated with Habitat Restoration in the Terrapin Creek Watershed in Kentucky**

Terrapin Creek watershed, located in southwestern Kentucky and northwestern Tennessee, is a 140 km<sup>2</sup> sub-basin of the Obion River watershed dominated by remnant bottomland forest, wetlands, row crops, and pasture. It contains a unique aquatic species assemblage consisting of several endemic taxa found either only in the watershed or with limited distribution within Kentucky. In 1992, the state of Kentucky purchased 22

acres in Graves County, Kentucky and established the Terrapin Creek State Nature Preserve (TCSNP). Since 1992, the preserve has grown to 260 acres, which has resulted in increases in restored floodplain and wetland habitats within the central portion of the watershed. The goal of this work is to assess the relationship between changes in landuse/landcover (LULC) and diversity of the fish fauna in this watershed. Remotely sensed data from multiple time periods before and after establishment of the preserve are used to classify and quantify changes in LULC. These changes in LULC are then compared to rarefaction standardized fish collections made in 1988 - 89, 2000 - 01, and 2007 - 09 from the main stem of Terrapin Creek to assess the relationship between terrestrial habitat composition and aquatic species diversity.

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### **0790 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Sarah N. Becker<sup>1</sup>, Brooke L. Talley<sup>1</sup>, Karen R. Lips<sup>2</sup>

<sup>1</sup>*Southern Illinois University, Carbondale, IL, United States*, <sup>2</sup>*University of Maryland, College Park, MD, United States*

### **Familial Variation in Ecological Factors Influencing Anuran Body Temperatures**

We measured the cloacal body temperature ( $T_b$ ) of anurans to determine which factors affect anuran  $T_b$  in the field. Previous researchers have assumed that air or substrate temperature is a good proxy for the  $T_b$  of an anuran because they are small ectotherms that should conform to ambient temperature. We collected  $T_b$  of 170 individuals of 8 species (*Acris crepitans*, *Hyla versicolor* / *chrysoyelis* complex, *Pseudacris crucifer*, *P. triseriata*, *Rana catesbeiana*, *R. pipiens*, *R. areolata* and *R. sphenoccephala*) from 9 locations throughout Illinois during the 2009 breeding season. For each capture we measured the following variables thought to influence  $T_b$ : substrate temperature, substrate type (moist soil, vegetation, water and dead vegetation), date, time, species, sex, latitude and SVL.  $T_b$  ranged from 9.8 - 26.2°C (average = 18.7°C) and the difference from substrate temperature ranged from -2.3 - 9.8°C (average = 1.2°C). We used an analysis of covariates (ANCOVA) to determine which variables significantly explained the variation of  $T_b$  within Ranidae (n=54) and Hylidae (n=116). Only substrate temperature significantly affected  $T_b$  in Ranidae, while substrate temperature, substrate type, species, time, and SVL all significantly affected  $T_b$  in Hylidae. Hylids were cooler later in the night and smaller hylids were warmer than larger hylids. While substrate temperature may be a good estimate of large aquatic ranid  $T_b$ , the  $T_b$  of small arboreal amphibians is affected by several additional factors. Accurate estimates of amphibian  $T_b$  are needed for studies of niche modeling, disease modeling and climate change predictions.

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**0086 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD**

Christine Bedore, Stephen Kajiura, Lindsay Harris

*Florida Atlantic University, Boca Raton, FL, United States*

**Electroreception in the Cownose Ray (*Rhinoptera bonasus*)**

Electroreception has been demonstrated to facilitate close-range detection and localization of cryptic prey in elasmobranch fishes, although the sensitivity of batoid species to these fields remains poorly explored. Furthermore, there is a paucity of data describing the bioelectric field characteristics of prey items that comprise the diet of these fishes. The cownose ray is a batoid elasmobranch that preferentially preys upon bivalve molluscs. Early studies have shown bivalve species to produce electric fields an order of magnitude weaker than other elasmobranch prey items, such as teleost fish; however the sensitivity of cownose rays to these remarkably weak bioelectric fields remains unknown. This study quantified the electric field characteristics of bivalve prey and the behavioral response of cownose rays to these prey-generated electric fields. We determined the voltage production by the gills of live hard clams to be  $14.46 \mu\text{V} \pm 1.05 \text{ SE}$  at the opening of the incurrent siphon. These data were used to generate a prey-simulating electric field, which was used in a behavioral assay to investigate the electrosensitivity of cownose rays. The weakest electric field detected by an individual was  $1.75 \text{ nV cm}^{-1}$  and the median sensitivity was  $48.7 \text{ nV cm}^{-1}$ . The maximum orientation distance by an individual to a  $12 \mu\text{A}$  electric stimulus was 20.01 cm, with a median detection distance of 9.91 cm. The median sensitivity was similar to that of the bat ray, another benthic-pelagic batoid; however, cownose rays were less sensitive to electric fields than most other species of batoids studied to date.

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**0785 Fish Systematics I, Ballroom D, Monday 12 July 2010**

Michael Bell<sup>1</sup>, Windsor Aguirre<sup>1</sup>, Haili Zhang<sup>1</sup>, Christoff Furin<sup>1</sup>, Frank von Hippel<sup>1</sup>, David Kingsley<sup>1</sup>

<sup>1</sup>*Stony Brook University, Stony Brook, New York, United States*, <sup>2</sup>*DePaul University, Chicago, Illinois, United States*, <sup>3</sup>*Stanford University School of Medicine, Stanford, California, United States*, <sup>4</sup>*University of Alaska Anchorage, Anchorage, Alaska, United States*

**Twenty Years of Contemporary Evolution and Speciation by Anadromous Threespine Stickleback After Colonizing an Alaskan Lake**

Loberg Lake was colonized between 1983 and 1989 by anadromous Threespine Stickleback after the freshwater resident stickleback population was exterminated. We

have sampled it at one to five sites since 1990 for morphology and at one point since 1999 for DNA. We performed forced mating trials in 2004 and 2005 to study assortative mating. Morphological analysis of alizarin-stained specimens indicates only minor variation of lateral plate morph frequencies among sites within years but large changes between years for all phenotypic traits, including body shape, body size, operculum shape, lateral plate morph frequency, low-morph lateral plate number, and gill-raker number. Allelic frequencies for two genetic loci, Ectodysplasin and K<sup>+</sup>/Na<sup>+</sup> ATPase, have also changed significantly. All phenotypic and genetic traits examined initially resembled those of a local anadromous Threespine Stickleback population and have diverged significantly toward those of freshwater populations. Allelic variation at microsatellite loci is high and similar to that of anadromous populations, and it does not indicate a relationship to nearby freshwater populations. Forced mating trials in 2004 and 2005 demonstrated that Loberg Lake females discriminate against anadromous males as mates. Evolution of the new Loberg Lake population simulates genetic divergence and speciation of Threespine Stickleback in boreal coastal lakes around the northern hemisphere since deglaciation and demonstrates that adaptive radiation of freshwater populations could have occurred within decades after postglacial invasion of fresh water. Information on contemporary evolution of the Loberg Lake Threespine Stickleback is available at <http://life.bio.sunysb.edu/ee/belllab/loberg.html>.

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## 0017 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Mauro Belleggia<sup>1</sup>, Daniel Figueroa<sup>3</sup>, Felisa Sánchez<sup>1</sup>, Claudia Bremec<sup>1</sup>

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

### **The Feeding Ecology of *Mustelus schmitti* in the Southwestern Atlantic: Dietary Shifts and Geographic Variations**

*Mustelus schmitti* is distributed from Brazil (22°S) to Argentina (47°45'S) and occurs from shallow waters to 120m. Food habits of *M. schmitti* were studied based on analysis of stomach contents. Specimens were collected from three research cruises carried out by (INIDEP) during 2008-2009 at four different regions on the Argentinean continental shelf (34oS - 43oS). Prey items were identified to the lowest possible taxon, counted and weighted. The hypothesis that the consumption of each prey group is determined by total length was assessed by fitting generalized linear models (GLM), and using the Maximum Likelihood Estimation to fit a model to data by maximizing an explicit likelihood function. 97.5% of 525 stomachs analyzed contained food. The %IRI revealed that the species fed mostly on decapods (54.7%), followed by polychaetes (24%) and fishes (15.9%). Regional differences were observed among the prey species. *M. schmitti* showed plasticity in its feeding behavior, factor that contributes to the extensive latitudinal and bathymetrical range exhibited by this species. Models show that

polychaetes decreased and fish increased in importance as the narrownose smoothhound grew in size; while crustaceans increased in importance from small to medium size, and then decreased in the large specimens. The feeding on different preys at different stages of the species life cycle suggests an efficient resource partitioning in the study area. Dietary shifts, in general, minimize intraspecific competition and could also favor the wide distribution of this species.

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## **0648 AES GRUBER AWARD, 551 AB, Friday 9 July 2010**

Martin Benavides<sup>1</sup>, Kevin Feldheim<sup>2</sup>, Clinton Duffy<sup>3</sup>, Sabine Wintner<sup>4</sup>, Lisa Natanson<sup>5</sup>, Matias Braccini<sup>6</sup>, Demian Chapman<sup>1</sup>

<sup>1</sup>*Stony Brook University, Stony Brook, NY, United States*, <sup>2</sup>*Field Museum of Chicago, Chicago, IL, United States*, <sup>3</sup>*Department of Conservation, Auckland, New Zealand*, <sup>4</sup>*KwaZulu-Natal Sharks Board, Natal, South Africa*, <sup>5</sup>*National Marine Fisheries Service, Narragansett, RI, United States*, <sup>6</sup>*University of British Columbia, Vancouver, BC, Canada*

### **Global Genetic Stock Structure of the Copper (*Carcharhinus brachyurus*) and Dusky Sharks (*Carcharhinus obscurus*): Interspecific Comparisons and Implications for Management**

Sharks of the genus *Carcharhinus* comprise a large fraction of global shark fin and meat landings, yet assessment and management of these species is hampered by a lack of stock structure information. Here, we use genetic data to elucidate the broadscale stock structure of two large-bodied, exploited carcharhinids. The copper shark, *Carcharhinus brachyurus*, is a coastally-oriented carcharhinid with a near-global distribution. Listed as "Near Threatened" by the International Union for the Conservation of Nature (IUCN), presumed independent stocks associated with discrete continental shelves in New Zealand, Australia and South Africa are each listed by the IUCN as "Least concern". The dusky shark, *Carcharhinus obscurus*, is a globally-distributed, coastal and pelagic species that makes up an estimated 1.2-1.7% of the global fin trade. It is declining in several regions because of its extremely low productivity and it is assessed as globally "Vulnerable" by the IUCN. Regional IUCN assessments range from "Near Threatened" (Australia) to "Endangered" (U.S. Atlantic and Gulf of Mexico). We have used 560-650 base pairs of the mitochondrial control region to assess the global stock structure of these exploited congeners. Using more than 200 globally distributed samples we found both species were divided into multiple discrete stocks (global  $\Phi_{st}$  for *C. brachyurus*= 0.95 [p<0.000001], global  $\Phi_{st}$ =0.47 [p <0.0001] for *C. obscurus*). We outline the global stock structure of each species and the implications for assessment and management. In general, oceanic expanses appear to be less of a barrier to dispersal in *C. obscurus* when compared to *C. brachyurus*.

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## **0746 General Ichthyology, Ballroom B, Friday 9 July 2010**

Andrew Bentley<sup>1</sup>, Henry MI Bart<sup>2</sup>, Edward O Wiley<sup>1</sup>, David Vieglais<sup>1</sup>, Nelson Rios<sup>2</sup>, Laura Russell<sup>1</sup>, Djihbrihou Abibou<sup>2</sup>

<sup>1</sup>*University of Kansas Biodiversity Institute, Lawrence, KS, United States*, <sup>2</sup>*Tulane University Museum of Natural History, Belle Chase, LA, United States*

### **The Return of Fishnet**

A newly redesigned Fishnet2 portal is set for launch (<http://fishnet2.net>). At present, there are 26 institutions or multi-institution organizations providing data to the Fishnet2 cache. These institutions house 4 million records, of which 1 million are in the Fishnet2 cache. Data sharing agreements with collections at 110 additional institutions are being pursued, which will ultimately increase the number of data records to 70 million. Like the other taxon-based networks (Manis, Ornis & HerpNet), Fishnet2 is based on DiGIR. However, Fishnet2 differs in that data are served from a centralized cache, allowing faster response times, greater stability, and an overall better user experience. The search interface has been improved to provide cleaner, simpler, and more intuitive search capabilities, while retaining fully functional advanced searching capabilities. The developmental roadmap for FishNet2 includes taxonomic resolution, integration with BioMaps for advanced data visualization and analysis in a web based environment, support for TAPIR, IPT & direct data uploads via a curatorial interface, usage reporting interfaces for providers, and simplified data consumer feedback. Another feature of Fishnet2 is a collaborative georeferencing portal. This portal works in conjunction with the GEOLocate georeferencing software system to allow users access to collection-event data, and work collaboratively to quickly and efficiently georeference the collection locations. This will improve the quality of data in fish collections, and by extension, the quality of data served to the user community.

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## **0747 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Andrew Bentley<sup>1</sup>, Henry MI Bart<sup>2</sup>, Edward O Wiley<sup>1</sup>, Dave Vieglais<sup>1</sup>, Nelson Rios<sup>2</sup>, Laura Russell<sup>1</sup>, Djihbrihou Abibou<sup>2</sup>

<sup>1</sup>*University of Kansas Biodiversity Institute, Lawrence, KS, United States*, <sup>2</sup>*Tulane University Museum of Natural History, Belle Chasse, LA, United States*

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### **0322 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Margot A. Bergstrom, Jacqueline F. Webb

*University of Rhode Island, Kingston, RI, United States*

#### **Hydrodynamic Detection of Different Prey Species by the Widened Lateral Line Canal System of a Lake Malawi Cichlid**

The mechanosensory lateral line is used by fishes for prey detection, predator avoidance, navigation and communication, but the relationship between lateral line morphology and feeding behavior, for example, is not well understood. The peacock cichlids, *Aulonocara* spp., endemic to Lake Malawi, are reported to use their widened lateral line canal system for the detection of the hydrodynamic stimuli generated by benthic invertebrates. We have begun to characterize the stimuli generated by three model prey species (adult *Artemia*, mayfly nymphs, and *Daphnia magna*) using digital particle image velocimetry (DPIV). Results indicate that the three prey species do generate different hydrodynamic stimuli. We will analyze the ability of *Aulonocara hansbaenschi* to feed on these three prey species under light and dark conditions using standard digital video. For a behavioral trial, a live and a dead (fresh frozen) individual of one of the prey species will be tethered to each of six 4"x4" mesh platforms placed in a 2x3 grid submerged in the sandy substrate of a large experimental tank and individual fish will be allowed to forage for 30 minutes. The relationship of stimulus characteristics and several parameters of both search and prey detection behaviors be evaluated. *Aulonocara* is unique among African cichlids in that it can successfully feed at night using its lateral line system. This study will provide important insights into the functional and ecological significance of lateral line-mediated feeding behavior in species with widened lateral line canals. Supported by NSF grant IOS-0843307 to JFW.

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## 0724 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

Diego Bernal<sup>1</sup>, Craig Heberer<sup>2</sup>, Scott Aalbers<sup>3</sup>, Suzzane Kohin<sup>2</sup>, Bart DiFiore<sup>4</sup>, Chugey Sepulveda<sup>3</sup>

<sup>1</sup>University of Massachusetts Dartmouth, Dartmouth, MA, United States, <sup>2</sup>NMFS, Southwest Fisheries Science Center, La Jolla, CA, United States, <sup>3</sup>Pfleger Institute of Environmental Research, Oceanside, CA, United States, <sup>4</sup>Middelbury College, Middelbury, VT, United States

### **Molecular and Biochemical Stress Responses and Post-release Survival in Thresher Sharks Captured by the California Recreational Fishery**

The common thresher shark (*Alopias vulpinus*) is target of a growing recreational fishery in southern California utilizing heavy troll gear with large J-hooks. The use of this gear results in a high percentage of sharks being foul-hooked in the caudal fin, which reduces their ability for forward locomotion and ram ventilation, both of which may ultimately impact post-release survivorship. The focus of this study was to: assess the survivorship of rod-and-reel captured and released common thresher sharks, and, to quantify the physiological indicators of stress in the blood associated with these capture techniques. Survivorship estimates were quantified using pop-off satellite archival tags (PSATs) deployed on sharks hooked by the caudal fin using the methods of the recreational shark fishery. A total of 19 PSATs were deployed on threshers (165-221 cm fork length and ~68 to 204 kg) with ~74% of the tagged sharks surviving the capture-event. All observed mortalities were from individuals with fight times that exceed 85 min. Although blood stress parameters from nine threshers experiencing varying fight times show a minimal change in several plasma levels of electrolytes and metabolites (e.g., Na<sup>+</sup>, Cl<sup>-</sup>, K<sup>+</sup>, Ca<sup>++</sup>, Mg<sup>++</sup>, and glucose), lactate, hematocrit and blood-associated stress proteins (i.e., heat shock proteins) significantly increased with the capture-related event. This suggests that stress levels increase with fight time and that a prolonged struggle time (> 85 min) associated with this foul-hooking techniques lead to high mortality, which raises questions about catch and release conservation measures for this type of recreational fishery.

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## 0678 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Michael Bessert<sup>1</sup>, Chenhong Li<sup>2</sup>

<sup>1</sup>University of Wisconsin-Stout, Menomonie, WI, United States, <sup>2</sup>University of Nebraska, Lincoln, NE, United States

### **Conservation Genetics of *Fundulus sciadicus* (Fundulidae), a Great Plains Endemic**

The plains topminnow (*Fundulus sciadicus*) is a freshwater killifish endemic to the Great Plains of North America. Rising concerns for future viability of this species have prompted recent changes in its conservation status. In a previous rangewide study, extremely low variation was detected at the mtDNA control region, yet revealed distinct population structure. A battery of ten variable nuclear (microsatellite) loci was developed and used to re-examine population structure among the previously collected sites plus four new sites from Minnesota and Colorado. Measures of allelic richness and heterozygosity corroborate earlier target populations suggested for conservation (those with highest gene diversity). In addition, Bayesian techniques place previously undocumented disjunct populations in an appropriate phylogeographic context and allow for estimation of historical demography in the species.

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## 0377 NIA I, 556 AB, Saturday 10 July 2010

Ricardo Betancur-R.<sup>1</sup>, Arturo Acero P.<sup>2</sup>, Guillermo Orti<sup>1</sup>, A. Hines<sup>3</sup>, Amy Wilbur<sup>3</sup>, Wilson Freshwater<sup>3</sup>

<sup>1</sup>The George Washington University, Washington, D.C., United States, <sup>2</sup>Universidad Nacional de Colombia sede Caribe (CECIMAR), Santa Marta, Colombia, <sup>3</sup>Center for Marine Science, University of North Carolina Wilmington, Wilmington, NC, United States

### **Reconstructing Lionfish Invasion in the Western Atlantic: Mitochondrial Haplotypes Reveal Restricted Dispersal of One Species and a Compounded Founder Effect in the Caribbean Sea**

The Indo-Pacific lionfishes (*Pterois miles* and *P. volitans*), introduced off Florida, are rapidly dispersing and establishing throughout the Western Atlantic (WA). The extent and chronology of the invasion has been systematically documented, showing that lionfishes were established along the US Atlantic coast and Bermuda by 2001. They then dispersed and subsequently became established in the Bahamas between 2004 and 2006, and have been rapidly spreading into the Caribbean Sea since 2007. Previous population genetic studies based on mitochondrial sequences revealed a decrease in genetic diversity in the WA compared with native locations, as a result of a strong founder

effect. This study has shown that while both species are present along the US east coast and Bermuda, only *P. volitans* has dispersed into the Bahamas and Caribbean Sea. Genetic diversity, pairwise  $F_{st}$ , and SAMOVA analyses of two native (70 individuals) and six invasive *P. volitans* populations (728 individuals) throughout the North WA, the Bahamas, the northwestern and southern Caribbean Sea showed significant differentiation between the north WA (nine haplotypes) and the Caribbean (four haplotypes), with a significant reduction in genetic diversity in the latter. These results coincide with the chronology of the invasion documented from sightings as well as predictions made by recent models of Caribbean fish connectivity. Our analyses show no evidence of multiple independent introductions of red lionfish across the WA. Despite the devastating consequences that have resulted from the lionfish introduction, it provides an excellent model system for inferring marine connectivity and dispersal patterns in reef species.

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### **0035 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010**

Dana Bethea<sup>1</sup>, Loraine Hale<sup>1</sup>, Lisa Hollensead<sup>2</sup>

<sup>1</sup>NOAA Fisheries SEFSC Panama City Laboratory, Panama City, FL, United States,

<sup>2</sup>Florida State University, Tallahassee, FL, United States

### **Diet of the Roundel Skate *Raja texana* from the Northern Gulf of Mexico, USA**

To better evaluate the trophic role of skates in benthic marine ecosystems, feeding ecology of the roundel skate (*Raja texana*) was examined from offshore waters in the northern Gulf of Mexico. A complete diet analysis was performed using several single and compound measures of prey quantity. Then, prey items were grouped into six broad prey categories, overall trophic level estimated (TL=3.6), and diet assessed for life-stage (immature and adult), sex, and season (winter, spring, summer, fall). Analysis of 195 non-empty stomachs from immature skates (mean length = 38.4 cm) indicated shrimp were the most important prey category, with *Sicyonia* sp. and *Solenocera* sp. the most important identifiable types present. Euphausiids and teleosts were also important prey categories in the diet of immature skates with *Bregmaceros* spp. was the most important identifiable teleost species present. Adult skate diet (mean length = 50.8) was also predominantly shrimp (n=167 non-empty stomachs); however, fishes, crabs (mostly *Portunus* sp.), and other unidentifiable crustaceans made up a much larger portion of the diet by prey category. Adults tended to feed on larger prey and had a more diverse diet ( $H' = 4.51$ ) than immature skates ( $H' = 3.11$ ). Diet did not differ significantly between sexes. While shrimp dominated the diet in all seasons, diet was the most diverse in summer (June-August;  $H' = 4.17$ ) and least diverse in fall (September-November;  $H' = 2.84$ ). These are the first quantitative feeding ecology results published for this species; however, it occupies a trophic niche similar to that of several other demersal shark and skate families.

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0280 Herp Physiology, 556 AB, Monday 12 July 2010

Catherine Bevier<sup>1</sup>, Ananda Brito<sup>2</sup>, Beatriz Magalhães<sup>3</sup>, Carlos Navas<sup>2</sup>

<sup>1</sup>Colby College, Waterville, ME, United States, <sup>2</sup>University of São Paulo, São Paulo, SP, Brazil, <sup>3</sup>Universidade Católica de Brasília, Brasília, DF, Brazil

### **The Effects of Modulating the Epibiotic Microbial Community in Two Frogs from the Atlantic Forest**

Amphibian skin glands synthesize and secrete many compounds, including antimicrobial peptides (AMPs) important for protection against microbial pathogens. Epibiotic bacteria that produce antifungal compounds and that also protect the amphibian hosts, specifically from chytridiomycosis caused from infection by *Batrachochytrium dendrobatidis*, have also been identified. AMPs vary among species, which, along with the microenvironment, influences a frog's epibiotic community profile by favoring growth of some bacteria and inhibiting others. This suggests there are vital relationships among AMP production, intact epibiotic communities, and healthy amphibian populations. Here we tested the hypothesis that the microbial community profile influences the composition of anuran skin secretions. We compared results of our experimental manipulation from two syntopic anuran species that use different microhabitats during the breeding season. Male *Physaelamus cuvieri* call while floating in the water and had significantly more epibiotic bacteria initially than the treefrog, *Hypsiboas polytaeniis*. Treatment frogs were sterilized in an antibiotic bath for 72 h, and skin secretions were collected using mild electric shock at four time points during the experiment. After sterilization, male *P. cuvieri* inoculated with bacteria cultured from the skin of *H. polytaeniis* had significantly more epibiotic bacteria than those inoculated with their own community, while male *H. polytaeniis* inoculated with the two communities harboured similar numbers of bacteria. This suggests that epibiotic communities may be flexible and induced from environmental conditions rather than controlled by host-specific characters. Analyses of skin secretion compositions are forthcoming, and will provide information on the role of epibiotic bacteria on amphibian AMPs.

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**0546 Fish Ecology, 555 AB, Sunday 11 July 2010; ASIH STOYE AWARD  
ECOLOGY & ETHOLOGY**

Katherine Birkett

*University of Michigan, Ann Arbor, MI, United States*

**Changes in Fish Community Structure Due to Benthification in a Southeastern Michigan River**

Invasive zebra mussels (*Dreissena polymorpha*) have long been recognized for their ability to drastically alter aquatic habitats into which they are introduced, which has earned them the title of “ecosystem engineers” in the scientific literature. Their tendency to blanket hard surfaces and substrata, coupled with their voracious appetite for food particles suspended in the water column, has led to the benthification of many North American lakes and rivers. This relatively new term refers to the sequestration of an aquatic ecosystem’s energy in the benthic zone due to increased light and nutrient availability, as well as greater spatial heterogeneity in these areas. The purpose of this study is to investigate the effects of benthification on fish communities in the Huron River of southeastern Michigan. Zebra mussels were introduced inadvertently to a small inland lake in this system by boaters in the mid-1990’s, and have subsequently colonized areas of the river’s main stem several kilometers downstream. Surveys on fish and benthic macroinvertebrates at sites both with and without zebra mussels were conducted in the summer of 2008. The data revealed an increased presence of benthically-oriented fish species in mussel-infested areas, as well as a markedly low abundance of planktivorous species relative to sites without zebra mussels. A general decrease in fish species diversity was also seen at the infested sites. These observations support the hypothesis that those fish species that are able to take advantage of newly benthified ecosystems are the most likely to thrive.

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**0783 Herp Systematics, 551 AB, Monday 12 July 2010**

Sayantana Biswas<sup>1</sup>, Aaron M. Bauer<sup>1</sup>, Todd R. Jackman<sup>1</sup>, Kartik Shanker<sup>1</sup>

<sup>1</sup>Villanova University, Villanova, PA, United States, <sup>2</sup>Villanova University, Villanova, PA, United States, <sup>3</sup>Villanova University, Villanova, PA, United States, <sup>4</sup>Centre for Ecological Sciences, Bangalore, Karnataka, India

**Systematics and Biogeography of the Genus *Cnemaspis* Strauch 1887**

*Cnemaspis* Strauch 1887 (Reptilia: Gekkonidae) is one of the most species-rich genera of geckos with ~90 currently described species. Along with the genera *Cyrtodactylus* and *Hemidactylus*, together they constitute approximately one quarter of all extant gekkotan lizards. The genus *Cnemaspis* is disjunctly distributed in Africa, south and Southeast

Asia. No test of monophyly of the genus or hypothesis of intrageneric relationship is available, except for a small subset of Sri Lankan species. Current rates of new species descriptions remain unabated with over 50 species described since the mid 1980's. We address the genus level taxonomy of *Cnemaspis* with representative sampling from all the major regions of its distribution. We present a phylogeny that includes about half of the described species using mitochondrial (ND2) and nuclear genetic markers (RAG1, phosducin). *Cnemaspis* is polyphyletic. We split the genus into four different genera with the name *Cnemaspis* retained by majority of the Southeast Asia species (type: *boulengeri*). African members are allocated to the genus *Ancylodactylus* Müller 1907. Remaining south and southeast Asian species are placed in two new genera. We provide revised morphological diagnoses for the respective genera. In addition our results provide the framework that will accommodate future descriptions and offer new insights that will help better understand diversification of these four genera of geckos.

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## **0682 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010**

Joseph J. Bizzarro<sup>1</sup>, Mason N. Dean<sup>2</sup>, Adam P. Summers<sup>3</sup>

<sup>1</sup>University of Washington, School of Aquatic and Fishery Sciences, Seattle, WA, United States, <sup>2</sup>Max Planck Institute of Colloids & Interfaces, Potsdam, Germany, <sup>3</sup>University of Washington, Friday Harbor Labs, Friday Harbor, WA, United States

### **Standardized Diet Compositions and Trophic Levels of Rays**

The rays are a taxonomically diverse, paraphyletic group within the monophyletic Batoidea, encompassing all species that aren't skates and representing a majority (~355 extant species) of the superorder. Rays occupy a variety of marine habitats, generally replacing skates in shallow, warm-temperate and tropical seas, but also occurring in oceanic and deep sea regions. A wide variety of feeding modes and methods of prey acquisition have been reported, such as planktivory (e.g., Mobulidae), piscivory (e.g., Gymnuridae), durophagy (e.g., Rhinopteridae), excavation (e.g., Dasyatidae), and electroshock (Torpedinidae). In addition, predation and physical disturbance by rays have been demonstrated to regulate abundance and composition of prey resources. The diet and trophic ecology of this diverse and important group of predatory fishes, however, are poorly known. To better understand the ecological role of rays in marine communities, standardized diet compositions and trophic levels were calculated from a review of applicable quantitative studies. Diet composition and trophic level were estimated for all species with sufficient information and evaluated phylogenetically on ordinal, family, genus, and species levels. These results were then compared to those of similar studies conducted on sharks and skates. In addition, morphological and habitat variables were included to further investigate sources of variability in ray diet compositions and trophic levels. Results of this study will help demonstrate the ecological role of rays in marine communities and distinguish data poor taxa that should be priorities for future research.

## 0350 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Maria del Pilar Blanco-Parra<sup>1</sup>, Felipe Galván-Magaña<sup>1</sup>, Fernando Márquez-Farías<sup>2</sup>, Carlos Alberto Niño-Torres<sup>4</sup>

<sup>1</sup>Centro Interdisciplinario de Ciencias Marinas, IPN, La Paz, B.C.S., Mexico, <sup>2</sup>Instituto Nacional de Pesca. Centro Regional de Investigaciones Pesquera, Mazatlán, Sin., Mexico, <sup>3</sup>Universidad Autónoma de Sinaloa. Facultad de Ciencias del Mar, Mazatlán, Sin., Mexico, <sup>4</sup>Autónoma de Baja California Sur, Departamento de Biología Marina, La Paz, B.C.S., Mexico

### **Feeding Ecology of the Banded Guitarfish, *Zapteryx exasperata*, Inferred from Stable Isotopes and Stomach Contents Analysis**

The feeding ecology and trophic level of the banded guitarfish, *Zapteryx exasperata*, from the Gulf of California were assessed by stable isotope analysis (SIA) of carbon and nitrogen of muscle samples, and by stomach contents analysis (SCA).  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values showed no significant differences between sexes (ANOVA,  $F = 0.0$   $p = 0.94$  for  $\delta^{13}\text{C}$ ;  $F = 0.1$   $p = 0.78$  for  $\delta^{15}\text{N}$ ), suggesting that males and females have a similar diet. Those similarities were supported by the Morisita-Horn index value (0.75). The main prey species found were the daisy midshipman, *Porichthys margaritatus*, (54%), followed by the northern anchovy *Engraulis mordax* (6.84%) and striped cusk eel, *Ophidion galeoides* (6.35%). No diet overlap between juveniles and adults was found ( $CI = 0.23$ ) and significant isotopic differences were observed ( $\delta^{13}\text{C}$ , ANOVA,  $F = 13.3$   $p = 0.0004$  and  $\delta^{15}\text{N}$ , ANOVA,  $F = 4.7$   $p = 0.03$ ). A general increasing trend in  $\delta^{15}\text{N}$  values with increasing body length ( $F = 8.15$   $p = 0.005$ ) was observed. The mean trophic level estimated in this work by the two methods was  $\sim 4.1$ , indicating that this species is a top predator in the Gulf of California. The trophic niche breadth ( $Bi = 0.11$ ) and diversity index ( $H' = 2.32$ ) indicated that the banded guitarfish from the Gulf of California is a specialist feeder, predated mainly on benthic fishes.

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## 0363 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD

Erin Blevins, George Lauder

Harvard University, Cambridge, MA, United States

### **The Wall: Effects of Swimming Near the Substrate on a Robotic Ray Model**

Benthic fish live at the interface of the fluid and solid world. Their bodies and behaviors are specialized for life at this boundary; the substrate provides camouflage, prey habitat and, when it comes to locomotion, the potential to supplement swimming. A wide range of benthic fish use the substrate for a direct boost to propulsion, from pelvic fin punting

by skates and rays to fin-walking in sharks, batfish, lungfish, and many other taxa. However, even without direct contact locomotion is influenced--and can even be enhanced--by the presence of a nearby substrate, as wall effects alter the fluid flows experienced by undulating fins and bodies. To model the hydrodynamics of undulation near a solid surface and determine the effects on locomotion, simple model fins (30 Shore A Neoprene) were attached to a robotic flapper, with heave and pitch values corresponding to known stingray kinematics. Locomotor performance (self-propelling swimming speed) was determined for fins with free and actuated posterior edges across a range of frequencies (0.5, 1, 1.5 and 2 Hz) in freestream and near-wall positions. Digital particle image velocimetry was used to visualize the effect of the wall on fluid motion. For the same combination of fin & kinematics (free edge, 1 Hz), up to a 14% speed increase occurred near the wall ( $p < 0.05$ ), indicating that benthic fish may experience a locomotor benefit when swimming near the substrate.

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### **0364 Lundberg Symposium, Ballroom D, Sunday 11 July 2010**

Barbara Block

*Stanford University, Pacific Grove, CA, United States*

### **The Physiology, Ecology and Conservation of Northern Bluefin Tunas**

Northern bluefin tunas (*Thunnus thynnus* and *Thunnus orientalis*) are among the largest and most valuable species in the ocean. As an endothermic top predator, they play a pivotal role in marine ecosystems throughout the Atlantic and Pacific Oceans and adjacent seas. The bluefin tuna maintain warm body temperatures in frigid seas. Laboratory studies on captive Pacific bluefin metabolic and cardiac performance have demonstrated remarkable specializations that underlie niche expansion into cooler waters. In a project called TAG-A-Giant, over 1700 electronic tags have been deployed in Atlantic and Pacific bluefins and ~75,000 days of movement, behavior and physiological ecology data have been recorded the wild. The capacity to track ontogenetic data on migrations, physiology and ecology for up to five years has greatly improved our knowledge of how bluefin tunas use the ocean environs. The tagging data demonstrates that extensive trans-oceanic movements occur in short durations and provides evidence for site-directed fidelity to known breeding areas. Genetics and microconstituent data corroborate the hypothesis that there are multiple populations of Atlantic bluefin in the North Atlantic and Mediterranean Sea. Marine fish such as tunas with wide spatial distributions were once thought to be resilient to overexploitation however Atlantic populations of bluefin tuna have been proposed for a 2010 endangered species listings (CITES, Appendix I). The new tagging data can be integrated into spatially explicit fisheries models that improve our capacity to assess current and future bluefin tuna population sizes, improving our opportunity for conservation of the species.

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## 0283 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Sean Blomquist<sup>1</sup>, Karen Lannom<sup>2</sup>

<sup>1</sup>*Tennessee Technological University, Cookeville, Tennessee, United States*, <sup>2</sup>*University of Tennessee, Knoxville, Tennessee, United States*

### **Predicting the Effects of Long-term Sedimentation on Native Aquatic Salamanders and Fishes: An Application of RUSLE to Forests of Tennessee under Three Management Systems**

Forest management activities are recognized as a major source of decreased water quality. Although the use of best management practices (BMPs) for forestry reduces sedimentation, changes in hydrology and temperature fluctuations from removal of the tree canopy, sedimentation has been recognized as a persistent source of decreased water quality where BMPs are followed. Our objectives were to 1) predict locations of soil erosion in ~89,000 ha of managed forests, 2) compare the relative amount of sediment production under three forest management systems, and 3) identify areas decreased habitat quality for 11 species of native aquatic salamanders and fishes. We applied plans for forest management activities and the Revised Universal Soil Loss Equation to 602 sub-watersheds to spatially and temporally predict expected sediment volumes. Major sources of sediment included road construction and maintenance, timber harvests, and prescribed burns. Portions of the habitat of all 11 species were predicted to exceed sediment volumes that may have sub-lethal effects. Forest road construction and maintenance, including that from skidder trails and graveled and graded roads were the largest single source of sediment and the forest management system had little effect on the volume of sediment produced. Effectively retiring skidder trails, decreasing the maintenance interval of maintained roads, and ensuring stream crossings are adequate for the expected flood volume of the stream may help reduce sedimentation from forest roads. The results of our research will be directly applied to aid design of the Northern Cumberlands Forest Resources Habitat Conservation Plan (HCP) in Tennessee.

## 0132 Herp Development, 556 AB, Sunday 11 July 2010

Stephanie Bloom<sup>1</sup>, Carlos Infante<sup>2</sup>, Anne Everly<sup>2</sup>, James Hanken<sup>2</sup>, Nanette Nascone-Yoder<sup>1</sup>

<sup>1</sup>College of Veterinary Medicine, North Carolina State University, Raleigh, NC, United States, <sup>2</sup>Museum of Comparative Zoology, Harvard University, Cambridge, MA, United States

### Evolutionary-developmental Basis of Novel Gut Morphology in Frogs

We studied gut development in the obligate carnivorous tadpole of the South American frog, *Lepidobatrachus laevis*, to identify morphogenetic mechanisms that underlie the evolution of anatomically diverse digestive organs in vertebrates with distinct feeding strategies. Unlike the typical gut anatomy of omnivorous anuran larvae (e.g., *Xenopus laevis*), *Lepidobatrachus* tadpoles have a distensible stomach delimited by a pyloric sphincter, an elongated gastroduodenal (GD) loop, a rudimentary pancreas, and a short, uncoiled intestine. We used a novel “phenotypic engineering” approach to determine whether exposing *Xenopus* embryos to small-molecule inhibitors of candidate signaling pathways could induce *Lepidobatrachus*-like gut features, thus implicating specific molecular pathways in the evolution of larval carnivory. Compounds that inhibit the synthesis or signaling of retinoic acid (RA), a molecule involved in gut patterning, cause the *Xenopus* foregut to adopt features similar to *Lepidobatrachus*. In the reciprocal experiment, *Lepidobatrachus* embryos treated with ectopic RA develop a more characteristic anuran foregut. Interestingly, the expression domain of Pitx2, a transcription factor that mediates left-right asymmetry of the GD loop, is located much more posteriorly in *Lepidobatrachus* embryos, consistent with its unusual gut topography. *Xenopus* treated with RA synthesis/signaling inhibitors also exhibit a posteriorly shifted Pitx2 domain, whereas *Lepidobatrachus* Pitx2 expression is shifted anteriorly upon RA treatment. Alterations in RA and/or Pitx2 domains may underlie the evolution of digestive anatomy and thus facilitate the generation and integration of novel adaptive phenotypes. Small molecule-mediated phenotypic engineering offers a useful approach for uncovering morphogenetic mechanisms in non-model species. Supported by NSF (EF-0334846 – AmphibiaTree – to JH).

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**0632 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Christopher Boeckman<sup>1</sup>, Aaron Geheber<sup>1</sup>, Kyle Piller<sup>1</sup>

<sup>1</sup>*Southeastern Louisiana University, Hammond, LA, United States*, <sup>2</sup>*Southeastern Louisiana, Hammond, LA, United States*, <sup>3</sup>*Southeastern Louisiana University, Hammond, LA, United States*

**A Temporal Study of Body Shape Change and Niche Position of Darters in the Pearl River**

The Pearl River system drains approximately 23,000km<sup>2</sup> in central Mississippi and eastern Louisiana. In the past 50 years, the Pearl River has been subjected to several human induced modifications that have resulted in significant changes in habitat and the fish community. In particular, darters (Family Percidae) have been negatively impacted by these changes. Many species of darters co-occur in similar habitats, but ingest different prey items or occupy slightly different microhabitats, thereby allowing them to co-exist. Niche-partitioning has presumably allowed for high species richness and co-existence of darters in the Pearl River. More than twenty species of darters are known from the system, including the Pearl Darter, *Percina aurora*, which has not been collected in the drainage since the early 1970s. The purpose of this study was to use geometric morphometrics to analyze the degree of niche overlap among the darter species in the Pearl River and to examine temporal changes in niche position among the species as a result of the extinction of *P. aurora* in the Pearl River. We used body shape as a surrogate for niche-position, as it has been used in other studies. To date, specimens have been analyzed from Pools Bluff Sill from the 1960's-1980's. Results suggest that *P. aurora* is a generalist in terms of body shape, and that following the extinction of *P. aurora*, other species have filled in the niche formerly occupied by *P. aurora*.

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**0776 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010**

Ronald Bonett, Andrea Blair, Sarah Emel, Ana Lilia Trujano-Alvarez

*Department of Biological Sciences, University of Tulsa, Tulsa, OK, United States*

**Do Alternative Developmental Modes Promote Reproductive Isolation in Oklahoma Salamanders?**

Shifts in developmental timing are responsible for morphological divergence in many groups of organisms, but less attention has been given to the role of this phenomenon in establishing patterns of reproductive isolation and speciation. The Oklahoma salamander (*Eurycea tynerensis*) is a small stream-dwelling plethodontid endemic to the Ozark Plateau of east-central North America, and exhibits paedomorphosis and metamorphosis among populations. Alternative developmental modes of *E. tynerensis*

are tightly correlated with the substrate of the streambed that they inhabit, which dictates access to permanent water. Most populations exhibit only a single developmental mode, however over the last few seasons we have located habitat transition areas and populations that exhibit mixed life history strategies. We analyze mitochondrial and nuclear markers to test for reproductive isolation among *E. tynerensis* that exhibit alternative developmental modes, and we more broadly test if the evolution of alternative developmental modes acts as a diversifying mechanism in this group.

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## **0244 Fish Conservation, Ballroom B, Friday 9 July 2010**

Stephen Bortone

*Gulf of Mexico Fishery Management Council, Tampa, Florida, United States*

### **A Logic Model to Facilitate the Incorporation of Artificial Reefs into Fishery Management**

For the past 35 years, artificial reefs have been often touted as a way of assisting in fisheries management but as of yet, artificial reefs play almost no role in the regular management of any fishery. Part of the reason for the exclusion of artificial reefs as a component of fishery management plans are the lack of data that convincingly demonstrate the efficacy of artificial reefs to fishery managers. The logic model adopted here promotes the determination of program goals and objectives based on available resources to conduct activities that result in outputs that assure short, medium and long-term outcomes relevant to specific fisheries. A program's objectives can be several and include: 1) reduced natural mortality, 2) reduced fishing mortality, 3) increased survivorship, 4) increased fitness, and 5) improved essential fish habitat. The logic model is expanded to include the evaluation of features of artificial reefs using a hypothesis-based approach. If followed, this procedure should provide the data necessary to allow managers to satisfy program goals that will lead to improved fisheries management. Using the Logic Model approach also helps reef managers to partition reef attributes and biological attributes into manageable components that allow for efficient testing of hypotheses related to factors often controllable by managers. Adopting a scientifically rigorous method to evaluate artificial reefs as potential components of a fishery management plan will give direction to future research on the utility of artificial reefs. More importantly, it will encourage fishery managers to include artificial reefs as fishery management alternatives.

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## 0177 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Brian Bowen<sup>1</sup>, Jeff Eble<sup>1</sup>, Zoltan Szabo<sup>1</sup>, Luiz Rocha<sup>2</sup>, Matthew Craig<sup>3</sup>

<sup>1</sup>University of Hawaii, Kaneohe, Hawaii, United States, <sup>2</sup>University of Texas, Port Aransas, Texas, United States, <sup>3</sup>University of Puerto Rico, Mayaguez, Puerto Rico, United States

### **Phylogeography of Indo-Pacific Reef Fishes: Coloration, Speciation, and the Indo-Pacific Barrier**

In many genera of reef fishes, sister species are indistinguishable based on morphology, and taxonomic descriptions are based on differences in coloration. However genetic surveys of pygmy angelfishes (genus *Centropyge*), wrasses (genus *Halichoeres*), and butterflyfishes (genus *Chaetodon*) indicate that coloration can be an uncertain basis for designating evolutionary partitions. Here we contribute range-wide (Indo-Pacific) mtDNA surveys of an angelfish and a butterflyfish, both of which show diagnostic differences in coloration between Pacific and Indian Ocean populations. The angelfish *Pygoplites diacanthus* is regarded as a single species across the Indian and Pacific Oceans, whereas the butterflyfish is regarded as two species: *Chaetodon lunulatus* in the Pacific and *Chaetodon trifasciatus* in the Indian Ocean. The color morphs overlap in a region west of the Indo-Pacific barrier, the nearly continuous land bridge between Asia and Australia that forms during low sea level stands associated with glaciation. In this case color differences and mtDNA divergence indicate long-term isolation, but with movement of the Pacific form into the Indian Ocean.

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## 0638 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Kelly Boyle

Department of Zoology and Hawaii Institute of Marine Biology, University of Hawaii at Manoa, Honolulu, HI, United States

### **Divergent Sound Production Mechanisms in the Chaetodontid Butterflyfish Genera *Forcipiger* and *Hemitaurichthys***

The production of low frequency sounds for communication has evolved multiple times within teleosts and involves mechanisms that include the swim bladder as a sound source in combination with intrinsic or extrinsic musculature. Evolution of sound production mechanisms, however, is poorly studied among closely related taxa. We conducted high-speed videography (600 fps) and electromyography (EMG) experiments with forcepsfish (*Forcipiger flavissimus*) and pyramid butterflyfish (*Hemitaurichthys polylepis*) to test hypotheses on conservation of kinematics and muscle activity involved

in sound production by sister genera. Both species produce sounds with similar spectral content and intensity: peak frequency of  $79 \pm 25.4$  (SE) Hz and sound pressure level of  $125 \pm 8.9$  dB re:  $1\mu\text{Pa}$  for *F. flavissimus* and  $97 \pm 32.6$  Hz and  $123 \pm 3.7$  dB for *H. polylepis*. However, pyramid butterflyfish produce sounds in rapid pulse trains whereas forcepsfish only single pulses. *Forcipiger* sound pulse production includes a rapid elevation of the head, anterior movement of the ventral pectoral girdle relative to the body cavity and swim bladder, and contractions of the anterior epaxialis, A1 & A2 adductor mandibulae and sternohyoideus muscles at the onset of sound emission. In contrast, sound pulses produced by *Hemitaenichthys* lack head motion but show a rapid buckle of the skin over a small area of anterior hypaxial musculature lateral to the anterior swim bladder and behind the dorsal pectoral girdle. The high muscle firing rate and buckling mechanism in the pyramid butterflyfish may promote the production of rapid pulses observed in defense of spawning sites.

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## **0055 Roads Symposium I, Ballroom B, Saturday 10 July 2010**

Steven Brady

*Yale University, New Haven, CT, United States*

### **Roads to Perdition? Amphibians in Roadside Pools**

The network of roads on the landscape is vast: approximately 80 % of land in the contiguous U.S. lies within 1 km of a road. This road presence contributes a suite of direct (e.g., roadkill) and secondary effects that negatively influence communities. Secondary effects are multifarious in form, and include habitat conversion, fragmentation, contamination from runoff, and pollution from noise and light. Despite the prevalence and diversity of secondary road effects, our understanding of their long-term consequences remains nascent. This stems in part from the dearth of studies that address these secondary effects, and in part from the traditional investigative approaches typically employed. Traditional ecological approaches tend to assume all local populations respond equivalently, in this case to secondary road effects. Yet, widespread processes such as dispersal, contemporary evolution, and inherited environmental effects may generate strong variation among local populations, yielding profound differences in response. For example, road salt exposure and field-based transplant experiments reveal not only that secondary effects of roads negatively influence pre-metamorphic performance in wood frogs and spotted salamanders, but also that the magnitude of this effect depends upon population origin. Strikingly, when reared in a common garden, individuals from roadside wetlands survive 24 % less than local conspecifics from wetlands located more than 200 m from a road. This suggests that the subset of the population most susceptible to roads may be that which is least capable of persisting in roadside environments, highlighting the need to evaluate road effects in light of local population variation.

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## **0580 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Rob Bragg, Stephen Richter

*Eastern Kentucky University, Richmond, KY, United States*

### **A Comparison of Amphibian Communities Between Natural Ponds and Constructed Ponds of Multiple Age Classes**

Amphibians continue to decline worldwide, and habitat loss is one of the primary factors. A habitat of concern in the eastern United States is the isolated vernal pond, which serve as primary breeding habitat for many amphibians. When these habitats are removed by human activity, some states require mitigation through a “no net loss” policy. However, only six states regulate geographically isolated wetlands, and 17 states only regulate wetlands based on the Clean Water Act, which provides no protection for isolated ponds. When mitigation does take place, it is often poorly monitored and lacks sufficient standards for success. As amphibian conservation and management become increasingly important in light of rapid declines due to habitat loss, the ability to construct habitat and monitor it efficiently will be crucial in preservation of species. The primary research objective was to compare amphibian communities between natural isolated ponds and constructed ponds from multiple construction age classes (2-20 years) in Daniel Boone National Forest, eastern Kentucky. Abundance and composition of amphibian communities were quantified using aquatic minnow trapping and standardized dipnetting. To determine factors shaping community composition, habitat variables including canopy cover, hydroperiod, coarse woody debris, aquatic vegetation, and distance to nearest possible source pond were collected in all ponds. Because artificial ponds of multiple ages were sampled, a chronology of amphibian community succession was developed. Implications of the study to be discussed will include factors important to best replicate natural isolated ponds and the amount of time required to colonize for different species.

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## **0606 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010**

Elizabeth L. Brainerd

*Brown University, Providence, RI, United States*

### **The Real Story Behind the Remarkable Discovery of Liem's Ground Fishes**

With the death of Karel F. Liem in September 2009, ichthyology and evolutionary biology lost a beloved iconoclast. Karel was suspicious of any absolute statements in science, and made valuable contributions in several areas by questioning accepted theories. In the 1970s, a widely espoused theory of trophic ecology held that morphological specialization for feeding on one specific food type would necessarily impair performance on other types. Karel showed that this is not the case for some

African cichlids. These fishes are able to be "jacks of all trades and master of one," and he showed that suction feeding is the key to retaining tropic versatility. In 1990 (Amer. Zool. 30:209), Karel aimed to "stimulate discussion" with a modest set of proposals including claims that character displacement is absent in fishes and that aquatic vertebrate feeding systems "defy the terrestrial paradigm." These provocative statements led Robinson and Wilson (Am. Nat. 151:223) to coin the term "Liem's paradox," and to suggest an insightful solution. However, a tremendously important discovery reported in Figure 5 of Karel's 1990 Amer. Zool. paper has largely been overlooked. During one of his MCZ trips to Galapagos, Karel discovered that Darwin's ground finches are actually fishes! This discovery was discussed further in one published abstract (Amer. Zool. 30:134A), but the significance of this remarkable finding is only now becoming clear. These unfortunate fishes have become locked in the terrestrial paradigm, forced into convergence and character displacement by loss of the sublime versatility afforded by the aquatic environment.

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## **0043 Roads Symposium II, Ballroom B, Saturday 10 July 2010**

### Bill Branch

*Maryland State Highway Administration, Baltimore, MD, United States*

### **The MD RT 30 Hampstead Bypass: The Planning and Design of a Green Highway**

The Maryland Route 30 Bypass at Hampstead, Carroll County is a long-awaited safety and congestion relief project proposed by the Maryland State Highway Administration. However, an unanticipated challenge arose during the final design stages and prior to the submittal of state and federal environmental construction permit applications. In 1997, the northern population of the bog turtle (*Clemmys muhlenbergi*) was listed as a threatened species under the Endangered Species Act. The rural residential and agricultural lands surrounding Hampstead provide essential habitat for this rare turtle. While many saw this as potentially threatening to the project, others saw this as an opportunity for a creative approach for habitat and species protection. This presentation will discuss the process that was undertaken to study potential conflicts between road construction and the protection of a federally threatened species, engineering design decisions made in order to add additional protections for the turtle, and development of a habitat management plan which insures the future protection of bog turtles and their habitat. Additional environmental stewardship initiatives to benefit wildlife that have been taken as a result of bog turtle habitat protection will also be discussed. Environmental issues and processes need not be a wedge driven between competing interests. Inclusion and dialog throughout coordination and design processes shows that a consensus can be built that not only results in a better project but also serves to insure the long-term viability of valuable natural resources. This "green" highway approach may provide a blueprint for resolving similar conflicts in the future.

## 0221 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Nereida Bravo<sup>1</sup>, Karen Crow-Sanchez<sup>1</sup>, David Ebert<sup>2</sup>

<sup>1</sup>San Francisco State University, San Francisco, CA, United States, <sup>2</sup>Moss Landing Marine Laboratories, Moss Landing, CA, United States

### **Phylogenetic Affinities in the Rajiformes and Implications for the Evolution of Multiple Embryos per Egg Capsule**

Skates of the order Rajiformes can be found in many different benthic habitats all over the globe. Within the genus *Raja*, there are approximately 28 species in the genera Rajidae. However many of these genera are paraphyletic, and currently there are no phylogenetic hypotheses proposed based on molecular data. Within the Rajiformes, oviparity is the dominant mode of reproduction. All species of skates lay a single embryo per egg capsule except for two, *Raja binoculata* and *Raja pulchra*, which have multiple embryos per egg capsule. Our first goal is to propose a molecular phylogeny for five genera that are closely related to the genus *Raja* based on three mitochondrial DNA loci, 12S, 16S, and CO1. Our second goal is to infer the evolutionary history of having multiple embryos per egg capsule. This will inform the broader question of factors affecting the fecundity and genetic diversity of *Raja binoculata* and *Raja pulchra*.

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## 0619 Fish Ecology, 555 AB, Sunday 11 July 2010

Matthew Breece<sup>1</sup>, Dewayne Fox<sup>1</sup>, Tom Savoy<sup>1</sup>, Daniel Erickson<sup>1</sup>

<sup>1</sup>Delaware State University, Dover, Delaware, United States, <sup>2</sup>Delaware State University, Dover, Delaware, United States, <sup>3</sup>Connecticut Department of Environmental Protection, Old Lyme, Connecticut, United States, <sup>4</sup>Oregon Department of Fish and Wildlife, Newport, Oregon, United States

### **Marine Migration and Habitat Use of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the New York Bight**

Atlantic Sturgeon were plentiful along the Atlantic seaboard prior to precipitous declines in the early 20<sup>th</sup> century resulting from over harvest and habitat destruction. By utilizing new capture techniques and standardized passive acoustic telemetry equipment, we were able to implant acoustic transmitters into 51 Atlantic sturgeon off the Delaware coast and follow their marine movements in 2009. Additionally we utilized Atlantic sturgeon (n=39) tagged from other regions (Hudson River, Long Island Sound and North Carolina coast). Migratory Atlantic sturgeon arrived off the Delaware-Maryland coast in spring (April 4 to May 29) and slowly made their way northward exiting the array by early summer (April 9 to June 29) before entering distant arrays in the Hudson River and Long Island Sound. In the fall, Atlantic sturgeon exhibited more

directed southerly movements transiting the array in 2 or 3 days in early November. A large aggregation of telemetered adult and juvenile Atlantic sturgeon was discovered occupying polyhaline marine waters near the mouth of Delaware Bay during the summer months. Atlantic sturgeon were detected much more frequently at receiver locations in state waters (< 3 miles offshore) when compared to waters under federal jurisdiction. A better understanding of Atlantic sturgeon marine movements will aid managers in developing recovery strategies for Atlantic sturgeon.

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## **0627 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Cheryl Brehme, Robert Fisher

*U.S. Geological Survey, San Diego, CA, United States*

### **Roads and Conservation of Herpetofauna in Southern California**

Habitat conservation plans (HCPs) are being created across the southern California region for the preservation of lands to conserve a wide array of species. Much of these lands are permeated by roads. Animals that avoid roads may be susceptible to effects of habitat fragmentation. We documented road avoidance behavior in two species of lizards using fluorescent dye tracking techniques. Animals that do not avoid roads are at risk of extirpation due to increased mortality. We conducted a comprehensive road mortality study on 10 different roads totaling 94 km and found very high mortality of amphibians where the roads were adjacent to stream habitat. Repeat surveys were conducted at different times and environmental conditions. In comparison to daytime surveys, we found over two times more dead individuals at night and over 25 times more dead individuals on wet nights, particularly toads that use both stream and upland habitat for resource use. Finally, there is reason to believe that Pacific pond turtles do not avoid roads. Females, in particular, require multiple habitats for resource use as they breed in pond habitat and lay their eggs in the uplands. Populations adjacent to roads are highly male-biased with little to no recruitment. By understanding species behavioral responses to roads and their resource needs, we can identify those most at risk from roads within their habitat. We also must consider methodological bias in assessing road effects. This will aid us in making informed management decisions to ensure species persistence within the HCPs of southern California.

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## **0630 Herp Conservation I, 556 AB, Thursday 8 July 2010**

Cheryl Brehme, Greta VanScoy, Sara Schuster, Robert Fisher

*U.S. Geological Survey, San Diego, CA, United States*

### **Long Term Monitoring of Arroyo Toads: Multi-Year Trend Analysis and Program Evaluation**

Since 2003, we have conducted an occupancy monitoring program for the endangered arroyo toad (*Bufo californicus*) on Marine Corps Base Camp Pendleton (MCBCP). To address the problems associated with large variations in adult toad activity, we track the presence of arroyo toad breeding populations by documenting the presence of eggs and larvae. Multi-year occupancy models show that arroyo toad population dynamics differ according to hydrology. Population dynamics of ephemeral systems are highly variable and driven by stochastic processes (i.e. amount of rainfall), while perennial systems are more stable and likely driven by deterministic processes (i.e. predation, competition, habitat alteration). In the perennial systems, detection of toad larvae is consistently negatively associated with non-native aquatic species. We believe these responses are a result of both direct and indirect effects. We also used simulated data based on the first 6 years of monitoring to assess the power of current and alternate sampling scenarios to detect both constant and variable changes in the distribution of breeding arroyo toads. We evaluated four designs representing the same effort or reduced effort: all permanent sampling sites, a combination of permanent and rotating sites, sampling every other year, and sampling a reduced number of sites. We found that all designs had relatively high power to detect a 20% decline in occupancy over a 6-year period and were able to distinguish between differing patterns of decline simulated for ephemeral and perennial watersheds.

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## **0730 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Patricia Brennan<sup>2</sup>, Gregory Watkins-Colwell<sup>1</sup>

<sup>1</sup>*Yale Peabody Museum of Natural History, New Haven, CT, United States*, <sup>2</sup>*Yale University, Ecology & Evolutionary Biology, New Haven, CT, United States*

### **Intraspecific Variation and Seasonality in Hemipene Morphology in *Thamnophis sirtalis***

The genital morphology of snakes is incredibly diverse, yet we know little about the evolutionary forces that are responsible for this variation. Despite many existing studies of hemipene morphology we lack information necessary to understand whether patterns of hemipene variation have any functional significance. There is little data on the levels of intraspecific variation in hemipene morphology, and nothing is known about the

seasonal patterns of genital morphology of the same individuals followed during an entire year. We established a colony of *Thamnophis sirtalis* in the lab and each month everted, photographed and measured each hemipene to determine the morphological variation in hemipenes, and whether we could detect any seasonal patterns. Our results show that intraspecific variation is very high and it is uncorrelated with body size (length/mass). Despite the fact that garter snakes are seasonal breeders, we did not detect any seasonal patterns of variation on the characters we could measure.

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### **0305 AES Conservation & Management, 552 AB, Friday 9 July 2010**

Karyl Brewster-Geisz, LeAnn Hogan, Jacqueline Wilson, Peter Cooper, Joe Desfosse, Guy DuBeck, Steve Durkee, Richard Hall, Margo Schulze-Haugen, George Silva

*NOAA/NMFS, Silver Spring, MD, United States*

### **Status of Atlantic Shark Management in the United States**

The Highly Migratory Species (HMS) Management Division of the National Marine Fisheries Service (NMFS) is responsible for the management of the U.S. federal shark fisheries in the Atlantic Ocean including the Gulf of Mexico and Caribbean Sea. Over the past few years, there have been numerous changes in how the shark fisheries are managed, which have required changes to the fishery management plan (FMP). In July 2008, NMFS implemented new management measures in the Atlantic shark fisheries, including a requirement that all sharks be landed with fins naturally attached and the creation of a small shark research fishery focusing on the sandbar shark (*Carcharhinus plumbeus*). Based on recent stock assessments, NMFS released Draft Amendment 3 to the Consolidated HMS FMP in July 2009. Under the Draft Amendment 3, management measures were proposed that would implement measures to rebuild blacknose sharks (*C. acronotus*), end overfishing of shortfin mako (*Isurus oxyrinchus*) and blacknose sharks, and establish federal management of smooth dogfish (*Mustelus canis*). The final management measures for Amendment 3 are expected to publish in late spring 2010. NMFS will continue to update management measures, as needed, based in part on shark stock assessments.

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## 0248 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

Richard Brinn<sup>2</sup>, D. Michelle McComb<sup>1</sup>, Levy Gomes<sup>3</sup>, Bernardo Baldisserotto<sup>4</sup>, Lucelle Dantas de Araujo<sup>5</sup>, Janessa Sampaio de Abreu Ribeiro<sup>6</sup>, Jaydione Marcon<sup>5</sup>

<sup>1</sup>Florida Atlantic University, Boca Raton, Florida, United States, <sup>2</sup>Florida International University, Miami, Florida, United States, <sup>3</sup>Centro Universitario Vila Velha, Vila Velha, Brazil, <sup>4</sup>Universidade Federal de Santa Maria, Santa Maria, Brazil, <sup>5</sup>Universidade do Amazonas, Manaus, Brazil, <sup>6</sup>Universidade Federal do Mato Grosso, Cuiaba, Brazil

### **Stress in the Amazonian Ornamental Cururu Stingray *Potamotrygon cf. histrix* During Transport**

In the middle Rio Negro region of the Brazilian Amazon over 60% of the local economy is based on ornamental fish exports which include several freshwater stingray species in the family Potamotrygonidae. The cururu stingray, *Potamotrygon cf. histrix*, is one of six legal stingray exports and has an annual quota of 6,000 individuals. Stress is high during the first 24 hours of transport due to a combination of poor water quality and handling procedures. The goals of this study were two-fold: 1) to test the efficacy of an antibiotic and probiotic treatment in reducing stress and mortality during transportation of the freshwater stingray 2) and to confirm whether serum corticosterone is a reliable measurement of stress in this species. A total of 76 stingrays were collected and placed into control, probiotic, and antibiotic treatment groups. Several water parameters including pH, temperature, conductivity, and oxygen were sampled throughout experimentation. Serum corticosterone was measured in individuals at baseline (within 3 minutes of capture), during pre-transport (in river pens), and at 3, 12, and 24 hours into transport. No mortality was observed, and baseline corticosterone levels ( $7.2 \pm 0.7$  ng/ml) and pre-transport levels ( $10.1 \pm 0.4$ ) were significantly lower than all other treatments including the 24 h antibiotic ( $124.9 \pm 28.5$ ) and 24 h probiotic ( $153.2 \pm 37.4$ ) treatments. Our results indicate that probiotic and antibiotic treatments did not reduce stress and corticosterone levels increase with transport time and are a reliable indicator of stress in the cururu stingray, *Potamotrygon cf. histrix*.

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**0765 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; NIA BEST STUDENT POSTER AWARD**

Kristen Brochu<sup>1</sup>, William Crampton<sup>2</sup>, Nathan Lovejoy<sup>1</sup>

<sup>1</sup>University of Toronto, Toronto, ON, Canada, <sup>2</sup>University of Central Florida, Orlando, FL, United States

**Testing the Predator Avoidance Hypothesis: Evolution of EOD Phase Number in *Gymnotus***

*Gymnotus*, the banded electric knifefish, is a diverse genus, with 35 known species, found in a variety of habitats throughout the Neotropics. *Gymnotus* has the largest range of any gymnotiform, extending from Argentina to southern Mexico, with species on both the eastern side of the Andes (cis-Andean) and the western side (trans-Andean). Individuals emit an electric organ discharge (EOD) that is species-specific and is used for navigation and communication. Both *Gymnotus cylindricus* and *Gymnotus maculosus*, which occur in Central America, have monophasic EODs (i.e. composed of a single phase), while all adult cis-Andean *Gymnotus* species studied to date exhibit multiphasic EODs. Biphasic waveforms are hypothesized to have evolved as a mechanism to avoid electro-receptive predators, while known trans-Andean species are hypothesized to have evolved the basal monophasic state due to the scarcity of electro-receptive predators in the region. Seven species of *Gymnotus* exhibit exclusively trans-Andean distributions; however, to date only two of these species have a known EOD and only one has been included in molecular studies (*G. cylindricus*). Here, we consider the evolution of *Gymnotus* EOD phase number in a phylogenetic context in order to evaluate the relevance of the predator avoidance hypothesis in *Gymnotus*. We collected trans-Andean *Gymnotus* species from multiple sites in Panama and Costa Rica and conducted recordings of their EODs. We sequenced multiple nuclear and mitochondrial genes to incorporate these taxa into molecular phylogenetic investigations.

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**0073 Herp Conservation III, Ballroom B, Sunday 11 July 2010**

Robert Brodman

Saint Joseph's College, Rensselaer, IN, United States

**The Effects of an Aquatic Glyphosate Herbicide on *Ambystoma* Salamander Larvae**

Some herbicides (e.g. Atrazine, Round-up) are threats to amphibians. The EPA has not approved Atrazine and Round-up for aquatic use; however, these herbicides have negative effects on amphibians when they reach wetlands. We need more research, especially long-term studies, to determine if aquatic approved herbicides are safe for

amphibians. We applied a 5% solution of the aquatic-approved glyphosate herbicide Accord to six species of *Ambystoma* larvae under laboratory conditions and then monitored survival, growth, development, and behaviors for four months post-hatching. Herbicide treatment affected all six species, however not all species were affected in the same way. Herbicide treated Tiger Salamanders, Marbled Salamanders, Blue-spotted Salamanders, and Jefferson Salamanders had significantly reduced survival. Overall, about half of the herbicide treated larvae survived compared to about three-quarters of the control larvae. Treated Tiger Salamanders, Marbled Salamanders, and Jefferson Salamanders were significantly smaller. Treated Blue-spotted Salamanders, Jefferson Salamanders, and Marbled Salamanders were significantly less developed and all six species had significantly greater instances of fluctuating asymmetry than control larvae. Treated Spotted Salamanders, Tiger Salamanders, Streamside Salamanders, and Jefferson Salamanders ate significantly fewer worms during feeding assays. Treated Blue-spotted Salamanders, Jefferson Salamanders, Tiger Salamanders, and Streamside Salamanders were significantly less active than control larvae. Treated Tiger Salamanders and Spotted Salamander were significantly more aggressive than control larvae. Treated Tiger Salamanders and Streamside Salamanders spent significantly less time in vegetation than control larvae. Aquatic herbicides have long-term lethal and sublethal impacts on *Ambystoma* larvae during development that can affect their fitness.

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## 0188 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

Edward Brooks<sup>1</sup>, Andrew Danylchuk<sup>8</sup>, Steven Cooke<sup>4</sup>, John Mandelman<sup>6</sup>, Greg Skomal<sup>7</sup>, David Philipp<sup>3</sup>, Katherine Sloman<sup>2</sup>, David Sims<sup>5</sup>, Stephanie Liss<sup>3</sup>, Cory Suski<sup>3</sup>

<sup>1</sup>Cape Eleuthera Institute, Eleuthera, Bahamas, <sup>2</sup>University of Plymouth, Plymouth, Devon, United Kingdom, <sup>3</sup>University of Illinois, Urbana, Illinois, United States, <sup>4</sup>Carlton University, Ottawa, Ontario, Canada, <sup>5</sup>Marine Biological Association of the United Kingdom, Plymouth, Devon, United Kingdom, <sup>6</sup>New England Aquarium, Central Wharf, Boston, Massachusetts, United States, <sup>7</sup>Massachusetts Division of Marine Fisheries, Oak Bluff, Massachusetts, United States, <sup>8</sup>University of Massachusetts, Amherst, Massachusetts, United States

### **The Physiological Consequences of Longline Capture in Caribbean Reef Sharks (*Carcharhinus perezii*)**

Longline fishing is arguably the most common capture method for sharks around the world, resulting in the capture and release of a large number of non-target or protected species annually. To date, however, the physiological disruption caused by longline capture, and the subsequent impacts on post-release survival and behaviour are poorly understood. To quantify the lethal and sub-lethal effects of longline capture in the commonly exploited Caribbean reef shark (*Carcharhinus perezii*), 40 individuals (Male=18, Female=22) were captured using standard, mid-water longlines. Hook timers provided

accurate hooking duration to the nearest minute. Once sharks were landed, to quantify their levels of stress, blood samples were taken and used to measure a suite of physiological parameters. No sharks died while on the longline. Although there were significant non-linear relationships between hooking duration and pH, lactate, pCO<sub>2</sub> and glucose, there was no significant variation in HCO<sub>3</sub><sup>-</sup> and haematocrit. Analysis is ongoing for plasma ion concentrations (Na<sup>+</sup>, Cl<sup>-</sup>, Ca<sup>2+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>), whole blood haemoglobin, and urea. In parameters analyzed to date, the greatest level of physiological disruption appears to occur at 100-150 minutes of hooking; control animals and those hooked for the maximum duration of 240 minutes presented the least disturbed blood chemistry. Further analysis of the ionic and osmotic disruption induced by the capture event will likely clarify these initial trends and aid in predicting the fate of sharks post-release.

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### **0757 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010**

Christopher W. Brown<sup>1</sup>, Thomas C. Owens<sup>2</sup>, Robert N. Fisher<sup>1</sup>

<sup>1</sup>USGS Western Ecological Research Center, San Diego Field Station, San Diego, CA, United States, <sup>2</sup>Dept. of Herpetology, San Diego Zoo, San Diego, CA, United States

### **Restoration of Western Pond Turtles in the MSCP Region of San Diego, California**

Riparian systems in coastal San Diego have endured heavy impacts from fragmentation, urban development, altered hydrology, invasive species and high intensity wildfires. These systems are home to the western pond turtle which is covered under the San Diego Multi-Species Conservation Plan. This interagency habitat conservation plan was implemented to conserve nearly forty different animal species in the region and even more plant species. The USGS San Diego Field Station and San Diego Zoo are studying the recovery of the western pond turtle in a population heavily impacted by exotic species and altered hydrology. This population has produced gravid females in the wild but no detectable recruitment in recent years. In collaboration with the San Diego Zoo, we are implementing and assessing effectiveness of two management tools by removing invasives from available habitat and headstarting in an effort to increase survival probability. First, we examine the western pond turtle's response to invasives control through capture/recapture rates, age structure of captured turtles and proportion of gravid females observed. Second, we report on the success of captive rearing of eggs harvested from gravid females found in the wild population.

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## **0540 AES Behavior & Ecology, 552 AB, Friday 9 July 2010**

Lori Brown<sup>1</sup>, Thomas Savoy<sup>2</sup>, John Manderson<sup>3</sup>, Dewayne Fox<sup>1</sup>

<sup>1</sup>*Delaware State University, Department of Agriculture and Natural Resources, Dover, DE, United States*, <sup>2</sup>*CT Department of Environmental Protection, Hartford, CT, United States*, <sup>3</sup>*NOAA Fisheries Service, Northeast Fisheries Science Center, James Howard Marine Science Laboratory, Sandy Hook, Highlands, United States*

### **The Atlantic Cooperative Telemetry Network: A Collaborative Approach to Telemetry Data Exchange in the Eastern United States**

The recent advent of relatively low cost passive acoustic telemetry equipment has made it possible to examine large scale habitat utilization and movement patterns of aquatic organisms. However, due to these large scale movements it is not always reasonable for researchers to maintain an array that documents the full extent of activity. The Atlantic Cooperative Telemetry (ACT) Network was created to maximize this technology's potential by facilitating data sharing coast-wide. What started with word-of-mouth and email exchanges is now a more formalized network of research groups from Maine to Florida with arrays ranging in size from small river drainages to coastal systems. Currently, the ACT Network provides members with transmitter codes deployed by other participants. The level of data exchange depends on individual researchers; general or detailed information about transmitter locations can be provided on a case by case basis. We intend to enhance the ACT Network by developing an interactive web-based data sharing system, providing summary detection locations and times to registered members. We feel that the ACT Network could be used as a model for enhancing collaborative efforts as well as serving a role in existing networks like the Ocean Tracking Network and Integrated Ocean Observing System.

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## **0135 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010**

Simon C. Brown<sup>1</sup>, Joseph J. Bizzarro<sup>2</sup>, Gregor M. Cailliet<sup>1</sup>, David A. Ebert<sup>1</sup>

<sup>1</sup>*Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, United States*, <sup>2</sup>*School of Aquatic & Fishery Sciences, University of Washington, Seattle, WA, United States*

### **Inter-annual and Regional Variation in the Diet of Two Common Skate Species (*Bathyraja aleutica* and *B. interrupta*) on the Western Gulf of Alaska Continental Shelf**

The Aleutian (*Bathyraja aleutica*), and Bering (*B. interrupta*) skates are common ground fishes occurring throughout the outer continental shelf and upper slope of the Gulf of Alaska. Inter-annual and regional variation in the diet of these skates was investigated

to elucidate their ecological roles in the Gulf of Alaska continental shelf ecosystem. Specimens were collected from fishery-independent trawl surveys of the Alaska Department of Fish and Game and National Marine Fisheries Service conducted in three eco-regions: Shelikof Strait, Alaska Peninsula, and the south-eastern side of Kodiak Island during May-September, 2006-2007. Decapod crustaceans were the primary prey items in the diets of both skates. Among decapods, pandalid shrimps dominated the diets of both species. Inter-annual dietary differences were noted for *B. aleutica* and *B. interrupta* within Shelikof Strait in that euphausiids comprised a much greater proportion of the diet during 2007, and the contribution of pandalid shrimps was relatively less substantial. The diets of *B. aleutica*, and *B. interrupta* during 2006 were similar, consisting primarily of pandalid shrimps, with crabs and fishes of secondary importance. These skates appear to be generalists, consuming locally-abundant invertebrates and fishes (e.g. pandalid shrimps, tanner crabs, gadids, and osmerids). As common benthic competitors with other ground fishes, these two skate species may play an influential role in trophic dynamics and regulation of demersal marine assemblages in the Gulf of Alaska ecosystem.

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### **0507 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Tanya Brunner<sup>1</sup>, Breanna Ondich<sup>1</sup>, Mollie Taylor<sup>2</sup>, Mark McRae<sup>1</sup>, Lori McRae<sup>1</sup>

<sup>1</sup>University of Tampa, Tampa, Florida, United States, <sup>2</sup>Florida State University, Tallahassee, Florida, United States

#### **Stomach Content Analysis of *Kuhlia xenura* in Two Hawaiian Streams.**

Fishes in the family Kuhliidae are found in subtropical and tropical fresh, estuarine, and marine waters of the Indo-Pacific. *Kuhlia xenura* is endemic to the Hawaiian Islands and likely spawns in marine habitats. Known locally as the Hawaiian flagtail or āholehole, these fish are euryhaline and are abundant in the terminal reaches of Hawaiian streams. *Kuhlia xenura* has recently been split from the more widely distributed *Kuhlia sandvicensis*, so there is little species-specific information available on any aspect of their biology, including diet. Juvenile fish were collected in 2007 and 2008, during day and night hours, from freshwater and estuarine habitats of Hakalau and Kolekole Streams on the Island of Hawai'i. Stomach contents were identified to the lowest taxonomic level possible, and the habitat origins for these food items were identified. Stomach contents included larval fish, larval and adult arthropods (mainly insects and crustaceans), annelids, and flatworms. In addition, freshwater algae (primarily filamentous greens and diatoms) were found in most but not all fish. Items found in *K. xenura* stomachs included terrestrial, freshwater, and marine species, and differences in day and night feeding have been identified. Because *K. xenura* move between fresh and salt water, they are an indicator of ecological connections between terrestrial, stream, and coastal marine ecosystems, especially with respect to nutrient flow. An understanding of their feeding ecology will also aid in the management of this culturally important food fish.

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**0273 AES GRUBER AWARD, 551 AB, Friday 9 July 2010**

Walter Bubley<sup>1</sup>, Paul Tsang<sup>1</sup>, David Koester<sup>2</sup>, James Sulikowski<sup>2</sup>

<sup>1</sup>University of New Hampshire, Durham, NH, United States, <sup>2</sup>University of New England, Biddeford, ME, United States

**A Reassessment of Spiny Dogfish, *Squalus acanthias*, Reproductive Parameters Following Increased Fishing Pressure in the Northwest Atlantic**

Spiny dogfish (*Squalus acanthias*) are considered the most abundant shark species in the Northwest Atlantic, but recent concerns regarding population size argue for updating their life history parameters. The last comprehensive study conducted on spiny dogfish in the Northwest Atlantic was over 20 years ago and prior to increased fishing pressure. A recent study examining fecundity in response to this fishing pressure observed a decrease in the median size of females at maturity as well as the size at first maturity using gross morphological criteria. One goal of our present study was to conduct a more complete examination of reproductive parameters of spiny dogfish in the Northwest Atlantic, using hormonal and histological assessments, as well as morphological observations. Blood and gonads were collected monthly from spiny dogfish from July 2006 - February 2009. Gross morphological parameters of reproduction were measured, including gonad weight for both sexes, ovarian follicle number and size, as well as pup number and size for females, with clasper length and calcification for males. Testes were processed and stained histologically to examine spermatogenesis. Plasma testosterone, estradiol, and progesterone concentrations were quantified using specific radioimmunoassays. The results showed changes in regards to size and age at maturity, fecundity and hormone concentrations, when compared to studies prior to the increased fishing pressure. By examining spiny dogfish reproductive parameters using a combination of histological, hormonal, and morphological endpoints, they provide a more accurate and higher resolution assessment of maturity and seasonality, which can be incorporated into fishery management plans.

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**0195 Poster Session III, Exhibit Hall D, Sunday 11 July 2010; ASIH STORER HERPETOLOGY AWARD**

Scott W. Buchanan

Montclair State University, Montclair, New Jersey, United States

**Movement Ecology and Habitat Utilization of the Eastern Hognose Snake (*Heterodon platirhinos*) at Cape Cod National Seashore**

The Eastern Hognose Snake (*Heterodon platirhinos*) is a species of increasing conservation concern in the northeastern United States. Once common in certain geographic areas,

populations of this species have declined in recent decades. Investigations of movement ecology and habitat utilization of *H. platirhinos* in the northeastern U.S. will contribute to the effort to conserve this species. A radiotelemetry research project was initiated in 2009 to track adult *H. platirhinos* at Cape Cod National Seashore (CACO). A total of ten adults (7 females, 3 males) were surgically implanted with Holohil SI-2T (9g and 11 g) and SB-2T (5g) radio transmitters. Individuals were relocated approximately every four days, on average (less frequently September-November). At each unique location data was collected on body temperature, behavior, geographic location, and microclimate. Body temperature was determined by measuring the pulse frequency of the transmitters. Body mass and length measurements were taken in the field approximately every two weeks. In an effort to characterize habitat utilization and assess habitat preferences of *H. platirhinos* at CACO, data were collected at two spatial scales (1m<sup>2</sup> quadrat and 15m radius) on a suite of *a priori* selected physical and vegetative characteristics deemed potentially meaningful. Data collection was carried out using identical methods at an equal number of paired "random" points. Five snakes were successfully tracked to hibernacula. Radiotelemetry will continue on these individuals and on other opportunistic captures in the 2010 active season.

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## **0024 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010**

Kurt Buhlmann<sup>1</sup>, Tracey Tuberville<sup>1</sup>, Stephanie Koch<sup>2</sup>, Brian Butler<sup>3</sup>, Veronica Palmero<sup>3</sup>

<sup>1</sup>*University of Georgia, Savannah River Ecology Laboratory, Aiken, South Carolina, United States*, <sup>2</sup>*U.S. Fish and Wildlife Service, Sudbury, Massachusetts, United States*, <sup>3</sup>*Oxbow Associates, Inc., Boxborough, Massachusetts, United States*

### **Reintroduction and Head-starting as Conservation Tools for Blanding's Turtles**

The use of reintroduction and headstarting as conservation tools for amphibians and reptiles has been debated in the literature and among scientists and conservation biologists. We constructed a decision-making tree to help resource managers and conservation biologists determine if reintroduction or population augmentation might be an appropriate tool in certain circumstances. Using the Blanding's Turtle as our target species we have designed a reintroduction protocol that involves identification of a suitable recipient site given the landscape needs of this species, genetic concerns, and evaluation of threats that may have caused the species local extirpation initially. We identified an appropriate donor population for reintroduction stock with consideration given to that population's demography and potential impacts to that population. We evaluated various life stages (i.e., hatchlings, head-started hatchlings, juveniles) to be considered or rejected for use. Using life history traits of Blanding's turtles we also modeled the numbers of animals required and over how many years to achieve the eventual goal of a viable, self-sustaining population on the recipient site. Results of a pilot reintroduction project based on the findings above will also be presented.

**0792 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Benjamin Bulen, Christopher Distel, Michelle Boone

*Miami University, Oxford, Ohio, United States*

**Single Exposures to Environmentally Variable Concentrations of Carbaryl and their Influence on the Tadpole Food Web**

Declining amphibian populations have sparked a great interest into the use and possible repercussions of pesticides. It is important to explore a range of pesticide concentrations because they are present in varying concentrations in the environment. Our approach was based off a trophic cascade in the food web which occurs when insecticide exposure eliminates zooplankton. In this mesocosm study we tested the hypotheses that American toad (*Bufo americanus*) and the northern leopard frog (*Rana pipiens*) tadpoles would respond only to indirect effects of the insecticide carbaryl. We tested the species over a range of five concentrations (2.0, 0.2, 0.02, 0.002, and 0 mg carbaryl/L). Specifically, we predicted a threshold effect where carbaryl concentrations great enough to reduce zooplankton abundance would have negative indirect effects on tadpoles, but the degree of these effects would not be concentration-specific. Similarly, we predicted concentrations so low that zooplankton were not reduced would not differ in effect from controls. We did not observe a threshold effect, or any negative effect on tadpoles. The highest carbaryl concentration expedited the time to metamorphosis in the northern leopard frogs by approximately 4 d. The toads were unaffected by any concentration of carbaryl. Despite significant reductions in zooplankton abundance, periphyton abundance was unaffected by carbaryl. Taken together, these results suggest that the presence of multiple tadpole species may buffer each other from negative effects of pesticides.

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**0185 Herp Systematics, 551 AB, Monday 12 July 2010**

Frank Burbrink, Alex Pyron

*City University of New York/CSI, Staten Island, New York, United States*

**How Does Ecological Opportunity Influence Rates of Speciation and Morphological Diversification in New World Ratsnakes (Tribe Lampropeltini)?**

Ecological adaptive radiation theory predicts an increase in both morphological and specific diversification when organisms colonize new environments. Bursts of morphological diversification, characterized by low within-subclade morphological disparity, may be associated with these increases in speciation rates. Conversely, increasing species density, reduction in available habitat, or increasing extinction

probabilities are expected to cause rates of diversification to decline. We test these hypotheses by examining the tempo and mode of speciation in the lampropeltine snakes. Using divergence dating and ancestral area estimation methods we demonstrate that these snakes colonized the New World approximately 24 million years ago when few competitive species existed there. We show that this ecological opportunity produced an early burst of diversification in these snakes associated with low subclade morphological disparity. These patterns support the hypothesis that morphological variation tends to be strongly partitioned among lineages when clades undergo early bursts of species diversification. The subsequent reduction in speciation rates may be indicative of density dependent effects due to a saturation of available ecological opportunity, rather than increases in extinction rates at the onset of the Pleistocene/Pliocene glacial cycles. This evidence runs counter to the general Pleistocene species pump model.

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### **0360 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010**

Russell Burke

*Hofstra University, Hempstead, NY, United States*

#### **Headstarting Turtles – Learning from Experience**

Head-starting, which I define as the release of captive-raised hatchlings for conservation purposes, is a controversial topic in turtle conservation that has received little serious academic examination. I distinguish head-starting from translocation generally, which can also include releases of wild-caught adults, and focuses on movement of animals from one location to another. Head-starting is less controversial in other taxa, and has a long history of success in augmenting populations for wildlife and conservation purposes. It is more difficult to measure the success rates of turtle head-starting efforts than many other taxa because turtles have delayed maturity, are usually difficult to mark permanently, are inconspicuous as subadults, and typically experience high subadult mortality under natural conditions. Also, population models usually indicate that turtle conservation efforts are more effectively focused on adult survivorship. Very likely only a small percentage of turtle head-starting programs are evaluated, and even fewer are reported in the literature, so a robust analysis of their success rates would be impossible. Nevertheless, turtle head-starting programs are popular with the public and are common in many countries. I propose a series of goals for turtle head-starting programs, and urge higher reporting rates of both successes and failures.

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## **0640 Turtle Ecology & Conservation, 555 AB, Friday 9 July 2010**

Derek Burkholder<sup>1</sup>, Michael Heithaus<sup>1</sup>, Craig Layman<sup>1</sup>, Jordan Thomson<sup>2</sup>

<sup>1</sup>Florida International University, Miami, Florida, United States, <sup>2</sup>Simon Fraser University, Vancouver, British Columbia, Canada

### **Foraging Ecology and Stable Isotopic Analysis of Green Sea Turtles (*Chelonia mydas*) in Shark Bay, Western Australia: Are Green Turtles Really Herbivores?**

Foraging by large bodied herbivores can play a significant role in structuring primary producer communities and nutrient dynamics in ecosystems. Therefore, it is important to understand the foraging behavior and diet of large herbivores to better understand their ecological roles. From 2006-2009 we assessed the diet of green sea turtles (*Chelonia mydas*) in the relatively pristine seagrass ecosystem of Shark Bay, Western Australia using animal-borne video and stable isotopic analyses. We collected video data from 16 turtles, stable carbon and nitrogen signatures from 65, and isotopic values from basal resource pools and primary consumers. Contrary to expectations that green turtles would forage primarily on seagrasses, carbon isotopes varied widely and were more depleted than most seagrasses. Instead, they were more consistent with foraging on macroalgae or cnidarians and ctenophores. This was supported by video data. Because tissues used in isotopic analyses represent diet assimilated over months to more than a year, the spread in isotopic values for individuals suggests a high degree of individual specialization within the population.

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## **0476 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010**

Sabrina Burmeister, Mukta Chakraborty

University of North Carolina, Chapel Hill, North Carolina, United States

### **Hormonal Modulation of Auditory Responses to Mating Calls in Túngara Frogs**

Acoustic communication in frogs and fishes typically occurs within the context of reproduction. Males vocalize to attract females for mating and females locate and assess males based on their vocalizations. In frogs, mate choice by females is manifest as acoustically guided locomotion, or phonotaxis. In the túngara frog (*Physalaemus pustulosus*), the gonadal hormone estradiol is necessary and sufficient for female phonotaxis toward mating calls. Furthermore, estradiol receptors are expressed in the auditory midbrain and some of its forebrain targets, suggesting that estradiol can modulate neural responses to mating calls. To test whether estradiol modulates auditory responses to mating calls, we manipulated estradiol levels by injecting females with estradiol or an estradiol synthesis blocker, fadrozole, and then presented females with

either a conspecific or heterospecific mating call. We examined auditory responses by measuring expression levels of the activity dependent gene, *egr-1*. We found that estradiol augmented responses to conspecific mating calls in the auditory midbrain, the striatum (a motor nucleus), preoptic area (important for sexual behavior), septum (important for sexual behavior), and the nucleus accumbens (important for goal-directed behaviors), but not the thalamus. In summary, estradiol increases auditory responses to mating calls in sensory, motor, and motivational brain regions that are important for phonotaxis, suggesting that estradiol promotes phonotaxis by increasing neural responses to mating calls. Thus, estradiol acts to coordinate gonadal development with behavior such that sexual responses (phonotaxis) occur in the appropriate context (reproduction).

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## **0801 Fish Systematics II, Ballroom D, Monday 12 July 2010**

Thaddaeus Buser

*University of Washington, Seattle, WA, United States*

### **Molecular Systematics of the Brown Catshark (*Apristurus brunneus*)**

The brown catshark, *Apristurus brunneus* (Gilbert, 1892), is a species of deep-water catshark (family: Scyliorhinidae) found along the outer continental shelf and upper slope from British Columbia to Baja California. Morphological analyses by Compagno (1984) has led to speculation that *A. brunneus* may be a complex containing one or more cryptic species. One possible new species may be represented by the population living within the Salish Sea (Puget Sound and Straight of Georgia basin). For our study we gathered tissue samples of *A. brunneus* from throughout its range for the purposes of molecular phylogenetic analysis. Additionally we gathered samples of a closely related species, *A. kampae*, to serve as an outgroup. Proven phylogenetic markers were amplified from two mitochondrial genes: cytochrome *c* oxidase I (COI) and cytochrome *b* (*cyt b*); and one nuclear gene: recombination activating gene 1 (RAG1). This is the first molecular systematic study of *A. brunneus* as a possible cryptic species complex and the results of this study could reveal a new, possibly endemic, species of shark in Puget Sound. The implications for such a finding could be far reaching as the distribution of this species would be confined to an area in close proximity to urban and industrial areas (e.g. Seattle, Vancouver, Bellingham), making it highly vulnerable to the effects of localized disturbances (e.g. pollutants, commercial fishing, etc.). Additionally, the molecular data produced by the study will be useful in a broader study to resolve the species-level relationship of members of the genus.

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**0439 SSAR SEIBERT CONSERVATION AWARD, 555 AB, Friday 9 July 2010**

Patrick Cain, Richard Seigel

*Towson University, Towson, Maryland, United States*

**The Cost of Soup: An Assessment of the Commercial Harvest of Snapping Turtles (*Chelydra serpentina*) in Maryland**

Models of the life history characteristics of turtles (e.g., extended age to maturity, low annual fecundity, low hatchling survival) have shown that the key to sustaining turtle populations is high annual adult and sub-adult survival. This combination of life history characteristics makes turtles highly susceptible to the negative effects of commercial harvesting, which usually targets adults. Recently, several states have taken action to suspend or end commercial harvest of freshwater turtles. In many mid-Atlantic states, however, the commercial harvesting of snapping turtles (*Chelydra serpentina*) is common, where typically only a fishing license is required without bag limits. We investigated the current status of the snapping turtle harvest in Maryland. In October 2007, Maryland's Department of Natural Resources (MD-DNR) convened a workgroup to discuss new snapping turtle harvest regulations in Maryland. To address concerns of the workgroup, we collected information on harvested snapping turtle demographics and harvesting techniques by accompanying commercial harvesters in the field, and visiting a turtle butchery to investigate aspects of trade. Observations with harvesters showed a limited season (April-May) because many harvesters switch to blue crab (*Callinectes sapidus*) harvests exclusively in early June. Trap locations are widely spread and most sites are visited only once a season. The turtle butchery revealed that large individuals are processed for meat, but most are shipped to China for food. Using the information we collected, MD-DNR enacted a size limit to protect 50% of reproductive females and a species-specific permit with mandatory reporting, as recommended by the workgroup.

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**0415 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010**

Briana Callahan, Tiffany Swarmer, Derek Girman

*Sonoma State University, Rohnert Park, CA, United States*

**Impacts of Vicariance on the Genetic Structure of the California Giant Salamander (*Dicamptodon ensatus*)**

While there are many factors that influence abundance, distribution and the overall genetic structure and history of a species, the two key contributors that this study addresses are vicariance and vagility. The California Giant Salamander, *Dicamptodon ensatus*, is a model species for studying the effects of vicariance and dispersal in the northern California area. The speciation of *D. ensatus* is estimated to have occurred between 6.5 and 9.5 MY ago making them one of the oldest lineages of salamanders in

California. *D. ensatus* is endemic to the northern California coastal region and occupies a small range of less than 20,000 square kilometers which stretches from southern Mendocino County down to Santa Cruz. Their range is interrupted by the San Francisco Bay, which began forming 2-3 million years ago and may be a barrier to gene flow resulting in significant genetic differentiation. In order to assess the level of genetic divergence between the northern populations above the bay and the southern populations below the bay, we sequenced a portion of the highly variable mitochondrial control region from samples taken from 8 sites within their range and found consistent differences among sites in the two regions. Given that their entire range is small enough to qualify this species as near threatened, the isolation and genetic differentiation of the southern populations may indicate the need for management efforts in the region.

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**0665 Herp Systematics, 551 AB, Monday 12 July 2010**

David Cannatella

*University of Texas, Austin, Texas, United States*

### **Why Stable Taxonomies Are Both Useful and Important**

Taxonomies (or classifications) ideally reflect phylogeny, but differ from phylogenies. One phylogeny can yield many different taxonomies; these taxonomies may be equally informative or not. Although informativeness is a desirable quality of taxonomies, it is not the only one. Taxonomies are general reference systems for biologists, and as such, stability is a useful quality. Reducing stability and continuity of classifications diminishes their usefulness. Recent attempts to estimate amphibian phylogeny have lead to classifications that have unnecessarily destabilized the meaning, content, and continuity of taxonomic names, especially the names of species. The name of a species (genus-species combination) is the distinctive token used to refer to a particular taxon. Given this, stability should be maintained, except in cases of nonmonophyly. Even then, changes to multiple species names should be minimized. In this presentation, recent taxonomies will be analyzed to exemplify solutions that maintain the meaning and content of taxon names, as well as maximize phylogenetic informativeness. These solutions include the use of unranked taxa and infrageneric ranks. To deny the importance of stability is to abandon a fundamental responsibility of systematists in advancing biological taxonomies as reference systems for the end user community.

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## 0110 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Michael Cardwell<sup>1</sup>

<sup>1</sup>California State University Sacramento, Sacramento, CA, United States, <sup>2</sup>Loma Linda University, Loma Linda, CA, United States

### **Foraging Behavior of the Northern Mohave Rattlesnake**

A wild population of Northern Mohave Rattlesnakes (*Crotalus s. scutulatus*) was monitored using radiotelemetry in the western Mohave Desert between August 2001 and November 2004. Behavior during ten witnessed predation events and foraging activity during >2400 additional active season observations are analyzed in the context of abiotic factors such as climate and lighting, as well as the behavior of heteromyid rodents, their most common prey. Lengthy searches for envenomated bipedal prey may contribute to understanding the evolutionary benefit resulting from the species' highly toxic venom. A stereotypical foraging tactic termed burrow entrance ambush position (BEAP) is described and adaptations of predatory behavior during the drought year 2002 are examined.

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## 0246 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Andrea Carey, Ken Oliveira, Whitney Hable

University of Massachusetts Dartmouth, North Dartmouth, MA, United States

### **Polychlorinated Biphenyls in *Anguilla rostrata* Males Disrupt Fertilization and Embryogenesis**

Environmental contaminants such as polychlorinated biphenyls (PCBs) may be contributing to the decline of the American eel, *Anguilla rostrata*. Due to their unique catadromous life cycle mature adults are not accessible for study and little is known about the effects of PCBs on fertilization and larval development. Using methods similar to the maturation of *Anguilla japonica*, *A. rostrata* males and females were artificially matured by weekly injections of hormones. To test the effect of PCBs on male gametogenesis, males were co-injected with 2 different concentrations (1.0 or 10 µg/Fish) of PCBs. The injections were designed to mimic the slow release of PCBs which occurs during gametogenesis as the *A. rostrata* are migrating to spawn in the Sargasso Sea. Upon maturation, sperm from six different males were used in six separate fertilizations using the oocytes from one female. Fertilization success and embryogenesis were assessed 2-4 hours post fertilization (PF), 24 hours PF, and 48 hours PF and hatched larvae were kept for six days and then terminated to analyze survival effects. A significant difference in the percent of normally developing larvae was found at 2-4 hours PF and 24 hours PF between the controls and the eels injected with the high concentration of PCBs. No significant differences were found for observations

completed 48 hours PF or at six days post hatch. Based on these results, PCB accumulation in males appears to have a significant effect on fertilization and embryogenesis in *A. rostrata*.

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## **0202 Herp Development, 556 AB, Sunday 11 July 2010**

Gerardo Carfagno<sup>1</sup>, James Carithers<sup>2</sup>, Leah Mycoff<sup>2</sup>, Richard Lehtinen<sup>2</sup>

<sup>1</sup>*Gettysburg College, Gettysburg, PA, United States*, <sup>2</sup>*The College of Wooster, Wooster, OH, United States*

### **Predators, Plasticity and Costs of Inducible Defenses: How the Cricket Frog (*Acris blanchardi*) Lost its Spot**

For an inducible defense to evolve, the defense must be costly. If it is not, the defense should always be expressed (a constitutive defense). However, costs of inducible defenses have not been well documented. Using predator exposure experiments, we demonstrate that dark tail coloration in Blanchard's cricket frog (*Acris blanchardi*) tadpoles is an inducible defense. Specifically, *Acris* tadpole tail spots in treatments with dragonfly predators were significantly larger when compared to treatments with fish predators. However, tadpoles in control tanks (with no predators) had tail spots that were not significantly different in size from the dragonfly treatment. Therefore, this defense is unique among those known as the presence of fish induces the loss (not the appearance) of this morphology. As tadpoles express the tail spot in the absence of predation risk, this phenotype also does not appear to have any substantial allocation cost. We also document the palatability of *Acris* tadpoles to fish, and demonstrate reduction in movement and differential habitat use in the presence of predator cues. Under predation risk, tadpoles became less active and occupied the shallowest regions of their habitats. This combination of plastic morphology and behavior likely facilitates successful breeding in a range of aquatic habitats with different predator assemblages. While effective in reducing vulnerability to dragonfly attacks, the tail spot likely increases vulnerability to fish. Our results suggest that the antagonistic effects of predator-specific inducible defenses may represent another type of cost relevant to the conditions under which inducible defenses are expected to evolve.

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**0131 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Wade Carruth, Scott Harrison, David Rostal

*Georgia Southern University, Statesboro, GA, United States*

**Genetic Diversity Within and Among Large and Small Populations of the Gopher Tortoise (*Gopherus polyphemus*)**

This study focuses on three isolated populations of *Gopherus polyphemus* that differ in their estimated consensus population size: George L. Smith State Park, Georgia (GLS) at 300-500 individuals; Fort Stewart Army Reservation, Georgia (FSAR) at 3000-5000 individuals; and Kennedy Space Center, Merritt Island, Florida (KSC) at >15,000 individuals. The main objective is to characterize the genetic variation within and among GLS, FSAR, and KSC populations of *G. polyphemus* using 8 microsatellite loci. Two primary questions are addressed: 1) What is the degree of population genetic subdivision among the three populations? and 2) Is the level of genetic variation (allelic diversity, expected heterozygosity, etc.) lower in smaller populations? We found significant population genetic structure among all three populations. Both the 500 and 5000 estimated consensus size populations were significantly lower than the 15000 estimated consensus size population in allelic richness, expected heterozygosity, and the proportion of polymorphic loci.

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**0715 AES Conservation & Management, 552 AB, Friday 9 July 2010**

Daniel Cartamil<sup>1</sup>, Omar Santana-Morales<sup>2</sup>, Miguel Escobedo-Olvera<sup>2</sup>, Dovi Kacev<sup>4</sup>, Leonardo Castillo-Geniz<sup>3</sup>, Oscar Sosa-Nishizaki<sup>2</sup>, Jeffrey Graham<sup>1</sup>

<sup>1</sup>*Scripps Institution of Oceanography, La Jolla, CA, United States*, <sup>2</sup>*Centro de Investigación Científica y de Educación Superior de Ensenada, Ensenada, Baja California, Mexico*, <sup>3</sup>*Centro Regional de Investigación Pesquera de Ensenada, Ensenada, Baja California, Mexico*, <sup>4</sup>*San Diego State University, San Diego, CA, United States*

**The Artisanal Elasmobranch Fishery of the Pacific Coast of Baja California, Mexico**

Artisanal fisheries account for up to 80% of elasmobranch fishing activity in Mexican waters, yet details associated with fishing effort and species composition are generally unavailable. This chapter describes a survey of the artisanal elasmobranch fishery of the Pacific coast of Baja California, Mexico from 2006 - 2008. The objectives were to determine the geographical extent, size, and targets of the artisanal fishery, and describe the catch characteristics at Laguna Manuela, a representative artisanal camp where elasmobranchs are the primary target. Forty-four fishing sites were identified in the region, of which 29 (66%) targeted elasmobranchs at least seasonally, using primarily

bottom-set gillnets and longlines. At Laguna Manuela, 25 species of elasmobranchs were documented. Gillnetting accounted for 60% of fishing effort, and the most commonly captured species were *Rhinobatos productus*, *Zapteryx exasperata*, and *Myliobatis californica*. Longline fishing accounted for 31% of fishing effort, and the most commonly captured species were *Prionace glauca* and *Isurus oxyrinchus*. Catch was composed of mainly juveniles for many species, suggesting that the immediately surrounding area (Bahia Sebastian Vizcaino) may be an important elasmobranch nursery habitat. The results of this study will serve as a valuable baseline to determine future changes in the artisanal fishery, as well as changes in species demography and abundance.

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## **0680 Herp Conservation I, 556 AB, Thursday 8 July 2010**

Nicholas Caruso, Karen Lips

*University of Maryland, College Park, Maryland, United States*

### **Resurveying Populations of Plethodontid Salamanders in Great Smoky Mountain National Park**

We used historic records (Highton 2005) to compare current and historic abundances of 73 populations of plethodontid salamanders at 40 sites in Great Smoky Mountains National Park between March and November 2009. We swabbed 667 animals and used qPCR to determine presence of *Batrachochytrium dendrobatidis* (*Bd*). We sampled all salamanders encountered in 2, 150-m<sup>2</sup> plots at each of 9 low (<1000 m), 20 mid (1000-1500 m) and 11 high (>1500 m) elevation sites. Each site had been surveyed 1-58 times previously, and 1-3 plethodontid species were known from each site. We used mixed-effects models and occupancy models to determine if abundance had declined over time. 45 (64%) of the populations were less abundant than historically. Declines occurred throughout the park and at all elevations. Declining populations co-occurred with non-declining populations. *Plethodon glutinosus* complex declined significantly ( $t_{128} = -5.549305$ ;  $p < 0.0001$ ) at all 22 sites where those two species were historically present. *P. jordani* declined more at higher elevations ( $t_{89} = -3.018$ ;  $p = 0.0033$ ); populations of *P. ventralis* ( $t_{35} = -0.023$ ;  $p = 0.9817$ ) and *P. serratus* ( $t_{116} = -1.562210$ ;  $p = 0.1209$ ) declined at some sites, but showed no elevational pattern; and *P. metcalfi* did not decline ( $t_7 = -0.168$ ;  $p = 0.8716$ ). Only 1 *Desmognathus santeetlah* was positive for *Bd* at a site where *P. metcalfi* populations were stable. As reported for other areas, population responses varied among species, elevations, and sites, and indicate species-specific interactions with their environment.

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**0103 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; NIA BEST STUDENT POSTER AWARD**

Fernando R. Carvalho, Luiz R. Malabarba

*UFRGS, Instituto de Biociências, Departamento de Zoologia and Programa de Pós-Graduação em Biologia Animal, Porto Alegre, RS, Brazil*

**Redescription and Osteology of *Hyphessobrycon compressus* (Meek, 1904) (Teleostei: Characidae)**

*Hyphessobrycon* Durbin is largely recognized as a non-monophyletic characid genus, including more than 120 valid species widespread throughout the Neotropical region (Mexico to Argentina). Most species are from South America, but the type species, *Hyphessobrycon compressus*, was described from the río Papaloapam basin at El Hule, Oaxaca, Mexico. Little information is available on morphology and osteology of this species, precluding the formulation of consistent hypothesis about its relationships and in the diagnosis of a monophyletic *Hyphessobrycon*. Morphometric and meristic data were taken from 64 specimens (19.7-36.4 mm SL), seven cleared and stained (30.9-35.7 mm SL), occurring in Mexico and Guatemala. Principal characters of *Hyphessobrycon compressus* are: premaxilla with two tooth rows, outer row with 1-4 (mode 2) and inner row with 6-7 (mode 6) uni-tricuspid teeth; outer row tooth bases misaligned and overlapped with the base of inner row teeth; scales in longitudinal series 40-45 (mode 43); anal fin with two or three large hooks (larger than the segment bearing the hook) on the last unbranched and first and sometimes second branched rays; dorsal fin with black spot on its anterior half; 3<sup>rd</sup> infraorbital the largest, its ventral portion not reaching the sensory channel of preopercle. Although we still lack an analysis of character distribution among *Hyphessobrycon* species and related taxa, it is remarkable that *H. compressus* shares the arrangement of the premaxillary teeth, the dorsal fin black spot, and the absence of a longitudinal black stripe on body with some rosy tetra species.

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**0106 NIA I, 556 AB, Saturday 10 July 2010; NIA BEST STUDENT PAPER AWARD**

Fernando R. Carvalho, Luiz R. Malabarba

*UFRGS, Instituto de Biociências, Departamento de Zoologia and Programa de Pós-Graduação em Biologia Animal, Porto Alegre, RS, Brazil*

**A New Genus of Miniature Characidae (Teleostei: Characiformes) from the Rio Arinos, Tapajós Basin, Northwestern Brazil**

The family Characidae is the largest among Characiformes, with an enormous morphological, ecological, behavioral, and biological diversity. Regardless the large

number of species that have been described to this family, new taxa presenting unusual and unique characters are continually being discovered. We present here a new genus and species of a miniature characid fish, previously identified as *Hyphessobrycon* due to the overall color pattern and incomplete lateral line. The new taxon is distinguished from all Characidae by presenting an unique arrangement of two series of unicuspid teeth in the dentary (outer row with three long teeth and inner row with at least nine slightly smaller teeth), different and apparently non-homologous to those observed in *Aphyocharacidium*, *Henochilus*, and *Parecbasis* (usually with tri- or more cuspids). Paedomorphic features related to the new species are the small size of adult males (up to 20.9 mm SL), anal fin with few total rays (up to 18), incomplete lateral line (up to 8 perforated scales), and small, unicusps teeth in jaws. Other characteristics of the new taxon are the presence of a black spot on dorsal fin and caudal peduncle. The new genus and species is known from the rio Arinos drainage, a tributary of the rio Juruena, rio Tapajós basin, Mato Grosso State, Northwest Brazil.

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**0139 NIA II, 551 AB, Monday 12 July 2010; ASIH STOYE AWARD GENERAL ICHTHYOLOGY**

Tiago Carvalho

*University of Louisiana at Lafayette, Lafayette/LA, United States*

**Osteology and Relationships of the Monotypic *Iracema caiana* Triques, 1996 (Gymnotiformes: Rhamphichthyidae) Using High Resolution X-Ray Computed Tomography**

*Iracema caiana* was described from a tributary of the Rio Negro (Amazon basin) in Brazil based on characters of external morphology alone. *Iracema* is currently differentiated from other rhamphichthyid genera by the presence of a series of round pigment blotches on the lateral body surface, and an intermediate number of anal-fin rays between the values observed in the other two genera. In the original description *Iracema* was hypothesized as the sister group to *Gymnorhamphichthys* based on shared loss of scales on the anterior portion of the body. Most osteological data on *Iracema* have not been available due to a lack of specimens for clearing and staining; the genus remains known from only four specimens in the type series. In order to access osteological information on *Iracema*, two specimens were scanned using high resolution computed tomography performed by a Feinfocus microfocal X-ray source at the University of Texas at Austin. 3-D models of the bony skeleton were reconstructed using the program VG Studio Max at Academy of Natural Sciences of Philadelphia. Osteological information arising from this study suggests several shared characters of *Iracema* and *Rhamphichthys*. Derived features on the branchial basket, opercular series, and the presence of ossified intermuscular bones in the M.adductor mandibulae suggest that *Iracema* is the sister group of *Rhamphichthys*, refuting the hypothesis of previous studies. The relationships of Rhamphichthyoidea are still under study, and the inclusion of more taxa using

characters of internal morphology is crucial to interpret the phylogeny and evolution of this group.

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**0444 AES Stress Symposium II, 551 AB, Sunday 11 July 2010**

Brandon Casper, Michele Halvorsen, Arthur Popper

*Department of Biology, University of Maryland, College Park, MD, United States*

**Sharks and Environmental Noise... Are We Stressing Them Out?**

Anthropogenic noise has become a major global issue as it is becoming more apparent that human aquatic activities can have a negative effect on the survival of large fish stocks. It is not clear, though, whether these noise issues could have an effect on the health and behavior of elasmobranch fishes, many of which are already being severely threatened worldwide due to overfishing. Many sources of anthropogenic noise produce sounds within the hearing range of these fishes, but it is unknown if elasmobranchs could be affected by these sounds. A review will be made of what is known in regards to elasmobranch hearing as well as a discussion of current noise exposure research involving fishes and other aquatic organisms and how it might be applicable to elasmobranch physiology. With these in mind, the goal will be to address whether anthropogenic noise could be having deleterious effects on elasmobranch fishes.

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**0338 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Delilah Castro, Katrina Weber, Eli Greenbaum

*University of Texas at El Paso, El Paso, TX, United States*

**Widespread Cryptic Diversity in the African Frog Genus *Amietia* (Anura: Pyxicephalidae) in Eastern Democratic Republic of the Congo**

The Sub-Saharan frog genus *Amietia* currently includes 15 species of frogs that occur in a panoply of habitats from lowland rainforest to montane grassland. In a preliminary study to evaluate evolutionary relationships and identify cryptic species within the genus, we sequenced one nuclear (RAG1) and two mitochondrial (16S and cyt b) genes from 44 samples of *Amietia* and two outgroups in the genera *Phrynobatrachus* and *Ptychadena*; 24 additional sequences (East and South Africa) were included from GenBank. Data from DNA sequences were analyzed with maximum-likelihood and Bayesian inference criteria with the programs GARLI and MrBayes after appropriate models of nucleotide substitution were identified in the program jModelTest. Results confirmed the monophyly of the genus *Amietia*, and three well-supported clades are evident near the base of the tree: (1) a basal lineage from montane forests of the

Itombwe Plateau and Mt. Kabobo in eastern DRC; (2) a clade restricted to southern Africa; and (3) a clade including species from East Africa and multiple habitats in eastern DRC. Two montane lineages from eastern DRC (including the Itombwe/Kabobo lineage) that have been historically identified as *A. angolensis* are a complex of at least two species, neither of which is likely to be conspecific with populations from the type locality. Described species in some clades will require careful comparison to type material to confirm their identity, but the eight lineages identified from eastern DRC (only 5 species are recognized from DRC) suggest the current diversity of *Amietia* is underestimated.

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## **0204 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Ted Cavender

*Museum of Biological Diversity, Columbus, Ohio, United States*

### **Chromosome Studies on the Sucker Family, Catostomidae**

A simple field technique was employed to study the basic chromosome structure of a selected number of catostomid species. Metaphase plates were prepared and photographed, then karyotyped for study. The following sucker species were karyotyped: *Carpionotus cyprinus*, *Hypentelium nigricans*, *Minytrema melanops*, *Moxostoma anisurum*, *Moxostoma cervinum*, *Moxostoma duquesnei*, *Thoburnia atripinnis*, and *Thoburnia rhotoea*. A published metaphase plate of *Myxocyprinus asiaticus* was also utilized. In addition certain outgroup taxa were karyotyped for comparison such as *Cyprinus carpio* (Cyprinidae), *Gyrinocheilus aymonieri* (Gyrinocheilidae), *Acantopsis choirorhynchos* and *Botia modesta* (Cobitidae). In general the suckers' chromosome complement conformed to that already known for some members having a tetraploid number of 100 chromosomes. However some species, for example *Moxostoma anisurum* and *M. duquesnei*, exhibited a Robertsonian rearrangement with 98 chromosomes while displaying one very large metacentric pair. Among the outgroups studied each one demonstrated at least one major difference that made comparisons with suckers very difficult. For example, the *Gyrinocheilus* was found to possess a diploid number of only 48 chromosomes.

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**0346 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Taryn Cazzolli, Aaron Bauer

*Villanova University, Villanova, PA, United States*

**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, 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 used histological methods and light microscopy to investigate the morphology of the nasal region across all major gekkotan lineages. We confirm that gekkotans as a group exhibit relatively larger nasal conchae and greater olfactory epithelial surface area than most other lizards. However, there is significant variation in structure across the gekkotan families and greater olfactory specialization is seen in the “modern” gekkotan families, as opposed to pygopoids and eublepharids. Geckos are unique in the degree to which different sensory modalities are used and integrated to locate prey and this is reflected in their foraging mode, which has elements of both ambush and active foraging characteristics.

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**0407 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT  
PHYSIOLOGY, 555 AB, Friday 9 July 2010**

Claudia Ceballos, Nicole Valenzuela

*Iowa State University, Ames, IA, United States*

**Sex-specific Body Growth Plasticity and Sexual Size Dimorphism in Snapping  
Turtles**

Sexual dimorphism can be affected by the differential response that each sex may have to the environment. Recently two hypotheses were proposed to explain such a sex-specific body size plasticity. The adaptive canalization hypothesis states that if the larger sex is under strong directional selection it cannot afford to deviate from achieving a larger body size because its fitness could be reduced. Consequently, both sexes are expected to exhibit similar body growth plasticity. Alternatively, the condition dependence hypothesis states that if the larger sex is more sensitive to the environment it will opportunistically achieve a larger body to increase its fitness. In this case, the larger sex will exhibit greater sensitivity to the environment. To understand the role that sex-specific body growth plasticity plays in shaping sexual size dimorphism, snapping turtles were raised in captivity under several environments combining warmer/colder

temperature, higher/lower protein diet, and higher/lower food quantity. Body growth between sexes and treatments was compared. We found that under low food quantity conditions, males grew significantly larger than females, but under high food quantity females grew significantly larger than males. Comparing the amount of body size change between sexes we found that males were significantly more plastic than females, supporting the condition dependence hypothesis. These results demonstrate that sex-specific body growth plasticity is a mechanism that can have a significant influence in shaping patterns of sexual dimorphism. Our results are consistent with large-scale interspecific body size patterns such as Rensch's rule.

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### **0558 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Mônica Ceneviva-Bastos<sup>1</sup>, Lilian Casatti<sup>1</sup>, Virgínia Sanchez Uieda<sup>2</sup>

<sup>1</sup>UNESP - São Paulo State University, São José do Rio Preto, São Paulo, Brazil,

<sup>2</sup>UNESP - São Paulo State University, Botucatu, Brazil

### **Can Seasonal Variations Influence Trophic Interactions on Preserved Habitats? Responses from Two Brazilian Streams**

Seasonal shifts can lead to changes in stream biota composition and, consequently, on trophic interactions. Many studies have reported seasonal diet changes for fish species known to play an important role in food webs, though few researchers approach this influence on food webs as a whole. Under the hypothesis that the trophic relations and, consequently, the food web structure are under influence of seasonality, two forested streams (S1, S2) were sampled in both dry and wet seasons. Sampling included algae, macrophytes, plankton, macroinvertebrates, and fish, followed by diet analysis of all heterotrophic taxa. Overall 2,250 individuals of 125 trophic species, four of which were macro-producers, were identified in the four samples. Fine particulate organic matter was the main basal resource consumed, resulting in a high proportion of species at the first trophic level and high omnivory in all samples. All fish species have been considered top species since they had no predators. The predominantly sandy-bottomed S1 stream had lower richness and abundance than the rocky S2, along with parameters such as number of trophic species, links, and trophic levels. The number of top and intermediate species and trophic levels in S1 was higher in the wet season, whereas the number and density of links, predators, and connectance were higher in the dry season for both streams. These findings have indicated that despite the influence of seasonality on the community structure of well preserved streams, trophic relations appear to behave in a more stable way between seasons.

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## 0517 Fish Systematics II, Ballroom D, Monday 12 July 2010

Ryan Chabarría, Frank Pezold

*Texas A&M University-Corpus Christi, Corpus Christi, TX, United States*

### **A Review of Caribbean Species of the Genus *Sicydium* (Gobiiformes: Sicydiinae) Using Morphological and Molecular Data**

The genus *Sicydium* is comprised of 22 nominal amphidromous species native to rocky tropical streams with narrow coastal plains in Mexico, Central America, the Caribbean islands, northern South America and West Africa. There is taxonomic confusion within the genus because there has never been a comprehensive review of species. Variable color patterns in life, similar or overlapping diagnostic meristic counts and mensural features, and parochial studies associated with new species descriptions have all contributed to the problem. As part of a review of the genus, nominal species of *Sicydium* have been examined in an analysis of oral morphology, squamation, dentition, pigmentation and the mitochondrial gene cytochrome b. Seven of the 12 nominal species previously described from the Caribbean Basin have been generally accepted as valid. Preliminary data from this analysis suggest that the number of species in the basin may be lower.

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## 0062 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Prosanta Chakrabarty<sup>1</sup>, James Albert<sup>1</sup>

<sup>1</sup>*Museum of Natural Science, Louisiana State University, Baton Rouge, Louisiana, United States*, <sup>2</sup>*University of Louisiana at Lafayette, Lafayette, Louisiana, United States*

### **Not So Fast: Freshwater Fishes of Middle America and a New Take on the Great American Biotic Interchange**

The prevailing view of the origins of the freshwater fishes of Middle America (Central America + Mexico) is of lineages rushing across the Isthmus of Panama and rapidly radiating there shortly following the closure of the marine gap between North and South America three million years ago: preliminary evidence presented here challenges that view. Although the major clades of freshwater fishes on Middle America are largely derived from South America, the phylogenetic history of these groups point to a much more diverse biogeographic history than implied by the traditional view. Range expansions of Middle American taxa (originally derived from South American lineages) across the Isthmus of Panama back to northern South America are deemed 'Isthmian biogeographic reversals'. We document examples in 14 clades representing most major groups of Neotropical freshwater fishes; e.g., characiforms, gymnotiforms, siluriforms, cyprinodontiforms, and cichlids. Preliminary phylogenetic data suggests that the Plio-

Pleistocene rise of the Panamanian Isthmus should be seen only as the most recent of many geological and geographic phenomena involved in the formation of the modern Middle American ichthyofauna. Contrary to the conventional view, the Late Pliocene - Early Pleistocene rise of the Isthmus of Panama (c. 3.5-2.6 Ma) allowed reciprocal yet asymmetrical interchanges between the ichthyofaunas of Central America and the trans-Andean region of northwestern South America, with more species moving south than north.

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## 0089 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Shun-Ping Chang<sup>1</sup>, Sheng-Hai Wu<sup>1</sup>

<sup>1</sup>National Chung Hsing University, Taichung city, Taiwan, <sup>2</sup>Changhua Christian Hospital, Changhua city, Taiwan

### **Molecular Cytogenetic Studies of Two Treefrog Species of the Genus *Kurixalus* (Rhacophoridae, Anura)**

Genetic mechanism of sex determination in amphibians is always decided by the available information on sex chromosomes or breeding. *Kurixalus eiffinger* and *K. idiootocus* are two small treefrogs, both endemic to Taiwan and adjacent islands. However, chromosomal researches of these two species were limited. We performed specific cytogenetic studies of the two species by conventional Giemsa staining, C-banding, Ag-NOR staining, and fluorescence in situ hybridization. Both species and both sexes showed a diploid chromosomal number of  $2n=26$ . The karyotypes of the two species were very similar, differed only in that chromosomes 2, 3, and 9 of *K. eiffinger* and chromosomes 2 and 4 of *K. idiootocus* were submetacentric. Constitutive heterochromatin was mainly located at pericentromeric regions, and telomeric (TTAGGG)<sub>n</sub> sequences were restricted to the end of all chromosomes. Ag-NOR staining revealed that NORs were located at the 8q and 12q near the centromere of *K. eiffinger* and *K. idiootocus*, respectively, and both possessed size heteromorphism in all NOR-bearing chromosomes. Other applications of molecular cytogenetics are also illustrated, particularly genomic in situ hybridization (GISH), an approach which allows the determination of chromosome homologies between sexes. The results of reciprocal hybridization showed no specific chromosomal difference between male and female within the same species, suggesting the absence of sex chromosome in both species. A specific emphasis was placed on the usefulness of the present cytogenetic studies that form the basis for future work on karyotype standardization and gene mapping of the species, as well as for comparative studies within the family Rhacophoridae.

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## 0652 AES Genetics, 552 AB, Sunday 11 July 2010

Demian Chapman<sup>1</sup>, Kevin Feldheim<sup>2</sup>, Rowena Eng<sup>1</sup>, Lisa Natanson<sup>3</sup>, Mahmood Shivji<sup>4</sup>

<sup>1</sup>*Stony Brook University, Stony Brook, NY, United States*, <sup>2</sup>*Field Museum of Chicago, Chicago, IL, United States*, <sup>3</sup>*National Marine Fisheries Service, Narragansett, RI, United States*, <sup>4</sup>*Nova Southeastern University, Dania Beach, FL, United States*

### **Is There Genetic Evidence of a Recent Population Bottleneck in White Sharks (*Carcharodon carcharias*) from the Northwest Atlantic?**

The white shark, *Carcharodon carcharias*, is one of the largest marine predators in the northwest Atlantic, where some authors suggest it has declined precipitously due to overexploitation. This seems plausible, because from the 1970s onward this species was targeted by recreational anglers and featured as bycatch in expanding commercial shark fisheries. White sharks were subsequently fully protected in the northwest Atlantic by the National Marine Fisheries Service (NMFS) in 1997, although illegal harvest and trade is known to occur in this region. A resurgence of interest in the status of the northwest Atlantic white shark population has stemmed from recent high-profile sightings of this charismatic species. We are currently employing a multi-analytical approach to test the hypothesis that northwest Atlantic white sharks have experienced a recent loss of genetic diversity due to a population bottleneck. We show that contemporary northwest Atlantic white sharks are genetically distinct from other populations and comprise a demographically distinct unit (pairwise  $\Phi_{st}$  ranging from 0.125 to 0.88) that has relatively low mtCR diversity (4 haplotypes in 23 animals). We will present an ongoing analysis of nuclear microsatellite data that aims to determine if these markers register a signal of recent population decline (e.g. M-ratio testing). Lastly, we detail attempts to reconstruct the genetic diversity of white sharks in the 1960s and 1970s using DNA recovered from archived vertebrae. Historical genetic diversity will be directly compared to contemporary genetic diversity in this study, which could serve as a model for similar studies of other elasmobranchs.

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## 0581 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Lauren Chapman

*McGill University, Montreal, Quebec, Canada*

### **Life in Low Oxygen: The Role of Developmental Plasticity**

Divergent aquatic oxygen environments (e.g., high versus low dissolved oxygen) provide a valuable tool for exploring the potentially diverse roles of plasticity in the process of adaptation and evolutionary change. In a series of studies on widespread

African cichlids, we have addressed the consequences of life-long exposure to hypoxic stress, the significance of plasticity in facilitating persistence in highly heterogeneous environments, and the potential for plasticity to facilitate evolutionary change. Results from lab-rearing experiments under high- or low-oxygen conditions provide evidence for a strong element of developmental plasticity in morpho-physiological traits (e.g., gill size, critical oxygen tension) but also evidence of genetic components to diversity among populations (e.g. body shape, egg size, metabolic rate), as well as interaction between population (genetic) and treatment (hypoxia) effects (e.g., brain mass). Phenotypic plasticity may allow individuals to survive when circumstances change and subsequently allow genetic changes to take place as a result of selection for a better adaptedness to the changed environment. Given the global increase in the frequency and severity of hypoxia, it is important to understand the degree to which phenotypic plasticity can compensate for costs of oxygen acquisition.

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### **0153 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Di-Rong Chen<sup>1</sup>, Yi-Fu Lin<sup>1</sup>, Lin-Hua Ke<sup>1</sup>, Te-En Lin<sup>2</sup>, Sheng-Hai Wu<sup>1</sup>

<sup>1</sup>National Chung-Hsing University, Taichung, Taiwan, <sup>2</sup>Taiwan Endemic Species Research Institute, Nantou, Taiwan

### **Microhabitat Use and Home Range of the Yellow-margined Box Turtle (*Cuora flavomarginata*) in Yunlin, Taiwan**

Studies of home range size and microhabitat use of yellow-margined box turtle are important for making strategic decisions on conservation plans. We collected 168 turtles from a site designated for water reservoir in central Taiwan and moved them to a temporary enclosed area. We started tracking nine turtles (four from the enclosed area, and five in adjacent forest area) one day every week by radio telemetry from July 2009. Using GPS recorded locations where we found the turtles, we estimated home range size with minimum convex polygons (MCP) method. We also measured several microhabitat variables at each location. We recorded 226 turtle locations. Mean home range size outside the enclosed area was  $0.30 \pm 0.14$  ha, and in the enclosed area was  $0.23 \pm 0.02$  ha. Mean home range size was smaller between November and January than that from July to October. Turtles were most commonly found under understory vegetation and leaf litter with high percentage of canopy cover (80-100%). The moisture of hiding places was 71-80% between July and October, and was over 90% between November and January.

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## 0232 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Xin Chen, Frank Burbrink

*City University of New York, The Graduate Center and College of Staten Island, New York, NY, United States*

### **Patterns of Diversification in Old World Ratsnakes**

Ratsnakes represent a species-rich assemblage within Colubrinae, and are distributed across both holarctic and oriental regions. Recent studies have divided the ratsnakes into two major groups, the Old World (OW) ratsnakes (e.g., *Elaphe*, *Coronella*, *Coelognathus* etc.) and the New World (NW) ratsnakes (tribe Lampropeltini). Burbrink and Pyron (2010) demonstrated that the Lampropeltini experienced a rapid adaptive radiation of species in the early/mid Miocene upon colonization of the New World. This explosive radiation and morphological and dietary diversification was likely due to ecological opportunity via a lack of competitors in the temperate parts of the New World. In comparison, OW ratsnakes originated in tropical regions and diversified heavily in temperate and subtropical habitats of the Palearctic. We examine potential factors that have driven this extratropical diversification in OW ratsnakes. First, we estimate the phylogenetic history of ratsnakes globally using species tree inference methods with multilocus nuclear gene data. We examine phylogenetic patterns of diversification in OW ratsnakes and potential correlates of diversity, including morphological, biogeographic, and ecological characteristics. Our results provide further information and understanding of the factors that drive speciation and morphological diversity in snakes.

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## 0492 Fish Systematics I, Ballroom D, Monday 12 July 2010

Yongjiu Chen, Frank Pezold

*Texas A&M University - Corpus Christi, Corpus Christi, Texas, United States*

### **Phylogeny of the Gobiidae (Gobiiformes) Inferred from Nuclear DNA Sequence Analyses**

The Order Gobiiformes includes more than 2,000 species of fishes generally known as gobies and sleepers. The phylogenetic status and placement of many gobiiform taxa is controversial, but a classification including nine families, including a Gobiidae with five subfamilies, has been most widely accepted. Based on mitochondrial DNA sequence analyses, Thacker (2009) suggests a classification of six gobioid families, Rhyacichthyidae, Odontobutidae, Eleotridae, Butidae, Gobiidae and Gobionellidae. The Gobiidae *sensu* Thacker (2009) includes the families Microdesmidae, Ptereleotridae, Kraemeriidae and Schindleriidae in addition to the Gobiinae, while the Gobionellidae includes the subfamilies Gobionellinae, Amblyopinae, Oxudercinae and Sicydiinae. To

further explore phylogenetic relationships of the Gobiidae (*sensu* Pezold, 1993), we have initiated a study of DNA sequences for two nuclear genes - 960 bp of Recombination Activating Gene 1 (Rag 1) and 720 bp of Rhodopsin. 60 species representative of the Ptereleotridae, Eleotridae (Butinae and Eleotrinae) and Gobiidae (Gobiinae, Gobionellinae, Oxudercinae and Sicydiinae) have been examined thus far. The two nuclear gene trees inferred from sequence datasets are largely concordant with the phylogenetic topology for major groups found by Thacker (2009). The nuclear gene trees also recovered the four gobioid families, Eleotridae, Butidae, Gobiidae (Ptereleotridae and Gobiinae) and Gobionellidae (Gobionellinae, Oxudercinae and Sicydiinae) found by Thacker (2009) as monophyletic. Although some relationships among genera are beginning to resolve consistently across genes, significant disagreements persist to challenge resolution, and support for some nodes is weak.

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## **0261 Fish Conservation, Ballroom B, Friday 9 July 2010**

Barry Chernoff, Kathleen Miller, Michelle Tipton

*Wesleyan University, Middletown, CT, United States*

### **Metapopulation Dynamics and Recovery of the Eightmile River, CT, after Dam Removal**

Resilience and recovery are terms often used in the ecological and conservation literature. Yet often the criteria for the application of these terms remains vague. In this presentation, we will examine the changes in metapopulation structure of fishes and benthic macroinvertebrates over the three years since a small dam was removed from the Eightmile River, designated as a U.S. Wild and Scenic River. Our data show that communities above and below the former dam site have changed dramatically and still differ significantly from control populations in the east and west branches of the river. Notably, tessellated darters, *Etheostoma olmstedi*, have increased dramatically in the section above the former dam. Brown bullheads, *Ameiurus nebulosus*, increased in abundance during draw down with lowered flows and soft substrates but have declined since the dam was removed and channelization is becoming more pronounced. Richness of fishes has increased above the former dam but decreased below it. Measures of diversity,  $H'$ , have increased above and below the dam site while control areas have remained constant. The data from both fish and benthic macroinvertebrates indicate that the patterns of change or "recovery" differ in the sections of river above and below the dam. These results will be compared to other rivers that have recovered following dam removal. We will discuss the concept of recovery and the relationship of recovery to ecological resilience.

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## **0480 Herp Conservation II, Ballroom B, Sunday 11 July 2010**

Rebecca Christoffel<sup>1</sup>, Gordon Burghardt<sup>2</sup>, Harry Greene<sup>3</sup>

<sup>1</sup>*Iowa State University, Ames, Iowa, United States*, <sup>2</sup>*University of Tennessee, Knoxville, Tennessee, United States*, <sup>3</sup>*Cornell University, Ithaca, New York, United States*

### **SCALES: Saving Snakes is Our Aim!**

Global reptile populations are experiencing declines as great as those of amphibian populations, but few organizations exist with the aim of drawing people's attention to the plight of these organisms, or marketing their importance, management and conservation. This is especially true in the case of snakes, a group for which one of the leading causes of declines has often been identified as intentional killing by humans. SCALES - the Snake Conservation and Leadership Education Society - was established in 2010. Our mission is to increase people's knowledge, appreciation and respect for snakes and to promote responsible management and conservation of snakes. More specifically, our goals are to: 1) increase people's knowledge, appreciation and respect for snakes through educational outreach; 2) promote the biological and cultural importance of snakes; 3) promote responsible conservation and management of snakes; 4) promote scientific and scholarly study of snakes; 5) assist in training leaders to effectively educate people about snakes in their local communities; and, 6) foster communication about snakes and the threats facing them across international boundaries. We seek individuals and organizations with whom we can partner to further our mission of saving snakes through educational outreach, communications which incorporate insights from conservation psychology, and development of a training program for leaders in snake conservation and management.

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## **0756 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Jae Chung<sup>1</sup>, Candy Hwang<sup>1</sup>, Matthew Bender<sup>1</sup>, Francisco Sapigao<sup>1</sup>, Gary Bucciarelli<sup>2</sup>, Thomas Vandergon<sup>1</sup>, Rodney L. Honeycutt<sup>1</sup>, Lee Kats<sup>1</sup>

<sup>1</sup>*Pepperdine University, Malibu, CA, United States*, <sup>2</sup>*University of California, Los Angeles, Los Angeles, CA, United States*

### **Longterm Coexistence of Native Amphibians and Invasive Crayfish Mediated by Flood Events**

For over 15 years we have studied native amphibian-invasive predator interactions in streams in the Santa Monica Mountains of Southern California. Invasive predators and competitors have driven local populations of native amphibians to extinction in many streams in Southern California. Invasive crayfish (*Procambarus clarkii*) are known to attack and consume the eggs, larvae and adults of three species of native stream-

breeding amphibians. Once introduced, crayfish populations are persistent, and we have not observed their complete erasure in any stream that they have invaded. In the majority of streams with crayfish, local amphibians are no longer found. However, we have long-term data indicating the persistence of amphibians in high gradient streams. In years when rainfall is above average (usually El Niño events), crayfish densities are greatly reduced as they are either killed or washed away, resulting in large numbers of dead crayfish in downstream regions that are normally not inhabited by crayfish. In non-flood years, crayfish proliferate and successful amphibian reproduction is minimal. Further, during low rainfall years, we have implemented crayfish removal from streams in an effort to reduce their numbers. When crayfish densities are reduced by either high rainfall or removal, native amphibians respond by successful breeding events. Our long-term study suggests that flood events combined with trapping and removal of invasive crayfish can maintain native amphibian populations in high gradient streams.

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**0695 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010**

James Church

*Iowa State University, Ames, IA, United States*

### **Limiting Similarity in Trophic Morphology: Its Consequences for Local Community Structure, and Distributional Limits**

A central theme in ecology is determining the mechanisms which constrain community membership. Interspecific competition between closely related species is an important mechanism regulating community structure. One prevalent theory in community ecology indicates that there is a limit to the similarity between coexisting species. Decades of research on salamanders of the genus *Plethodon* has indicated that interspecific competition is prevalent at local scales. Much of the time, morphological traits of these salamanders are concordant with the process of interspecific competition. Here we examine patterns of morphological-trait variation across the entire range of *P. teyahalee*. We then compare the morphological characteristics of *P. teyahalee* to that of several surrounding species of *Plethodon*, as well as five *Plethodon* species which coexist with this species. These results are consistent with the theory of limiting similarity, where morphologically similar species tend not to coexist, and species with dissimilar morphology can coexist. Further, we relate morphology to environmental characteristics across these species. Results from these analyses suggest where the distribution of *P. teyahalee* may be constrained by competitive interactions and where environmental factors govern this species distributional limit.

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**0264 AES Stress Symposium I, 551 AB, Sunday 11 July 2010; AES GRUBER AWARD**

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

<sup>1</sup>University of New England, Biddeford, Maine, United States, <sup>2</sup>New England Aquarium, Boston, Massachusetts, United States

**The Acute Physiological Effects and Recovery from Graded Periods of Air Exposure in Skates from the Western Gulf of Maine**

Sustained bouts of air exposure occur during capture/handling processes, and functionally inhibit ventilation in obligate water-breathing fishes. However, despite reports of widely ranging interspecific abilities to cope with periods of air exposure, few studies have investigated the direct physiological alterations it causes, and no study has addressed this in western North Atlantic Rajids (skates). In the current laboratory study, mixed venous/arterial whole-blood samples and clinical data have been obtained from the little skate (*Leucoraja erinacea*) (n = 32) immediately following variable bouts of air-exposure, and again 5-days later to evaluate recovery. Although analyses to derive additional ionic and metabolic values and intracellular (erythrocyte) pH are underway, preliminary results show that ventilation rates decreased in each group exposed to air. Blood acid-base status (declines in blood pH and pO<sub>2</sub>; and HCO<sub>3</sub><sup>-</sup> concentrations; elevations in pCO<sub>2</sub>) became progressively more disturbed the longer skates were subjected to air. Interestingly, blood lactate concentrations remained negligible even in the most prolonged (50-minute air exposure) group, suggesting *L. erinacea* did not shift to anaerobiosis during forced hypoventilation. Blood pH declines were likely the primary result of hypercapnia and respiratory acidosis due to the compromised ability to offload CO<sub>2</sub> at the gills. After a 5-day recovery period, blood acid-base disturbances were resolved in all experimental groups. However, 28% of skates subjected to 50 minutes of air exposure died before recovery status could be assessed. Data on the nature and threshold for coping with air exposure by species can have considerable influence on regulatory fishing measures.

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## 0366 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Todd Clardy, Eric J. Hilton

*Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, United States*

### **Osteology of the Prickleback Genus *Xiphister* (Perciformes: Zoarcoidei: Stichaeidae) with Comparisons to Other Stichaeids**

Fishes of the family Stichaeidae, commonly known as pricklebaks are a diverse group of six subfamilies, 37 genera and over 75 species distributed in the intertidal and continental slope waters of the North Pacific, Arctic and North Atlantic Oceans. The phylogeny of stichaeids has been studied to a limited degree, but the understanding of their relationships has been hampered in part by a lack of fundamental descriptive data. The two species of the genus *Xiphister* (*X. mucosus* and *X. atropurpureus*) are slender elongate fishes from intertidal and nearshore habitats of the North Pacific from southern California to southeastern Alaska. In this presentation, we will describe and illustrate the osteology of *Xiphister* based on a broad size range of juvenile and adult specimens (28.9-196 mm SL) using cleared and stained specimens, dry skeletons and radiographs. Following a trend seen in many other stichaeid taxa, many skeletal elements are reduced in *Xiphister*. For example, while most bones of the pectoral girdle are robust, the pectoral radials and fins are highly reduced in size. Small pelvic bones are present, but the pelvic fins are absent. The neurocranium is well developed, elongate, and narrow between the orbits. In most zoarcoids, supraneurals are absent. However, in *Xiphister*, a single supraneural is present between the skull and first neural arch. Based on these results, we will make preliminary comparisons to the osteology of other stichaeids, which will provide a foundation for a morphological systematic analysis of the family Stichaeidae.

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## 0336 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

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

<sup>1</sup>*Mote Marine Laboratory, Sarasota, FL, United Kingdom*, <sup>2</sup>*East Tennessee State University, Johnson City, TN, United States*

### **Behavior of *Trichonotus elegans* (family Trichonotidae) and its Cohabitation with the Garden Eel, *Gorgasia maculata***

The behavior of the protogynous hermaphrodite, *Trichonotus elegans*, was studied off the central west coast of the volcanic island of Sangeang, Indonesia (8° 12' 0"S : 119° 4' 0"E). *T. elegans* lives in swarms in close association with colonies of the garden eel, *Gorgasia maculata*. The harems of *T. elegans* consists of a male and 2 to 5 females, that often

overlap territories of garden eels. A male mates almost every morning with each of his females shortly after the sun rises over the volcanic mountains. Males of adjacent harems have skirmishes at their territorial boundaries, raising their filamentous dorsal fins, chasing each other – sometimes in rapid “circle fights.” Mating takes place on the sand, the male pressing and quivering his body against the female, and the female laying eggs on top of the sand. Once the male leaves her, she buries the eggs into the sand by mouth. After mating, the adults rise off the sand and form swarms that feed on plankton. They feed in sexually mixed or segregated swarms all day (unless potential predators come into the area). At sunset, they dive into the sand in their territories where they remain until dawn. We collected eggs by scooping sand from the mating areas and placing them in containers with sea water. The pelagic larvae hatched out at approximately sunset.

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**0653 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556 AB, Friday 9 July 2010**

Matthew Close, David Cundall

*Lehigh University, Bethlehem, PA, United States*

**Differences in Lower Jaw Form and Function Among Three Macrostromatan Snake Families**

We compared lower jaw and suspensorial behavior during swallowing in three genera (*Boa*, *Python*, and *Nerodia*), representing three macrostromatan families, to determine differences in lower jaw function of snakes with similar gapes. Specifically, we wanted to know whether boas, pythons and watersnakes were 1) similar in their ability to swallow large prey and 2) similar in the extensibility of the intermandibular soft tissues during swallowing. Using video records of snakes feeding on prey of four prey mass/snake mass ratio categories (10-20%, 20-30%, 30-40%, and 40%-50%), we measured changes in posterior head width, gape angle, and intermandibular distance. For the two smaller prey size categories, *Boa* and *Python* both exhibit larger intermandibular distance changes, larger gape angles, and smaller changes in head width than *Nerodia*. The same trends exist for larger prey size categories, except that *Boa* and *Python* exhibit smaller gape angles than *Nerodia*. Apart from the obvious skeletal correlates, these kinematic features correlate with differences in organization and extensibility of intermandibular soft tissues among clades.

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## 0020 Fish Systematics II, Ballroom D, Monday 12 July 2010

Kathleen Cole

*University of Hawaii at Manoa, Honolulu, HI, United States*

### **How Does a Gonad Get from Here to There?**

Among hermaphroditic goby taxa (Gobiiformes, Gobiidae), there is considerable morphological variability in the composition and configuration of gametogenic tissue. This prompts the question as to how gonad ontogeny and morphogenesis in gobiids may have developed such anatomical variation. The early development of the gonadal anlagen among gobiids, though not well-studied, conforms to that of other teleosts, hence our knowledge of features of teleost gonadogenesis may be informative. Simple uni-directional hermaphroditism likely involves the least number of ontogenetic alterations, being accomplished by a simple heterochronic shift in normal gonochore gonadogenesis events. Among goby taxa having a persistent ovotestis, both sex-specific germ cell lines are retained in differing tissue fields. Regulators of ovarian differentiation (i.e., FOXL2) and testis differentiation (i.e., DMRT1) typically differ from that of oogenesis (i.e., SOX3) and spermatogenesis (i.e., Dmrt1). Consequently, in hermaphroditic gobiids, sex cell and gonadal differentiation are likely controlled by differing regulatory pathways in each gonadal form. Whether these regulators act in concert or in opposition likely determines the ultimate taxon-specific pattern of reproductive morphogenesis. The diversity of gonad and gonad-associated morphology among hermaphroditic gobiids suggests that there is considerable ontogenetic lability in the development of the reproductive complex and that modifications in ontogenetic processes have taken several different directions across hermaphroditic clades. Small changes in germ cell behavior and ontogenetic processes, based on known developmental processes associated with teleost gonad and germ cell differentiation, appear to be sufficient to explain the variety of developmental patterns of gonad ontogeny despite the extensive morphological diversity found among hermaphroditic gobies.

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**0685 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556  
AB, Friday 9 July 2010**

Andrew Coleman<sup>1</sup>, Thane Wibbels<sup>1</sup>, Ken Marion<sup>1</sup>, Yi-hui Huang<sup>1</sup>, Nicole White<sup>2</sup>,  
John Dindo<sup>3</sup>

<sup>1</sup>University of Alabama at Birmingham, Birmingham, AL, United States, <sup>2</sup>Birmingham  
Southern College, Birmingham, AL, United States, <sup>3</sup>Dauphin Island Sea Lab, Dauphin  
Island, AL, United States

**Examining Female Allocation Strategies and Hatchling Fitness in the  
Mississippi Diamondback Terrapin (*Malaclemys terrapin pileata*)**

Numerous populations of diamondback terrapins, *Malaclemys terrapin*, are experiencing declines from historic levels. Along the Gulf Coast of Alabama, only isolated remnant aggregations of Mississippi diamondback terrapins currently exist. To address high levels of nest predation by raccoons, which represent a major threat, a head start program was initiated at U.A.B. Obtaining hatchlings have offered an opportunity to further study terrapin biology, including relationships between female allocation strategies and hatchling physiology and fitness. In the summer of 2009, twelve clutches (average of 7.75 eggs/clutch) were obtained from females that subsequently were measured, weighed, and tagged. The length, width, and mass of every egg were measured. After hatching, carapace length and width, plastron length, and mass of every hatchling were measured once a week. Each clutch was fed daily until satiation. Effects of female size and age on egg size and hatchling growth were examined. Rates of hatchling growth were treated as an indicator of hatchling fitness, but other potential indicators were also evaluated, such as righting response times and orientation behavior. So do larger and older females produce more fit hatchlings? The results were compared to the predictions of the optimal egg size theory. In addition, this evolutionary question has conservation implications for populations facing extirpation due to road mortality of nesting females.

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## **0274 Fish Conservation, Ballroom B, Friday 9 July 2010**

Bruce B. Collette<sup>1</sup>, Kent E. Carpenter<sup>1</sup>

<sup>1</sup>National Marine Fisheries Service Systematics Laboratory, Washington, DC, United States, <sup>2</sup>Old Dominion University, Norfolk, VA, United States

### **Why Red List Tunas and Billfishes?**

The Red List Categories of the International Union for the Conservation of Nature have been widely used to provide an explicit, objective framework for the classification of a broad range of species according to their risk of extinction. This system has proved invaluable for the conservation of terrestrial and freshwater organisms but, until recently, it has not been widely used for marine organisms. There are nine clearly defined categories in the IUCN Red List system: Extinct; Extinct in the Wild; Critically Endangered; Endangered; Vulnerable; Near Threatened; Least Concern; Data Deficient; and Not Evaluated. Several species such as the three species of bluefin tunas (Atlantic, *Thunnus thynnus*; Southern, *T. maccoyii*; and Pacific, *T. orientalis*), the Monterey Spanish Mackerel (*Scomberomorus concolor*), and the White Marlin (*Kajikia albida*), are under severe fishing pressure. Critical evaluation as to which category they belong may be helpful in persuading governments that some of these species need additional protection. Recent provisional Red List Assessments categorized the Atlantic and Southern bluefins as Endangered. This is consistent with multi-national stock assessments and, therefore, indicates that Red List assessments will aid in making a case for conservation effort. Monaco has started efforts to list the Atlantic Bluefin on CITES (Convention on International Trade in Endangered Species) at the next meeting of the parties in March in Doha.

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## **0505 Fish Systematics II, Ballroom D, Monday 12 July 2010**

Jordan G. Colosi, Jessica R. Glass, Thomas J. Near

Yale University, New Haven, CT, United States

### **Six New Darter Species Show the Importance of Molecular Phylogenies for Species Delimitation**

The Corrugated Darter, *Etheostoma basilare*, is a complex of cryptic species endemic to the tributaries of Tennessee's Caney Fork River. An updated molecular phylogenetic analysis using multiple nuclear genes supports the hypothesis that *E. basilare* comprises seven deeply divergent clades. This phylogeny was used as a guide to reassess morphological variation in the complex: meristic trait analyses on over 600 specimens were performed, and the results show that the species in the complex are not truly cryptic and that formal species description is warranted. When applied to the *E. basilare* complex, traditional methods for diagnosing darter species that do not make use of molecular phylogenies

either fail to uncover the morphological variation we have found, or diagnose species that are not monophyletic according to our phylogenetic hypothesis. Given our results and the fact that using molecular phylogenies as a guide for finding morphological variation is becoming increasingly common, we suggest that a new paradigm is emerging in the practice of species delimitation.

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#### **0775 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Jorge Contreras, Juan Garcia, Armando Contreras, Salvador Narvaez

<sup>1</sup>Laboratorio de Herpetología and <sup>2</sup> Laboratorio de Ornitología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León., San Nicolás de los Garza, Nuevo León, Mexico

#### **Herpetological Study at Parque Nacional Cumbres de Monterrey, Nuevo Leon, Mexico**

The Parque Nacional Cumbres de Monterrey, is a Natural protected area in Nuevo Leon, Mexico, and it is part of the Sierra Madre Oriental. We conducted a herpetological inventory, and ecological distribution according to vegetation type and altitudinal gradient. The area was divided into 6 zones: submontane scrubland, oak forest, oak-pine forest, pine-oak forest, pine forest and crop impacted areas. We realized 8 field trips during May-September 2009, each field trip with duration of 2-4 days. Observed 37 species with 363 individuals recorded. From the registered species, 14 live in the submontane scrubland, 12 in the oak forest, and 7 in the oak-pine forest, 17 in the pine-oak forest, 15 in the pine forest y one in crop impacted area. In order to analyze the variety non-parametric estimators like Chao1, ACE y Jackknife 1 were used and from individuals were observed one time (Singletons) and two times (Doubletons), was obtain the expected richness giving results for Chao1= 37, for the rate ACE= 37 and the rate Jackknife 1= 38.75; and for the Singletons = 0 and Doubletons = 0. This indicates that the species abundance is adequate based in the sampling.

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#### **0777 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Jorge Contreras, David Lazcano, Armando Contreras

<sup>1</sup>Laboratorio de Herpetología and <sup>2</sup> Laboratorio de Ornitología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León., Apartado Postal 513 y 425., Mexico

#### **The Herpetofauna Changes from Cerro El Potosi, Nuevo Leon, Mexico**

In the northeast of Mexico the Cerro el Potosí is a state high priority area for conservation of its biota. It is situated in the Sierra Madre Oriental with an altitude of

3750 meter above sea level, these characteristics determines particular ecological conditions for the presents of endemic flora and fauna. We applied Jaccard and Cody indexes to compare changes in time. The first indexes serves to compare historical and present records, and that have been influences by different anthropogenic causes, such as forest fires and agricultural and livestock activities, also pseudoecotourism. On the other hand, the Cody index helps to identify gain or loss of species. Historical data were obtained from national and international preserved collection, taking its locality and altitude references. A list of 29 species reptiles and amphibians was obtained, 24 were historical reports and 16 obtain from October 2006-October 2008. The Jaccard index obtained had a 42% similarity, while Cody index reports an 8.5 lost of species. Until now our work indicates that reptiles and amphibians fauna of Cerro El Potosí have been heavily impacted.

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### **0793 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010**

Kevin Conway<sup>1</sup>, Ralf Britz<sup>2</sup>, Joerg Bohlen<sup>3</sup>

<sup>1</sup>*Saint Louis University, St. Louis, MO, United States*, <sup>2</sup>*Natural History Museum, London, United Kingdom*, <sup>3</sup>*Institute of Animal Physiology and Genetics, Libechev, Czech Republic*

#### **Using Your Head as a Switch Blade: Development of the Sub-orbital Spine in Cobitidae**

Members of the families Cobitidae and Botiidae, and one genus of the Nemacheilidae (*Serpenticobitis*), possess a sub-orbital spine (SOS), which can be erected by moving it laterally and anteriorly. Though this complex modification has been utilized in systematic studies of cypriniforms for over a century we know little about its development. Using unique developmental series of *Cobitis* we investigated the ontogeny of the SOS, documenting for the first time its complete development from the earliest stages of ossification through to that of the adult. First signs of development occur in specimens ~10mmSL, where it is represented by a thin perichondral lamina, the lateral ethmoid, around the lateralmost tip of the ectethmoid process of the lamina orbitonasalis. At ~10.2mm-SL the majority of the lamina orbitonasalis has already been replaced by endochondral bone with only a small region of cartilage remaining at its point of connection with the ventral ethmoid plate. By 12mm-SL the medial face of the lateral ethmoid is completely separate from the remainder of the ethmoid region, its distalmost tip extended as a sharp, spine-like process of membrane bone. By 13.5mm-SL the first signs of a short bifurcation, characteristic of the adult stage, are present along the distal edge of the spine-like membrane bone process. Differentiation of the lateral ethmoid is basically complete prior to 19mm-SL, at which point it is comparable to that of the adult and only changes in size, not structure. We review previous phylogenetic hypotheses concerning spined-loaches and discuss the phylogenetic significance of the SOS.

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## **0448 Fish Community Ecology, 555 AB, Monday 12 July 2010**

April Cook<sup>1</sup>, Tracey Sutton<sup>1</sup>, John Galbraith<sup>2</sup>, Michael Vecchione<sup>3</sup>

<sup>1</sup>*Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, United States*, <sup>2</sup>*NOAA Fisheries Northeast Fisheries Science Center, Woods Hole, MA, United States*, <sup>3</sup>*NOAA Fisheries National Systematics Lab, Washington, DC, United States*

### **Deep-pelagic (0-3000 m) Fish Assemblage Structure over the Mid-Atlantic Ridge Relative to the North Atlantic Subpolar Front**

Only a tiny fraction of the world's largest volume of living space, the ocean's mid-water region, has ever been sampled. It is one of the least understood areas on earth, so as part of the International Census of Marine Life field project, MAR-ECO, a discrete-depth trawling survey was conducted in 2009 aboard the NOAA ship Henry Bigelow to examine pelagic assemblage structure and distribution over the Charlie-Gibbs Fracture Zone (CGFZ) of the northern Mid-Atlantic Ridge. The survey consisted of 11 stations divided into two transects, one northwest and one southeast of the CGFZ, which roughly coincides with the Subpolar Front. Sampling was conducted from 0-3000 m using a Norwegian "Krill" trawl with five codends that opened and closed by a pre-programmed timer. Seventy-five species of fish (29 families, 14 orders) were collected. Maximum species diversity was observed between 700-1900 m. Other key features observed were a strong diel migrating component and frequent captures of putative bathypelagic fishes in the epipelagic zone (0-200 m). Fish assemblage structure and distribution will be discussed as a function of physical oceanographic features. The results of this expedition have increased our knowledge about oceanic community structure in association with mid-ocean ridge systems and mesoscale circulation patterns.

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## **0039 Herp Conservation I, 556 AB, Thursday 8 July 2010**

Robert Cook<sup>1</sup>, Peter Paton<sup>2</sup>, Todd Tupper<sup>3</sup>, Brad Timm<sup>4</sup>

<sup>1</sup>*US National Park Service, Wellfleet, MA, United States*, <sup>2</sup>*University of Rhode Island, Kingston, RI, United States*, <sup>3</sup>*Northern Virginia Community College, Alexandria, VA, United States*, <sup>4</sup>*University of Massachusetts, Amherst, MA, United States*

### **Temporal Variation in Anuran Detection Probabilities at Cape Cod National Seashore: Implications for Long-Term Monitoring**

To facilitate more precise use of anuran calling surveys in southeastern Massachusetts, we investigated the effect of temperature and temporal factors on detection probabilities. We surveyed 103 wetlands over six years at Cape Cod National Seashore,

Massachusetts, USA and used automated recording systems and calling surveys to quantify diel chronology. Of eight species recorded, calling intensity of all except *Lithobates sylvaticus* peaked between dusk and midnight. Full choruses of *Hyla versicolor* and *Anaxyrus fowleri* occurred nearer sunset than other species. Detection probabilities of all species varied seasonally, with peak detection periods ranging from 11 to 33 days. Detection probability during peak periods ranged from 0.06 for *Scaphiopus holbrookii* to 0.84 for *Pseudacris crucifer*. Calling chronology varied annually in five species. Water temperature affected detectability more than air, but for four species, models incorporating both water and air temperature received greater support. Moreover, for six of eight species, models incorporating temperature and a seasonal effect received the greatest support, indicating that detectability is a function of both temperature and point in time within the calling season. These results provide region-specific estimates of peak detection periods and detection probabilities, which can help refine survey periods used in regional monitoring programs and to plan more localized efforts. In the latter case, our results indicate that for six of the eight species we recorded, duration of peak calling periods are long enough and detection probabilities high enough to effectively monitor them locally by conducting 2-8 surveys during peak detection periods at 6-33 sites.

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## 0626 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Joshua Copus, Alice Gibb

*Northern Arizona University, Flagstaff, AZ, United States*

### **An Ecomorphological Approach to Understanding Feeding in Butterflyfishes (Chaetodontidae)**

Butterflyfish (Chaetodontidae) are diverse in distribution and resource use. We investigate the relationship between morphology and diet in the *Lepidochaetodon* subgenus using field studies of behavior and diet, and laboratory studies of each species consuming a variety of ecologically-relevant food items. For lab studies, we use high-speed video to record, describe and quantify feeding behaviors. *Chaetodon trichrous* and *C. kleinii* possess the typical *Chaetodon* jaw morphology, with a pointed snout and brush-like teeth. *C. unimaculatus* has a distinct morphology, with more robust oral jaws and teeth. Field observations reveal these two species feed in the water column on plankton and also “pick” benthic invertebrates; *C. kleinii* also feeds on attached benthic prey (Alcyonarians), when available. *C. unimaculatus* (HI) scrapes hard coral and picks benthic invertebrates; however, we did not observe any water-column feeding for this species. In the lab, *Chaetodon trichrous* and *C. kleinii* readily demonstrate midwater suction-feeding behavior, with very little apparent ram: they approach and orient to the prey, then draw prey into the mouth via a wave of cranial expansion. Feeding on unattached benthic prey occurs via the same suction behavior. Feeding on soft coral differs in that the fish approaches the prey more closely and bites/tears off pieces of coral. Thus, our preliminary analysis suggests these two species show two distinct feeding behaviors depending on prey type. In addition, we predict *C. unimaculatus*, a

coral scraping specialist in HI, will demonstrate a third type of feeding behavior when feeding on hard corals.

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**0071 AES Conservation & Management, 552 AB, Friday 9 July 2010**

Enric Cortes<sup>1</sup>, Megan Winton<sup>1</sup>

<sup>1</sup>NOAA / NMFS, Panama City, FL, United States, <sup>2</sup>Moss Landing Marine Laboratories, Moss Landing, CA, United States

### **Predicting the Global Vulnerability of Sharks to Habitat Loss**

Recent risk assessment approaches (Productivity and Susceptibility Analyses) have focused on evaluating the vulnerability of stocks of sharks and other fishes to the effect of fishing. We modified a model previously applied to birds and lemurs to assess the global vulnerability of a suite of shark species to habitat loss. We used dietary, habitat and distribution information to calculate a range size index (RSI) and a habitat loss specialization index (HLSI) that combined habitat and dietary specialization measures. We used the number of reported FAO regions occupied by a species as a measure of its range. The HLSI was computed as the product of dietary specialization (D) and habitat specialization (H). Dietary specialization was calculated with Levin's standardized measure of dietary breadth based on updated standardized diet composition information that summarizes quantitative studies using an average weighted by sample size in each study. Habitat specialization was ranked on a scale linked to the diversity of up to ten identified habitat types used by each species. We then plotted HLSI against RSI, computed global vulnerability based on Euclidean distance, and ranked the global vulnerability of all species analyzed. The values we obtained should be interpreted as indicative of global vulnerability of shark species to habitat loss; however, similar analyses with more detailed information could be conducted at smaller spatial scales. This rapid-assessment technique based on basic biological information predicts the relative vulnerability of species to habitat loss and thus can be useful for identifying species of potentially greater conservation concern.

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## **0016 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Aurelie Cosandey-Godin, Boris Worm

*Dalhousie University, Halifax, Nova Scotia, Canada*

### **Keeping the Lead: How to Strengthen Shark Conservation and Management Policies in Canada**

Internationally, shark conservation is increasingly being recognized as a major environmental challenge, but management efforts to halt the overexploitation of sharks have lagged behind. We examine the state of knowledge on Canadian shark species and analyze the role of existing management and legislation in ensuring shark conservation in Canada. Despite Canada's early leadership, this review reveals major shortcomings in the present management framework. According to IUCN assessments, almost half of shark species occurring in Canadian waters may be threatened, yet Canadian endangered species legislation has not been applied to protect these species. Although research and monitoring efforts are well developed for a few commercial shark species, very little is known about numerous bycatch species taken incidentally. Shark bycatch regulations do not account for discard mortality, a severe omission, which contributes to the overexploitation of several shark species. With respect to shark finning, Canada uses the widely adopted 5 percent ratio rule, which contains loopholes that may allow for wasteful discarding. These problems are not unique to Canada but illustrate broader issues pertaining to the global management of endangered fish species. To strengthen conservation and management of sharks, this paper recommends a set of key policies and management priorities, which exemplify proper precautionary management of endangered shark species in Canada and could serve as a blueprint for improving international conservation efforts. We present a structured approach for grading progress in shark conservation efforts, and identify best practices that could be used as a goalpost elsewhere.

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## **0045 Roads Symposium I, Ballroom B, Saturday 10 July 2010**

Patricia Cramer

*Utah State University, Logan, UT, United States*

### **Transportation Planning and Herp Conservation**

The transportation world has traditionally been slow to recognize the needs of amphibians and reptiles in the planning and delivery of projects. There are, however, examples across the United States where projects have included mitigation features for herpetofauna. This paper will review the current state of herp-related wildlife crossings in the United States; the trends in the creation of crossings and the evolution of concern for these taxa; and a review of the traditional transportation planning process as well as

the new planning paradigm. This review will also incorporate previous and current transportation legislation that pertains to wildlife enhancements. The audience for this paper will learn how to enlighten and motivate a Department of Transportation to be concerned about these smaller fauna, and how to help the transportation agency plan for crossings. The discussion will further include the necessary pre- and post-construction biological research, such as priority data parameters and time frames for monitoring. The need to build partnerships will be demonstrated using case studies, such as the Paynes Prairie Ecopassage project. Additional examples of success stories and pitfalls will also be presented.

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#### **0487 Poster Session II, Exhibit Hall D, Saturday 10 July 2010**

Emily Croteau<sup>1</sup>, Sarah Thomason<sup>2</sup>, Howard Whiteman<sup>1</sup>

<sup>1</sup>*Watershed Studies Institute and Department of Biological Science, Murray State University, Murray, KY, United States*, <sup>2</sup>*Department of Biological Science, Murray State University, Murray, KY, United States*

#### **Assessments of Polymorphic Microsatellites for Parentage Assignment in a Facultatively Paedomorphic Salamander, *Ambystoma talpoideum***

Environmentally-cued polymorphisms (polyphenisms) occur when discrete phenotypes are produced as a result of a genotype by environment interaction. One of the most intriguing polyphenisms among vertebrates is facultative paedomorphosis in salamanders whereby depending on the environment experienced during larval development, individuals either metamorphose into terrestrial adults or become paedomorphic, branchiate morphs. The mole salamander, *Ambystoma talpoideum*, is one such species that exhibits facultative paedomorphosis, and much is known about its ecology, however little data exists on the fitness payoffs to alternative morphs. Using a combination of microcosm experiments, field and molecular analyses we will characterize patterns of reproductive success. As a first step we optimized microsatellite markers to ascertain the degree of polymorphism and hence utility for parentage analyses. Thus far we have assessed polymorphism in 5 microsatellite loci, and ascertained varying degrees of polymorphism (number of alleles 4 - 11). With these levels of polymorphism it is our hope to create pedigrees of individuals to determine parentage of particular morphs, trace inheritance of morphs within families, and follow patterns of reproductive success.

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**0331 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Brian Crother<sup>1</sup>, Mary White<sup>1</sup>, Jay Savage<sup>2</sup>, Mallory Eckstut<sup>3</sup>, Matthew Graham<sup>3</sup>, David Gardner<sup>1</sup>

<sup>1</sup>*Southeastern Louisiana University, Hammond, Louisiana, United States*, <sup>2</sup>*San Diego State University, San Diego, California, United States*, <sup>3</sup>*University of Nevada, Las Vegas, Las Vegas, Nevada, United States*

**Pleistocene Divergence of the Foxsnakes *Pantherophis vulpinus* and *P. gloydi* Across the Mississippi River**

The traditional boundary for the foxsnakes has been between those in the Central Lowlands Province and surrounding the western Great Lakes (*Pantherophis vulpinus*) and those surrounding the eastern Great Lakes region (*P. gloydi*). Recent phylogeographic study has suggested that the Mississippi River represents the true species boundary, where foxsnakes west of the Mississippi (*P. vulpinus*) are divergent from all other foxsnakes, and foxsnakes east of the Mississippi (previously presumed to be *P. vulpinus*) had similar haplotypes to those foxsnakes in the *P. gloydi* range. We examined *Pantherophis vulpinus* and *P. gloydi* across their range to determine timing of divergence between these lineages. We examined the Cytochrome b gene for 34 foxsnakes, used *P. guttata* as an outgroup, and used the program BEAST to evaluate timing of genetic divergence. Pooled estimates of divergence time between *P. gloydi* (east of the Mississippi) and *P. vulpinus* (west of the Mississippi) resulted in a most recent common ancestor between 369,100 and 1,183,000ya, with a mean estimate of 742,800ya. These dates span the mid-Nebraskan through the Kansan Pleistocene glacial cycles, and we propose that this divergence between eastern and western clades across the Mississippi River resulted from allopatric speciation from glacial lobes and the Mississippi River widening during interglacial cycles. Despite the fact that our dates correspond with geographically consistent events, our current estimates are extremely broad. Increasing the number of genes analyzed and subsequent use of coalescent-based analyses may reveal more precise dates regarding the divergence of these two species.

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**0613 AES Behavior & Ecology, 552 AB, Friday 9 July 2010**

Jennifer Cudney, Roger Rulifson

*East Carolina University, Greenville, NC, United States*

**Elucidating the Behavior of Spiny Dogfish (*Squalus acanthias*) that Overwinter in Coastal North Carolina Waters with Acoustic Telemetry Methodologies**

The management of spiny dogfish sharks (*Squalus acanthias*) is highly controversial in North Carolina. Participants and industry representatives across the entire eastern US coast claim that current state and federal survey efforts are not adequate to describe the complex behaviors and general abundance of dogfish. A comprehensive understanding of movement and migration patterns is a critical component of validating current survey methods. Previous mark-recapture research has identified separate behavioral contingents of spiny dogfish, and a "mid-Atlantic contingent" that exhibits a general north-south migration pattern between North Carolina and Cape Cod. The purpose of this research is to use acoustic telemetry technology to further characterize the behavior of spiny dogfish that overwinter in North Carolina. In 2009 and 2010, 90 spiny dogfish were tagged with Vemco V-16 acoustic transmitters. VR2W acoustic receivers were moored just south of Cape Hatteras, NC. Mobile tracking surveys were conducted between Oregon Inlet, NC and Ocracoke Inlet in February and March of 2009 and 2010. In 2009, 7 spiny dogfish were detected on the VR2W receivers and 6 were detected using mobile tracking surveys. Data collection in 2010 is ongoing. Supplementary fishery independent data, satellite sea surface temperature (SST) data, tide data, and acoustic dopplar current profiler (ADCP) data were compared to movement data to identify environmental factors that influence behavior.

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**0699 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Paul Cupp

*Eastern Kentucky University, Richmond, KY, United States*

**Long-term Nest Site Fidelity in Green Salamanders, *Aneides aeneus***

This study examines the use of breeding crevices by *A. aeneus* females at field sites in SE KY. Over a 15 year period, the crevices of specific rock outcrops were monitored for the presence or absence of females brooding egg clutches during the summer breeding period. Of the visible rock crevices with *A. aeneus* present, only a relatively few had brooding females with eggs. These crevices were often used every year or in alternate years over several years to brood eggs and young. In these crevices, female *A. aeneus* had a significantly higher rate of success in rearing young compared to those females in newly initiated brooding crevices or in sporadically used brooding crevices at these field

sites. Nest site fidelity has some influence on the continued use of these crevices. These crevices must have properties that result in their selection by females (or males?) as breeding sites.

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**0357 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010; ASIH STOYE AWARD CONSERVATION**

Andrea Currylow, Rod Williams, Brian MacGowan

*Purdue University, West Lafayette, IN, United States*

**Behavioral Effects of Anthropogenically Altered Habitat on a Declining, Long-lived Vertebrate, *Terrapene carolina carolina***

Habitat alteration in the form of timber harvesting has received increased attention over the past decade, especially in light of amphibian population declines. Little attention, however, has focused on reptilian responses to various forest management practices. The eastern box turtle (*Terrapene carolina carolina*) is a long-lived and geographically widespread forest species, yet is experiencing precipitous decline. This species' ubiquitous range and close ties to micro-environmental fluctuations make it ideal for study amid anthropogenic disturbances. We tracked 23-41 eastern box turtles using radio telemetry from 2007-09. Turtles were tracked up to three times per week during annual active season (May-October) for two years prior to, and one year following, scheduled timber harvests. Annual and seasonal home ranges were calculated and compared as Minimum Convex Polygons (MCP). Microhabitat characters were recorded using iButton temperature loggers and vegetation surveys. Pre- and post-harvest home ranges thus far have shown no significant differences in size. Pre-harvest home range sizes for all adults ranged from 0.8 to 187.7 hectares and did not significantly vary between the sexes (av. ♂:14.4ha., av. ♀:6.2ha). The first year of post-harvest data yielded home range sizes ranging from 0.3 to 95.1 and did not vary significantly between the sexes (♂:7.0ha., av. ♀:8.3ha). This experimental design using radio telemetry data and direct observation of a wild turtle population prior to and in response to anthropogenic habitat alteration is the first of its kind. Ultimately, the results of this research can influence management decisions to enhance habitat on forested lands.

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## 0563 AES Genetics, 552 AB, Sunday 11 July 2010

Caitlin Curtis<sup>1</sup>, Mike Tringali<sup>1</sup>, Gregg Poulakis<sup>2</sup>

<sup>1</sup>Florida Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, St Petersburg, FL, United States, <sup>2</sup>Florida Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Port Charlotte, FL, United States

### **Population Genetics of the Endangered Smalltooth Sawfish, *Pristis pectinata***

The smalltooth sawfish, *Pristis pectinata*, is thought to have undergone a severe population level decline, and has been included on the United States endangered species list since 2003. In 2009, National Marine Fisheries Service designated over 800,000 acres of critical nursery habitat areas to aid in protecting this species along the southern / southwestern Florida coastline. We are characterizing the genetic diversity in and among these nursery areas, including the Peace and Caloosahatchee River drainages of southwestern Florida. In addition, we are assessing the genetic relatedness among individuals of the same size class (i.e. potential sibling groups) that were tagged and non-lethally sampled at the same time and location. To date, we have analyzed over 100 samples with 16 polymorphic microsatellite loci, and the heterozygosity and allelism among these individuals is surprisingly high, up to 33 alleles for one microsatellite locus. Preliminary analyses show no sign of a recent genetic bottleneck. Genetic relatedness among potential sibling groups within and among river drainages will also be discussed. For example, preliminary data suggest that up to half of the potential sibling groups tagged in the Peace River contain at least a pair of full siblings, though this percentage may be lower in the Caloosahatchee River. In conjunction with tagging and acoustic telemetry studies, these genetic relatedness estimates are being applied to test hypotheses pertaining to habitat usage for young of the year *P. pectinata* in the Caloosahatchee canal system.

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## 0278 Fish Ecology, 555 AB, Sunday 11 July 2010

Judson M. Curtis<sup>1</sup>, Gregory W. Stunz<sup>1</sup>, R. Deborah Overath<sup>1</sup>, Robert R. Vega<sup>2</sup>

<sup>1</sup>Texas A&M University Corpus Christi, Corpus Christi, TX, United States, <sup>2</sup>Texas Parks & Wildlife Department, CCA-CPL Marine Development Center, Corpus Christi, TX, United States

### **Detection of Wild Versus Hatchery-reared Spotted Seatrout Using Otolith Chemistry**

The spotted seatrout, *Cynoscion nebulosus*, comprises an economically valuable recreational fishery along the Texas coastline with over one million fish harvested

annually. Stock enhancement efforts from local hatcheries have attempted to supplement wild populations to increase abundance and potential harvest of this species. The efficacy of these efforts is obviously dependent upon survival of these hatchery-reared fish once released into the wild. Although significant resources are spent on stock enhancement, the fate of hatchery-reared fish is still largely unknown. The natural tag properties of fish otoliths represent a mechanism by which we can track the fate of hatchery-reared fish and make inferences about their movement and survivorship upon release into the wild. Juvenile spotted seatrout (25-40 mm) were collected from four Texas bays and from three Texas hatcheries. Sagittal otoliths were analyzed for stable isotopic and trace element compositions. Our results show evidence that otolith chemistry is a powerful tool for identifying natal origins of spotted seatrout and can provide important data on survivorship and movement of these fish. These results will be combined with genetic analyses, thereby enhancing our ability to track the fate of hatchery-reared fish. These data will provide managers with information needed to make decisions concerning the better management of the Texas spotted seatrout fishery.

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#### **0147 AES Ecology, 551 AB, Thursday 8 July 2010**

Tobey Curtis<sup>1</sup>, Camilla McCandless<sup>2</sup>, John Carlson<sup>3</sup>, Harold Pratt, Jr.<sup>2</sup>, Nancy Kohler<sup>2</sup>, George Burgess<sup>4</sup>, Gregory Skomal<sup>5</sup>

<sup>1</sup>NOAA Fisheries Service, Gloucester, MA, United States, <sup>2</sup>NOAA Fisheries Service, Narragansett, RI, United States, <sup>3</sup>NOAA Fisheries Service, Panama City, FL, United States, <sup>4</sup>Florida Museum of Natural History, Gainesville, FL, United States, <sup>5</sup>Massachusetts Division of Marine Fisheries, Oak Bluffs, MA, United States

#### **Seasonal Distribution of White Sharks in the Western North Atlantic Ocean**

Despite recent advances in field research on white sharks (*Carcharodon carcharias*) in several regions around the world, opportunistic capture and sighting records remain the primary source of information on this species in the North Atlantic Ocean. This is due to their sparse distribution and the apparent absence of discrete coastal aggregation sites in this hemisphere. Few studies have attempted quantitative analyses of available data to describe seasonal distribution, population structure, habitat use, and relative abundance. This study builds upon previously published data combined with recent unpublished records and presents a synthesis of over 550 confirmed white shark records compiled over a 210-year period (1800-2009). This is the largest white shark dataset yet compiled for the western North Atlantic. Descriptive statistics and GIS analyses were employed to quantify the seasonal distribution of various sub-components of the population. White sharks range widely along the Atlantic coast of North America (18-51 °N latitude). All size classes were present in continental shelf waters in every month of the year, occurring over a temperature range of 11-28 °C. Median latitude of white shark occurrence varied seasonally, with sharks moving to higher latitudes during the summer months. Core areas of high shark density also varied seasonally, with high

density between Massachusetts and New Jersey during summer, and off Florida's east coast during winter. White sharks are currently prohibited from commercial and recreational harvest in the region, but the level of bycatch in various fisheries remains uncertain.

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**0590 AES GRUBER AWARD, 551 AB, Friday 9 July 2010**

Jonathan Dale<sup>1</sup>, Natalie Wallsgrove<sup>2</sup>, Brian Popp<sup>2</sup>, Kim Holland<sup>1</sup>

<sup>1</sup>*Hawaii Institute of Marine Biology, University of Hawaii at Manoa, Kaneohe, HI, United States*, <sup>2</sup>*University of Hawaii at Manoa, Honolulu, HI, United States*

**Ontogenetic Dietary and Habitat Shifts in Brown Stingrays (*Dasyatis lata*) in Hawai'i Inferred from Stomach Content and Stable Isotope Analysis**

Elasmobranchs may regulate ecological communities through a variety of density and trait mediated interactions. Stomach content and stable isotope analysis were used to assess the diet and habitat use of brown stingrays (*Dasyatis lata*), and to examine the possibility of competitive interactions with juvenile hammerhead sharks (*Sphyrna lewini*) in Kāne'ohe Bay. Stingrays fed almost exclusively on crustaceans, with shrimps and crabs making the greatest contributions to the diet. An ontogenetic shift in stingray diet was consistent with positive relationships between stingray size and both  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values. A dramatic decrease in bulk  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  was evident for large stingrays, which corresponded with the onset of sexual maturity. To test the hypothesis that the observed decrease represented a habitat shift from bay to offshore waters,  $\delta^{15}\text{N}$  values of individual amino acids were determined. The trophic level of stingrays increased with size independent of bulk  $\delta^{15}\text{N}$  values, indicating that differences in source  $\delta^{15}\text{N}$  between habitats were responsible for the decrease in bulk  $\delta^{15}\text{N}$ . There were low levels of dietary overlap between stingrays and hammerheads, due to a larger contribution of teleosts in the hammerhead diet. Hammerheads were also depleted in  $\delta^{13}\text{C}$  and enriched in  $\delta^{15}\text{N}$  relative to stingrays, suggesting that primary carbon sources differ between these two species and hammerheads feed at a higher trophic level. The combined analyses indicate that Kāne'ohe Bay is an important juvenile habitat for brown stingrays, and suggest strong dietary resource partitioning between these two sympatric elasmobranch species.

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**0013 AES Genetics, 552 AB, Sunday 11 July 2010**

Toby Daly-Engel<sup>1</sup>, Kanesa Duncan<sup>3</sup>, Kim Holland<sup>2</sup>, John Coffey<sup>2</sup>, Holly Nance<sup>4</sup>, Robert Toonen<sup>2</sup>, Brian Bowen<sup>2</sup>

<sup>1</sup>University of Arizona, Tucson, AZ, United States, <sup>2</sup>Hawaii Institute of Marine Biology, Kaneohe, HI, United States, <sup>3</sup>University of Hawaii, Honolulu, HI, United States, <sup>4</sup>Clemson University, Clemson, SC, United States

**Male-Mediated Dispersal in an Incipient Global Ring Species, the Scalloped Hammerhead Shark (*Sphyrna lewini*)**

Many sharks have high dispersal ability coupled with coastal habitat requirements, potentially yielding complex population structure with implications for management of depleted stocks. The scalloped hammerhead, *Sphyrna lewini*, is a large shark with a circumglobal distribution, observed in the open ocean but linked ontogenetically to coastal embayments for parturition and juvenile development. A previous mtDNA survey demonstrated strong genetic partitioning overall (global  $\Phi_{ST} = 0.519$ ) and significant population separations across oceans and between discontinuous continental coastlines. Here we survey the same global range with increased sample coverage (N = 403) and 13 microsatellite loci to assess the male contribution to dispersal and population structure. Biparentally-inherited microsatellites reveal low or absent genetic structure across ocean basins and global genetic differentiation ( $F_{ST} = 0.035$ ) that is an order of magnitude lower than the corresponding measures for maternal mtDNA lineages ( $\Phi_{ST} = 0.519$ ). Nuclear allelic richness and heterozygosity are high throughout Indo-Pacific, while genetic structure is low. In contrast, allelic diversity is low while population structure is higher for populations at the ends of the range in the West Atlantic and East Pacific. These data are consistent with the proposed Indo-Pacific center of origin for *S. lewini*, and indicate that females are philopatric or adhere to coastal habitats, while males facilitate gene flow across oceanic expanses. We conclude that *Sphyrna lewini* is an incipient global ring species with gene flow between populations countering the isolating effects of distance, whose genetic continuity is impeded only by secondary vicariance at the Isthmus of Panama.

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## 0191 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Nathan Dammeyer<sup>2</sup>, Catherine Phillips<sup>1</sup>, Timothy Bonner<sup>2</sup>, Zachary Shattuck<sup>2</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, San Marcos, Texas, United States, <sup>2</sup>Texas State University, San Marcos, Texas, United States

### **Movement Patterns of *Etheostoma fonticola***

Movement patterns provide insight into dispersal capabilities, connectivity among subpopulations, and persistence within specific geographic locations. The endangered fountain darter *Etheostoma fonticola* is restricted to the headwaters of the Comal and San Marcos rivers of the Edwards Plateau region of central Texas. *Etheostoma fonticola* is highly susceptible to drought due to water usage by surrounding municipalities, and it is not known if they can move from disturbed habitats to more suitable habitats during a low water event. Two separate mark-recapture studies using Visible Implant Elastomer examined movement during two different flow regimes. Rapid recovery of habitat and associated populations was observed following a period of severe drought with darters likely moving into newly suitable habitat from adjacent habitat patches. *Etheostoma fonticola* generally conformed to the restricted movement paradigm with high site fidelity and limited capability of longer-distance movements. Continuity of suitable habitat is likely an important factor in facilitating survival during periods of low flow.

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## 0754 Plenary, Ballroom A, Thursday 8 July 2010

Indraneil Das

Universiti Malaysia Sarawak, Kota Samarahan, Sarawak, Malaysia

### **Perceptions, Use and Conservation of Amphibians by Indigenous People Worldwide**

Humans and frogs, much like frogs and water, are inextricably linked. The association, thus, between early human consciousness and these largely aquatic organisms is substantial and widespread in many cultures. This paper explores both the antiquity of the human-amphibian relationship worldwide, synthesizing data from prehistoric and ancient historic textual sources (including bestiaries, herbals and pharmacopoeias), and more recent attitudes to amphibians. The sources of information were data from zoo-archaeological material or cultural artifacts; folklore and indigenous beliefs; ancient (including religious) texts, rhymes, and taboos; uses in societies for narratives of their social functions, pharmacological, culinary and agricultural researches; representations in advertisement and postage stamps, toys, models and other products; and for food and medicine by both Western and indigenous (non-Western) societies around the world. While the use of animal-derived drugs as superstition, some established local

knowledge have been reported by scientists in recent times. Typically, the "new" data may range from the discovery of species, their ecological characteristics, to their potential use by man, especially as food, in traditional medicine, for enhancement of senses in hunting or for poisoning darts. It is therefore argued here that the tendency by practitioners of modern science to dismiss nativism as absurd and illogical, is not borne by the available evidence.

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**0342 Poster Session I, Exhibit Hall D, Friday 9 July 2010**

Jennifer Dautrich, Amy Maynard, Anabela Maia, Cheryl Wilga

*University of Rhode Island, Kingston, Rhode Island, United States*

**Turning Ability in Juvenile Spiny Dogfish, *Squalus acanthias***

Sharks move through the environment using a variety of steady swimming and maneuvering behaviors. Turning is one maneuver used routinely to change direction, to avoid predators and in foraging. Turning behavior in juvenile spiny dogfish, *Squalus acanthias*, was studied under two different treatments: with food present (foraging turns) and without food present (routine turns). Foraging turns were expected to have a greater change in heading, be of larger duration, have smaller chord lengths and be faster than routine turns. Sharks were video taped during the treatments. Turns were digitized from video frames and angle, velocity, acceleration, duration, and chord length calculated to compare treatments using T-tests. No difference was found in the duration of turns between treatments. However, change of heading, acceleration, and velocity were greater while chord length was smaller in foraging turns. The similarity in duration between treatments may be due to the higher velocity compensating for the greater change in angle with food present. When foraging, sharks turn faster and tighter with smaller chord lengths and larger angles compared to routine turns. When food is available, sharks are more motivated to move with sharper and faster turns to capture the prey than when food is not available. Individuals that turn with a greater degree of maneuverability and speed could out compete other sharks in the area foraging for the same food items.

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**0362 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010;  
ASIH STOYE AWARD ECOLOGY & ETHOLOGY**

Christopher Davis, Martin O'Connell

*University of New Orleans, New Orleans, LA, United States*

**Diet of Young Lemon Sharks (*Negaprion brevirostris*) within a Nursery at the  
Chandeleur Islands, Louisiana**

Lemon sharks (*Negaprion brevirostris*) use shallow coastal waters with seagrass beds and mangrove fringed habitats as nursery grounds. Young *N. brevirostris* use these highly productive habitats as nurseries because they typically contain large amounts of prey items that fulfill their extensive food and growth requirements. I studied the diet of 42 *N. brevirostris* (male n = 22; female n = 20; fork length range = 536 to 1220 mm) collected within nursery habitats at the Chandeleur Islands, Louisiana in 2009. I examined the stomach contents from 19 of these sharks (23 remaining sharks had empty guts) to describe their diet within the nursery habitats. In the study area, YOY and juvenile *N. brevirostris* fed primarily on teleost fishes (77.91 % I<sub>RI</sub>) and crustaceans (1.02 % I<sub>RI</sub>). The dominant recognizable teleost prey species were longnose killifish (*Fundulus similis*: 1.85 % I<sub>RI</sub>), pinfish (*Lagodon rhomboides*: 1.42 % I<sub>RI</sub>), and inland silversides (*Menidia beryllina*: 1.10 % I<sub>RI</sub>). I also compared the diets of young *N. brevirostris* among the three different habitats in which they were captured: sand substrate, seagrass beds, and marsh fringe. Stomach contents of sharks captured on sand bottoms contained approximately 70% of the total weight of all prey items, followed by seagrass (28.5%) and marsh fringe (2.3%). These findings support the suggestion that the Chandeleur Islands provide important nursery habitats for this apex predator.

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**0117 Fish Ecology, 555 AB, Sunday 11 July 2010; ASIH STOYE AWARD  
CONSERVATION**

Justin Davis

*University of Connecticut, Storrs, CT, United States*

**A Moveable Feast: Striped Bass Predation on Alosines during Vernal  
Spawning Migrations**

Spawning aggregations are localized concentrations of a species at a predictable time of year. Predators often evolve migratory patterns and feeding strategies that take advantage of these aggregations. During these relatively small spatio-temporal windows, predators may be highly efficient and thus make an outsized impact on prey populations. Targeted study of these predator-prey interactions can reveal trophic dynamics that are not readily apparent from studies focusing on other habitats and

seasons. Here we describe predator-prey interactions between striped bass (*Morone saxatilis*) and anadromous alosines (blueback herring *Alosa aestivalis* and American shad *A. sapidissima*) during springtime spawning migrations into freshwater. Despite widespread consensus that newly abundant striped bass are exerting considerable predatory pressure on spawning alosines, the feeding ecology of migrant striped bass in the freshwater environment is largely unreported. In samples of marine striped bass collected from the Connecticut River in May-June of three consecutive years, diet composition varied with striped bass size. The diet of smaller striped bass reflected a generalist feeding strategy; diet became increasingly specialized for alosine prey among larger (> 60 cm TL) individuals. Approximately 21% of the striped bass population fed heavily on alosines. Striped bass daily ration estimates (% body weight/day) ranged from 0.1-1.6 % for blueback herring and 0.8-7.0% for shad. Future analyses will incorporate aspects of striped bass feeding ecology into quantitative modeling exercises to test the hypothesis that striped bass predation on spawning alosines is responsible for recent declines in alosine populations.

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## **0119 Fish Systematics II, Ballroom D, Monday 12 July 2010**

Matthew Davis, Prosanta Chakrabarty

*Louisiana State University Museum of Natural Science, Baton Rouge, LA, United States*

### **Evolutionary Relationships of the Synodontoidei (Euteleostei: Aulopiformes)**

Synodontoidei, lizardfishes and their allies, includes 6 genera and approximately 70 species of predatory fishes distributed in the Atlantic, Indian, and Pacific Oceans in benthic inshore habitats. Recent studies of aulopiform relationships recover a monophyletic Synodontoidei as the basal aulopiform lineage. These studies form the foundation for a robust phylogenetic hypothesis of synodontoid interrelationships; however, there is a need for additional phylogenetic analysis with greater taxonomic sampling. Previous studies have been limited to one or two species representing each genus and the relationship among families within the suborder are generally weakly supported. An expansive taxonomic sampling of this suborder is presented that incorporates recently collected material from Vietnam, Taiwan, and Australia to provide a more robust hypothesis of evolutionary relationships within the synodontoid clade. Synodontoid interrelationships are reconstructed using molecular data from the nuclear genes *RAG1*, *zic1*, *plagl2*, and *ENC1* and the mitochondrial gene *COI*. This systematic framework is used to explore evolutionary and taxonomic questions within the group, including divergence times of the synodontoids and the systematic placement of the enigmatic *Trachinocephalus myops*.

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## 0455 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

Mason Dean<sup>1</sup>, Daniel Huber<sup>2</sup>, Joseph Bizzarro<sup>3</sup>, Lara Ferry-Graham<sup>4</sup>

<sup>1</sup>Max Planck Institute, Dept. Biomaterials, Potsdam, Germany, <sup>2</sup>University of Tampa, Tampa, FL, United States, <sup>3</sup>University of Washington, Seattle, WA, United States, <sup>4</sup>Moss Landing Marine Laboratory, Moss Landing, CA, United States

### **Durophagy in Cartilaginous Fishes**

Durophagy – typically defined as “the eating of hard prey” – is comparatively rare among the cartilaginous fishes, but has evolved at least once in each of the three major lineages. If we consider “hard” prey items to be those that require the removal of some mineralized, non-nutritious coating in order to be ingested or digested, then from a functional standpoint, durophagy is less about eating hard foods than dealing with hard structures that limit access to soft, nutritious ones. Here, we highlight the myriad independent evolutionary pathways and feeding mechanisms that have permitted access to this ecological niche in cartilaginous fishes. Although durophagous chondrichthyans apparently all employ a fracturing technique of exoskeleton destruction, the means of achieving the bite forces and skeletal reinforcements necessary for this mode of dealing with prey vary widely. Relative to non-durophagous species, hard-prey eaters exhibit any combination of modifications of skeletal material (tissue material properties), skeletal structure (cortical thickening, trabeculation, cross-sectional shape), dental morphology, cranial geometry (lever arms), muscular morphology (hypertrophication, fiber angle) and/or feeding behavior (winnowing, cyclic biting). Modifications to muscular physiology (fatigue-resistance, fiber type), and gastric structure and physiology may also exist in durophagous species; however, this has yet to be examined. In assembling the mechanisms of chondrichthyan durophagy, we outline the functional requirements and constraints on the feeding mechanism and highlight areas for future study.

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## 0088 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Alison Deary, Eric Hilton

*Virginia Institute of Marine Science, Gloucester Point, VA, United States*

### **Comparative Ontogeny of the Oral Jaws in the Drums (Sciaenidae) of Chesapeake Bay: Relationship with Diet and Habitat Use**

Adult drums (Sciaenidae) occupy a diversity of habitats and it has been demonstrated that the morphology of the feeding apparatus can influence the exploitation and selection of essential fish habitat, as well as the strategy utilized for prey capture. This presentation will describe the anatomy and ontogeny of the oral jaws in seven genera of

Sciaenidae that have representatives in the Chesapeake Bay, including *Sciaenops*, *Cynoscion*, *Leiostomus*, *Menticirrhus*, *Micropogonias*, *Pogonias*, and *Bairdiella*. Clearing and staining techniques were used to examine changes in the structure of the oral jaw from larval and post-larval specimens. There is variation in the density of teeth along the oral margin between taxa. It has been shown that adults of closely related species show segregation in feeding niches that are matched by differences in mouth position, dentition, and structure of the oral jaws. Further, benthic feeding species have a more inferior mouth position, relatively longer premaxillae, and enlarged ascending processes of the premaxillae. Little research has investigated the ontogenic shifts in the oral jaws in larval sciaenids. However, the variation in adult structure is likely correlated with ontogenic changes in the individual bones forming the oral jaws, as well as differences in habitat and diet utilization. Starvation and predation are the main causes of larval mortality, and by studying the ontogeny of structures that are used for feeding, such as the oral jaws, better predictions regarding larval survival can be devised.

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**0657 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; NIA BEST STUDENT POSTER AWARD**

A. Mickey Dehn, Jay A. Nelson

*Towson University, Towson, MD, United States*

**Ever Eat a Palm Tree? Growth, Histology, and Digestive Physiology of a Wood-Eating Catfish, *Panaque nigrolineatus***

Fish of the genus *Panaque* (Loricariidae) are known to consume wood, although evidence for nutrient assimilation from wood is sparse. Two feeding experiments were conducted to assess the effects of diet and the involvement of gut microbes on *Panaque* growth. In trial 1, fish were assigned to treatments of four combinations of diet (tulip poplar or zucchini) and drug exposure (antibiotic or no antibiotic). All groups had mean negative growth and an interaction between diet and antibiotic exposure was observed ( $F=6.8333$ ,  $df=1$ ,  $P=0.0188$ ). In trial 2, fish were given a diet of either palm hearts or palm wood. Fish fed only palm hearts gained an average of  $8.48 \pm 2.494\%$  (SE) of their initial body mass, while fish fed only palm wood gained an average of  $1.08 \pm 3.321\%$ . Negative growth on exotic woods compared with large positive growth on palm hearts and small growth on native palm wood, raises questions about whether *Panaque* can generally extract energy from wood. Histological examination of the gut and analyses of gut short chain fatty acids will also be presented. Use of wood as food is novel among fishes and may help explain the loricariid radiation. Understanding mechanism(s) of recalcitrant carbon bond degradation by *Panaque* has potential applications for agriculture and biofuel development.

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## **0797 Herp Morphology, 556 AB, Sunday 11 July 2010**

Jennifer Deitloff, Valerie Johnson

*Auburn University, Auburn, AL, United States*

### **Color Variation Between Clutches and Sexes in *Drymarchon couperi***

Many species exhibit variation in the color of their scales, feathers, or fur. Various forms of natural selection, such as mimicry, crypsis, and species recognition, can influence the evolution of color. In addition, sexual selection can drive patterns of color variation. In *Drymarchon couperi* (Eastern Indigo snake), a federally threatened species, the sides of the head and the chin can vary in color from black to reddish-orange to pale yellow or white. Despite captive breeding and release programs for *Drymarchon couperi*, not much is known about its biology in the field. Past researchers have proposed that the color variation on the head and chin is associated with the sex of an individual, with males showing more red color. In addition, clutches of snakes seem to be more similarly colored to one another. Therefore, we tested the hypothesis that color of the sublabial, chin, and neck scales of individuals of *Drymarchon couperi* is associated with sex and clutch. We used color spectrometry to determine the reflectance values of sublabial, chin, and neck scales within ultra-violet, yellow, orange and red wavelengths. To test our hypothesis we compared color between clutches and sexes, including an interaction term to determine if these characteristics influence color of individuals. We found that both sex and clutch are associated with color. Further studies will address whether eyes of this species of snakes can discriminate between color variants and if color is used for species recognition or mate choice.

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## **0786 Herp Conservation I, 556 AB, Thursday 8 July 2010**

Pablo R. Delis<sup>1</sup>, Walter E. Meshaka Jr.<sup>1</sup>

<sup>1</sup>*Shippensburg University, Shippensburg, Pennsylvania, United States*, <sup>2</sup>*State Museum of Pennsylvania, Harrisburg, Pennsylvania, United States*

### **Variability in Snake Assemblage Structure at Sites in the Letterkenny Army Depot in South-Central Pennsylvania**

In the light of the present and widespread biodiversity crisis, biologists worldwide are exploring the population status and trends in local amphibian and reptile communities. Despite a wealthy history of scientific inquiries, little is known about snake assemblage dynamics in Pennsylvania. Using mostly cover boards, we surveyed the snake assemblage at Letterkenny Army Depot (LEAD) in south-central Pennsylvania. In 2008 and 2009, we collected 81 individuals belonging to eight different species of snakes: one viperid and seven colubrid. In relative terms, the Ringneck Snake, *Diadophis punctatus*, was the most abundant in open forest, whereas the Eastern Black

Racer, *Coluber constrictor*, was the most abundant in open grassland and also, overwhelmingly (61.29%), the most dominant overall. This ongoing long-term study will strengthen our understanding of LEAD's apparently uneven snake assemblage and further the much needed knowledge on aspects of snake ecology in south-central Pennsylvania.

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**0446 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010**

Leo Demski

*New College of Florida, Sarasota, Florida, United States*

### **An Heuristic Model of the Neural Control of Feeding in Elasmobranchs**

Considerable information has accrued in the past 20 years concerning sensory modalities (vision, mechanoreceptive and electroreceptive lateral line, olfaction, audition) involved in finding food in sharks and batoids. Comparative gross anatomical studies that correlate relative brain area development to feeding ecology provide suggestions of the relative importance of these modalities in various species. Differences relate to both phylogeny and habitat. Details on the processing mechanisms are less well understood but information on similar systems in teleosts and tetrapods can be used for inference. Localization of regions (telencephalon, optic tectum and cerebellum) concerned with multimodal sensory processing and cognitive functions that are likely involved in feeding have been identified and the complexity of their development parallels that of the fish's behavior. Information on regions (hypothalamus, telencephalon) controlling appetite and motivation to search for food is available from a few brain stimulation studies in sharks and the mapping of central distributions of peptide hormones (neuropeptide Y, cholecystokinin, galanin, gonadotropin-releasing hormone II) involved in feeding activation in elasmobranchs and/or other vertebrates.

A synthesis of information in these categories is summarized in a tentative model of overall feeding control.

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**0437 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010**

John Denton<sup>1</sup>, Melanie Stiassny<sup>1</sup>

<sup>1</sup>*Richard Gilder Graduate School, AMNH, New York, NY, United States*, <sup>2</sup>*Department of Ichthyology, AMNH, New York, NY, United States*

**Postcranial Photophore Innervation Patterns in Myctophid fishes: Preliminary Results**

Lanternfishes (Teleostei; Myctophiformes) are among the most abundant of mesopelagic fishes in the World's oceans. A noteworthy feature of the family is the presence of conspicuous, non-bacterial photophores arrayed in highly ordered patterns on the bodies of most species. Although photophore presence/absence, number, and position have served as important taxonomic characters in this family for over fifty years, the diversity and phylogenetic significance of innervation patterns among postcranial primary photophore complexes (Prc, AO, Pol, PO, SAO, VO) remains relatively unexplored. As part of an ongoing phylogenetic analysis of myctophid intrarelationships, we use a triple-staining protocol for bone, cartilage, and nerves to visualize and describe postcranial photophore innervation patterns in several species of myctophine and lampanyctine lanternfishes. Preliminary comparison of photophore structure and innervation among myctophids, and between the families Myctophidae and Neoscopelidae, are presented and future directions discussed.

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**0593 NIA I, 556 AB, Saturday 10 July 2010; NIA BEST STUDENT PAPER AWARD**

Lesley S. deSouza, Jonathan W. Armbruster

*Auburn University, Alabama, United States*

**The Influence of the Rupununi Portal on Freshwater Fish Distributions in the Guiana Shield**

The Guyana Shield region in northern South America has a rich and diverse ichthyofauna with a high degree of endemism. The fauna of this region is shaped not only by the geology of the area but climatic events as well. The Rupununi district of southwestern Guyana is an area where seasonal rainfall floods a vast savanna. During the rainy season this inundated savanna connects the Rupununi River, a tributary of the Essequibo River to the Takutu River. The Takutu flows into the rio Negro via the rio Branco and ultimately into the Amazon River. Thus the potential exists for faunal exchange between the Essequibo River and the Amazon. This connection is referred to as the Rupununi portal and this study investigates how this feature influences freshwater fish diversity between the drainages it links. In this study, fishes on either

side of the portal were extensively sampled. Statistical comparisons of fish community structure from the two sides of the Rupununi portal were made using three common metrics: species richness, Shannon diversity and Bray-Curtis similarity indices. Significant community differences were found between the Essequibo and Amazon side of the Rupununi portal. While this feature serves as a conduit for some fish, it appears to be functioning as a barrier to dispersal for a greater proportion of species. Our study highlights the significance of the Rupununi portal in shaping fish distributions in this region. Therefore, this feature may have contributed to the development of a highly endemic ichthyofauna in the Guiana Shield.

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#### **0420 Poster Session III, Exhibit Hall D, Sunday 11 July 2010**

Valentina Di Santo<sup>1</sup>, Wayne A. Bennett<sup>2</sup>

<sup>1</sup>*Boston University, Boston, MA, United States*, <sup>2</sup>*University of West Florida, Pensacola, FL, United States*

#### **Comparison of Farming and Guarding Behavior of Dusky Damselfish on Coral Rubble and Intact Reef in Dry Tortugas National Park**

In the past 30 years, cold events and disease have reduced branching coral reefs in Dry Tortugas National Park, USA to rubble fields. Damselfish constituted the main source of herbivory in branching coral habitat, but it is unclear how the equilibrium between territoriality and grazing resources has been affected by habitat change. In this study, the agonistic behavior and algal garden farming of dusky damselfish (*Stegastes adustus*) was compared between coral rubble and patch reef territories. Underwater observations showed no significant difference in mean numbers of antagonistic grazers entering both rubble and patch territories ( $p=0.12$ ); however dusky damselfish showed a more conspicuous aggressive strategy in rubble territories ( $p=0.03$ ). Gardens exhibited a clear higher species diversity ( $p=0.0001$ ) in rubble (species=13) than in patch reef (species=7). It is plausible that dusky damselfish defending flat rubble territory are better able to detect possible intruders than damselfish guarding more complex patch reef. In a highly saturated living space, dusky damselfish successfully colonize live and dead coral areas and, while patch reef may offer a more concealed site, the newly created rubble fields represent bigger territories and the chance to cultivate a greater variety of algae.

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## 0300 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Juleen Dickson, Jacqueline F. Webb

*University of Rhode Island, Kingston, RI, United States*

### **Comparative Development of Lateral Line Canals in Three Lake Malawi Cichlids: Insights into the Evolution of Widened Canals**

Of the four cranial lateral line canal morphologies found among teleost fishes, widened canals are the most limited in their distribution and are found convergently in more than a dozen families, including the endemic Lake Malawi genus *Aulonocara* spp. When compared to narrow canals, widened canals have increased sensitivity at lower frequencies and appear to be an adaptive morphology for midwater or benthic prey detection. We hypothesize that this adaptive morphology is the result of the alteration of the pattern and timing (rate, onset/offset) of canal and neuromast development. An ontogenetic series of *Aulonocara baenschi* (widened canals, 5-22 mm SL, n=16), *Labeotropheus fuelleborni* (narrow canals, 8-21.5 mm SL, n=9) and *Metriaclima zebra* (narrow canals, 8-23 mm SL, n=7) were analyzed using histological material. The pattern and timing of canal development (using stages previously defined for another cichlid, *Archocentrus nigrofasciatus*), and ontogenetic trends in neuromast length/width and canal diameter, were documented in transverse sections of the mandibular and supraorbital canals. The pattern of development in all three species (narrow and widened canals) was similar to that described in *A. nigrofasciatus*. However, the rate of increase in both neuromasts size and canal diameter appears to be higher in *A. baenschi* than in *L. fuelleborni* and *M. zebra*, thus explaining the generation of larger neuromasts (mean = ~180  $\mu$ m long in a 22 mm SL juvenile) and widened canals (mean= ~270  $\mu$ m, in a 22 mm SL juvenile) in *Aulonocara*. Supported by NSF grant IOS-0843307 to JFW.

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## 0171 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Casey Dillman<sup>1</sup>, Eric Hilton<sup>2</sup>

<sup>1</sup>*Saint Louis University, St. Louis, MO, United States*, <sup>2</sup>*Virginia Institute of Marine Science, Gloucester Point, VA, United States*

### **Towards a Predictive Taxonomy of Sturgeons (Acipenseridae): The Preliminary Study of Morphological and Molecular Datasets**

The family Acipenseridae, the sturgeons, includes 25 extant species, making it the most species-rich family of basal actinopterygians to have living representatives. The systematic relationships of sturgeons remain poorly understood. In a preliminary analysis of 62 morphological characters based on new observations of 11 extant sturgeon species and the well-preserved fossil sturgeon *Priscosturion* (Late Cretaceous), the

monophyly of the family is firmly established based on numerous characters of the skull, sensory canal system, pectoral girdle, and the presence of a row of dorsal scutes. However, the monophyly of the genus *Acipenser* was not recovered; this is similar to the results of recent published molecular studies as well as our preliminary analyses of new molecular data. Although suitable specimens of all species of Acipenseridae were not available for this preliminary analysis, it will serve as the basis for an expanded systematic and taxonomic treatment of both morphological and molecular data (mitochondrial and nuclear) for all species of sturgeons. The resolution of the phylogenetic relationships among sturgeon species is necessary for a rigorous taxonomic analysis. For instance, the group *A. stellatus* + *Pseudoscaphirhynchus*, recovered in our preliminary morphological study, has been also recovered in phylogenetic analyses of molecular data, suggesting that this group should be formally recognized in a revised taxonomy of sturgeons. Our new, taxonomically comprehensive morphological and molecular study of the systematic relationships of sturgeons will ultimately result in a predictive taxonomy, which is necessary for the effective communication of all aspects of sturgeon biology, including conservation and management.

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**0497 Herp Physiology, 556 AB, Monday 12 July 2010; ASIH STOYE AWARD  
ECOLOGY & ETHOLOGY**

Christopher Distel, Michelle Boone

*Miami University, Oxford, Ohio, United States*

**Pesticide has Asymmetric Effects on Sympatric Anuran Populations over Time**

While some of the global amphibian declines have been associated with sublethal pesticide exposure, a mechanism of decline has not been described. We evaluated the effects of the common insecticide carbaryl on American toads (*Bufo americanus*) and northern leopard frogs (*Rana pipiens*) across life stages using a series of aquatic and terrestrial mesocosm experiments. American toads responded negatively to insecticide exposure, while northern leopard frogs received no effect. We then used a matrix population model to determine the impacts of insecticide exposure on American toad populations over time. The model suggested that repeated insecticide exposure may have negative effects on toad populations.

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## 0614 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Tiffany Doan<sup>1</sup>, Omar Torres-Carvajal<sup>2</sup>

<sup>1</sup>Central Connecticut State University, New Britain, CT, United States, <sup>2</sup>Universidad Católica del Ecuador, Quito, Ecuador

### Biogeographic Patterns of Peruvian Lizards

Peru has approximately 178 lizard species, which is the highest species richness of a country its size in South America, only exceeded by the much larger Colombia, Argentina, and Brazil. Even though a large quantity of herpetological research has been conducted in Peru, the lizard fauna remains poorly known. We mapped the distributions of all lizards within Peru using all available literature and museum records. We divided up the country into 1-degree latitude/longitude cells. Peru encompasses 146 1-degree cells, but in 24 of those cells not a single lizard species has been recorded. The absence of lizard data from these areas is not likely to result from the actual absence of lizard species. Lizards in Peru occur in all habitats, from Amazon rainforest to over 5000 m in the Andes Mountains. We have identified six major distribution patterns among the Peruvian lizard species, which include Amazonian, central-southern Peruvian cis-Andean, northern cis-Andean, southern trans-Andean, northern dry valleys and desert, and coastal. Factors affecting Peruvian lizard distribution patterns, endemism, and herpetological sampling patterns will be discussed.

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## 0347 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Terry J. Donaldson

University of Guam Marine Laboratory, Mangilao, Guam, United States

### Characterization of Spawning Aggregations of Two Nesting Triggerfishes (Balistidae)

Two Indo-West Pacific triggerfish species, *Balistoides viridescens* and *Pseudobalistes flavimarginatus*, migrate from their home ranges to spawning aggregation sites prior to the new and full moon. Males engage in lek-like behavior by establishing temporary territories containing nest sites that they defend against intrusions by rival males. Females arrive at the spawning aggregation site at or just before the night of the new or full moon and are courted by males as they pass through adjacent male territories. *Pseudobalistes flavimarginatus* aggregations occur on sand and fine rubble bottoms, and build or maintain existing nests consisting of mounds of rubble within pits excavated in the sand. Courtship may begin late in the afternoon and continue past sunset, with paired spawning in the nest. Both males and females abandon the aggregation site by the following morning. *Balistoides viridescens* males similarly defend holes in coral

pavement that are used as nest sites and attract females to spawn in them, but engage in limited post-spawning defense of the nest after spawning has been completed. Both sexes may abandon the aggregation site until the next period of spawning aggregation formation. In some cases, however, they may remain at the site and interact with one another or join others and act as a loosely-organized social group that persists until just after the following quarter-phase of the moon. Then, the group disperses and individuals may depart for their respective home ranges only to return on the next successive new or full moon period.

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