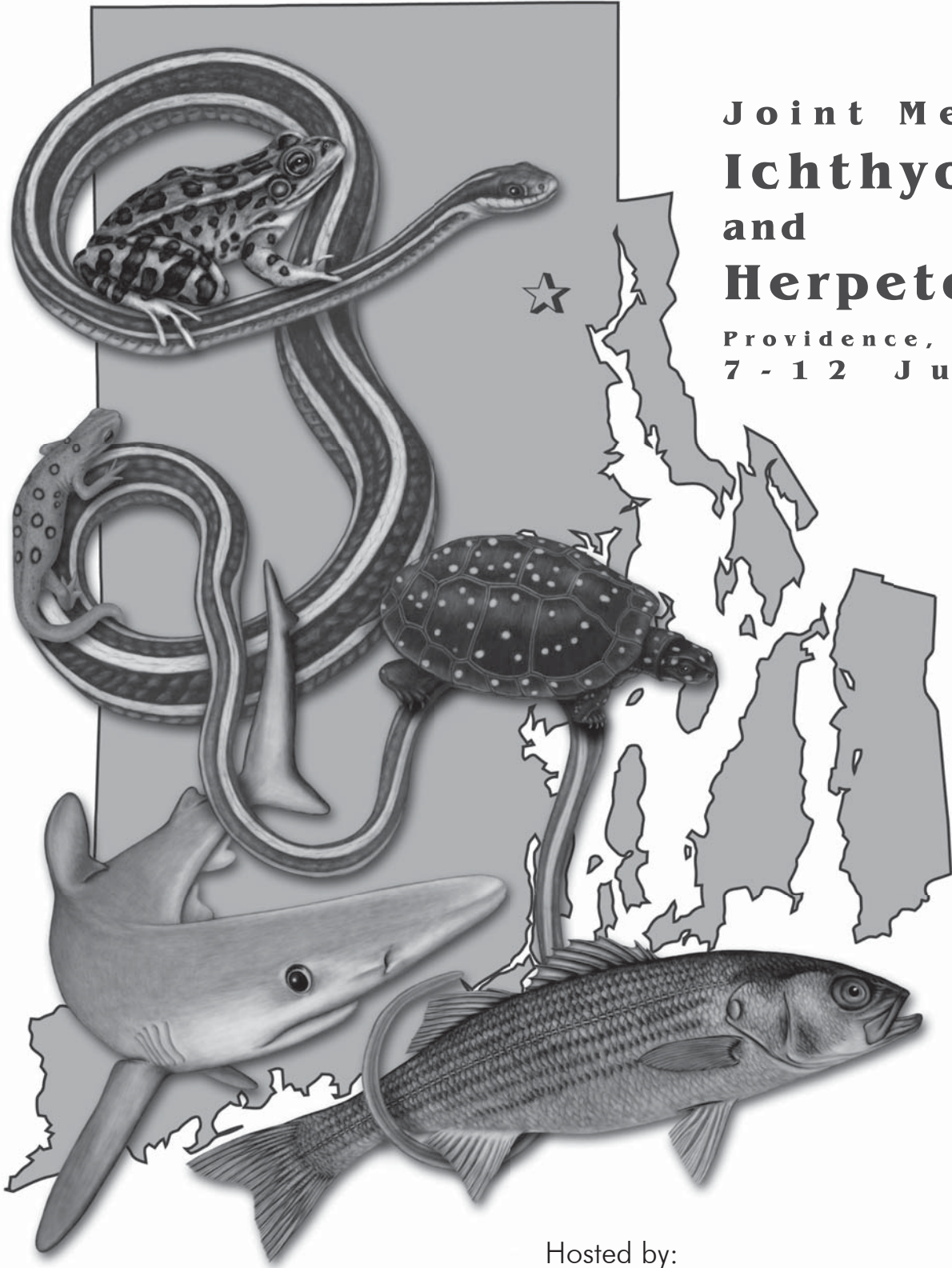


ABSTRACT BOOK



Joint Meeting of Ichthyologists and Herpetologists

Providence, Rhode Island
7 - 12 July 2010

Hosted by:

University of Rhode Island
Brown University
University of Connecticut

ABSTRACTS - 2010
JOINT MEETING OF ICHTHYOLOGISTS & HERPETOLOGISTS
COMPILED BY MARTHA L. CRUMP & M.A. DONNELLY
(for co-authored abstracts, the underlined name indicates the presenter)

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?

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.

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.

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.

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.

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

Dominique Adriaens¹, Renaud Boistel², Barbara De Kegel¹, Joachim Christiaens¹, Manuel Dierick³, Luc Van Hoorebeke³

¹*Ghent University, Gent, Belgium*, ²*CNRS/Université de Poitiers, Poitiers, France*, ³*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.

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

Dominique Adriaens¹, Anthony Herrel¹

¹*Ghent University, Gent, Belgium*, ²*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.

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.

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

Matthew Ajemian¹, Sean Powers¹

¹*University of South Alabama / Dauphin Island Sea Lab, Dauphin Island, AL, United States*, ²*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.

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

Timothy J. Alberg¹, Douglas Moore², Jacqueline F. Webb¹

¹University of Rhode Island, Kingston, RI, United States, ²Brown 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/), 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.

0021 NIA II, 551 AB, Monday 12 July 2010

James Albert¹, Paulo Petry², Roberto Reis³

¹University of Louisiana at Lafayette, Lafayette, LA, United States, ²Museum of Comparative Zoology, Cambridge, MA, United States, ³Pontifícia 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.

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

R. Craig Albertson¹, W. James Cooper¹, James Wernle², Sarah Collines¹, Kenneth Mann²

¹*Syracuse University, Syracuse, NY, United States*, ²*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.

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.

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.

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.

0130 Fish Conservation, Ballroom B, Friday 9 July 2010

Larry G. Allen¹, Brad E. Erisman²

¹*California State University, Northridge, Northridge, CA, United States*, ²*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.

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.

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

Maria Clara P. Amorim¹, José Miguel Simões¹, Andreia Ramos², Paulo J. Fonseca²

¹Instituto Superior de Psicologia Aplicada, Unidade de Investigação em Eco-Etologia, Lisbon, Portugal, ²Faculdade 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.

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.

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

Corey Anderson¹, Dennis Jorgensen¹

¹Arizona State University, Tempe, Arizona, United States, ²World 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.

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

Paul Anderson¹, Paul Anderson², Erin Adams¹, Erin Adams², William Lindberg¹, David Mann³

¹University of Florida IFAS Program in Fisheries and Aquatic Sciences, Gainesville, FL, United States, ²The Florida Aquarium Center for Conservation, Tampa, FL, United States, ³University 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 ± 23 Hz at an average peak amplitude of 95.9 ± 0.8 dB (re: 1 μ Pa) in the frequency domain. In terms of particle acceleration, peak frequency averaged 265 ± 22 (mean \pm SE) Hz at an average peak amplitude of $1.52 \times 10^{-3} \pm 1.87 \times 10^{-4}$ m s⁻¹. Broadband hearing thresholds estimated from auditory evoked potentials (AEPs) of 11 *H. erectus* are 92.0 ± 1.5 dB (re: 1 μ Pa) and $1.73 \times 10^{-4} \pm 3.8 \times 10^{-5}$ m s⁻¹ 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.

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

Paul Anderson¹, Erin Tate¹, Daniel Huber², Danielle Noaker², Ilze Berzins³

¹The Florida Aquarium Center for Conservation, Tampa, FL, United States, ²The University of Tampa, Tampa, FL, United States, ³John 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.

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 α 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.

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.

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.

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

Paul Andreadis¹, Maulik Patel²

¹Stetson University, Biology Dept., DeLand, FL 32723, United States, ²Collier-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.

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.

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

Kimberly M. Andrews¹, Priya Nanjappa²

¹UGA Savannah River Ecology Lab, Aiken, SC, United States, ²Association 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.

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

Kimberly M. Andrews¹, Tracey D. Tuberville¹, James D. Westervelt², John Macey³, Larry Carlile³

¹UGA Savannah River Ecology Lab, Aiken, SC, United States, ²US Army ERDC, Champaign, IL, United States, ³Fort 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.

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

Maria Lúcia Araújo¹, Rosângela Lessa², Sara Melo³, Luiz Alberto Monjeló⁴

¹Universidade do Estado do Amazonas, Manaus, Amazonas, Brazil, ²Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brazil, ³Secretaria de Meio Ambiente, Rio Branco, Acre, Brazil, ⁴Universidade 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_∞ 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_∞ was 96.53 ($\pm CI\ 95\%=13.04$). DW_∞ 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.

**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.

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

Victoria Arch¹, Dwayne Simmons¹, Bryan Stuart², Patricia Quinones¹, Peter Narins¹

¹UCLA, Los Angeles, CA, United States, ²North 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.

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.

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.

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.

**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.

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

Henry Astley¹, Emily Abbott¹, Richard Marsh², Emanuel Azizi¹, Thomas Roberts¹

¹*Brown University, Providence, RI, United States*, ²*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 82nd 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 = ± 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.

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 Auster¹, Laura Kracker², Greg McFall³

¹*University of Connecticut, Groton, CT, United States*, ²*NOAA/NOS, Charleston, SC, United States*, ³*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.

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

Peter Auster¹, Jon Moore², Ken Sulak³

¹*University of Connecticut, Groton, Connecticut, United States*, ²*Florida Atlantic University, Jupiter, Florida, United States*, ³*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.

0800 Herp Systematics, 551 AB, Monday 12 July 2010

Christopher Austin¹, Marc Spataro², Stacy Peterson¹, Joshua Jordan¹, John McVay¹

¹Louisiana State University, Baton Rouge, Louisiana, United States, ²The 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.

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

Cynthia Awruch¹, Colin Simpfendorfer¹, Sue Jones²

¹Fishing and Fisheries Research Centre, James Cook University, Townsville, Queensland, Australia, ²School 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 albipinum*), 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.

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

Cynthia Awruch¹, Colin Simpfendorfer¹, Ned Pankhurst²

¹James Cook University, Townsville, Queensland, Australia, ²Griffith 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.

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.

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

MSc Clarianna Baicere-Silva¹, MSc Fernando Carvalho², Luiz Malabarba², Irani Quagio-Grassiotto³

¹*Universidade de Campinas/UNICAMP, Campinas, SP, Brazil*, ²*Universidade Federal do Rio Grande do Sul/UFRGS, Porto Alegre, RS, Brazil*, ³*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 spermatocytic 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. erythro stigma*, *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.

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

John Baker¹, Matthew Wund², Susan Foster¹

¹Clark University, Worcester, MA, United States, ²The 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.

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

Justin Baker¹, Brian Wagner², Robert Wood¹

¹*Saint Louis University, Saint Louis, MO, United States*, ²*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.

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.

0494 Herp Development, 556 AB, Sunday 11 July 2010

Brandon Ballengée¹, Stanley Sessions², David Green³

¹University of Plymouth, Plymouth, United Kingdom, ²Hartwick College, Oneonta, United States, ³McGill 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.

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.

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.

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

Crista Bank¹, Steve Cadrin², Ken Oliveira³

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

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 χ^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.

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

Brenna Barger¹, David Blackburn¹, Allison Fuiten¹, Arvin Diesmos¹, Rafe Brown¹

¹University of Kansas Biodiversity Institute, Lawrence, Kansas, United States, ²National 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.

0506 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Jonathan Baskin¹, Brian Diep¹

¹California State Polytechnic University Pomona, Pomona, CA, United States, ²San 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.

0161 Herp Systematics, 551 AB, Monday 12 July 2010

Aaron Bauer¹, Todd Jackman¹, Eli Greenbaum²

¹Villanova University, Villanova, PA, United States, ²University 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. parvimaclatus*, 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.

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.

0365 Fish Conservation, Ballroom B, Friday 9 July 2010

Collin Beachum¹, Jason Knouft¹, Donovan Henry², Lennie Pitcher³

¹*Saint Louis University, Saint Louis, MO, United States*, ²*USACOE, Saint Louis, MO, United States*, ³*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 km² 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.

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

Sarah N. Becker¹, Brooke L. Talley¹, Karen R. Lips²

¹*Southern Illinois University, Carbondale, IL, United States*, ²*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* / *chrysoscelis* 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.

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 nV cm^{-1} and the median sensitivity was 48.7 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 9.91cm. 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.

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

Michael Bell¹, Windsor Aguirre¹, Haili Zhang¹, Christoff Furin¹, Frank von Hippel¹, David Kingsley¹

¹*Stony Brook University, Stony Brook, New York, United States*, ²*DePaul University, Chicago, Illinois, United States*, ³*Stanford University School of Medicine, Stanford, California, United States*, ⁴*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⁺/Na⁺ 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>.

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

Mauro Belleggia¹, Daniel Figueroa³, Felisa Sánchez¹, Claudia Bremec¹

¹Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP), Mar del Plata, Buenos Aires., Argentina, ²Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Buenos Aires, Argentina, ³Laboratorio 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.

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

Martin Benavides¹, Kevin Feldheim², Clinton Duffy³, Sabine Wintner⁴, Lisa Natanson⁵, Matias Braccini⁶, Demian Chapman¹

¹*Stony Brook University, Stony Brook, NY, United States*, ²*Field Museum of Chicago, Chicago, IL, United States*, ³*Department of Conservation, Auckland, New Zealand*, ⁴*KwaZulu-Natal Sharks Board, Natal, South Africa*, ⁵*National Marine Fisheries Service, Narragansett, RI, United States*, ⁶*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 Φ_{st} for *C. brachyurus*= 0.95 [$p < 0.000001$], global Φ_{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*.

0746 General Ichthyology, Ballroom B, Friday 9 July 2010

Andrew Bentley¹, Henry MI Bart², Edward O Wiley¹, David Vieglais¹, Nelson Rios², Laura Russell¹, Djihbrihou Abibou²

¹University of Kansas Biodiversity Institute, Lawrence, KS, United States, ²Tulane 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.

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

Andrew Bentley¹, Henry MI Bart², Edward O Wiley¹, Dave Vieglais¹, Nelson Rios², Laura Russell¹, Djihbrihou Abibou²

¹University of Kansas Biodiversity Institute, Lawrence, KS, United States, ²Tulane University Museum of Natural History, Belle Chasse, LA, United States

The Return of Fishnet

A newly redesigned Fishnet2 portal has been launched at <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.

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.

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

Diego Bernal¹, Craig Heberer², Scott Aalbers³, Suzzane Kohin², Bart DiFiore⁴, Chugey Sepulveda³

¹University of Massachusetts Dartmouth, Dartmouth, MA, United States, ²NMFS, Southwest Fisheries Science Center, La Jolla, CA, United States, ³Pflegler Institute of Environmental Research, Oceanside, CA, United States, ⁴Middelbury 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⁺, Cl⁻, K⁺, Ca⁺⁺, Mg⁺⁺, 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.

0377 NIA I, 556 AB, Saturday 10 July 2010

Ricardo Betancur-R.¹, Arturo Acero P.², Guillermo Orti¹, A. Hines³, Amy Wilbur³, Wilson Freshwater³

¹The George Washington University, Washington, D.C., United States, ²Universidad Nacional de Colombia sede Caribe (CECIMAR), Santa Marta, Colombia, ³Center 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.

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

Dana Bethea¹, Loraine Hale¹, Lisa Hollensead²

¹NOAA Fisheries SEFSC Panama City Laboratory, Panama City, FL, United States,

²Florida 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.

0280 Herp Physiology, 556 AB, Monday 12 July 2010

Catherine Bevier¹, Ananda Brito², Beatriz Magalhães³, Carlos Navas²

¹Colby College, Waterville, ME, United States, ²University of São Paulo, São Paulo, SP, Brazil, ³Universidade 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 polytaenius*. 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. polytaenius* had significantly more epibiotic bacteria than those inoculated with their own community, while male *H. polytaenius* 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.

**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.

0783 Herp Systematics, 551 AB, Monday 12 July 2010

Sayantana Biswas¹, Aaron M. Bauer¹, Todd R. Jackman¹, Kartik Shanker¹

¹Villanova University, Villanova, PA, United States, ²Villanova University, Villanova, PA, United States, ³Villanova University, Villanova, PA, United States, ⁴Centre 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.

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

Joseph J. Bizzarro¹, Mason N. Dean², Adam P. Summers³

¹*University of Washington, School of Aquatic and Fishery Sciences, Seattle, WA, United States*, ²*Max Planck Institute of Colloids & Interfaces, Potsdam, Germany*, ³*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-Parra¹, Felipe Galván-Magaña¹, Fernando Márquez-Farías², Carlos Alberto Niño-Torres⁴

¹Centro Interdisciplinario de Ciencias Marinas, IPN, La Paz, B.C.S., Mexico, ²Instituto Nacional de Pesca. Centro Regional de Investigaciones Pesquera, Mazatlán, Sin., Mexico, ³Universidad Autónoma de Sinaloa. Facultad de Ciencias del Mar, Mazatlán, Sin., Mexico, ⁴Autónoma 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 ~ 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.

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.

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.

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

Sean Blomquist¹, Karen Lannom²

¹Tennessee Technological University, Cookeville, Tennessee, United States, ²University 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 Bloom¹, Carlos Infante², Anne Everly², James Hanken², Nanette Nascone-Yoder¹

¹College of Veterinary Medicine, North Carolina State University, Raleigh, NC, United States, ²Museum 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).

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

Christopher Boeckman¹, Aaron Geheber¹, Kyle Piller¹

¹*Southeastern Louisiana University, Hammond, LA, United States*, ²*Southeastern Louisiana, Hammond, LA, United States*, ³*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 23,000km² 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*.

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.

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.

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

Brian Bowen¹, Jeff Eble¹, Zoltan Szabo¹, Luiz Rocha², Matthew Craig³

¹University of Hawaii, Kaneohe, Hawaii, United States, ²University of Texas, Port Aransas, Texas, United States, ³University 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.

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 ± 25.4 (SE) Hz and sound pressure level of 125 ± 8.9 dB re: $1\mu\text{Pa}$ for *F. flavissimus* and 97 ± 32.6 Hz and 123 ± 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.

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.

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.

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.

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 Bravo¹, Karen Crow-Sanchez¹, David Ebert²

¹San Francisco State University, San Francisco, CA, United States, ²Moss 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*.

0619 Fish Ecology, 555 AB, Sunday 11 July 2010

Matthew Breece¹, Dewayne Fox¹, Tom Savoy¹, Daniel Erickson¹

¹Delaware State University, Dover, Delaware, United States, ²Delaware State University, Dover, Delaware, United States, ³Connecticut Department of Environmental Protection, Old Lyme, Connecticut, United States, ⁴Oregon 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 20th 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.

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.

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.

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

Patricia Brennan², Gregory Watkins-Colwell¹

¹*Yale Peabody Museum of Natural History, New Haven, CT, United States*, ²*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.

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.

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

Richard Brinn², D. Michelle McComb¹, Levy Gomes³, Bernardo Baldisserotto⁴, Lucelle Dantas de Araujo⁵, Janessa Sampaio de Abreu Ribeiro⁶, Jaydione Marcon⁵

¹Florida Atlantic University, Boca Raton, Florida, United States, ²Florida International University, Miami, Florida, United States, ³Centro Universitario Vila Velha, Vila Velha, Brazil, ⁴Universidade Federal de Santa Maria, Santa Maria, Brazil, ⁵Universidade do Amazonas, Manaus, Brazil, ⁶Universidade 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 ± 0.7 ng/ml) and pre-transport levels (10.1 ± 0.4) were significantly lower than all other treatments including the 24 h antibiotic (124.9 ± 28.5) and 24 h probiotic (153.2 ± 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*.

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

Kristen Brochu¹, William Crampton², Nathan Lovejoy¹

¹University of Toronto, Toronto, ON, Canada, ²University 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.

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.

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

Edward Brooks¹, Andrew Danylchuk⁸, Steven Cooke⁴, John Mandelman⁶, Greg Skomal⁷, David Philipp³, Katherine Sloman², David Sims⁵, Stephanie Liss³, Cory Suski³

¹Cape Eleuthera Institute, Eleuthera, Bahamas, ²University of Plymouth, Plymouth, Devon, United Kingdom, ³University of Illinois, Urbana, Illinois, United States, ⁴Carlton University, Ottawa, Ontario, Canada, ⁵Marine Biological Association of the United Kingdom, Plymouth, Devon, United Kingdom, ⁶New England Aquarium, Central Wharf, Boston, Massachusetts, United States, ⁷Massachusetts Division of Marine Fisheries, Oak Bluff, Massachusetts, United States, ⁸University 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, pCO₂ and glucose, there was no significant variation in HCO₃⁻ and haematocrit. Analysis is ongoing for plasma ion concentrations (Na⁺, Cl⁻, Ca²⁺, K⁺, Mg²⁺), 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.

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

Christopher W. Brown¹, Thomas C. Owens², Robert N. Fisher¹

¹USGS Western Ecological Research Center, San Diego Field Station, San Diego, CA, United States, ²Dept. 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.

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

Simon C. Brown¹, Joseph J. Bizzarro², Gregor M. Cailliet¹, David A. Ebert¹

¹*Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, United States*, ²*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.

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

Tanya Brunner¹, Breanna Ondich¹, Mollie Taylor², Mark McRae¹, Lori McRae¹

¹*University of Tampa, Tampa, Florida, United States*, ²*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.

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

Walter Bubley¹, Paul Tsang¹, David Koester², James Sulikowski²

¹University of New Hampshire, Durham, NH, United States, ²University 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.

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 (1m² 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.

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

Kurt Buhlmann¹, Tracey Tuberville¹, Stephanie Koch², Brian Butler³, Veronica Palmero³

¹*University of Georgia, Savannah River Ecology Laboratory, Aiken, South Carolina, United States*, ²*U.S. Fish and Wildlife Service, Sudbury, Massachusetts, United States*, ³*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.

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 lampropeltinine 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.

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.

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

Derek Burkholder¹, Michael Heithaus¹, Craig Layman¹, Jordan Thomson²

¹*Florida International University, Miami, Florida, United States*, ²*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.

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).

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. kampa*, 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.

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.

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.

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.

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

Michael Cardwell¹

¹*California State University Sacramento, Sacramento, CA, United States*, ²*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.

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*.

0202 Herp Development, 556 AB, Sunday 11 July 2010

Gerardo Carfagno¹, James Carithers², Leah Mycoff², Richard Lehtinen²

¹*Gettysburg College, Gettysburg, PA, United States*, ²*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.

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.

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

Daniel Cartamil¹, Omar Santana-Morales², Miguel Escobedo-Olvera², Dovi Kacev⁴, Leonardo Castillo-Geniz³, Oscar Sosa-Nishizaki², Jeffrey Graham¹

¹*Scripps Institution of Oceanography, La Jolla, CA, United States*, ²*Centro de Investigación Científica y de Educación Superior de Ensenada, Ensenada, Baja California, Mexico*, ³*Centro Regional de Investigación Pesquera de Ensenada, Ensenada, Baja California, Mexico*, ⁴*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.

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-m² 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.

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

Fernando R. Carvalho, Luiz R. Malabarba

UFGRS, 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; 3rd 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.

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*, *Hemichilus*, 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.

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.

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.

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: Pycnophylacidae) 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 *Ptychocheilichthys*; 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.

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 rathbunae*. 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 dispolyploid number of only 48 chromosomes.

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.

**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.

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

Mônica Ceneviva-Bastos¹, Lilian Casatti¹, Virgínia Sanchez Uieda²

¹UNESP - São Paulo State University, São José do Rio Preto, São Paulo, Brazil,

²UNESP - 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.

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.

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

Prosanta Chakrabarty¹, James Albert¹

¹*Museum of Natural Science, Louisiana State University, Baton Rouge, Louisiana, United States,* ²*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.

Shun-Ping Chang¹, Sheng-Hai Wu¹

¹National Chung Hsing University, Taichung city, Taiwan, ²Changhua 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. idiotocus* 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. idiotocus* were submetacentric. Constitutive heterochromatin was mainly located at pericentromeric regions, and telomeric (TTAGGG)_n 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. idiotocus*, 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.

0652 AES Genetics, 552 AB, Sunday 11 July 2010

Demian Chapman¹, Kevin Feldheim², Rowena Eng¹, Lisa Natanson³, Mahmood Shivji⁴

¹*Stony Brook University, Stony Brook, NY, United States*, ²*Field Museum of Chicago, Chicago, IL, United States*, ³*National Marine Fisheries Service, Narragansett, RI, United States*, ⁴*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 Φ_{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.

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.

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

Di-Rong Chen¹, Yi-Fu Lin¹, Lin-Hua Ke¹, Te-En Lin², Sheng-Hai Wu¹

¹National Chung-Hsing University, Taichung, Taiwan, ²Taiwan 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 ± 0.14 ha, and in the enclosed area was 0.23 ± 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.

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.

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.

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.

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

Rebecca Christoffel¹, Gordon Burghardt², Harry Greene³

¹*Iowa State University, Ames, Iowa, United States*, ²*University of Tennessee, Knoxville, Tennessee, United States*, ³*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.

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

Jae Chung¹, Candy Hwang¹, Matthew Bender¹, Francisco Sapigao¹, Gary Bucciarelli², Thomas Vandergon¹, Rodney L. Honeycutt¹, Lee Kats¹

¹*Pepperdine University, Malibu, CA, United States*, ²*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.

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.

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

Angela Cicia¹, Lela Schlenker², James Sulikowski¹, John Mandelman²

¹University of New England, Biddeford, Maine, United States, ²New 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 pO₂; and HCO₃⁻ concentrations; elevations in pCO₂) 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 CO₂ 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.

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 pricklegebacks 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.

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

Eugenie Clark¹, Diane Nelson²

¹*Mote Marine Laboratory, Sarasota, FL, United Kingdom*, ²*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.

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.

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.

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

Andrew Coleman¹, Thane Wibbels¹, Ken Marion¹, Yi-hui Huang¹, Nicole White², John Dindo³

¹University of Alabama at Birmingham, Birmingham, AL, United States, ²Birmingham Southern College, Birmingham, AL, United States, ³Dauphin 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.

0274 Fish Conservation, Ballroom B, Friday 9 July 2010

Bruce B. Collette¹, Kent E. Carpenter¹

¹National Marine Fisheries Service Systematics Laboratory, Washington, DC, United States, ²Old 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.

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.

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

Jorge Contreras, Juan Garcia, Armando Contreras, Salvador Narvaez

¹Laboratorio de Herpetología and ² 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.

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

Jorge Contreras, David Lazcano, Armando Contreras

¹Laboratorio de Herpetología and ² 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.

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

Kevin Conway¹, Ralf Britz², Joerg Bohlen³

¹*Saint Louis University, St. Louis, MO, United States*, ²*Natural History Museum, London, United Kingdom*, ³*Institute of Animal Physiology and Genetics, Libečov, 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.

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

April Cook¹, Tracey Sutton¹, John Galbraith², Michael Vecchione³

¹Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, United States, ²NOAA Fisheries Northeast Fisheries Science Center, Woods Hole, MA, United States, ³NOAA 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.

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

Robert Cook¹, Peter Paton², Todd Tupper³, Brad Timm⁴

¹US National Park Service, Wellfleet, MA, United States, ²University of Rhode Island, Kingston, RI, United States, ³Northern Virginia Community College, Alexandria, VA, United States, ⁴University 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.

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.

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

Enric Cortes¹, Megan Winton¹

¹NOAA / NMFS, Panama City, FL, United States, ²Moss 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.

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.

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.

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

Emily Croteau¹, Sarah Thomason², Howard Whiteman¹

¹*Watershed Studies Institute and Department of Biological Science, Murray State University, Murray, KY, United States*, ²*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.

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

Brian Crother¹, Mary White¹, Jay Savage², Mallory Eckstut³, Matthew Graham³, David Gardner¹

¹*Southeastern Louisiana University, Hammond, Louisiana, United States*, ²*San Diego State University, San Diego, California, United States*, ³*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.

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.

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.

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.

0563 AES Genetics, 552 AB, Sunday 11 July 2010

Caitlin Curtis¹, Mike Tringali¹, Gregg Poulakis²

¹Florida Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, St Petersburg, FL, United States, ²Florida 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.

0278 Fish Ecology, 555 AB, Sunday 11 July 2010

Judson M. Curtis¹, Gregory W. Stunz¹, R. Deborah Overath¹, Robert R. Vega²

¹Texas A&M University Corpus Christi, Corpus Christi, TX, United States, ²Texas 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.

0147 AES Ecology, 551 AB, Thursday 8 July 2010

Tobey Curtis¹, Camilla McCandless², John Carlson³, Harold Pratt, Jr.², Nancy Kohler², George Burgess⁴, Gregory Skomal⁵

¹NOAA Fisheries Service, Gloucester, MA, United States, ²NOAA Fisheries Service, Narragansett, RI, United States, ³NOAA Fisheries Service, Panama City, FL, United States, ⁴Florida Museum of Natural History, Gainesville, FL, United States, ⁵Massachusetts 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.

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

Jonathan Dale¹, Natalie Wallsgrove², Brian Popp², Kim Holland¹

¹*Hawaii Institute of Marine Biology, University of Hawaii at Manoa, Kaneohe, HI, United States*, ²*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.

0013 AES Genetics, 552 AB, Sunday 11 July 2010

Toby Daly-Engel¹, Kanesa Duncan³, Kim Holland², John Coffey², Holly Nance⁴, Robert Toonen², Brian Bowen²

¹University of Arizona, Tucson, AZ, United States, ²Hawaii Institute of Marine Biology, Kaneohe, HI, United States, ³University of Hawaii, Honolulu, HI, United States, ⁴Clemson 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.

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

Nathan Dammeyer², Catherine Phillips¹, Timothy Bonner², Zachary Shattuck²

¹U.S. Fish and Wildlife Service, San Marcos, Texas, United States, ²Texas 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.

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.

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.

**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_{RI}) and crustaceans (1.02 % I_{RI}). The dominant recognizable teleost prey species were longnose killifish (*Fundulus similis*: 1.85 % I_{RI}), pinfish (*Lagodon rhomboides*: 1.42 % I_{RI}), and inland silversides (*Menidia beryllina*: 1.10 % I_{RI}). 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.

**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.

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*.

0455 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

Mason Dean¹, Daniel Huber², Joseph Bizzarro³, Lara Ferry-Graham⁴

¹Max Planck Institute, Dept. Biomaterials, Potsdam, Germany, ²University of Tampa, Tampa, FL, United States, ³University of Washington, Seattle, WA, United States, ⁴Moss 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.

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.

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.

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.

0786 Herp Conservation I, 556 AB, Thursday 8 July 2010

Pablo R. Delis¹, Walter E. Meshaka Jr.¹

¹*Shippensburg University, Shippensburg, Pennsylvania, United States*, ²*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.

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.

0437 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

John Denton¹, Melanie Stiassny¹

¹*Richard Gilder Graduate School, AMNH, New York, NY, United States*, ²*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.

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.

0420 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Valentina Di Santo¹, Wayne A. Bennett²

¹*Boston University, Boston, MA, United States*, ²*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.

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 μ m long in a 22 mm SL juvenile) and widened canals (mean= ~270 μ m, in a 22 mm SL juvenile) in *Aulonocara*. Supported by NSF grant IOS-0843307 to JFW.

0171 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Casey Dillman¹, Eric Hilton²

¹*Saint Louis University, St. Louis, MO, United States*, ²*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.

**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.

0614 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Tiffany Doan¹, Omar Torres-Carvajal²

¹Central Connecticut State University, New Britain, CT, United States, ²Universidad 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.

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.

0555 NIA II, 551 AB, Monday 12 July 2010

Carlos DoNascimento¹, John Lundberg², Mark Sabaj Pérez², Nadia Milani³

¹*Universidad de Carabobo, Valencia, Carabobo, Venezuela*, ²*The Academy of Natural Sciences, Philadelphia, PA, United States*, ³*Universidad Central de Venezuela, Caracas, Distrito Capital, Venezuela*

An Unexpectedly Diverse Group of Miniature and Sexually Dimorphic Neotropical Catfishes Representing a New Genus (Siluriformes, Heptapteridae)

Small body size has been a main limiting factor veiling our knowledge of the Neotropical fish diversity, with most of the currently known miniature species described in the last few decades. Frequently, these are found in museum collections catalogued as immature stages, this being the case for the species reported here. Independent collecting efforts in the Peruvian Amazon and Venezuelan Orinoco as well as a revision of material already available in museums has resulted in the recognition of at least five different species of tiny catfishes, that were identified either as heptapterid juveniles or in the slightly more accurate cases as *Imparfinis* juveniles. Nonetheless, a detailed morphological study revealed that they represent fully mature individuals, easily assignable to the *Nemuroglanis* subclade of Heptapteridae, but not to *Imparfinis* or to any other available name in that family. Morphology of the pectoral girdle and fin exhibits striking contrasting conditions between males and females, and along with modifications of the most anterior ribs, also indicate that they constitute a monophyletic group that is here proposed as a new genus. Derived traits of the transverse process of the fourth vertebra, postcleithral process and head laterosensory system support a sister group relationship between *Horiomyzon* and this new genus, indicating that a single miniaturization event occurred for this subgroup of heptapterids. Some comments on the vast geographic distribution of the new genus related to the psammophily are provided and compared to the deep river channel habitat of *Horiomyzon*.

0294 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Courtney Donovan, Jonathan Breton, Ken Oliveira

University of Massachusetts Dartmouth, Dartmouth, MA, United States

Oocyte Size Distribution and Fecundity Across Age and Total Length Range for George's Bank Stock of Yellowtail Flounder

Yellowtail flounder populations inhabit a range of regions along the Atlantic Coast of North America. All US stocks of this species, including George's Bank, have been severely overfished with limited population recovery over the last several decades. Management strategies have been hindered by a lack of biological data, including life history characteristics within and between stocks. An enhanced comprehension of fecundity is important for understanding recruitment, and ultimately for determining sustainable fishing strategies that will permit fishing exploitation while at the same time allowing stocks to rebuild. Fecundity was evaluated for yellowtail flounder from the George's Bank stock using hand counts and an autodiametric method previously implemented on different fish species. Small subsamples of gonad were weighed and the oocytes were teased apart until completely separated. These oocytes were hand counted using a computer imaging program, Image Pro, which also measured for diameter and roundness. Fecundity data were compared between fish ages and lengths. Average oocyte diameter was determined and compared with fish GSI. Analyzed data of estimated fecundity and range of oocyte diameter allowed for the preliminary development of a fecundity curve. The final results may be used in future research pertaining to yellowtail flounder growth and maturation which will influence fisheries management guidelines and stock assessments.

0634 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010

Michael Doosey

Natural History Museum, University of Kansas, Lawrence, Kansas, United States

Survey of Osteological Characters of the Branchial and Hyoid Arches of Euteleosteomorpha (Actinopterygii: Teleostei)

In the recent classification of teleost fishes, Wiley and Johnson (2010) listed seventy-seven osteological characters of the branchial and hyoid arches that are synapomorphies for various euteleost groups. These synapomorphies are reviewed across the diversity of euteleosts extending to the suborder level. The purpose of this research is to validate these asserted synapomorphies and search for new characters that may add support to the monophyly of established clades. Character descriptions and states were collected from the primary literature and compared with observations from cleared and stained specimens.

0370 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Lara Douglas, Steven Beaupre

University of Arkansas, Fayetteville, AR, United States

Effects of Large-Scale Habitat Manipulation on Body Condition in Timber Rattlesnakes (*Crotalus horridus*)

Identifying methods for monitoring the consequences of habitat restoration for organisms is a crucial conservation goal. We studied the effects of large scale (4.2 to 18 ha) habitat modifications on timber rattlesnakes (*Crotalus horridus*). The Arkansas Game and Fish Commission managed thirteen plots in an upland hardwood ecosystem in Madison County using selective harvest, prescribed burning, both treatments, or neither treatment. After monitoring for two years before and two years after modifications occurred, we analyzed changes in body condition of timber rattlesnakes tracked using radio-telemetry during the study period. Body conditions of rattlesnakes using manipulated habitat increased or remained unchanged during the study period, while body conditions of snakes using only control areas decreased to levels significantly lower than body conditions of snakes in manipulated areas. Repeated-measures analysis of only snakes available throughout the entire study revealed an increase in body condition among snakes using manipulated habitats and a decrease in body condition among snakes using only control habitats. Despite dramatic changes in vegetation at manipulated sites, density of snake prey (small mammals) did not detectably increase at manipulated sites until the second year following manipulations, and then only at sites that were cut or both cut and burned. Changes in *C. horridus* physiology appear to rapidly integrate ecosystem-level changes that may be difficult to detect using other methods (e.g. mammal trapping); therefore we suggest *C. horridus* has potential to serve as an indicator species for forest restoration.

0739 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Andrea Drayer, Stephen Richter

Eastern Kentucky University, Richmond, KY, United States

Comparison of Amphibian Communities in Artificial and Natural Ponds in Forested Ecosystems.

Habitat loss plays a key role in the decline of amphibians worldwide. To mitigate loss of wetland habitat, artificial ponds are often constructed. The objective of our study is to determine the effectiveness of constructed wetlands by comparing natural and artificial ponds. For our study, artificial ponds were defined as being constructed within the last 25 years, while natural ponds were natural or created/modified >> 50 years ago. Five forested natural ponds and five forested artificial ponds in the Daniel Boone National Forest, Kentucky were sampled for amphibians by dipnetting, minnow trapping, visual encounter surveys, and drift fence surveys from February through July 2009. Pond characteristics were measured including hydroperiod, canopy cover, aquatic vegetation, water quality, and temperature. Preliminary data suggest less fluctuation in pond level, longer hydroperiod, less shallow littoral zone, and more aquatic vegetation in artificial ponds when compared to natural ponds. Although artificial ponds consistently had higher species richness, species composition varied among ponds. Species composition was influenced by habitat requirements of individual species. For example, species that require longer hydroperiods for development of larvae, including *Notophthalmus viridescens* (red-spotted newts), *Rana catesbeiana* (American bullfrogs), and *Rana clamitans* (green frogs) were more abundant in artificial ponds; while species with specialized breeding habitat requirements, including *Ambystoma opacum* (marbled salamanders) and *Hemidactylum scutatum* (four-toed salamanders), were observed more often in natural ponds. Results of our study will provide useful information for land managers to improve constructed habitats and to increase success of future amphibian habitat enhancement and mitigation projects.

0762 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Erich Druskat, Joseph Mello

NOAA Fisheries, Woods Hole, MA, United States

Occurrence of the Smalltooth Sandtiger, *Odontaspis ferox* (Risso 1810), in the Western North Atlantic Ocean Documented by the Northeast Fisheries Observer Program

The smalltooth sandtiger, *Odontaspis ferox* (Risso, 1810), a large, deep-water shark species has been reported as occurring in the western North Atlantic Ocean based on a

single female caught off the North Carolina coast in September 1994 during a research vessel bottom trawl survey (Sheehan, 1998). In July 2003 and again in October 2009, certified observers from the Northeast Fisheries Observer Program described and photographed captured specimens of this species during trawl trips targeting squid in waters off the eastern coast of the United States. In each case, the distinguishing feature that confirmed the specimen as *O. ferox* was the presence of multiple rows of small intermediate teeth separating the two rows of large anterior teeth of the upper jaw from the smaller lateral teeth (Bigelow and Schroeder, 1948; Garrick, 1974; Anderson and Ahmed, 1993; Compagno, 2001). The International Union for Conservation of Nature's redlist currently lists *O. ferox* as vulnerable for the following reasons; this species may be naturally rare, has an assumed low fecundity as seen in the closely related *Carcharias taurus*, and developing deep-sea fisheries apply an increasing amount of pressure (Graham et al., 2003; Pollard et al. 2007). However, as noted in previous accounts, it is only when an occasional individual of this deep-water species comes onto the continental shelf that there is an opportunity for its capture, therefore *O. ferox* may be more common than suggested by the few documented captures (Daugherty, 1964; Bransetter and McEachran, 1986; Bonfil, 1995).

0184 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

Marcus Drymon, Sean Powers

Dauphin Island Sea Lab, Dauphin Island, AL, United States

Where Old Meets New: Using Gut Contents and Stable Isotopes to Describe the Trophic Ecology of the Consummate Mesopredator, the Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)

As proposed regulators of marine foodwebs, it is imperative to quantify the trophic role of sharks in coastal ecosystems. This is particularly true for wide-ranging species, such as the Atlantic sharpnose shark. Two years of monthly longline sampling in the coastal waters of Mississippi and Alabama revealed a regional gradient in the distribution of this species. The aims of this study were to use stable isotopes and gut contents to determine if the observed distributional gradient translated into regional and seasonal variation in trophic role for this species. Across regions, our data indicated that Atlantic sharpnose sharks occupy a trophic position intermediate to secondary and tertiary consumers. Stable isotope values in liver tissue varied significantly between size classes, with adult tissues enriched in nitrogen and depleted in carbon. There was a significant interaction effect between season and region for both nitrogen and carbon, in both liver and muscle tissue. Eastern region nitrogen isotope trends were characterized by high levels in the spring and low levels in the fall. In the western region, carbon signatures were lowest in the spring and fall and highest in the summer. Our stable isotope analysis was supported by examination of stomach contents and highlighted the usefulness of using these two methods in tandem. Our data suggest isotopic results from liver tissue should be interpreted with caution in light of high lipid content in that

tissue, and highlight the need to choose appropriate spatial scales when examining the feeding ecology of highly mobile marine predators.

0624 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Kathleen Duffy, Nancy Kohler

Apex Predators Program, National Marine Fisheries Service, Northeast Fisheries Science Center, Narragansett, RI, United States

Feeding Ecology of the Scalloped Hammerhead (*Sphyrna zygaena*) in the Western North Atlantic

Scalloped hammerheads (*Sphyrna zygaena*) are apex predators with circumglobal distribution in tropical and warm temperate waters. Their role in the western North Atlantic ecosystem was explored by examining indices of standardized diet composition derived from stomach contents of sharks caught from research and commercial vessels, and in recreational tournaments. Impacts on the diet caused by biotic and abiotic factors were evaluated. Sample location had the strongest influence on diet with sharks occurring in inshore waters feeding primarily on inactive demersal fish and secondarily on pelagic fish. Cephalopods were by far the largest food group found in sharks caught offshore. There were fewer empty stomachs found in the offshore sample (33%) than in the inshore sample (45%), but the volume of stomach contents in those with food was higher inshore (0.6% BW versus 0.4% BW). Season also played a significant role in the diet. The lowest percentage empty (9.6%), the largest average stomach content volume (0.8% BW), and the largest number of prey items per stomach (8.1), occurred in the summer. The summer sample also had the largest number of different prey types (1.8), although this was not statistically different from the other seasons. Most of these seasonal differences were found in sharks caught both inshore and offshore. Shark sex, state of maturity, decade caught, and gear type or source had little or no significant influence on diet.

0621 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

Kathleen Duffy¹, Nancy Kohler¹, W. David McElroy²

¹*Apex Predators Program, National Marine Fisheries Service, Northeast Fisheries Science Center, Narragansett, RI, United States,* ²*Population Biology Branch, National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA, United States*

Temporal Changes in the Diets of the Blue Shark *Prionace glauca*, and Shortfin Mako, *Isurus oxyrinchus*, in Waters off the Northeastern United States

Using the food habits data collected by the NEFSC Apex Predators Program over the past 38 years, we examined temporal changes in prey species, taxonomic and ecological prey groups, and overall trophic levels for two pelagic shark species, the blue shark, *Prionace glauca*, and the shortfin mako, *Isurus oxyrinchus*, found off the northeast coast of the United States. Indices of standardized diet composition were analyzed to identify changes in the prey species consumed, and then related to temporal changes in the distribution and abundance of these prey items. The two shark species have dissimilar feeding strategies and respond differently to environmental changes and fluctuations in prey availability. The blue shark has a generalized diet consisting of teleosts, elasmobranchs, marine mammals, cephalopods, and other food items (e.g., salps, crustaceans, trash) and easily switches between prey types. The shortfin mako is more specialized, consuming mainly bluefish, and appears resistant to dietary change when its preferred prey becomes less abundant.

0256 Turtle Ecology & Conservation, 555 AB, Friday 9 July 2010

Neil Duncan

Hofstra University, Hempstead, New York, United States

Tracking Newly Emerged Diamond Back Terrapins with a PIT Tag Locating System

Few studies have been conducted on the movements of neonate turtles, because techniques are limited by the small sizes of individuals, relatively large mass of tracking devices, and the difficulties of tracking small animals in water. Additionally, many small UHF and sonic transponders are limited by line of sight and short battery life. I conducted a short-term pilot study in Jamaica Bay, New York to test the feasibility of tracking overwintering diamondback terrapin (*Malaclemys terrapin*) hatchlings on land utilizing RFID technology. I surgically implanted 8.5mm PIT tags in 60 terrapin hatchlings newly emerged from protected nest sites. After release, I attempted to locate each individual with a FS2001F-ISO tag reader and portable BP antenna (Biomark Inc).

78% of the hatchlings were located at least once, and some as many as 7 times. Locations have ranged from 1-25m from nest release points in vegetation and the high tide line and as many as 13 days post-release. Although potentially labor intensive, the RFID tagging system allows for passive location of individuals without disturbance at a reasonable cost.

0023 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Andrew Durso, Stephen Mullin

Eastern Illinois University, Charleston, IL, United States

Interactions of Diet and Behavior in Death-feigning Snakes (*Heterodon*)

The three species of hog-nosed snakes (*Heterodon*) are well-known for their defensive behaviors, including escape, intimidation, and death-feigning. That this last behavior discourages vertebrate predators has been called into question, and several authors proposed that it is a physiological side-effect of eating toads. We are testing this hypothesis in nature by comparing individuals of *H. platirhinos* and *H. nasicus* with differing frequencies of toads in their diet, and by using stable isotope analysis to determine the contribution of toads to the diets of each snake species. We hypothesize that those individuals with lower proportions of toads in their diet will exhibit either longer latency to death-feigning or shorter death-feints, or both. Additionally, we propose that the more generalist species, *H. nasicus*, will exhibit these same behavioral characteristics when compared with *H. platirhinos*. Differences between sexes may also exist in both species, based on the observation that the adrenal glands of male *Heterodon* are much larger than those of females (one probable indicator of detoxification ability).

Our data from the stable isotope analyses will attempt to validate decades of fecal and stomach-content analyses. In addition to presenting comparative morphometrics for the two species collected at our study sites, we present preliminary stable isotope data. Furthermore, we discuss the differences observed in ethograms generated for each species based on initial encounters and simulated predatory threats. All three species of *Heterodon* are threatened in parts of their range, so further study of this unusual genus will augment its conservation.

0138 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

David Ebert¹, Joseph Bizzarro¹, Marie Cachera¹

¹Moss Landing Marine Labs, Moss Landing, CA, United States, ²University of Washington, Seattle, WA, United States, ³European Institute for Marine Studies, Brest, France

Diet and Trophic Ecology of the Starry Skate (*Raja stellulata*, Jordan and Gilbert, 1880) off Central California

The diet and trophic ecology of *Raja stellulata* were investigated off central California using stomach content and stable isotope analysis. Among 137 collected stomach samples, 128 contained prey items (93.4 %). The most important general prey categories for this species were crustaceans (Index of Relative Importance (IRI): 53.2%), teleosts (IRI : 31.9%), and cephalopods (IRI : 15.0%). Among these categories, the following taxa contributed most to dietary composition: hippolytid shrimps, crangonid shrimps, *Sebastes* spp., agonids, *Octopus rubescens*, and *Rossia pacifica*. The trophic level estimated for *R. stellulata* based on stomach content data was the highest among California skates (3.95). Stable isotopes analysis, conducted using tissue samples from 36 skates and several representative prey items, generally supported results of stomach content analysis. However, trophic level estimates calculated from stomach content analysis were significantly greater than those calculated by stable isotope analysis for paired samples ($t = 3.67$, $P < 0.001$). The results of this study indicate that *R. stellulata* is an upper trophic level predator and a likely competitor of local groundfishes.

0741 General Ichthyology, Ballroom B, Friday 9 July 2010; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Jeff Eble

University of Hawaii, Honolulu, HI, United States

Long-distance Dispersal in Indo-Pacific Reef Fishes, with a Focus on the Brown Surgeonfish (*Acanthurus nigrofuscus*)

While greater dispersal ability is thought to play an important role in establishing and maintaining larger ranges, direct estimates of larval dispersal in a number of predominately small range species indicates that the extent of long-distance dispersal may be much less than historically presumed. To provide insight into the relationship between geographic range size and dispersal ability we supplemented previous collections of the brown surgeonfish (*Acanthurus nigrofuscus*) from Hawaii (N = 281) with eight range-wide samples (Seychelles to Moorea; N = 279). An assessment of mtDNA cytochrome b diversity across the 17 collection sites revealed three populations

($F_{CT} = 0.452$; $P < 0.001$), with collections from the Eastern Indian Ocean (Christmas Island) through to the Central Pacific (Hawaii) comprising one large population. This pattern of limited genetic subdivision across the West and Central Pacific, as well as across the well defined biogeographic barrier of the Indo-Malay Archipelago, has been observed in a growing number of widely distributed reef fishes. Conversely, fishes with smaller ranges often exhibit pronounced fine-scale population differentiation. Whether genetic connectivity over tens of thousands of kilometers translates into demographic connectivity at scales greater than recent direct larval tracking suggest is still to be determined. However, concordant biogeographic and phylogeographic patterns indicate that some reef fishes are capable of regularly exchanging larvae over thousands of kilometers, and that in all likelihood, the extent of realized dispersal varies considerably between species and regions.

0637 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Kerstin Edberg¹, Philip Lienesch², Jeffery Marcus³, Robert Wood¹

¹*Saint Louis University, St. Louis, MO, United States*, ²*Western Kentucky University, Bowling Green, KY, United States*, ³*University of Manitoba, Winnipeg, MB, Canada*

Genetic Isolation as a Result of Dam Construction: A Look at the Effects on Two Species of Darters

The addition of dams into a riverine system causes a wide range of changes to the river as well as to the fish assemblages of that river. Although there have been many studies documenting the changes that occur to the fish assemblages in the impounded river, there have been fewer studies examining the effects of the reservoir on the fish inhabiting the tributaries upstream of the impoundment. One possible impact of the reservoir downstream is that it might act as a barrier to fish migration from one stream to another. To determine the extent to which reservoirs restrict migration, we looked for genetic isolation in two species of darters (*Etheostoma caeruleum* and *Etheostoma kantuckeense*) from the Barren River Lake drainage basin. Twenty individuals of each species were collected from a total of 6 sites (3 streams directly connected to Barren River Lake, 3 streams directly connected to Barren River upstream of the reservoir). To determine the degree of isolation among the study populations, collected individuals were genotyped at several microsatellite loci. If the reservoir is restricting gene flow between populations, we predict that the populations in streams directly connected to Barren River Lake will show lower allelic diversity and heterozygosity. Current results will be discussed along with implications for conservation of stream fishes.

0551 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Richard C. Edmunds¹, Wasila M. Dahdul², James P. Balhoff⁴, Jeffrey Engeman², Terry Grande⁵, Eric J. Hilton⁶, Cartik Kothari⁴, Hilmar Lapp³, John G. Lundberg⁷, Peter E. Midford³, Todd J. Vision⁴, Paula Mabee², Monte Westerfield¹

¹Institute of Neuroscience, University of Oregon, Eugene, OR, United States, ²Department of Biology, University of South Dakota, Vermillion, South Dakota, United States, ³National Evolutionary Synthesis Center, Durham, North Carolina, United States, ⁴Department of Biology, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, United States, ⁵Department of Biology, Loyola University Chicago, Chicago, Illinois, United States, ⁶Department of Fisheries Science, Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, Virginia, United States, ⁷Academy of Natural Sciences, Philadelphia, Pennsylvania, United States

Using Phenoscape to Uncover the Genetic Basis of Evolutionary Phenotypes

Phenotypic diversity across the tree of life results from evolutionary changes in genes that regulate development. These genetic and developmental controls of the phenotype are well documented in model organism databases and are now integrated with evolutionary phenotypes in the Phenoscape Knowledgebase (<http://kb.phenoscape.org>), an ontology-based database that links zebrafish model organism phenotypes with those documented in the systematics literature for ostariophysan fishes. The knowledgebase can be used to generate hypotheses for the genetic basis of evolutionary phenotypic diversity. We used the knowledgebase to make evo-devo queries into suites of catfish phenotypes (e.g., scales absent, basihyal element absent) to find candidate genes (*eda*, *edar*, and *brpf1*) responsible for these characteristics. The presence of transcripts from *eda* and *brpf1* has been confirmed by RT-PCR in early developmental stages (i.e. pre-hatching) in two catfish species, *Ictalurus punctatus* and *Ancestrus*. Sequencing of RT-PCR products confirmed high levels of homology for *eda* (99%) and *brpf1* (92%) between catfish species and lower levels of homology between catfish (*I. punctatus* and *Ancestrus*) and zebrafish (*Danio rerio*) for *eda* (45 and 45%) and *brpf1* (69 and 73%), respectively. Preliminary mRNA in situ hybridization on sections (*I. punctatus*) and whole-mounts (*Ancestrus*) has also confirmed the binding of *eda* and *brpf1* probes to the endogenous mRNAs. Ongoing in situ hybridizations aim to demonstrate the utility of the Phenoscape Knowledgebase in producing testable hypotheses for candidate genes involved in evolutionary changes in phenotype through the integration of datasets from diverse fields using expert knowledge and computation tools.

0260 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Scott Egan¹, David Graham Wolf¹

¹AECOM Environment, Westford, MA, United States, ²Mount Grace Land Conservation Trust, Athol, MA, United States

Are Canine-assisted Survey Teams more Successful at Detecting Eastern Box Turtles in Natural Habitats?

The Eastern Box Turtle (*Terrapene carolina*) is protected throughout its range in New England. Detection of this species in nature is hindered by habitat selection, cryptic coloration/patterns and secretive behaviors, which hinder scientist's ability to study and protect these animals. Detection dogs have assisted humans for a wide variety of applications, and have recently been used in wildlife censusing, monitoring, and research to improve detection probabilities. In 2005 we began training a 6-month old female German Shepherd Dog to use non-invasive "air scenting" (versus "trailing") techniques, a method commonly used in canine search and rescue. Training involved air scenting of radio-transmitted box turtles under controlled situations designed to reinforce the dog's success. Canine-human survey teams of 1-3 humans and one detection dog were deployed in 2007-2009 at ten separate sites in central and eastern Massachusetts over 26 field days. We documented total captures, level of effort, turtle activity (e.g., moving, buried), detection distance and environmental factors. A total of 49 previously undetected box turtles were captured. The detection dog identified 65% (n = 32) of the turtles in roughly half the effort, from distances up to approximately 20 meters, and was more effective at finding buried turtles in the substrate or under dense shrub thickets than humans. The detection dog's ability to cover more landscape, detect turtles from greater distances and under dense cover led to increased capture rates. Canine-assisted surveys can improve our ability to understand population extents to the benefit of science and conservation of the species.

0720 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Bastian Egeter, Bruce Robertson, Phillip Bishop

University of Otago, Dunedin, New Zealand

A DNA-Based Method to Identify Prey Remains of *Litoria raniformis* in Norway Rat Stomach Contents

The ability to detect prey remains in stomach or faecal samples of potential predators is paramount to any study investigating predator diets. Preliminary results from this study revealed that the traditional methods of visually identifying prey remains in stomach contents were ineffective where Southern bell frogs (*Litoria raniformis*) had been

consumed by Norway rats (*Rattus norvegicus*), due to the high level of mastication effected by Norway rats. The aim of this study was to develop a technique that would reliably detect anuran remains in Norway rat stomach contents, a species suspected as being a predator of a number of frog species worldwide. Genetic primers to amplify gene sequences specific to *L. raniformis* were designed. Feeding trials were conducted whereby Norway rats were presented *L. raniformis* individuals as food items. Norway rats were subsequently euthanised at various predetermined time intervals in order to determine the length of time that prey DNA was reliably detectable. The technique being investigated has been shown to be highly effective in detecting *L. raniformis* DNA in Norway rat stomach contents. This study has resulted in the development of a valid ecological research tool which has the potential to be widely applicable to other frog species that may be the subject of predation studies where traditional prey identification techniques are not reliable.

0269 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010; ASIH STOYE AWARD GENETICS, DEVELOPMENT & MORPHOLOGY

Jennifer Eichelberger

Southern Illinois University, Carbondale, Illinois, United States

Single Nucleotide Polymorphisms (SNPs) in *Scaphirhynchus* Sturgeons: What have we learned so far?

Pallid sturgeon (*Scaphirhynchus albus*) is a federally endangered species endemic to the Missouri and Mississippi river drainages. It is found in sympatry throughout its range with the more common shovelnose sturgeon (*S. platorhynchus*). Species discrimination can be difficult due to the presence of morphological intermediates, particularly in southern parts of the shared range. The ability to accurately identify pallid sturgeon is critical to adaptive management and conservation of this species. A panel of 19 DNA microsatellite markers is currently used to assign species, with some individuals displaying intermediate genotypes indicative of hybridization and likely backcrossing. I am developing a panel of Single Nucleotide Polymorphism (SNP) markers as a more efficient tool for genotyping *Scaphirhynchus*. Karyological evidence suggests that all extant sturgeons are derived from a tetraploid ancestor. All nuclear genes examined to date occur as pairs of isoloci with greater divergence among loci than between alleles within loci. Several single-locus SNP markers that exhibit allele frequency differences between species have been developed. In efforts to detect successful spawning of pallid sturgeon in the upper and middle Missouri River, a combination of two of these new SNP markers provides a powerful and efficient screening tool for detecting pallid larvae by eliminating the majority of shovelnose larvae from consideration. Due to decreased genetic differentiation between pallid and shovelnose sturgeon observed downstream, a larger panel of SNP markers will be required to develop a similar screening tool for use in southern parts of the range.

0486 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Dona M. Eidam¹, Frank A. von Hippel¹, J. Andres Lopez²

¹University of Alaska Anchorage, Anchorage, AK, United States, ²University of Alaska Fairbanks, Fairbanks, AK, United States

Trophic Ecology of Non-native Alaska Blackfish (*Dallia pectoralis*) in Cook Inlet Basin, Alaska

The Alaska blackfish (*Dallia pectoralis*) is a small freshwater mudminnow endemic to Beringia. Alaska blackfish occur on the Chukotka Peninsula of Eastern Russia, across Western Alaska, Central Alaska in the Yukon River drainage, and on the North Slope. First introduced to Southcentral Alaska in the 1950s, Alaska blackfish are believed to inhabit most Cook Inlet Basin waters. The species exhibits extreme hardiness from an ability to breathe atmospheric air and also legendary cold tolerance. Alaska blackfish ecology is poorly described, and fisheries managers express concern over possible predation of introduced blackfish on native salmonids as well as competition with native fishes for food. The aims of this study are to describe diet of non-native Alaska blackfish across seasons, sex, and age. Specimens are collected every month for a full year from a wetlands pond, stream, and lake. Morphometric measurements include gape width, eye diameter, and gill raker counts. Stomach contents are dissected and quantified by percent frequency of occurrence, percent abundance of food items, and percent volume for calculation of the index of relative importance (IRI). Intensity of feeding is measured by an index of fullness. Percent empty stomachs is also calculated. We expect non-native blackfish to be zoophagous opportunistic feeders whose primary diet consists of assorted invertebrates. We also expect non-native blackfish to be piscivorous on smaller conspecifics, native juvenile salmon and threespine stickleback.

0772 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Lilly Eluvathingal¹, Bhagyashri Shanbhag², Srinivas Saidapur²

¹Florida International University, Miami, Florida, United States, ²Karnatak University, Dharwad, India, India

Association Preference and Mechanism of Kin Recognition in Tadpoles of the Toad *Bufo melanostictus*

In experiments with specially designed choice tanks, tadpoles of *Bufo melanostictus* spend significantly greater amounts of time near kin than near non-kin. However, in the absence of kin, they prefer to spend more time near non-kin rather than stay away in isolation in the opposite blank zone with no company. This implies that association of

toad tadpoles with their kin is due to attraction rather than repulsion from non-kin. Experiments designed to elucidate the sensory basis of kin recognition showed that toad tadpoles recognize their kin based on chemical cues rather than visual cues. They can also discriminate between homospecific non-kin and heterospecific (*Sphaerotheca breviceps*) tadpoles since the tadpoles spent significantly greater amounts of time near the former than near the latter. These findings suggest that where kin are unavailable, selection may have favored living with non-kin so as to derive benefits from group living and that a phenotype-matching mechanism may operate for both kin and species discrimination in *B. melanostictus*.

0607 Turtle Ecology & Conservation, 555 AB, Friday 9 July 2010

Kayleigh Erazmus

Hofstra University, Hempstead, NY, United States

A Dietary Analysis of Female Northern Diamondback Terrapins (*Malaclemys terrapin terrapin*)

The diet of 87 adult female Northern Diamondback Terrapins (*Malaclemys terrapin terrapin*) was examined during two consecutive nesting seasons at the Jamaica Bay Wildlife Refuge, Queens, New York. Few such studies have been performed on the diet of *Malaclemys*, and none in the Northeast, where potential prey species differ from those that occur elsewhere in the range. Based on work from other locations in the *Malaclemys* range and the previous research of *Graptemyx* diets, I predicted that JBWR terrapins consume primarily snails, clams, crabs and mussels. I found that clams, crabs and mussels do make up a large portion of their diet, however there was little evidence of snail consumption. I also found a higher abundance of vegetation, especially sea lettuce (*Ulva*), than previously documented. In addition to this, the predominant prey taxa differed between the two years, with ribbed mussels (*Geukensia demissa*) and crabs (crustacea) being most abundant in 2008 and soft shell clams (*Mya arenaria*) and sea lettuce (*Ulva*) in 2009. The reason for this dietary shift is not clear, but suggested that long-term studies may be necessary to fully characterize *Malaclemys* diets.

0599 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Lori Erb

Massachusetts Natural Heritage and Endangered Species Program, Westborough, MA, United States

Conservation Planning for *Terrapene carolina carolina*: A Stochastic and Spatially Explicit Population Viability Analysis

The eastern box turtle (*Terrapene carolina carolina*) is listed as a Species of Special Concern in Massachusetts and is protected by the Massachusetts Endangered Species Act. Populations in Massachusetts and New York are at the northernmost edge of the species' range and occur at low densities. Box turtle habitat is rapidly being developed and fragmented, calling for a comprehensive conservation plan. A population viability model was used to develop a land protection plan and assess the risk of extirpation, within a 200 year time period, within four distinct regions of Massachusetts. Based on our land protection plan, the mean extinction risk was 2% for three regions; western, south shore, and Cape Cod. There were 15-20 sites in each region. Four to five sites in each of the three regions had a >5% chance of extinction. In contrast, the mean extinction risk was 5% for the northeastern region, which consists of three isolated locations. Metapopulation extinction risk was zero for each region individually as well as at the statewide level for all regions combined. This population viability analysis estimates that under our current conservation plan the species will have a high probability of persistence throughout the state for more than 200 years. Furthermore it provides a framework to identify research and monitoring needs and locations where management needs may be required.

0128 Fish Conservation, Ballroom B, Friday 9 July 2010

Brad Erisman, Gustavo Paredes, Ismael Mascarenas, Octavio Aburto, Philip Hastings

Scripps Institution of Oceanography, UCSD, La Jolla, CA, United States

Commercial Fisheries Trends for Aggregating Reef Fishes in the Southern Gulf of California, Mexico

We examined the current (1999-2007) and historical (1950's vs. present) importance of fish spawning aggregations and aggregating species to commercial reef fisheries of the Southern Gulf of California, summarized seasonal and annual trends in landings, effort, and revenue, and analyzed the potential impacts of fishing on aggregating species. Eight of the top ten most commercially important reef fishes from the region, in terms of landings and revenues, are known to form seasonal spawning aggregations. Among the

aggregating species, landings and fishing effort fluctuated among years for six species and increased steadily from 1999 to 2007 for two species. Seasonal peaks in landings, effort, catchability, and revenue coincided with the timing of spawning aggregations for six species, but fishing was not related to spawning in two species. The composition of aggregating reef fish species targeted by commercial fisheries have changed dramatically between the 1950's and the present, whereby a small number of high trophic level species have been replaced by a large number of species that cover a wide range of trophic levels. Our results indicate that aggregating species represent an important component of commercial reef fish fisheries of the Southern Gulf, and spawning aggregations are the major targets for fisheries for most of these species. Given the inherent vulnerability of aggregations to fishing and declines in reef fish populations and fisheries throughout the Gulf, the creation of sustainable fisheries will require the inclusion of specific management and conservation policies for fish spawning aggregations.

0424 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Tibisay Escalona¹, Tag Engstrom¹, Omar Hernandez¹, Brian Bock¹, Richard Vogt¹, Nicole Valenzuela¹

¹Iowa State University, Ames, IA, United States, ²California State University, Chico, CA, United States, ³FUDECI, Caracas, Distrito Capital, Venezuela, ⁴INPA, Manaus, Amazonas, Brazil, ⁵Iowa State University, Ames, IA, United States

Conservation Genetics of the River Turtle “Terecay” (*Podocnemis unifilis*)

We studied the population genetics of *Podocnemis unifilis* turtles within and among basins in the Orinoco and Amazon drainages using microsatellites. We detected high levels of genetic diversity in all sampled localities. However, ‘M-ratio’ tests revealed a substantial reduction in population size, consistent with current widespread exploitation. Our results reveal a consistent pattern across multiple analyses, showing a clear subdivision between the populations inhabiting the Amazon and Orinoco drainages despite a direct connection via the Casiquiare corridor, suggesting the existence of two biogeographically independent and widely divergent lineages. Genetic differentiation followed an isolation-by-distance model concordant with hypothesis about migration. It appears that migration occurs via the flooded forest in some drainages, and via river channels in those where geographic barriers preclude dispersal between basins or even among nearby tributaries of the same basin. These observations caution against making broad scale generalizations based on geographically restricted data, and indicate that geographically proximate populations may be demographically separate units requiring independent management. Although the patterns detected in our study are clear and expected, our results also indicate that further geographic sampling is necessary. Future sampling should include the Río Negro and other tributaries of the Amazon and Essequibo river basins, as well as other drainages in the Guianas, to fully describe the complete pattern of population structure for *P. unifilis* that

may be used for management plans. Until more genetic, ecological and behavioral information is available, including aspects of nest site fidelity, populations within basins should be treated as demographically independent management units.

0644 Herp Development, 556 AB, Sunday 11 July 2010

Tibisay Escalona¹, Nicole Valenzuela¹, Dean Adams¹

¹Iowa State University, Ames, IA, United States, ²Iowa State University, Ames, IA, United States, ³Iowa State University, Ames, IA, United States

Maternal Effects of Female Size on the Reproductive Characteristics of the Endangered South American Freshwater Turtle, *Podocnemis unifilis*

Because turtles lack parental care, parental investment is limited to energy allocation of nutrients to eggs and nest site selection. Thus, energy allocation is expected to be under strong selection and may result in optimal strategies. Here, the relationship between female size and several life history traits related to allocation to offspring are examined in the understudied freshwater turtle *Podocnemis unifilis*. In general, larger females laid larger clutches, which were composed of less elongated and relatively smaller eggs than clutches of smaller females. This suggests that larger females may optimize fitness by increasing the number of eggs, while smaller females may optimize fitness by producing larger eggs. Further, when holding the effect of female size constant, the relationship between egg size and clutch size was in the direction predicted by optimality trade-off models, but this negative trend explained very little variation in either variable. Interestingly, the relatively more elongated eggs produced by smaller females provides evidence for female offspring optimization, but not in the direction expected by optimality trade-off models, presumably to surpass a minimum propagule size needed for offspring survival when females are small. Thus, our results indicate that maternal effects are dependent on female size in *P. unifilis*, and that selection may be stronger on smaller than larger females. Therefore, our work represents a cautionary tale against examining reproductive output solely in terms of optimality trade-off models that focus mainly on larger females and which could miss important mechanisms underlying life history patterns exhibited by smaller females.

0332 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Mario Espinoza, Thomas Farrugia, Christopher Lowe

California State University, Long Beach, Long Beach, CA, United States

Influence of Water Temperature on Site Fidelity, Movements and Habitat Use of Gray Smooth-Hound Sharks, *Mustelus californicus* Gill (1863), in a Newly Restored Estuarine Habitat

It is thought that some elasmobranchs seeking a seasonally warmer environment use shallow temperate embayments as thermal refuges during summer months. Documenting abundances and long-term behavioral patterns in response to thermal gradients could increase our understanding on how the gray smooth-hound shark (GSH) may use a newly restored habitat in southern California. Abundance surveys and acoustic telemetry were employed to examine the influence of water temperature on site fidelity and habitat use of GSH in the new Full Tidal Basin (FTB) of Bolsa Chica. GSH were more abundant during summer months (May-September), and moved out of the basin during the winter (December-February) when this shallow embayment becomes colder faster than coastal waters. Sharks fitted with acoustic transmitters (n=22) were continuously detected inside the FTB for 5-153 d, and only during warmer months. Forays into coastal waters were uncommon until they left for the season. Long-term, fine-scale acoustic data revealed that GSH only used a small core area from the middle FTB (<5%); however, they exhibited consistent diel movement patterns along the basin. From 6-12:00 h, sharks moved towards warmer inner habitats, and from 17-20:00 h they moved to cooler outer habitats. GSH also selected soft mud-bottoms with eelgrass more intensively at night, presumably for feeding on potential prey available in the middle and outer zone. Behavioral data and monthly abundances suggest that this newly restored estuarine habitat may provide a thermal advantage for GSH seeking a seasonally warmer environment.

**0502 Fish Evolution, 555 AB, Saturday 10 July 2010; ASIH STOYE AWARD
GENERAL ICHTHYOLOGY**

Ron I. Eytan¹, Philip A. Hastings², Michael E. Hellberg¹

¹Louisiana State University, Baton Rouge, Louisiana, United States, ²Scripps Institution of Oceanography, La Jolla, California, United States

Multi-locus Phylogenetic Analysis, Species Tree Estimation, and Bayesian Divergence Dating of the Blenny Genus *Acanthemblemaria* (Teleostei: Blennioidei)

Acanthemblemaria is a genus of blennies distributed on both sides of the Isthmus of Panama and throughout tropical and sub-tropical waters of the western Atlantic and eastern Pacific. They are members of the Family Chaenopsidae, one of only two coral reef fish families with an exclusively Neotropical distribution. The genus consists of 21 named species, 9 in the Tropical Eastern Pacific and 12 in the Tropical Western Atlantic. Some of the most prominent features of these fishes are cranial spines and cirri that vary considerably among species. These characters, among others, have been used to infer sister relationships among taxa. We constructed a molecular phylogeny of *Acanthemblemaria* using six markers, five nuclear and one mitochondrial. Partitioned maximum likelihood, Bayesian, and species tree analyses recovered a monophyletic *Acanthemblemaria* and two pairs of transisthmian sister taxa, as well as possible cryptic species. One of the transisthmian pairs has a rarely reported relationship between the Galapagos and the southern Caribbean, as found in a previous morphological phylogeny of the genus. Surprisingly, cirri and head spines were misleading, as species with highly similar cirri and head spines were not closely related, indicating pervasive convergence in those characters. Bayesian divergence time estimates revealed relatively old clades and deeply divergent sister taxa, many of them older than the closure of the Panamanian Isthmus.

0649 SSAR SEIBERT CONSERVATION AWARD, 555 AB, Friday 9 July 2010

Scott Farnsworth, Richard Seigel

Towson University, Towson, MD, United States

Short and Long Distance Translocations of Eastern Box Turtles: Do Fences Make Good Neighbors or Conservation Practices

Human development represents a serious threat to wildlife populations through continued habitat loss and incidental mortality from construction activities. One approach to mitigate mortalities is to relocate individuals. The effectiveness of translocation for reptiles and amphibians has been questioned, with studies often

reporting higher mortality and increased movements of translocated individuals. Translocations of reptiles and amphibians have primarily involved moving animals long distances, well beyond an individual's home range. For reptiles this means finding new nesting, foraging, and overwintering sites, which may be problematic. Moving individuals only short distances, within their home range, may reduce those problems. As part of the mitigation plan for a highway construction project in central Maryland, groups of eastern box turtles (*Terrapene carolina carolina*) were translocated both short distances (<0.5km), and long distances (~5km). I tracked 94 turtles (31 long distance translocation, 29 short distance translocation, and 34 non-translocation) using radio telemetry. All construction related mortalities were a result of inadequate exclusion fencing to keep turtles from trespassing back onto the construction site. All mortalities due to construction were either non-translocation or short distance translocation animals. Telemetered animals were located back on the construction site 80 times. This suggests that without our intervention mortality rates would have been much higher. Preliminary results show that turtles in the non-translocation group had the lowest average movements while long distance translocation animals had the greatest average movements. Long distance translocation turtles also chose overwintering sites farther away from their initial overwintering sites than either short distance.

0587 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Terence Farrell¹, Melissa Pilgrim³, Boyd Bilhovde², Peter May¹

¹Stetson University, DeLand, FL, United States, ²Lake Woodruff National Wildlife Refuge, DeLeon Springs, FL, United States, ³University of South Carolina Upstate, Spartanburg, SC, United States

The Herpetofauna of Lake Woodruff National Wildlife Refuge, Florida

Lake Woodruff National Wildlife Refuge (LWNWR) is an 8,700 hectare conservation area along the eastern floodplain of the St. Johns River. We used a variety of techniques including terrestrial and aquatic drift fence trapping, coverboard arrays, dip netting, and diurnal and nocturnal visual surveys to sample the reptiles and amphibians at LWNWR. We found 51 reptile species and 20 amphibian species in these efforts. Most of the observed species were native but we also encountered six introduced species. While species richness was high, a few species were numerically dominant in most sampling efforts. For example, nocturnal surveys along a dike resulted in the observation of ten snake species but three species (*Nerodia fasciata*, *Thamnophis sauritis*, and *Sistrurus miliarius*) represented 87 percent of all captures. Similarly, in drift fence trapping in a diversity of habitats we found nine species of lizards but two species (*Anolis carolinensis* and *Scincella lateralis*) represented 65 percent of all captures. LWNWR has very high species richness compared to other national parks in the coastal portion of the southeastern United States. The great species richness is probably a result of the large size of the refuge, its proximity to other protected lands, and its high habitat diversity.

0359 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010

Shobnom Ferdous

Auburn University, Auburn, AL, United States

Geometric Morphometric Analysis of the Bagrid Catfish *Mystus* (Siluriformes: Bagridae)

Mystus Scopoli 1771 is a diverse catfish group within Bagridae with small- to medium-sized fishes. Out of the 44 species world wide, only 30 are considered to be part of *Mystus* sensu stricto. *Mystus* is distributed in Turkey, Syria, Iraq, Iran, Afghanistan, Pakistan, India, Nepal, Sri Lanka, Bangladesh, Myanmar, Thailand, Malay Peninsula, Vietnam, Sumatra, Java and Borneo. The genus has undergone several nomenclatural changes and other taxonomic modifications. Species of *Mystus* are morphologically similar and diagnostic characteristics are usually subtle. The group is poorly diagnosed and is not likely monophyletic. Taxonomic revisions of *Mystus* have been completed only on regional levels using traditional morphometrics. This study includes a geometric morphometric approach to examine differences in overall body shape to decide the taxonomic position of 18 *Mystus* species. 20 homologous landmarks were used on the lateral side to examine shape differences between species. A Principal Component Analysis (PCA) shows considerable dispersion between species and species groups within *Mystus*. Species were split between those with long adipose fins (adipose starts immediately after dorsal fin), medium dorsal fins (a small to relatively large gap is present between the dorsal and start of the adipose), and small adipose fins (adipose taller than long). Discriminant function analysis shows significant differences between species with long adipose fins and those with both short and medium adipose fins. Some overlap exists between short and medium adipose fin species. Geometric Morphometrics show promise in being able to separate species within each of the adipose fin groupings.

0095 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Cristina Cox Fernandes¹, Lucia Rapp Py-Daniel², Jonathan N. Baskin⁴, Alberto Akama³, Edie Marsh-Matthews⁵, Hector Lopez⁶

¹*University of Massachusetts, Amherst, MA, United States*, ²*Instituto Nacional de Pesquisas da Amazonia, Manaus, AM, Brazil*, ³*Universidade Federal do Tocantins, Porto Nacional, TO, Brazil*, ⁴*California State Polytechnic University, Pomona, United States*, ⁵*University of Oklahoma, Oklahoma, United States*, ⁶*Universidad Central de Venezuela, Caracas, Venezuela*

John G. Lundberg Trawls the Orinoco and the Amazon

In the late seventies JGL, together with American and Venezuelan colleagues, completed the first inventory of fishes of the lower Orinoco River, using trawl nets. Fifteen years later, together with Brazilian colleagues and a bunch of students, JGL trawled for another four years along the Brazilian Amazon River and its main tributaries. The main goal of these projects was fairly straightforward on paper, but famously challenging in practice: to collect and catalogue fish species from near the bottom of rivers. Before JGL, biologists interested in fish diversity of large rivers had typically only sampled fish using common commercial gear, such as seine nets, cast nets and gill nets. Thus the diversity of bottom-dwelling fishes (and other fauna) of these rivers had gone largely underestimated and underappreciated. In both river systems, JGL and collaborators collected a treasure trove of fishes, especially gymnotids and silurids, many of which had been previously undescribed. For instance, in 1970, Mago Leccia listed a total of 19 gymnotiformes collected from all sorts of aquatic habitats across Venezuela; yet by 1984, more than 24 species had been reported captured only with trawl nets in the lower Orinoco (Lopez-Rojas et al., 1984). In this talk, we reflect on JGL's contributions to our basic knowledge of freshwater fish diversity, especially in the gymnotids and silurids, ever since he lugged his trawls to South America.

0033 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Cristina Cox Fernandes¹, G. Troy Smith³, Alberto Akama⁴, Winnie W. Ho³, José Alves Gomes², Adilia Nogueira²

¹University of Massachusetts, Amherst, MA, United States, ²INPA, Manaus, Brazil, ³Indiana University, Bloomington, United States, ⁴Universidade Federal do Tocantins, Porto Nacional, Brazil

Hormonal and Behavioral Correlates of Morphological Variation in an Amazonian Electric Fish (*Sternarchogiton nattereri*: Apterontidae)

The weakly electric fish from the main channel of the Amazon river, *Sternarchogiton nattereri*, offers a striking case of morphological sexual dimorphism. Females and most males are toothless, or present only few minute teeth on the mandible, whereas some males exhibit exaggerated, spike-like teeth that project externally from the snout and chin. Steroids have the potential to influence the expression of sexually dimorphic traits, and might presumably be involved in tooth dimorphism in *S. nattereri*. In this study we assess the relationship between morphological variation and androgens (11-KT and T) in *S. nattereri*. We also examined and explored the relationship between reproductive condition, EOD frequency, and aspects of seasonality related to river water level. We found that male morphs differed significantly in plasma concentrations of 11-KT, with toothed males showing higher levels of 11-KT than toothless males. By contrast, we did not detect statistical differences in T levels among male morphs. We observed that *S. nattereri* males without teeth, with lower 11KT, also exhibit comparatively large testes. This suggests that non-toothed males are sexually mature, which in turn implies that these fishes engage in some kind of alternative reproductive tactic. There was no overall sex difference in EOD frequency, but we noticed that toothed males had significantly higher EOD frequencies than either toothless males or females. Our findings indicate that sexual dimorphism and 11KT levels in *S. nattereri* might be related to reproductive tactics not previously described in any Amazonian fish species.

0104 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Daniel Figueroa¹, Julieta Jañez², Mauro Tambella², Paula Rivera¹, Edgardo Di Giacomo³

¹Laboratorio de Ictiología, Departamento de Ciencias Marinas, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Argentina., Mar del Plata, Buenos Aires, Argentina, ²Fundación TEMA, Acuario. Ruta Provincial 25 Km. 0.700 (1625), Escobar, Buenos Aires, Argentina, ³Grupo de Estudio de Peces Cartilaginosos CONDROS, Laboratorio de Recursos Icticos, San Antonio Oeste, Río Negro, Argentina

The Benthic Chondrychthyes and the Internal Fecundation

A quality of the cartilaginous fishes is the internal fecundation. In order for copulation to take place, the Chondrychthyes have developed intromittent organs to transport the sperm to the female uterus. However, the density of water and the fish swimming turn the mating of the male and female bodies into a challenge for success. Squaliforms coil their bodies; at least one male clasper secures an end of the female body and the mouth teeth the other end. The teeth are fundamental components of copulation. Sharks possess a high trophic level within the trophic chain, a reason why their teeth should be appropriate to predation and female holding. But, benthic chondrychthyans, together with the colonization of benthos, lower their trophic level, thus affecting their teeth: crowns flatten, bases widen, in many a case pectoral fins hypertrophy and girdle related vertebrae fuse. These features would impede the mating of bodies, becoming teeth, as already observed in guitarfish, sting rays and skates in aquaria, more important for the process. In batoids there are examples of very sharp dental dimorphism, and accessory elements develop that facilitate copulation, such as rays' alar and malar spines, in addition to exhibiting the most complex claspers of all chondrychthyans. The prepelvic grips are additional holding elements in the elephant fish with the frontal tenaculum, a fish having mosaic dentition.

0279 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Michael Fine¹, Charles King¹, Timothy Cameron²

¹Virginia Commonwealth University, Richmond, VA, United States, ²Kettering University, Flint, Michigan, United States

Acoustical Properties of the Swimbladder in the Oyster Toadfish *Opsanus tau*

Both the swimbladder and sonic muscles of the oyster toadfish *Opsanus tau* (Linnaeus) increase in size with fish growth making it difficult to distinguish their relative contributions to sound production. We examined acoustics of the swimbladder independent of the sonic muscles by striking it with a piezoelectric impact hammer.

Amplitude and timing characteristics of bladder sound and displacement were compared for strikes of different amplitudes. Most of the first cycle of sound occurred during swimbladder compression, indicating that the bladder rapidly contracted and expanded as force increased during the strike. Harder hits were shorter in duration and generated a 30 dB increase in amplitude for a five fold or 14 dB range in displacement. For an equivalent strike dominant frequency, damping, bladder displacement and sound amplitude did not change with fish size, i.e. equal input generated equal output. The frequency spectrum was broad, and dominant frequency was driven by the strike and not the natural frequency of the bladder. Bladder displacement decayed rapidly (zeta averaged 0.33, equivalent to an automobile shock absorber), and the bladder had a low Q, averaging 1.8. Sound output of an acoustic source is determined by volume velocity (surface area x velocity), and bladder surface area, muscle dimensions and contraction amplitude increase with fish size. Therefore, larger fish will be capable of producing more intense sound. Since the bladder is a low Q resonator, its output will follow muscle contraction rates independent of its size and natural frequency.

0771 Herp Conservation I, 556 AB, Thursday 8 July 2010

Robert Fisher¹, Peter Harlow², Jone Niukula³, Pita Biciloa³, Alivereti Naikatini⁴, Vika Raiwalui⁵, Sarah Tawaka⁶, Sipuriano Qeteqete³

¹U.S. Geological Survey, San Diego, CA, United States, ²Taronga Zoo, Mosman, NSW, Australia, ³National Trust of Fiji, Suva, Fiji, ⁴South Pacific Regional Herbarium, University of the South Pacific, Suva, Fiji, ⁵Department of Environment, Ministry of Environment, Suva, Fiji, ⁶Quarantine Section, Ministry of Agriculture, Suva, Fiji

Rapid Assessment for Fijian (*Brachylophus* sp.) and Green (*Iguana iguana*) Iguanas in the Northeastern Fijian Islands

Currently all three living species of the endemic Pacific iguanas (genus *Brachylophus*) are found in Fiji. These species are known from scattered regions within the Fijian Islands and although there are anecdotal and a few published records of 'iguanas' on many islands in Fiji, their specific status is unknown. Recent records of a large lizard from Qamea Island were confirmed (in 2008) through photographs to be the green iguana (*Iguana iguana*). In late 2009 and early 2010 we undertook surveys of 16 islands to assess the status of native and invasive iguanas in this region. We confirmed populations of two species of *Brachylophus* iguanas on a few islands north of Vanua Levu, and discovered that the majority of islands in that region are no longer suitable habitat for iguanas. Invasive green iguanas were found to occur on three islands to the east of Taveuni (total area 47 Km²); in sympatry with *Brachylophus* on at least one island. Relatively large populations of *Brachylophus bulabula* were found for the first time on two islands located between Viti Levu and Vanua Levu; these islands could serve as a protected area for this endangered species. Our surveys indicate the need to rapidly act to eradicate the invasive green iguanas before they continue to spread (with human

assistance) to other islands. These surveys confirm that the endemic *Brachylophus* habitat is continuing to decline and few populations appear large or stable.

0488 Herp Systematics, 551 AB, Monday 12 July 2010

M. Caitlin Fisher-Reid, John J. Wiens

Stony Brook University, Stony Brook, NY, United States

A Multi-locus Phylogeny of *Plethodon* (Caudata: Plethodontidae)

Plethodon is the most species-rich genus of salamanders in North America, with 55 presently described species. Because of their abundance and diversity in eastern North America, they have been the subject of myriad studies by ecologists and evolutionary biologists. We present a new phylogenetic analysis of *Plethodon* based on multiple nuclear and mitochondrial markers, to use as a framework to address ecological diversification. Previous phylogenetic analyses of *Plethodon* have largely been based on mitochondrial data (either because no nuclear loci were used or because nuclear loci failed to strongly resolve relationships), particularly within species groups. Here, we collected new sequence data (2142 aligned base pairs) from five nuclear introns (associated with the genes GAPD, ILF3, Mlc2a, RPL12, and RHO). These data were then added to previously published sequence data (5590 aligned base pairs) from three nuclear genes (BDNF, POMC, RAG-1) and three mitochondrial genes (cytochrome b, ND2, ND4) from the most recent analysis of *Plethodon* phylogeny. Using likelihood and Bayesian analysis, we reconstructed and compared trees from the concatenated nuclear genes, concatenated mitochondrial genes, and the combined nuclear and mitochondrial data. We also estimated a species tree using Bayesian methods (i.e., using BEST). The reconstructed phylogeny will be used to analyze patterns of ecological diversification in the genus.

0422 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Aaron Fisk¹, Kit Kovacs², Christian Lydersen², Peter Klimley³, Warren Joyce⁴, Steven Campana⁴

¹University of Windsor, Windsor, Ontario, Canada, ²Norwegian Polar Institute, Tromsø, Norway, ³University of California Davis, Davis, California, United States, ⁴Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada

Movement Patterns and Dive Depths of Satellite-tagged Greenland Sharks in the North Atlantic and Arctic Ocean

The Greenland shark (*Somniosus microcephalus*) is among the largest fishes and one of two shark species that inhabits arctic oceans. Although this shark species is thought to be numerous and has a wide distribution, very little is known about its movement patterns or diving behaviour. Pop-up satellite archive tags (SAT, Wildlife Computer) were attached to Greenland sharks captured in the Canadian Arctic (Cumberland Sound, n = 16), European Arctic (Svalbard, n = 20) and eastern seaboard of Canada (Nova Scotia, n = 2) to examine movement patterns, dive depths and temperature preferences, over periods from months to a full year in this little studied elasmobranch. In general, at all locations, Greenland sharks remained at depths ≥ 200 m and at temperatures $\leq 5^\circ$ C; several of the sharks spent time at depths greater than 1000 m and made dives to depths of > 1500 m (limit of SAT tag). Although daily locations could not be determined, the pop-off locations for sharks tagged in Cumberland Sound were ~ 1000 km toward the north east in Baffin Bay. Sharks tagged in Nova Scotia moved 500-1000 km south along the North American coast or into the mid-Atlantic. There appeared to be no specific pattern to the pop-off locations for sharks tagged in Svalbard. This study demonstrates that the Greenland shark can be found at a wide range of depths (20 - 1500+ m), prefer cold temperatures (5° C) and can move large distances (> 1000 km) but that behaviour varies considerably among individuals.

0515 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Kevin Floyd, Carl Lieb

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

Effects of Roads on Lizard Population Demography in Southern New Mexico

Roads can potentially impact wildlife populations in several negative ways, such as decreasing individual survival rates. Here we report initial findings from year 1 of a 2-year study on how roads affect populations of side-blotched lizards (*Uta stansburiana*) and western whiptails (*Aspidoscelis marmorata*) in southern New Mexico. Study sites are located along both Interstate 10 (a large road with $>16,000$ vehicles per day) and New

Mexico State Highway 9 (a small road with about 500 vehicles per day). Arrays of pitfall traps are located near the road, with additional traps at 50 m and 125 m from the road. Trapping occurred from July through October 2009. Side-blotched lizards and western whiptails were the most common species encountered, with 62.6% and 30.7% of the 1334 total captures, respectively. Estimated monthly survival rates for side-blotched lizards along I-10 showed no trend with distance. However, for side-blotched lizards along NM-9 the survival rates were approximately 20% lower at the locations near the road than those away from the road. For western whiptails, survival rates did not change with distance from the road for either road, but overall survival rates were higher along NM-9. There is little evidence from the 2009 data that the roads are having consistent effects on either species. However, for both roads there is a large amount of inter-site variation, which makes the detection of potential road effects difficult. Results from the 2010 field season will help to clarify the initial conclusions presented here.

0290 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Brook Fluker, Bernard Kuhajda

University of Alabama, Tuscaloosa, AL, United States

Rediscovery of the Imperiled Trispot Darter, *Etheostoma trisella*, in Alabama, and Its Phylogeographic Structure within the Coosa River Drainage of the Mobile Basin

The Trispot Darter, *Etheostoma trisella*, is endemic to the Coosa River drainage (Mobile Basin). This species is a member of the subgenus *Ozarka*, a group of colorful darters which rely upon spring seeps in ephemeral streams for spawning, which makes them extremely susceptible to habitat destruction. *Etheostoma trisella* was historically found at two sites in Alabama (Cowans Creek, 1947 and Coosa River at Gadsden, 1958), but these were inundated by reservoir construction and the species was considered extirpated from the state and restricted to the Conasauga River system in the upper Coosa River drainage in Georgia and Tennessee. However, during October 2008 and February 2010 populations of *E. trisella* were rediscovered in Alabama in Little Canoe and Ballplay creeks in St. Clair and Etowah counties. Phylogenetic analysis of complete mitochondrial ND2 gene sequence data of *E. trisella* from Alabama, Georgia, and Tennessee populations revealed only slight haplotype variation (< 1% sequence divergence). This is unexpected given 1) the patterns of differentiation of other fishes with disjunct populations in the middle and upper Coosa River (e.g. *E. brevirostrum*, *E. ditrema*) and 2) the highly divergent populations of another Alabama *Ozarka* species, the Slackwater Darter (*E. boschungii*), which has up to 8.5% mtDNA sequence divergence between populations in separate tributaries to the lower bend of the Tennessee River. We are using microsatellite data to examine genetic structure and demographic history of *E. trisella* populations, data that will assist in proper conservation planning for this imperiled darter.

0375 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Clifford Fontenot¹, William Lutterschmidt¹

¹*Southeastern Louisiana University, Hammond, LA, United States*, ²*Sam Houston State University, Huntsville, TX, United States*

Temperature Preference and Body Coiling in the Aquatic Salamander *Amphiuma tridactylum* in a Laboratory Gradient

Understanding a species' thermal biology is critical to interpreting its physiology because of the direct relationship between the two. While our general knowledge of amphibian thermal biology is very incomplete, comprehensive interpretation of (largely) anecdotal reports of thermal information for relatively few species has elucidated some general patterns. However, thermal biology of the obligatory aquatic salamanders of the family Amphiumidae is essentially unknown. To help fill this void, we present data on *A. tridactylum* temperature preference in a laboratory gradient, and a profile of available seasonal air and water temperatures collected at a similar field site. These data suggest that the preferred (lab) temperature is available for at least part of each day during most of the year. During the study, we also observed a unique body coiling behavior. In 95 of the 205 observations in the thermal gradient, the individual was in a tight coiled posture of 3-4 body loops with the head at the top of the spring-shaped coil. Coiling behavior has not been previously described for *Amphiuma*, except in the context of one loose coil around eggs during nesting. We suggest that tight body coiling occurs only when the animal cannot find cover, perhaps as a defensive posture, rather than an active mechanism for avoiding desiccation by reducing evaporative surface area, which has been suggested for some salamanders.

0255 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Ryan Ford, James Gelsleichter

University of North Florida, Jacksonville, FL, United States

Preliminary Observations on Diet of the Blacknose Shark within its Southeastern Range

The blacknose shark (*Carcharhinus acronotus*) is a common small coastal shark found in nearshore waters along the southeast coast of the United States, from North Carolina into the Gulf of Mexico and extending further south into the Bahamas. Despite its abundance little is known about the diet of *C. acronotus* and the role it plays in the trophic structure of its primary habitat. The goal of the present study was to characterize the diet of *C. acronotus* throughout its range. This will be accomplished by examining gut contents in animals caught via fishery dependant and fishery independent gillnet and

longline surveys conducted throughout the Atlantic range of *C. acronotus*. To date stomachs collected contained *Scombridae* sp., *Litopenaeus setiferus*, other shrimp from the family Penaeidae, as well as a few as-yet-to-be-identified teleosts. The majority of guts contained teleosts. Approximately 50% of animals collected thus far have had empty stomachs, even though the majority of animals have been caught using gillnets. To remedy this, this study will also use stable isotope analysis to determine the carbon source of *C. acronotus*.

0769 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Angela M. Fornell

The University of Texas, Arlington, Arlington, TX, United States

Do Snake Foraging Strategies Affect Their Risk of Mortality from Potential Predators?

Predator foraging strategies are often divided into ambush or active for simplicity. Ambushing snakes sit in a coiled position increasing their surface area potentially making them vulnerable to predators looking down. Active foraging snakes that travel via lateral undulation adopt an "s" shape body position. Therefore, may have an advantage by reducing surface area, thus reducing detection. Clay models of varying size were molded into a coil or "s" shape. Models were further divided into uncolored or colored to represent cryptic and non-cryptic snakes, respectively. A 3-way ANOVA was used with predictor variables: size, color, and position (i.e., coiled v. "s" shape). I expect ambush foraging snakes to encounter predators less frequently due to the lack of movement. I, too, expect colored models, as well as large models to be attacked at greater frequency.

**0143 Herp Physiology, 556 AB, Monday 12 July 2010; ASIH STOYE AWARD
PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY**

Josh Foronda

Hofstra, Hempstead, NY, United States

**Metabolic Responses to Chronic Temperature in Two Populations of Italian
Wall Lizard *Podarcis sicula***

While much work has been done to study the immediate metabolic response to temperature, fewer observations have been made as to how chronic exposure to a given temperature will affect an organism's metabolism. In this study, we examined the effect of chronic temperature exposure in two geographically distinct introduced populations

of Italian wall lizards *Podarcis sicula*. Metabolic rates (VO₂/hr) at temperatures of 15°C and 30°C were measured for Long Island and New Jersey lizards maintained for one month at 20°C. Lizards from each population were then divided into two equal groups, maintained at either 15°C or 25°C for one month. After this time, lizards were again examined to measure metabolic rate at 15°C and 30°C. Lizard populations showed no difference in the overall effect of chronic temperature exposure. However, lizards did show an effect of chronic temperature on their metabolic response to immediate high temperature exposure. The results support the conservation of a metabolic strategy in northeastern *P. sicula* population.

0595 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Michael Frank, John Roe, Bruce Kingsbury

Indiana Purdue University - Fort Wayne, Fort Wayne, IN, United States

If You Build it and They Don't Come: Tools for the Repatriation of Extirpated Snake Populations

Habitat loss and fragmentation are factors leading to declines in many faunal populations. Restoring habitats to support the rebound of local populations may help to remedy these declines, but in cases where a species has been extirpated, natural recolonization is unlikely. Translocation has proven to be a successful strategy for the repatriation of some extirpated populations, but its effectiveness is unclear and understudied in snakes. Using the Northern Watersnake (*Nerodia sipedon*) we directly translocated individuals to a recently restored nature preserve from a nearby site in 2008. We also raised neonates in simplistic laboratory enclosures ("headstarts") until they were large enough to be translocated to the same preserve. These experimental release groups were compared to resident snakes. Compared to residents, translocated snakes selected aquatic habitats with a more open canopy, moved more extensively, and used areas outside of reserve boundaries more frequently. Headstarts showed restricted movements and used habitats in ways atypical of residents. Translocated and resident snakes grew at similar rates, but headstarts failed to grow appreciably. Both experimental groups had low survivorship relative to residents. Much of the mortality in headstarts occurred during the overwintering period, while mortality in directly translocated snakes was limited to the active season. Due to the poor performance of headstarts, we also examined the alternative approaches of releasing headstarts directly into constructed hibernacula and enriching captive conditions for headstarts prior to release. We compare and contrast the outcomes for these different approaches and provide recommendations for repatriation efforts involving snakes.

0622 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

James Franks¹, Eric Hoffmayer¹, Travis Holland¹, Ben Galuardi², Read Hendon¹

¹University of Southern Mississippi, Center for Fisheries Research and Development, Gulf Coast Research Laboratory, Ocean Springs, MS, United States, ²University of New Hampshire, Large Pelagics Research Lab., Durham, NH, United States

Behavior and Habitat Preferences of Cobia (*Rachycentron canadum*) in the Gulf of Mexico Inferred from Pop-Up Satellite Archival Tags

Cobia (*Rachycentron canadum*) is a large, coastal migratory species in the Gulf of Mexico (Gulf). Studies of cobia movements in the Gulf since 1988 using conventional tagging showed the species typically inhabited northern Gulf waters during summer months (the spawning season) and overwintered in southern Gulf waters off Florida, however, fine-scale movement patterns and habitat preferences were unknown. Five pop-up satellite archival tags (PSAT) (Microwave Telemetry, Inc., PTT-100 standard archival) attached to cobia caught on recreational fishing gear in the northern Gulf during summer of 2002 (n=2), 2003 (n=1) and 2004 (n=2) revealed horizontal movements, as well as vertical use of the water column as related to ambient water temperature and depth. Overall, tag deployments extended from April to November, with individual tag deployments ranging from 1.4 to 7.1 months for a total of 480 days of archived data. Overall depth and temperature ranges for the fish were surface - 140m and 18 - 33°C, respectively. The fish spent the majority of their time between 10 - 40m (four vertical excursions >100m were recorded, two by a single fish) and 22 - 28°C. Three fish remained in northern Gulf shelf and adjacent deeper waters, while two fish logged long-distance movements (one to southern Gulf waters via a western Gulf route; one to U.S. east coast Atlantic waters via an eastern Gulf route) in 94 and 214 days, respectively. Data obtained during the study revealed movement patterns and habitat use previously undocumented for this species.

0559 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Layla Freeborn, David Sever

Southeastern Louisiana University, Hammond, LA, United States

Reproductive Morphology of Marine Elapids with Focus on the Yellow-Bellied Sea Snake, *Pelamis platurus*

Past studies indicate that interspecific variation occurs within the anterior testicular ducts of squamates. However, ultrastructural descriptions of these ducts in snakes are limited to one previous study of the North American natricine snake *Seminatrix pygaea*. We examined the anterior testicular ducts of selected marine elapid snakes, with focus

on the yellow-bellied sea snake, *Pelamis platurus*. Sperm pass sequentially from the seminiferous tubules to the rete testis, then to numerous, convoluted tubules termed the ductuli efferetes. From the ductuli efferentes sperm are passed to the ductus epididymis. Our description of the anterior testicular ducts of *Pelamis platurus* will contribute to the growing body of literature dedicated to describing the ultrastructure of these ducts. Variations found within squamates may reveal morphological characters that can be mapped over existing hypotheses of squamate relationships. This in turn will be useful in elucidating the evolution of reproductive characters within Squamata.

0658 Amphibian Ecology, 551 AB, Monday 12 July 2010

Kealoha Freidenburg

Yale University, New Haven, CT, United States

Oviposition Site Choice and Carryover Effects in the Wood Frog

Ovipositing adults create the starting spatial distribution of a new generation, influencing initial growth, development, and survival of those individuals. For amphibians, the abiotic conditions necessary for successful hatching and rearing must remain within certain physiological limits to ensure offspring survival. Given the environmental heterogeneity that exists in most amphibian breeding sites, oviposition site choice may depend on fine-scale variation in environmental conditions. These conditions have the potential to affect the embryos and, through carryover effects, the surviving larvae. I hypothesized that the wood frog's natural oviposition sites represent optimal locations for embryo survival, growth, and development and that the light environment within a pond serves as a cue to these locations. I selected four ponds spanning a range of forest canopy cover and conducted egg mass transplants, comparing the performance of embryos left at the original oviposition site to those in an alternate site. To assess carryover effects, I placed larvae from the two embryonic locations in field enclosures and documented their performance. I found that oviposition decisions made by wood frogs have a sizable impact on the length of the embryonic period, developmental rate of embryos, and size at hatching. The early larval period was also affected by embryonic environment as evidenced in reduced survival rates, smaller size, and slower development at the alternate sites. Open canopy ponds produced larvae with higher growth and developmental rates than closed canopy ponds. Additionally, the carryover effects from the embryonic environment persisted more strongly in those larvae from closed canopy ponds.

0761 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Thomas French

Mass Division of Fisheries and Wildlife, Westborough, MA, United States

Headstarting as a Tool in the Restoration of an Endangered Population of Northern Red-bellied Cooter

The Plymouth, Massachusetts population of Northern Red-bellied Cooter (*Pseudemys rubriventris*) was listed as federally endangered in 1980. When listed, the population included fewer than 200 older adult turtles with very little recruitment. Beginning in 1985, the headstart of hatchlings has been one of the management tools used to increase the overall number of turtles, boost the population size in individual ponds, restore populations to ponds in which the species had disappeared, and to introduce the species to nearby ponds with appropriate habitat. Over these 24 years, a total of 3,431 hatchlings were kept for headstarting, 220 died, leaving 3,211 (94%) to be raised for about 9 months over the winter by cooperating organizations and released at a significantly larger size in the spring. This process includes covering each nest with a wire mesh cage to protect it from predators, monitoring each nest for emergence, releasing about 75-80% of all hatchlings directly into the pond and distributing the remainder of the hatchlings to cooperating organizations and individuals to raise over the winter. All nests are allowed to incubate under the natural temperature and weather conditions at the pond. The first headstarted female confirmed nesting was a 13 year old found in 2000. Although several instances of adult headstarted females laying eggs have now been discovered and numerous large adult headstarted turtles have been observed, and even captured, at several ponds in which only turtles of headstarted origin occur, the level of success of this project has not been well documented.

0151 AES Stress Symposium I, 551 AB, Sunday 11 July 2010; AES GRUBER AWARD

Lorenz H. Frick¹, Richard D. Reina¹, Terence I. Walker²

¹Monash University, Melbourne, Australia, ²Marine and Freshwater Fisheries Research Institute, Queenscliff, Australia

Are Physiological Indicators of Stress Reliable Predictors for Delayed Mortality of Sharks? Insights from a Controlled Study on Capture Stress

The immediate and delayed effects of capture stress on the physiology of sharks remain understudied, despite the urgent need for effective elasmobranch conservation and management measures. An assessment of the proportion of discarded sharks that die post-release as a consequence of excessive physiological stress requires a reliable

physiological indicator of stress that allows predicting of the survival of a discarded shark. We exposed Port Jackson sharks *Heterodontus portusjacksoni* and gummy sharks *Mustelus antarcticus* to varying durations of gill-net, longline, and trawl capture in a controlled setting, and monitored their post-capture condition via serial blood sampling during a 72-h recovery period subsequent to the capture event. Port Jackson sharks appear to be highly resilient to capture stress, as evidenced by a low degree of physiological disturbance and no mortality observed during or after any experiments. However, gummy sharks experienced severe disruptions to their acid-base and hydro-mineral balance, which were irreversible in some cases. Sharks that died post-capture showed significantly higher concentrations of plasma lactate and potassium, but these differences did not become apparent until hours after the capture event. These blood variables are therefore not suitable predictors of delayed mortality. Blood pH of gummy sharks was significantly depressed immediately after capture due to a combination of metabolic and respiratory acidosis. Intramuscular lactate concentration was highest immediately after capture, indicating that gummy sharks experienced intracellular acidosis. Suitability of blood and intracellular pH therefore deserves further investigation. These findings will help to elaborate methods for an assessment of post-release mortality of discarded sharks.

0647 AES Conservation & Management, 552 AB, Friday 9 July 2010

M.G. Frisk¹, T.J. Miller², K. Sosebee³, J. Musick⁴, P. Rago¹

¹*School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, New York, United States*, ²*Chesapeake Biological Laboratory, University of Maryland Center for Environmental, Solomons, MD, United States*, ³*Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, MA, United States*, ⁴*Virginia Institute of Marine Science, Gloucester Point, VA, United States*

Adult, Juvenile and Neonate Habitat Preferences of Spiny Dogfish, *Squalus acanthias*: Density, Temperature and Neonate Range Expansion in the Western Atlantic

We present analyses of the movement, distribution and habitat preference of spiny dogfish, *Squalus acanthias*, from Cape Hatteras to the Gulf of Maine based on data collected by the National Marine Fisheries Service during annual autumn and spring bottom trawl surveys (1963-2006). Cumulative distribution functions (CDF) were utilized to estimate temperature and depth preferences of spiny dogfish neonates, juveniles and mature females. Neonate, juvenile and adult spiny dogfish selected significantly narrower ranges of temperatures than available in the environment and significantly different from each other. Younger stages selected warmer waters than older stages during both the spring and fall (Spring: 50th percentile of neonate dogfish distribution was 10.3 °C, 9.3 °C for female juveniles and 8.0 °C for adult females, Fall: 50th percentile of neonate dogfish was 12.4 °C, 12.2 °C for juveniles and 11 °C for mature females. Further, neonate range appears to have expanded onto the eastern edge

of Georges Bank and into the eastern portion of the Gulf of Maine during periods of high spiny dogfish abundance in the 1980's. However, in recent years spiny dogfish still occupy this expanded range even after the population has declined. We explore the potential of the interaction between population size and environmental changes influencing range expansion, contraction and overall distribution of spiny dogfish.

**0298 Fish Ecology, 555 AB, Sunday 11 July 2010; ASIH STOYE AWARD
ECOLOGY & ETHOLOGY**

Bridgette Froeschke

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

**Using a Modeling Approach to Determine Essential Fish Habitat within the
Mission-Aransas National Estuarine Research Reserve**

Global climate changes, such as increased temperature of the world's oceans, are proposed to impact fisheries at the community, population and individual levels. Linking trends in fish population abundances with environmental characteristics is often difficult because fish may use a variety of habitats throughout their ontogeny and they often exhibit large inter-annual fluctuations in their abundance. An ecosystem-based approach will allow us to incorporate environmental changes into fisheries management. Declines of important fish species in the Gulf of Mexico underscore the importance of defining critical habitats as well as the processes that contribute to habitat value. This project directly addresses the priority of habitat conservation applicable to estuarine ecosystem management. The purposes were to: 1) evaluate differences in abiotic and biotic factors relative to abundance of nekton recruits at different sites within the Mission-Aransas Reserve; and, 2) develop a predictive species-habitat model delineating critical areas for nursery habitat of nekton that can be used to determine the mechanism of habitat selection. Objectives were accomplished by measuring abiotic and biotic community attributes while estimating nekton recruitment patterns in the Reserve. Data were collected at 50 sites in a stratified-random sampling design including four different habitats and were used to construct a species-habitat model delineating critical areas for nursery habitat for nekton. The findings provide a valuable new tool for fisheries managers to aid sustainable management of fishes. This study will provide crucial information needed to prioritize areas for habitat conservation and management of fishes in the Mission-Aransas Reserve.

0386 AES Conservation & Management, 552 AB, Friday 9 July 2010

John Froeschke¹, Gregory Stunz¹, Blair Sterba-Boatwright¹, Mark Wildhaber¹

¹Gulf of Mexico Fishery Management Council, Tampa FL, United States, ²Texas A&M University-Corpus Christi, Corpus Christi TX, United States, ³Texas A&M University-Corpus Christi, Corpus Christi TX, United States, ⁴U.S. Geological Survey, Columbia MO, United States

Testing the Shark Nursery Area Concept in Texas Bays Using a Long-term Fisheries-Independent Dataset

Using a long-term fisheries independent dataset, we experimentally tested the "shark nursery area concept" recently proposed by Heupel et al. (2007). We used the suggested working assumptions that juvenile shark nursery habitat would: 1) have an abundance of juveniles greater than the mean abundance across all habitats where they occur; 2) use same areas repeatedly through time (years); and 3) remain within the habitat for extended periods of time. We tested this concept using young-of-the-year (Age 0) and juvenile (Age 1+) bull sharks (*Carcharhinus leucas*) from gill-net surveys conducted in Texas estuaries from 1976-2006 to determine the nursery function of nine coastal estuaries. Of the nine bay systems considered for primary bull shark nursery habitat, only Matagorda Bay satisfied all three criteria for both cohorts. Both San Antonio and Matagorda Bays satisfied the criteria as nursery habitat for juveniles. Through these analyses we identified the utility of this approaching for characterizing nursery areas. We also note some practical considerations, such as of the influence temporal or spatial scales of the study when applying the nursery role concept to shark populations.

0267 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Allison Fuiten, Linda Trueb, Rafe Brown

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

Osteological Correlates of Ecomorph Variation in the Anuran Family Ceratobatrachidae

The ranoid family Ceratobatrachidae comprises 82 species of Southeast Asian and Melanesian forest frogs and represents two primary evolutionary radiations. One radiation involves 27 Philippine species and the other includes species in eastern Indonesia, Palau, Fiji, and the Solomon Islands. Within each radiation, arboreal and terrestrial ecomorphs have evolved independently a number of times. Members of *Platymantis* represent the majority of the species in the family and are present in both of the primary island radiations. Ceratobatrachidae provides an interesting model with

which to investigate convergent evolution and ecomorphology among closely related anuran taxa. For this study, the morphology of the skeletons of the two arboreal species (*P. guentheri* and *P. hazelae*) and one terrestrial species (*P. dorsalis*) from the Philippines were compared with one another, and with the skeletal morphologies of a terrestrial and an arboreal species from the Solomon Islands (*P. solomonis* and *P. guppyi*). This osteological examination of the *Platymantis* evaluates (1) which characters are more prone to change when an evolutionary lineage switches from a terrestrial to an arboreal life style or vice versa, and (2) which seem uncorrelated with the microhabitat utilized, and (3) whether similar modifications to skeletal structure can be observed in unrelated lineages in which there has been a shift between arboreal and terrestrial life styles. This study will provide a basis for further study of cases of convergent evolution across anurans.

0526 Fish Life History, 551 AB, Friday 9 July 2010

Benjamin Gahagan¹, Jason Vokoun¹, Gregory Whitley², Eric Schultz¹

¹University of Connecticut, Storrs, CT, United States, ²Southern Illinois University, Carbondale, IL, United States

Estimating Anadromous River Herring Natal Stream Homing Rates Using Otolith Microchemistry

River herring, two closely related anadromous alosine species found along the east coast of North America, are an ecologically significant forage fish. Populations of both alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) have declined across their range in the past 30 years. Fisheries managers have employed a variety of techniques to increase spawning opportunities and reduce adult mortality including trap and transport seeding of previously extirpated streams newly opened by fish passage. During spawning runs in 2008 and 2009 we collected returning adult river herring from 10 sites across the state of Connecticut. Juvenile fish were also collected prior to emigration. We removed sagittal otoliths from these fish and prepared transverse cross sections of the otoliths for Laser Ablation-Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) analysis. LA-ICPMS-derived trace element data were isolated from the otolith core (interior to the first saltwater signatures) for adults and compared with juvenile data, and water samples to statistically determine if returning fish were spawned at the site where they were collected. Discriminant function analysis was used to provide estimates of homing and straying rates of river herring. This basic ecological information will be useful for informing management and prioritizing conservation actions in the region.

0048 AES GRUBER AWARD, 551 AB, Friday 9 July 2010

Austin Gallagher¹, Lorenz Frick², Peter Bushnell³, John Mandelman⁴

¹*Three Seas Program, Northeastern University, Boston, MA, United States*, ²*Monash University, Clayton, Victoria, Australia*, ³*Indiana University South Bend, Southbend, IN, United States*, ⁴*Edgerton Research Laboratory, New England Aquarium, Boston, MA, United States*

Blood Gas, Oxygen Saturation, pH, and Lactate Values in Elasmobranch Blood Measured with an i-STAT® Portable Clinical Analyzer and Standard Laboratory Instruments

Assessments of the physiological response to different acute stressors are now being used to facilitate management decisions and conservation initiatives related to various fish species. Blood gas, pH, and blood lactate have been employed to ascertain condition and possibly post-release mortality in fishes, but data are often the most useful when collected immediately after individuals are captured. Portable clinical analyzers are now available that allow measurements to be made easily in the field. However, these instruments are designed for use with mammals use and therefore conduct measurements at 37°C. A few studies have validated the use of portable clinical analyzers for assessing blood gases and acid-base profiles in teleosts, but equivalent data are not available for elasmobranchs. We therefore examined the relationship of blood gas, pH, and lactate values measured with an i-STAT® portable clinical analyzer with those measured using standard laboratory blood gas (thermostatted to 25°C) and lactate analyzers using samples taken from three species of sharks. We found tight correlations ($r^2 > 0.90$) and between pH, pO₂, pCO₂, oxygen saturation, and lactate level values generated by the portable clinical and laboratory instruments. We thus developed equations for converting blood values measured in elasmobranchs with an i-STAT® portable clinical analyzer to those taken at 25°C. Additional studies need to address a wider range of temperatures and elasmobranch species, as it has been shown convincingly that the elasmobranch stress responses are highly variable interspecifically.

0367 NIA I, 556 AB, Saturday 10 July 2010; NIA BEST STUDENT PAPER AWARD

Riviane Garcez¹, Daniela Calcagnotto¹, Monica Toledo-Piza², Lurdes Almeida-Toledo¹

¹Universidade de São Paulo, Departamento de Genética e Biologia Evolutiva, São Paulo, São Paulo, Brazil, ²Universidade de São Paulo, Departamento de Zoologia, São Paulo, São Paulo, Brazil

Phylogenetic Relationships of the Cynodontidae (Teleostei, Characiformes) Based on Mitochondrial and Nuclear Gene Sequences

The Cynodontidae (sensu Lucena and Menezes, 1998) includes voracious predators that use their long canines to kill prey. The family, with 14 currently recognized species, was subdivided into two subfamilies, Cynodontinae and Roestinae. Members of the latter grow to a maximum of 20cm and include three species of *Roestes* and three of *Gilbertolus*. The Cynodontinae can reach 65cm of length and comprises the genera *Hydrolycus* (4 sp), *Cynodon* (3 sp) and *Rhaphiodon vulpinus*. Up to now phylogenetic hypotheses regarding the family and its relationships with other Characiformes are based only on morphological characters. In order to further test these hypotheses, in this study we analyzed 11 taxa representing all genera and all but three species (*G. atratoensis*, *G. alatus* and *C. septenarius*) using three gene regions from mitochondrial (16S and ATPase 6/8) and nuclear (S7) genomes for a total of 1910 nucleotide characters in a cladistic simultaneous analysis which resulted in two most parsimonious cladograms, 2295 steps in length (CI 0.676 and RI 0.717). The strict consensus was fully resolved except for the relationships of *Gilbertolus*. While the monophyly of most morphologically recognized genera was recovered, the use of other charciform taxa as outgroups resulted in a non-monophyletic Cynodontidae.

0376 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010; AES GRUBER AWARD

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

¹University of South Florida, Tampa, FL, United States, ²Mote Marine Laboratory, Sarasota, FL, United States, ³Boston University Marine Program, Boston, MA, United States

Multisensory Integration in Shark Feeding Behavior

Feeding by predators involves tracking, precisely localizing and finally striking at and capturing prey. In complex environments, animals rely on multiple senses for such difficult behavioral tasks. Olfaction, vision, mechanoreception, and electroreception

have individually been shown to be involved in feeding, but how sharks are integrating the information from these senses to search for food is poorly understood. We are investigating three species from different ecological niches: benthic, suction-feeding nurse sharks hunt nocturnally for fish on reefs; ram-suction feeding bonnetheads scoop crustaceans off the bottom of seagrass beds; and ram-biting blacktip sharks rapidly chase down midwater piscivorous prey. We deprived animals of information from each of the senses, alone and in combination, to elucidate their complementary and alternating roles in feeding on live prey, and to determine how pre-strike information influences capture kinematics. Feeding behavior in intact animals of all three species begins with olfactory tracking, which bonnetheads and nurse sharks use until they are very close to the source, while blacktip sharks demonstrate sensory switching at a distance from the prey, focusing on visual cues to strike. Blacktip sharks can, however, use other sensory cues to locate and capture prey if vision is blocked. With the nares blocked, bonnetheads and blacktip sharks cruise the tank until the prey is in visual range, then strike from a distance, but nurse sharks cease to feed. They can orient to prey using other cues if they happen upon it, but they will not ingest it, suggesting that they require olfaction to feed.

0565 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Michel Varajão Garey¹, Célio Fernando Baptista Haddad², Denise de Cerqueira Rossa-Feres¹

¹UNESP -São Paulo State University, Sao José do Rio Preto, São Paulo, Brazil, ²UNESP -São Paulo State University, Rio Claro, São Paulo, Brazil

Structure of Amphibian Community of Serra da Bocaina National Park

Several factors can influence the structure of communities, such as: inter and intra specific interactions, abiotic factors and landscape characteristics. The aim of this research was to analyze the amphibian community structure in a Tropical Rainforest area and verify the influence of environmental heterogeneity and climatic parameters over the amphibians richness and abundance. The study was conducted at Atlantic Rainforest in Serra da Bocaina National Park, located at Serra do Mar in the frontiers between the states of São Paulo and Rio de Janeiro, Brazil. Fifteen lentic environments located between 1300 and 1600m a.s.l. were monitored through the survey at breeding site method. By the end, 20 species were registered and no difference in the amphibians richness between the forest and the opened area was noticed. In the forest, 13 species were registered, while in the opened area 15 species were. Eight species occurred in both areas. The most abundant species was *Dendropsophus microps* and the most rare were *Leptodactylus furnarius*, *Proceratophrys melanopogon* and *Scinax eurydice*. No relation was observed between climatic parameters (monthly rainfall, monthly mean temperature, mean maximum and minimum temperature) and richness and abundance of calling males. In January was recorded the greatest richness of calling males (65%), while in June only one specie was recorded (5%). None of the environmental descriptors

influenced the amphibian abundance, and just the vegetation coverage was related to amphibians richness, being as bigger the vegetation coverage was, smaller was the richness.

0737 Herp Conservation III, Ballroom B, Sunday 11 July 2010

Mandy Gaudreau¹, Rachel Thiet¹, Lou Perrotti¹

¹Antioch New England, Keene, NH, United States, ²Roger Williams Park Zoo, Providence, RI, United States

Incidence of *Batrachochytrium dendrobatidis* in Rhode Island Anuran Populations

Chytridiomycosis is an emerging amphibian disease that has caused mass die-offs and species extinction worldwide. Chytridiomycosis is caused by infection of the keratinized epidermis of amphibians by the fungus *Batrachochytrium dendrobatidis* (*Bd*). Several anuran species commonly found in Rhode Island have tested positive for *Bd* in other northeastern states; typically these individuals present few or no clinical signs and do not suffer mortality from infection. Environmental factors have been shown to increase pathogenicity of *Bd*, making the geographical distribution of *Bd* important to know for conservation planning, particularly in light of predicted climate change. This study was conducted to evaluate whether *Bd* is present in Rhode Island anuran populations and to map its geographical distribution throughout the state. We used two-way chi square tests with contingency tables to evaluate relationships between species life history variables and the presence of *Bd*. Adult anurans were significantly more likely to be infected than tadpoles and aquatic species were significantly more likely to be infected than terrestrial species. Skin swab samples (n=47 at 11 sites) were taken from bullfrogs (*Lithobates catesbeianus*), green frogs (*Lithobates clamitans*), pickerel frogs (*Lithobates palustris*), wood frogs (*Lithobates sylvatica*), American toads (*Anaxyrus americanus*), and tadpoles. Twenty-one percent of samples tested positive for *Bd* in four anuran species. Positive *Bd* samples were found at a variety of habitats including vernal pools. Results from this study will improve our understanding of *Bd* infection and distribution in the northeastern United States and will aid in future anuran conservation planning.

0594 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; ASIH STORER ICHTHYOLOGY AWARD

Aaron Geheber

Southeastern Louisiana University, Hammond, LA, United States

Assessing the Impacts of Pools Bluff Sill on Fishes in the Pearl River (1988-2009)

Anthropogenic stream impoundments are regular occurrences across most drainages of the Southeastern United States. Despite the commonality of these perturbations, studies exploring the effects of impoundments on the abundances and movements of fishes are relatively low in numbers, and are stream system specific. The Pearl River, a Gulf coastal drainage of Louisiana and Mississippi, is no stranger to stream impoundments, containing two modifications (Pools Bluff Sill and Ross Barnett Dam) within its basin. The low head dam, Pools Bluff Sill, was constructed in the early 1950's near Bogalusa Louisiana, in order to maintain a navigable water level in a manmade shipping channel. Although some water passage is permitted across the sill, there is great concern that the sill may inhibit upstream movement of some fishes. In this study we utilize data collected from multiple sites in the Pearl River between 1988 and 2009. We examined the impacts of Pools Bluff Sill as a barrier to different ecological groups of fishes (i.e. non-benthic generalists, benthic specialists, etc.), in order to determine how species specific abundances relate to spatial dynamics of the Pearl River. Our results suggest that species most greatly impacted by the sill presence were benthic specialists, which possessed very high abundances below the sill (N=1 site) as compared to all above sill sites (N=15 sites). Non-benthic generalists were not as strongly affected, usually maintaining comparative abundances both above and below the sill. Implications of our results and possible actions for conservation will be further discussed.

0205 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Nicholas Geist, Alexandra Dallara

Sonoma State University, Rohnert Park CA, United States

The Role of Incubation Temperature and Clutch Effects in Development and Phenotype in Headstarted Western Pond Turtles (*Emys marmorata*)

Samples from a total of over 130 eggs of the western pond turtle, *Emys marmorata*, were incubated at 6 constant temperatures to examine the relative effects of temperature and clutch (i.e., maternal effects) on incubation duration, hatching success, sex determination, and juvenile growth. Hatchlings were raised in dedicated facilities at the San Francisco and Oakland zoos for headstarting under controlled conditions for

approximately 9-10 months to optimize juvenile growth prior to PIT tagging and rerelease into their natal waters. Sex determination was performed by endoscopic examination of gonads approximately 1 month before release. Preliminary data demonstrate that incubation temperature plays a significantly greater role in incubation duration and hatching success than clutch, while clutch/maternal effects are the predominant factor in juvenile growth rate. A Type 1a (MF) pattern of temperature-dependent sex determination (TSD) was verified for this species. Additionally, in situ temperature data recorded from 3 naturally incubated nests demonstrates that nests from this upland Northern California site commonly experience daily temperature fluctuations of up to 15 degrees C. Notably, constant temperature ex situ incubation of *E. marmorata* eggs at or above 30 degrees C resulted in significantly reduced hatching success, yet daily short-duration in situ temperatures typically exceed this temperature, and may reach or exceed 40 degrees C. These data suggest that further studies are needed to clarify the effects of cyclical temperature variation on development and phenotype in *E. marmorata*.

0471 AES Stress Symposium II, 551 AB, Sunday 11 July 2010

Jim Gelsleichter

University of North Florida, Jacksonville, FL, United States

Biomarkers of Physiological Stress Caused by Exposure to Environmental Pollutants in Sharks and their Relatives

Due to numerous factors, such as their relatively large size, slow growth and metabolism, and high trophic level, sharks and their relatives have the tendency to accumulate elevated concentrations of environmental pollutants. Because of this, it is critical to develop and use methods for detecting physiological effects of pollutant exposure in elasmobranchs. However, to date, very little research has focused on biomarkers of pollutant stress in these animals. In this review, we discuss recent research efforts focused on developing molecular and protein biomarkers of several environmental pollutants in sharks and rays including heavy metals, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, organophosphate pesticides, and estrogen-mimicking substances. We also highlight new efforts to use cellular biomarkers of pollutant stress in elasmobranchs, such as those that can detect gene and chromosome damage as a result of exposure to genotoxic substances.

0524 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Gary Gerald

Nebraska Wesleyan University, Lincoln, NE, United States

When to Run and When to Hide: The Influence of Environmental Conditions on Anti-predator Behaviors in Hatchling Turtles

Hatchling turtles experience considerable selective pressures upon emerging from the nest and advancing to water. As hatchlings, defense mechanisms in snapping turtles are limited, with their best options being either active escape or crypsis. Like all animals, their ability to successfully escape a predator lies in their locomotor capabilities. Previous studies have found that the duration of cryptic anti-predator behaviors is often determined by an individual's maximal locomotor capabilities. Simulating threatening situations, we examined the relationship between various static behaviors and locomotor abilities in hatchling snapping turtles (*Chelydra serpentina*) at different temperatures on both land and in water. Using step-wise regression models, we found that burst speeds and activity times were primarily negatively related to righting response and time spent motionless on land and in water. However, these relationships were statistically stronger at 25° and 30°C. This indicates that faster turtles are more likely to right themselves and begin moving sooner than slower ones. Our findings indicate that both temperature and attainable locomotor speeds can influence the decision by *C. serpentina* to either attempt to actively escape a potential predator or to utilize stationary cryptic-like behaviors.

0114 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Justin Gerlach

Nature Protection Trust of Seychelles, Cambridge, United Kingdom

Headstarting Indian Ocean Giant Tortoises - Perspectives from Releases of Adults and Juveniles on Small Islands

Head-starting programmes for Aldabra-Seychelles giant tortoises in the Seychelles islands are reviewed. These comprise large-scale conservation introductions of Aldabra tortoises (*Dipsochelys dussumieri*/*D. elephantina*/*Aldabrachelys gigantea*) to Curieuse and Fregate islands with release of adults and head-starting of juveniles, small scale releases of adults to several islands and reintroduction of Arnold's tortoises (*D. arnoldi*) to Silhouette island. Small scale releases have low success, probably due largely to social factors and health issues. Larger scale releases result in good breeding results but have been badly affected by poaching. Head-starting of juveniles has had variable results but has the potential to successfully prevent poaching if properly managed. However, long

term head-starting may cause problems in population management. Future potential for conservation of Indian Ocean giant tortoises is briefly reviewed.

0149 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Shannon Gerry, Jasmine Wang, David Ellerby

Wellesley College, Wellesley, MA, United States

Intraspecific Morphological Differences in Bluegill Sunfish

Bluegill sunfish, *Lepomis macrochirus*, show intraspecific morphological and behavioral differences dependent on environment. We hypothesized that bluegill from Lake Waban, MA would show morphological differences between pelagic and littoral regions that correlate to differences in swimming performance: littoral bluegill would show a truncated, maneuverable body form, while pelagic bluegill would have a streamlined body suitable for cruising. Bluegill were caught by hook and line and photographed for morphometric analysis. Using Image-J, fin size, area, and location relative to center of mass (COM) were measured and expressed relative to body length. Pelagic bluegill have a larger pectoral fin aspect ratio, a larger dorsal fin area, and pectoral fins located further from the COM than littoral bluegill ($P < 0.05$). These pectoral fins are likely to be effective in exerting power and torque during labriform swimming. Littoral bluegill have a deeper body, deeper caudal fins and wider mouths than pelagic bluegill ($P < 0.05$). Additionally, the soft dorsal, pelvic, anal, and caudal fins of littoral bluegill are positioned further from the center of mass ($P < 0.05$). The size and placement of these fins suggest that they will be effective in creating turning moments to facilitate maneuvering. These morphological features are shared by maneuvering fishes. Therefore, littoral bluegill have a morphology that is specialized for maneuverability, while pelagic bluegill are specialized for cruising. Future energetic and kinematic analyses will provide further insight into the functional consequences of this morphological variation.

0452 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Marina Gerson

California State University, Stanislaus, Turlock, CA, United States

Population Structure and Habitat Affinities of Blainville's Horned Lizard (*Phrynosoma blainvillii*) in the Arena Plains Unit of the Merced National Wildlife Refuge

Blainville's Horned Lizard (*Phrynosoma blainvillii*) is protected in the State of California due to population declines and loss of habitat. Anecdotal evidence suggests that horned lizards have been reduced in comparison to prior abundance in the central valley of California, and limited museum records exist for Merced County. Since Spring 2008, I have been conducting surveys for coast horned lizards on the Arena Plains Unit of the Merced National Wildlife Refuge. The data reveal a size- and age-structured population with equivalent numbers of males and females. Spring activity is dominated by adults, which become less abundant on the surface through summer and fall. Fall activity on the surface is dominated by neonates. While management of the refuge unit is targeted for use by overwintering waterfowl, suitable patches of habitat occur in at least four locations, and connectivity is provided in part by the presence of elevated, unimproved dirt access roads. Horned lizard abundance is correlated with soil and vegetation types in the refuge, and additional habitat patches may be made available through vegetation management. In combination these data suggest that this population is viable for long-term persistence, providing that management is provided to maintain suitably sparse vegetation cover through grazing and prescribed burn programs.

0485 General Ichthyology, Ballroom B, Friday 9 July 2010

Carissa Gervasi, David Taylor

Roger Williams University, Bristol, RI, United States

Abundance, Growth, and Diet of Juvenile Summer Flounder (*Paralichthys dentatus*) and Winter Flounder (*Pseudopleuronectes americanus*) in the Seekonk River, RI and the Taunton River, MA

Summer flounder, *Paralichthys dentatus*, and winter flounder, *Pseudopleuronectes americanus* utilize estuaries as nursery habitat during their early life history stages. In southern New England estuaries, however, little is known regarding the spatiotemporal overlap and potential biotic interactions between the flounder species. The purpose of this research was to assess the abundance, growth, and dietary habits of juvenile summer and winter flounder to determine if predator-prey and/or competitive relationships exist. From May to September 2009, flounder in the Seekonk and Taunton

Rivers were sampled biweekly using beach seines. Captured flounder were enumerated, measured for total length (mm), and a sub-sample was preserved for subsequent stomach content analysis. Summer flounder abundance (mean=0.34fish/m²) decreased significantly over time, but the abundance of winter flounder (mean=0.15fish/m²) remained relatively constant during the sampling period. Summer flounder grew significantly faster than winter flounder (growth rates=0.85 and 0.25mm/day, respectively), which may be attributed to differences in dietary habits. Decapods and fish were an important component of the summer flounder diet (52% and 4% by volume, respectively), while amphipods and nematodes were favored by winter flounder (both 37% by volume). These data suggest that competition for food resources is minimal between species. Among the identifiable fish prey in summer flounder stomachs, however, there was evidence of predation on winter flounder, albeit to a limited extent. In order to achieve a better understanding of the diets of the two species, future work will analyze fatty acids. Also, otolith studies will make it possible to more accurately determine growth rates.

0388 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Ahmad Gharzi

Department of Biology, Faculty of Sciences, Lorestan University, 68135 Khorramabad, Lorestan, Iran, Islamic Republic of

Fear and Thinking in the *Tropicolotes helenae* (Reptilia: Gekkonidae)

Tropicolotes helenae is an endemic gecko of Iran. For examination of thinking in *Tropicolotes* we examined more than 15 specimens as follows. We chose flat and light glass (wide: 4mm), elevation of glass from earth is near 50cm, and holded by four column in bellow section. Transfer each specimen to up of glass (center section), and my examination about all specimens was similar, and we classified to five steps as follows. Step (a) Still step, all specimens in first step were without any movements, this duration lasted between "2-15" minute. Step (b): head movement (Fig. 5); in this step body is still but head have movement, duration of this step is less (1 minute). Step (c): suspicious step, in this step don't occurred movement and in most specimens occurred only one suspicious step in front or back. In this step, gecko examine surface of glass for next step. Step (d): slow movement, after suspicious step, geckos do more steps in front axis. Step (e): normal movement, in this step geckos show normal movements. Based on several our observation, we considered that my examinee specimens show thinking (by fear) for his salvation, because in all specimens occurred step (b), and (c). On the other hand during second examination (in each specimen) we could not see these behaviors. First and secondary examination in each specimens confirmed thinking in *Tropicolotes*. This is very interesting, because in secondary step of each specimens don't occurred fear and movement in all specimens during second examination was normal.

**0124 Fish Life History, 551 AB, Friday 9 July 2010; ASIH STOYE AWARD
GENERAL ICHTHYOLOGY**

Katie Gherard

California State University Northridge, Northridge, California, United States

Age, Growth, and Batch Fecundity of the Gulf Corvina, *Cynoscion othonopterus*, from the Northern Gulf of California, Mexico

The Gulf Corvina, *Cynoscion othonopterus*, is a vital component of commercial fisheries in the northern Gulf of California, yet little is known about its life history. Four hundred and one specimens were collected from the commercial gillnet fishery at the Gulf of Santa Clara in Sonora, Mexico from March to October 2009 to determine the age structure, growth rate, and batch fecundity of adults. Fish ranged from 196 mm to 827 mm in total length and from 1 to 8 years of age. Von Bertalanffy growth model parameters were: $L_{\infty}=823.1\text{mm}$, $k=0.3837/\text{yr}$, and $t_0= 0.1808$ years, and $R^2=0.94$. Mean oocyte diameter differed significantly among development stages. Spawning females produced up to 970,813 oocytes per batch, and batch fecundity was correlated to both total length and gonad-free body weight. The growth rate of *C. othonopterus* is high in comparison with its congeners, which is likely due to the high productivity that characterizes the northern Gulf. The distribution of oocyte diameters and oocyte stages indicate that *C. othonopterus* are synchronous, multiple batch spawners with indeterminate annual fecundity. The high degree of synchronization in gonadal development among females reflects the semi-lunar spawning cycle of adults, which migrate to spawn in the estuaries of the Colorado River Delta over four day periods during six consecutive spring tides.

0650 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Alice Gibb¹, Miriam Ashley-Ross², Cinnamon Pace¹

¹*Northern Arizona University, Flagstaff, AZ, United States*, ²*Wake Forest University, Winston-Salem, NC, United States*

Like a Fish Out of Water? Species from Several Percomorph Orders Produce Coordinated Terrestrial “Leaps” in Response to Forced Stranding

Many fish species known to make voluntary terrestrial excursions (“amphibious” species, such as mudskippers and walking catfish) have obvious anatomical specializations, such as robust pectoral fins, to facilitate terrestrial movement. Reports of the inability of “non-amphibious” fish to move effectively on land, likely biased by observations of large, commercially-important species struggling unproductively on land, support the general hypothesis that specialized morphology is required for

effective terrestrial locomotion. Here, we document “leaping” behaviors produced during forced stranding in small, non-amphibious representatives of four teleost orders: Belontiiformes, Atheriniformes, Cyprinodontiformes and Perciformes. Leaping behavior is grossly similar to an aquatic escape response: consisting of an initial preparatory phase, wherein the body axis is bent into a “C” shape and a subsequent propulsive phase, wherein the body is straightened and maximum velocity is achieved. However, at the end of the propulsive phase of a leap, the fish enters an aerial phase, in which the body is launched from the substrate to follow a ballistic trajectory. During the aerial phase, rather than experiencing uncontrolled rotation, the fish maintains its heading and a consistent body orientation. The launch behavior and subsequent aerial posture together produce a coordinated and directed movement, which results in the net displacement of the fish several body lengths from its original position via a single leap. If a fish is not returned to water by the first leap, additional leaps are attempted. We suggest that this behavior serves to return small percomorphs to the water when they are voluntarily or involuntarily stranded.

0592 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

Nicholas J. Gidmark¹, Katie Lynn Staab², L. Patricia Hernandez², Elizabeth L. Brainerd¹

¹*Brown University, Providence, RI, United States*, ²*The George Washington University, Washington, DC, United States*

XROMM Analysis of Premaxillary Protrusion, 3D Maxillary Motion, Kinethmoid Rotation and Lower Jaw Depression During Feeding in Common Carp

Upper jaw protrusion has evolved independently in several fish lineages, and has been shown to enhance suction feeding performance. Determining the skeletal kinematics of jaw protrusion is difficult, as the involved bones can be covered by scales, other bones, connective tissues and skin. Here we use biplanar videofluoroscopy and X-ray Reconstruction of Moving Morphology (XROMM) to reconstruct 3D, 6-degree-of-freedom movements of the premaxillae, neurocranium, maxillae, kinethmoid, and lower jaw in-vivo in common carp, *Cyprinus carpio*. The kinethmoid (named for its ethmoidal location and high mobility) is a novel, midline bone in cypriniforms, located just dorsal and caudal to the mobile premaxillae. We found up to 120 degrees of sagittal plane rotation in this bone during food acquisition, and a significant correlation between the magnitudes of kinethmoid rotation and premaxillary protrusion. The kinethmoid is suspended in a ligament that runs from the neurocranium to the premaxillae; additional ligaments connect it with the palatines and maxillae. During premaxillary protrusion, the maxillae translate ventrally and rotate in the sagittal plane and about their long axes; these movements are all driven by a combination of a modified adductor muscle (A1beta) and lower jaw rotation. We hypothesize that these maxillary movements effect kinethmoid rotation and premaxillary protrusion. During food processing behaviors,

upper jaw protrusion and lower jaw depression are at least partially decoupled. Using 6-degree-of-freedom movements, we test previously proposed hypotheses of cypriniform jaw protrusion mechanics, focusing on the mechanism by which this kinetic skull configuration can decouple upper jaw protrusion from lower jaw depression.

0642 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Sarah Gignoux-Wolfsohn

Wesleyan University, Middletown CT, United States

Epigenetic Effects in Pigmentation of the Three-Spine Stickleback, *Gasterosteus aculeatus*

Recent literature in the Eco-Devo field has implicated epigenetic regulation as a factor in development. While genomes are determined by inheritance, the epigenome can be directly affected by the environment. Seven populations of both freshwater and anadromous three-spine sticklebacks, *Gasterosteus aculeatus*, were observed to exhibit different pigmentation patterns from environmentally distinct locations (specifically in water color and opacity). Based on these observations, our study aims to determine how much of this pigmentation difference can be correlated with varying patterns in methylation. Using genes known to play a role in fish pigmentation, primers for the promoter regions were generated. DNA was extracted from 35 fish, a zymo bisulfite-conversion kit was used, the promoter regions of the samples were amplified by PCR, and finally sequenced. Due to low quality of sequencing, the samples had to be cloned using a promega vector cloning kit and six colonies from each sample were chosen for sequencing. This protocol allows for visualization of the exact location of methylation of the DNA. We hypothesize that there exists a correlation between environment, pigmentation, and pattern of methylation. By using AMOVAs, we can determine whether there is more variation in methylation within a population than between populations. This study provides a novel characterization of variation of methylation patterns for pigmentation in *G. aculeatus* in relation to not only population but also environment.

0275 Fish Conservation, Ballroom B, Friday 9 July 2010

Christopher Gledhill¹, Andrew David²

¹National Marine Fisheries Service Pascagoula, MS Laboratory, Pascagoula, MS, United States, ²National Marine Fisheries Service Panama City, FL Laboratory, Panama City, FL, United States

Effectiveness of Two Marine Protected Areas on the West Florida Shelf

The Madison-Swanson and Steamboat Lumps Marine Protected Areas (MPAs) were established by the Gulf of Mexico Fishery Management Council in 1999 to protect spawning aggregations of gag grouper (*Mycteroperca microlepis*). No-take regulations went into effect in 2001. We have monitored fish assemblages within these reserves since 2001 using baited video cameras. However, we have not observed any definitive increase in the abundance of gag, red grouper (*Epinephelus morio*) or red snapper (*Lutjanus campechanus*) between 2001 and 2009 within the MPAs when compared with trends in abundance of these species along the west Florida shelf-edge. We attribute this to lack of compliance with fishing regulations since we have observed fishing activity during our surveys, fishing was observed during an aerial survey of vessels along the west Florida shelf conducted by the University of Miami in 2005, and at least one fisher has been prosecuted for fishing within the MPAs.

0477 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Adrian Gleiss¹, Brad Norman², Rory Wilson¹

¹Swansea University, Swansea, United Kingdom, ²ECOCEAN Inc., Perth, Australia

Being Most Moved by that Sinking Feeling: Implications of Movement Geometry for Optimisation of Travel in Dense Marine Animals

Optimization of animal movement depends on behavioural and ecological context. A primary determinant of movement optimization is travel speed, which modulates both power consumption and distance travelled and thus cost of transport (COT). We investigated the power requirements (using dynamic body acceleration as proxy for power) in relation to movement geometry of nine Whale sharks (*Rhincodon typus*) and discovered that movement geometry significantly affects power requirements in a manner similar to travel speed. Whale sharks dive repeatedly and use their negative buoyancy to glide during descents, while ascents were characterized by strong locomotory activity. Power requirements of ascents increased with the square of the pitch and were significantly greater than both level and descent swimming. The differences in geometry of different dive types are explored using four semi-empirical optimality models, based on minimum power. These models suggest that some dive

types minimise the horizontal cost of transport, whereas others minimise the cost of vertical movement. Negative buoyancy may play a substantial role in the optimisation of both searching and travel. Consideration of speed alone is insufficient to explain optimality in the movement of animals that use changes in potential energy to power part of their locomotory cycle.

0136 Herp Conservation I, 556 AB, Thursday 8 July 2010

Brad M. Glorioso¹, J. Hardin Waddle²

¹IAP World Services, Inc., U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, United States, ²U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, United States

Trend Detection in Long Term Anuran Monitoring: A Comparison of Vocalization and Visual Encounter Surveys

As worldwide concern about amphibian declines has become well known, many long-term monitoring programs have been initiated with the goal of detecting declines in abundance or site occupancy of amphibians over time. For anurans, two of the most commonly used methods for monitoring are vocalization surveys and visual encounter surveys. In 2009, in the Atchafalaya Basin of south-central Louisiana, we conducted 6 one person-hour visual encounter surveys at each of 64 sites for all post-metamorphic anurans. We also conducted vocalization surveys simultaneous to the visual encounter surveys, which allowed for direct comparison between survey types. Using only vocalization data results in a mean per site reduction of 56.4% in the number of species detected when compared to visual encounter data. Adding the vocalization detections to visual encounter data results in an increase of only 7% in the mean number of species detected per site. Twelve of the 13 species in our study area had higher occupancy and detection probabilities when using visual encounter data relative to vocalization data. In addition, our analyses show that the variance of occupancy and detection probability parameter estimates is generally lower in visual encounter surveys than vocalization surveys. The lower coefficient of variation in detection probability for visual encounter surveys should result in an increased power to detect trends in amphibian occurrence. When practical, visual encounter surveys should provide less variation than vocalization surveys, and result in higher occupancy and detection probabilities, making visual encounters a better method for detecting trends in anuran occupancy.

0535 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Scott Goetz¹, Ronald Rozar¹, Robert Reed¹, Kristen Hart², Gordon Rodda¹, Ray Snow³, Frank Mazzotti⁴, Michael Cherkiss⁴

¹U.S. Geological Survey, Fort Collins Science Center, Fort Collins, CO 80526, United States, ²U.S. Geological Survey, Southeast Ecological Science Center, Ft. Lauderdale, FL 33315, United States, ³National Park Service, Everglades National Park, Homestead, FL 33034, United States, ⁴University of Florida, Ft. Lauderdale Research and Education Center, Ft. Lauderdale, FL, 33314, United States

A Field Trial of Trap Effectiveness for Invasive Burmese pythons (*Python molurus bivittatus*) in South Florida

The impacts of invasive species are of economic and environmental concern, making effective control tools desirable. However data are lacking to validate the efficiency of control tools for many reptiles, and virtually no proven tools are available for control of large-bodied invasive snakes. Invasive Burmese pythons (*Python molurus bivittatus*) are established in South Florida and may have negative impacts on native fauna. We conducted a trap trial in the greater Everglades ecosystem to evaluate the capture efficiency of attractant baited traps. Two different trap designs were used in conjunction with standardized and opportunistic visual encounter surveys (VES). A total of 6,053 trap nights yielded three python captures (these individuals were marked and released) along with 69 non-target captures. Trap success was not dependent upon trap design. No pythons were observed during standard VES; two pythons were observed during opportunistic VES. After the trial, the 80.93 ha study plot was mechanically disced to assess python population size within the study site; 11 pythons were observed, resulting in a minimum population density of 0.136 snakes/ha. Capture rates may have been reduced by extremely high prey abundance as well as a lower python density during initial study stages. Our results illustrate some of the potential challenges for management of widespread populations of cryptic ambush predators such as pythons. The low capture rate observed in this study highlights the need for both validation of control methods in reptile trapping studies and utilization of techniques that account for the life history traits of target species.

0582 General Ichthyology, Ballroom B, Friday 9 July 2010

Justin Golub, Susan Foster

Clark University, Worcester, MA, United States

Timing and Frequency of Predator Dietary Cues Have no Effect on Embryonic Learning.

A variety of chemical cues exist in the environment at any given time, and an ability to use these cues to assess predation risk can greatly enhance survival. Aquatic predators produce dietary olfactory cues that can inform potential prey of their predator's diet. These cues can be learned and used by prey as indicators of immediate risk. Species that have undergone rapid proliferation into new environments, as has the threespine stickleback (*Gasterosteus aculeatus*), are exposed to novel predator regimes and might therefore rely on learned recognition of predator dietary cues rather than innate recognition. This logic should apply to all vulnerable ontogenetic stages. Being sedentary, embryos are at high risk of predation, and many egg predators continue to threaten fry. Thus, embryonic individuals should rely on learning to avoid predation, increasing their post-hatching survival. My previous research has demonstrated that, through repeated exposure, stickleback embryos learn to recognize the cues of predators that have recently eaten stickleback embryos, exhibiting increased avoidance behavior when exposed to these predators after hatching. However, it is unclear how quickly and when embryos learn predator cues. I varied the frequency and timing of exposure of embryos to predator cues, and examined post-hatching anti-predator behavior. Because learning opportunities carry the risk of predation by a nearby nest predator, embryos should require very few experiences, and should begin to learn predator cues from even the earliest stages of development to take advantage of every potential learning opportunity they encounter.

0610 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Rachel Goodman¹, Emmet Luck¹, Jason Kolbe², Liam Revell³, Paul Hime⁵, Ryan Bickel⁴, Jonathan Losos²

¹Hampden-Sydney College, Hampden-Sydney, VA, United States, ²Harvard University, Cambridge, MA, United States, ³National Evolutionary Synthesis Center, Durham, NC, United States, ⁴University of Southern California, Los Angeles, CA, United States, ⁵St. Louis Zoo, St. Louis, MO, United States

Shrinkage of Museum Specimens of *Anolis sagrei* During Fixation and Preservation

Museum collections of preserved specimens are important to biological research. However, researchers may experience limitations when comparing specimens of different ages, or when comparing wet-preserved specimens with live animals, due to potential shrinkage and deterioration of specimens. Therefore, it is important to study how fixation and preservation affect specimens. This study examined whether fixation and preservation have caused shrinkage of lizards (*Anolis sagrei*) over a decade of preservation. Fifty-two adult female lizards purchased from a commercial dealer were humanely euthanized at the completion of an unrelated experiment and immediately x-rayed and measured for snout-vent length (SVL) in 2000. They were formalin-fixed for one week and then re-measured and x-rayed. Lizards were subsequently stored in ethanol, and re-measured and x-rayed at 4, 10, and 58 months, and nearly 10 years later. One researcher conducted all morphological measurements on lizards in digital images of radiographs from 2000-2010 (length of head, spine, femur and tibia) using ImageJ computer software. We will test whether fixation and preservation differentially affect shrinkage of specimens, and also whether effects differ with respect to relative body proportions.

0380 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Noah Gordon¹, Matthias Scheutz³, Sunny Boyd²

¹University of Evansville, Evansville, IN, United States, ²University of Notre Dame, South Bend, IN, United States, ³Indiana University, Bloomington, IN, United States

Environmental Context Matters, Limits of Female Preference for Male Quality in the Grey Treefrog, *Hyla versicolor*

An understanding of the preferences and choices of females can provide us with outer boundaries in which sexual selection may act. Regardless of a female's actual preference, females may alter their mate choice decisions when the cost of mate choice is high or the benefits of mate choice are low. Consequently, choosy females may face a trade-off

between the quality of a potential mate and the distance a female must travel to secure that mate. Females surveying males might be expected to be choosier at short distances, and less so at greater distances since traveling farther to a mate may increase predation exposure, energy expenditure and the risk of losing one's choice to another female. We tested whether increased travel distance influences a female's speed, tortuosity or departure latency to male calls of varying quality using a no-choice experimental design. We show that the perceived distance to a potential mate strongly influences a female's departure latency. Additionally, we show that the quality-induced variation in female response time observed in previous studies is erased when females respond from greater distances. This suggests that in *H. versicolor* the influence of female choice on sexual selection is limited to relatively short distances.

**0291 Herp Physiology, 556 AB, Monday 12 July 2010; ASIH STOYE AWARD
PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY**

Sean Graham

Auburn University, Auburn, AL, United States

Does Thermal Flexibility of an Innate Immune Cascade Allow Immunological Flexibility for the Cottonmouth?

Complement—an immune protein cascade involved in pathogen lysis—was discovered as the temperature-labile component of vertebrate plasma. We investigated two thermal hypotheses involving the complement system of an ectothermic model, the cottonmouth (*Agkistrodon piscivorus*). We tested whether complement performance would conform to thermal optimal reaction norms commonly observed in ectotherm physiological studies. We predicted that complement efficiency would be maximal at or near the cottonmouth's preferred body temperature as determined from field measurements of wild-living snakes. We also tested thermal acclimatization of complement performance, by comparing temperature/performance curves from samples collected in three different seasons. We found no evidence for an optimal thermal reaction norm within the range of temperatures that we tested. Complement efficiency exhibited a significant positive correlation with temperature, and continued to increase in efficiency beyond the mean field body temperature preferred by this snake. We observed this pattern in all three seasons, and there was no difference in the slope of the complement/temperature relationship between these periods. These data suggest that, in this ectotherm, there is an invariable temperature-performance relationship exhibited by complement. This may allow trade offs between immune performance and energy, ultimately endowing them with immunological flexibility not available to endotherms.

0341 Fish Community Ecology, 555 AB, Monday 12 July 2010

Jennifer Granneman, Mark Steele

California State University Northridge, Northridge, CA, United States

An Assessment of Reef Fish Communities on Artificial and Natural Reefs in the Southern California Bight

Despite the extensive use of artificial reefs worldwide, it is still not clear how well these manmade structures mimic natural reefs or whether they succeed in increasing the net production of fishes in an area. To determine how closely artificial reefs mimic natural reefs, we studied five pairs of artificial and natural reefs in the Southern California Bight. Underwater visual transects were used to quantify fish and invertebrate assemblages on the reefs and to measure physical characteristics of the reefs. Artificial reefs had greater fish densities and higher species richness of fishes along the benthos than found on natural reefs, but there was no difference in fish density and species richness in the water column. Overall, artificial reefs were found to have significantly greater fish densities and higher species richness than natural reefs. Artificial reefs were also found to be more rugose and had greater vertical relief than natural reefs; whereas macroalgae was more abundant on natural reefs. The artificial reefs studied were generally smaller than the natural reefs, but largest artificial reefs tended to be most similar to the natural reefs. There was a positive correlation between both reef rugosity and invertebrate density with fish density. No significant correlation was observed between species density and reef size or macroalgae density. Multiple regression analysis revealed that reef rugosity was the best predictor of both species richness and fish density. Overall, the differences in habitat on the two reef types likely explain the patterns of fish density and species richness observed.

0344 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

David M. Green

Redpath Museum, McGill University, Montreal, Quebec, Canada

Spring Emergence in Fowler's Toad

Global climate warming is predicted to have effects on many aspects of the behaviour and ecology of organisms. Observations of increasingly early onset of spring breeding by anurans in northern latitudes have been related to an overall warming of temperatures, but there has also been apparently contradictory evidence. As temperature and precipitation are the two most likely proximal triggers of spring emergence in hibernating anurans, I tested their influence on the onset of springtime chorusing behaviour in a population of Fowler's toads over a period of 20 years. Although spring emergence from hibernation has tended overall to be earlier in spring

over the course of two decades, there was considerable variation in emergence date. Emergence probability correlated significantly with increased air temperatures above a minimum body temperature of 12°C for surface activity by toads. However, the triggering temperature for emergence from winter dormancy became progressively, and significantly, lower the longer the toads remained dormant underground. This indicates the likelihood that the toads' emergence may also be partly related to physiological depletion of body reserves. Rainfall was not significantly linked to emergence.

0416 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Eli Greenbaum¹, Jennifer Pramuk², John Carr³, Mark-Oliver Rödel⁴

¹University of Texas at El Paso, El Paso, TX, United States, ²Bronx Zoo/Wildlife Conservation Society, Bronx, NY, United States, ³University of Louisiana at Monroe, Monroe, LA, United States, ⁴Leibniz Institute for Research on Evolution and Biodiversity at the Humboldt University, Berlin, Germany

Evolutionary Relationships of African True Toads (Anura: Bufonidae: *Amietophrynus*) Inferred from Multiple Genes

African "true" toads (frog genus *Amietophrynus*) include about 38 morphologically conserved species that live in a panoply of habitats from the fringes of the Sahara to the mountains of South Africa. We examined the evolutionary relationships of these African bufonids by collecting approximately 4.5 kb of combined mitochondrial (12S-16S) and nuclear (CXCR4, POMC, and RAG1) sequence data from over 150 terminals from the genus *Amietophrynus*, and several non-*Amietophrynus* outgroups. These data were analyzed separately and in combination with previously published African toad data to give a greater representation of *Amietophrynus*. 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. Our phylogeny agrees in most respects with the results of the most comprehensive hypothesis investigating the relationships of African bufonids (e.g., the monophyly of African *Amietophrynus* is well supported). However, our improved taxonomic sampling elucidates several novel relationships, and widespread cryptic speciation suggests current diversity of *Amietophrynus* is vastly underestimated.

0076 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Katherine Greenwald¹, Robert Brodman¹

¹Ohio State University, Columbus, OH, United States, ²Saint Joseph's College, Rensselaer, IN, United States

Conservation of the Taxonomically Challenged: How Should We Protect Unisexual *Ambystoma* Salamanders?

Unisexual (all-female) populations of ambystomatid salamanders are widely distributed across eastern North America. These salamanders are generally triploid (three sets of chromosomes), but can be diploid, tetraploid and even pentaploid (two, four or five sets, respectively). The nuclear genome may be comprised of DNA from up to five "true" (bisexual) species: the blue-spotted salamander (*Ambystoma laterale*), Jefferson's salamander (*A. jeffersonianum*), smallmouth salamander (*A. texanum*), tiger salamander (*A. tigrinum*), and infrequently the streamside salamander (*A. barbouri*). Despite the complexity of the nuclear genome, all unisexuals form a monophyletic group based on their mitochondrial DNA. The maternal ancestor of the unisexuals was most closely related to *A. barbouri*, with the original hybridization event likely occurring 2.4-3.9 million years ago. Unisexual salamanders present an interesting conservation conundrum. They currently receive no protection despite the fact that some populations have highly restricted ranges and may therefore be vulnerable to stochastic local extinction. This lack of protection exists in part because the herpetological community does not list unisexual salamanders by a scientific or standard name, and they are therefore ignored by "species-centric" legislation such as the Endangered Species Act. Here we consider the history, taxonomic complexity, and resulting conservation issues surrounding this unique group.

0406 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Patrick Gregory

University of Victoria, BC, Canada

New Insights from Old Data: Body "Condition" Dynamics and Feeding Patterns in Garter Snakes (*Thamnophis sirtalis*) from Central Manitoba

Large data sets are gifts that keep on giving, especially when they are old enough that new methods and new hypotheses allow new investigations. Here, motivated by a recent paper on body-condition dynamics of garter snakes in California, I revisit data on *Thamnophis sirtalis* collected at a large communal hibernaculum in Manitoba in 1969-70. Similar to the previous study, I found significant differences in patterns of relative mass change between the sexes and between seasons. Males lost significantly more mass

relative to body length than did females, especially over winter and during the spring mating period. Males remained at the hibernaculum in spring longer than females and those that had higher initial relative mass stayed at the den longer, consistent with another previous study of Manitoba snakes. These results, in conjunction with studies of reproduction in females, point to very different temporal patterns of reproductive costs in the two sexes. These differences also are supported by differences in feeding patterns by sex and reproductive state in summer, although the strength of this difference can vary between years.

**0600 Fish Life History, 551 AB, Friday 9 July 2010; ASIH STOYE AWARD
ECOLOGY & ETHOLOGY**

Kasie Groom

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

Potential Sites for Arginine Vasotocin Modulation of Sensory Systems Differ with Phase in a Sex Changing Teleost (*Thalassoma duperrey*)

The neuropeptide arginine vasotocin (AVT) and its mammalian homologue, arginine vasopressin (AVP), modulate aggression, territoriality, mating, other social behaviors, and sensory systems in vertebrates. In fish, AVT neurons project to important sensory processing regions in the brain, including the torus semicircularis (auditory) and the tectum (visual). The density of varicosities, or potential AVT release sites, is used as an indicator of the relative amount of AVT released within a region of the brain. Sequentially hermaphroditic fish, such as the saddleback wrasse, *Thalassoma duperrey*, serve as excellent models in which to study the effects of neuropeptides on behavior and sensory systems. These species use visual and auditory signals during reproduction, exhibit rapid changes in behaviors associated with sex change, and exhibit these changes independently of gonadal condition and steroid levels. Differences in varicosity density between the sexual stages of the wrasse may indicate a corresponding difference in sensory processing, modulated by AVT. This study defines differences between *T. duperrey* sexes in the number and size of cells in the brain that contain AVT. In addition, differences in the number of varicosities in the torus semicircularis and the tectum of each sex are evaluated. Definition of the relationship of development, function, and modulation of AVT to behavior and sensory processing may have important implications in the fields of ethology and reproduction and serve a key role in the development of therapies for human behavioral disorders, such as autism.

0504 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Carlos E. Guarnizo, David Cannatella

University of Texas at Austin, Austin, TX, United States

The Effect of Elevational Range on Population Gene Flow in Amphibian Species

Dispersal has a critical role in shaping the distributions of organisms. Even though in most cases rates of dispersal between populations are assumed to be symmetric, factors such as wind or currents may generate asymmetries. Asymmetric dispersal rates have important consequences for adaptive evolution given a trade-off in adaptation to different habitats. Environmental gradients across elevation expose populations separated by short vertical distances to extremely different environmental and selective regimes. For the same reason, it is expected that elevation gradients promote asymmetric dispersal, especially in tropical regions, where there is no overlap in temperature across elevations. We wanted to test the hypothesis that in amphibians dispersal is more common from highlands to lowlands (downwards) than vice-versa. We base our hypothesis on the fact that 1) Highland tropical populations display lower thermal restrictions across different temperatures relative to populations at lowlands; and 2) aquatic eggs and tadpoles are likely to be passively dispersed to lower elevations. To test this hypothesis we calculated bi-directional population migration rate under a coalescent framework in the tropical montane frogs *Dendropsophus labialis* (with aquatic eggs and larvae) and *Pristimantis achatinus* (with terrestrial development) using mitochondrial and nuclear DNA sequences. Preliminary data indicate that, against our hypothesis, dispersal from lowlands to highlands was on average higher than from highlands to lowlands. This result might be related with the evidence that the biota is moving up the mountains as climate gets warmer.

0311 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Jenny Gubler, Kirsten Nicholson

Central Michigan University, Mount Pleasant, MI, United States

Testing Biogeographic Hypotheses with the *Anolis limifrons* Group

Mainland Central and South America has a complex geologic history directly impacting the biogeographic relationships of its flora and fauna. Current Central America is composed of several tectonic blocks (Maya, Chortis, Chorotega, Choco, in order from north to south) that have reconnected the continents from north to south. It is well known that many species have invaded Central America from both continents, but the timing of movement and impact on speciation for some groups is unknown. Anoles are a species-rich group resident in Central America, with several widespread species

spanning or nearly spanning the entire land bridge. We sought to examine the phylogeographic relationships of one widespread species, *Anolis limifrons* (and closely related species, some of which have been recently described and separated from *A. limifrons*) and test the prevailing hypothesis that the mainland *Norops* clade originated in a northern block (Maya or Chortis) and subsequently disbursed southwards towards the Panamanian Portal. Using molecular data from samples throughout the range, we reconstructed the phylogeographic history of *A. limifrons* and compared our results to the hypothesized pattern. There exists some support for the hypothesized north to south pattern, and some populations may be recognized as full species rather than one, single widespread species.

0738 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Michelle Guidugli, Stephen Richter

Eastern Kentucky University, Richmond, Kentucky, United States

Reproductive and Spatial Ecology of an Ephemeral Pond-Breeding Amphibian Community

For many amphibian species the temporal and spatial patterns of migration are poorly understood. To better understand these processes, an ephemeral pond-breeding amphibian community was studied at Central Kentucky Wildlife Management Area, Madison County, Kentucky. The study pond was completely encircled using a drift fence-pitfall trap array and checked continually from January to October 2009. Meteorological and habitat data were measured to determine their influence on the timing and orientation of amphibian migrations. Although several amphibian species inhabited the study pond, *Ambystoma jeffersonianum* (Jefferson's Salamander) and *A. maculatum* (Spotted Salamander) were dominant in their abundance and length of pond occupancy for breeding. Breeding migrations of these species were explained by increased daily cumulative precipitation, mean air temperatures, and maximum changes in barometric pressure. Exiting migrations were primarily explained by warmer air temperatures in the winter and early spring for adults and mild summer air temperatures and increased rainfall for *A. maculatum* metamorphs. Entering migrations were non-randomly orientated for *A. jeffersonianum* and *A. maculatum* adults; however, exiting migrations were only non-randomly orientated for *A. maculatum* adults and metamorphs. Entering movements were weakly associated with distance to forest edge; however, *A. maculatum* exiting migrations were more strongly explained by distance to forest edge. These results exemplify how closely movements of amphibian species are linked to their environment. Amphibian populations are declining due to habitat destruction and fragmentation; therefore, this understanding of when and where different aspects of their habitat are used will aid in future conservation and land management.

0732 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Kevin Guilfoyle, Katie Fisher, Kent Hatch

CW Post Campus, Long Island University, Brookville, NY, United States

Does Toe Clipping Cause Marine Toads Excessive Stress?

In trying to mitigate pain inflicted on research animals, animal care and use committees impose restrictions on practices used to mark them. What is determined to be "painful" is based on anthropomorphic intuition rather than scientific evidence. Organisms that are evolutionarily distant and physiologically different may perceive "pain" differently than we do. While there is no way to quantify "pain" as such, the measurement of corticosterone levels can provide a quantitative way of measuring the stress caused by procedures perceived to be painful. Such data can provide animal care and use committees with the quantitative data they need to make appropriate decisions regarding procedures. To determine the extent to which toe clipping, a common marking procedure, induces stress in amphibians we measured plasma corticosterone levels in the marine toad (*Bufo marinus*). We compared this to stress levels imposed by captivity and stress levels imposed by captivity and handling, using the toads as their own controls.

0263 AES Ecology, 551 AB, Thursday 8 July 2010

Simon Gulak, John Carlson

NOAA Fisheries, Panama City Beach, FL, United States

Habitat Use and Movement Patterns of Pelagic Sharks in the Gulf of Mexico Using Pop-up Archival Satellite Tags

Pop-up satellite tags have been deployed on a number of pelagic shark species in the Gulf of Mexico and US south Atlantic to determine migration, movement patterns and habitat use. Since 2005, one longfin mako, two oceanic whitetip and two bigeye thresher sharks have been tagged in the Gulf of Mexico. However, data have been obtained only for 1 oceanic whitetip shark and 2 bigeye threshers. Data were obtained for a deployment of 20 days for the oceanic whitetip shark and 18 and 113 days for the bigeye threshers. Preliminary analysis suggests oceanic whitetip sharks are extreme epi-pelagic species rarely venturing below the thermocline regardless of time of day or water temperature. However, bigeye thresher sharks demonstrated a diel pattern of vertical movement defined by greater mean depths and larger depth ranges during night time hours. Depth and temperature data also suggested a behavioral change in vertical movements associated with an increase in sea-surface temperatures. All animals were tagged adjacent to the Mississippi delta. After tagging, the oceanic whitetip and one big eye thresher shark moved west following the continental shelf against the Loop Current

with the tag popping off near the Yucatan Peninsula. The remaining bigeye thresher also moved west but remained in the same area.

0044 Roads Symposium II, Ballroom B, Saturday 10 July 2010

Kari Gunson

Eco-Kare International, Peterborough, Ontario, Canada

Re-connecting Herpetofaunal Habitat across Roads in Southern Ontario: A Landscape-Level Strategy

Herpetofauna, especially in industrialized regions, are increasingly subjected to habitat loss as a result of increased road construction. Roads destroy, fragment, and degrade habitats, decreasing species diversity adjacent to roads. Additionally, herpetofauna are subjected to increasing numbers of vehicle collisions as they search for resources in habitats bisected by roads. Southern Ontario has the greatest density of roads, vehicles and herpetofaunal species in Canada and only 30% of its wetlands remains. What remains is severely fragmented and roads have been identified as a major threat for five of eight turtle species by the Ontario Multi-Species Turtles at Risk Recovery Strategy. Many agencies, including government, non-profit groups, and academia are partnering to mitigate road impacts with measures such as signage, wildlife crossings and fencing, and public awareness campaigns. The majority of these measures are on a local project-by-project basis; however, there is a pressing need to be proactive and develop a landscape-scale mitigation strategy that ensures herpetofaunal population viability. This presentation describes the steps undertaken to establish this strategy in Southern Ontario. A landscape-level model prioritizing segments of road for mitigation was developed using Geographic Information Systems, the best available geospatial layers, and road-kill data for validation. Further, a series of tools were used (e.g., effective mesh size to determine where mitigation will maximize connectivity). Stewardship tools and public awareness campaigns empower citizens to participate. Strategies and challenges in integrating road construction plans are discussed. Finally, opportunities for application of a landscape-level strategy to a province-wide turtle-crossing sign initiative are discussed.

0774 Herp Conservation I, 556 AB, Thursday 8 July 2010

Jacquelyn Guzy, Earl D. McCoy, Henry R. Mushinsky

University of South Florida, Tampa, FL, United States

Maintaining Biodiversity: Factors Affecting Amphibian Species Richness Among Small Isolated Wetlands in Central Florida

The biodiversity value of a wetland is linked not only to its position in the landscape relative to other wetlands, but also to its habitat characteristics. Small, isolated wetlands serve as sources or sinks within a metapopulation and their general importance in conservation has been documented. We monitored amphibian species richness among 12 small, isolated wetlands (which occur on lands permitted for phosphate mining) in central Florida during the 2005 and 2006 breeding seasons. We used seven habitat and landscape variables to characterize the environments of the wetlands and generalized linear models to determine which of these variables had the greatest influence on the occurrence of seven amphibian species (*Anaxyrus terrestris*, *Gastrophryne carolinensis*, *Hyla gratiosa*, *Lithobates capito*, *L. catesbeianus*, *L. grylio*, and *Pseudacris nigrita verrucosa*). Significant models for each species incorporated six of the seven habitat and landscape variables: distance to permanent water (2 spp.), distance to nearest wetland (3 spp.), vegetation heterogeneity (2 spp.), hydroperiod (2 spp.), presence/absence of fish (1 sp.), and canopy cover (1 sp.). We suggest that a diversity of environmental conditions among wetlands produces the greatest amphibian biodiversity in this system, and that conservation and restoration efforts should emphasize environmental heterogeneity.

0441 Poster Session I, Exhibit Hall D, Friday 9 July 2010

S. Insley Haciski, Jacqueline F. Webb

University of Rhode Island, Kingston, RI, United States

Developmental Morphology of the Mechanosensory Lateral Line System in Embryos of the Little Skate, *Leucoraja erinacea*

As depressiform elasmobranchs, batoids evolved dramatic body modifications that are accompanied by novel modifications in the course and distribution of the lateral line canals. In addition to cranial and trunk canals that are also found in sharks, batoid lateral line canals extend onto the pectoral fins, which are fused to the rostrum. We carried out a detailed histological analysis to describe both the anatomy of the lateral line canals and the pattern and timing of its development in embryos of the little skate, *Leucoraja erinacea* (30-80 mm TL). The first canals to form (supraorbital and trunk), appear as superficial cords (as reported in the older literature) in embryos of ~30 mm TL. These cords have sunk into the epidermis by 47 mm TL, but a lumen is lacking. In a 55 mm TL embryo, the cords have formed tubular canals that sit in soft tissue with an

epithelial wall surrounding a lumen, and are connected to the external environment via tubules. Thus, the pattern of canal development is dramatically different from that in bony fishes. In a 65 mm TL embryo, the dorsal and ventral canals appear to differ in diameter (mean = 56.9 μm and 83.5 μm , respectively). While vital fluorescent staining revealed what appear to be multiple discrete neuromasts between adjacent tubules, histological analysis revealed discrete neuromasts in the dorsal canals (longer than they are wide; mean = 87.2 μm and 31.6 μm , respectively) and neuromasts that form a continuous sensory epithelium in the ventral canals.

0374 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Bridgette Hagerty, Franziska Sandmeier, C. Richard Tracy

University of Nevada, Reno, NV, United States

Identifying the Genetic and Immune Consequences of Translocating the Mojave Desert Tortoise

Human population growth has caused negative habitat modification resulting in displacement of desert tortoises (*Gopherus agassizii*) in the threatened Mojave population. In Clark County, Nevada, managers implement 'rescue' translocations to remove tortoises from sites scheduled for urban development. These tortoises are tested for antibodies to *Mycoplasma agassizii* (pathogen implicated in causing upper respiratory tract disease). Individuals not testing positive for high levels of antibodies to *Mycoplasma* (tested by ELISA) are relocated to a large, fenced area southwest of Las Vegas. Our objective was to identify potential negative effects to the translocation population using genetic and immunological evidence from translocated and resident individuals at the translocation site. We hypothesized that if translocatees originate from genetically different populations compared to residents, they could potentially cause outbreeding depression. Using microsatellites, we successfully identified the population of origin for residents and translocatees. We detected only one individual at the translocation site that was assigned to a genetically distinct subpopulation compared to the residents, suggesting that translocatees likely would not alter the genetic signature of the resident population. We hypothesized that only translocating individuals that do not test positive for antibodies to *Mycoplasma* also would cause tested individuals to have lower levels of natural antibodies (and acquired antibodies) to *Mycoplasma*. Using Western blots and ELISAs, we determined that individuals in the translocation site had significantly lower levels of natural antibodies than genetically similar animals found in adjacent locations. These results may have serious implications for the ability of individuals to respond to future disease outbreaks.

**0734 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT
PHYSIOLOGY, 555 AB, Friday 9 July 2010**

Travis Hagey¹, Luke Harmon¹, Kellar Autumn²

¹University of Idaho, Moscow, ID, United States, ²Lewis & Clark College, Portland, OR,
United States

**Predicting Adhesive Capabilities in *Anolis* and *Phelsuma* Lizards via the
Frictional Adhesion Model and Critical Detachment Angle**

Geckos are capable of climbing rapidly on nearly any surface using branched microscopic setae on the pads of their toes. Previously, based on results from *Gekko gecko*, Autumn et al (2006) proposed the frictional adhesion model. In this model, the adhesive force (F_n) is anisotropic and controlled by the shear force (F_s), $F_s \geq -F_n / \tan \alpha^*$, where α^* is the critical detachment angle of the seta. This model may allow us to predict the adhesive abilities of other seta-bearing lizards. To test the generality of the frictional adhesion model, we measured the detachment angle in two lizard genera, *Phelsuma* geckos that have similar setal morphology to that of *G. gecko*, and *Anolis* lizards, which have smaller, unbranched setae. Like *G. gecko*, *Phelsuma* climb well on vertical and even inverted surfaces with apparent ease. While *Anolis* are agile climbers on inclined and vertical surfaces, they are found only infrequently on inverted surfaces. We measured α^* species averages between 27° and 35° in *Phelsuma*, similar to that of *G. gecko*. By contrast, α^* varied from 16° to 20° between *Anolis* species, yielding shear:normal force ratios from 3.4:1 to 2.7:1. To adhere, some *Anolis* lizards must produce nearly 250% of the shear force required by particular gecko species. Our results suggest that the frictional adhesion model may apply broadly to seta-bearing animals. The low critical detachment angle in *Anolis* may limit their habitat choice to non-inverted surfaces.

**0213 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556
AB, Friday 9 July 2010**

Kathryn Hale, Stephen Mullin

Eastern Illinois University, Charleston, IL, United States

**Predatory Responses as a Function of Native and Introduced Prey Types in
Neonate Gartersnakes (Colubridae: *Thamnophis*)**

Two species of gartersnakes, *Thamnophis hammondi* and *T. sirtalis*, live sympatrically where several species of prey have been introduced into their geographic range. These introductions could present novel challenges (e.g., unique chemical defenses) for the snakes and may influence their predatory responses. We presented neonate snakes of both species with chemical cues on cotton swabs in a random order from the following

prey types: 1. adult *Pseudacris regilla* (Pacific Treefrog; native); 2. adult *Lithobates catesbeianus* (Bullfrog; introduced); and, 3. adult *Xenopus laevis* (African Clawed Frog; introduced). We used distilled water and cologne as visual and olfactory controls, respectively. We recorded the total number of tongue-flicks and latency to attack. Following five daily consecutive presentations, all neonates were fed exclusively white cloud minnows (*Tanichthys albonubes*) for two weeks, and again presented with the chemical cues. Both snake species preferred the native Pacific Treefrog to the introduced prey types in both the naive and biased trials, with the number of attacks on the Pacific Treefrog being greater than those on other prey types. Only *T. hammondi* showed a preference for cues from the African Clawed Frog. A stronger response in *T. hammondi* was also elicited for naive as opposed to biased presentations for all prey types. Our study indicates that *T. hammondi* may have developed an innate predatory response to the African Clawed Frog, and these predators may be a useful resource in eradication efforts of this invasive anuran.

0253 AES Conservation & Management, 552 AB, Friday 9 July 2010

Loraine Hale, Ivy Baremore

NOAA Fisheries, Panama City, FL, United States

Age and Growth 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 by fisheries observers onboard commercial longline vessels. Sharks ranged in size from 39 cm fork length to 202 cm fork length, with an average size of 152 cm. All sandbar sharks were independently and directly aged by two readers using vertebral band counts (n=1245). Annual periodicity of growth bands has previously been validated. Ages were examined for precision and bias within and between readers. Growth curves including the von Bertalanffy growth curve, a modified two-parameter von Bertalanffy growth curve, and a Gompertz growth curve were derived from consensus counts of vertebral band counts and compared to find the model with the best fit to the data. Size selectivity of the gear was assessed and the growth estimates were used in stock assessment models for the species.

**0700 Herp Conservation III, Ballroom B, Sunday 11 July 2010; ASIH STOYE
AWARD ECOLOGY & ETHOLOGY**

Alexander Hall

Southwestern University, Georgetown, TX, United States

**Artificial Night Light and Nocturnal Anuran Calling Behavior in Northern
Michigan Vernal Pools**

Artificial lighting affects the physiology of nocturnal anurans; however, its effects on their behavior are still largely unknown. The goal of this study was to determine if artificial night lighting significantly affects male anuran calling behavior. Using the North American Amphibian Monitoring Program (NAAMP) protocol, seven vernal ponds in northern Wisconsin and Michigan were surveyed under a lit (800 lux) condition using a high intensity floodlight and an unlit condition (0.00001-0.1 lux). Overall, significantly fewer anurans called during lit than unlit surveys. Seven anuran species were detected during these surveys but only *Pseudacris c. crucifer* and *Hyla versicolor* were heard often enough for post hoc statistical testing. A non-significant trend revealed fewer *P. c. crucifer* called during lit surveys than unlit surveys. *H. versicolor* did not alter its calling behavior due to the lighting condition. Detected moonlight also accounted for some of the calling variance. Future conservation efforts directed towards anurans should address the potentially harmful effects of artificial night lighting on calling behavior.

0794 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Allison Hall, Amanda Hayes, Katelyn McCann, Charles Zwemer, Scott Boback

Dickinson College, Carlisle, Pennsylvania, United States

**Pressure and Duration of Constriction in *Boa constrictor* is Influenced by Prey
Heartbeat**

Constriction is energetically costly and therefore snakes should minimize time spent constricting prey. However, the consequences of arresting a constriction event too soon could be deadly. Thus, the duration of constriction is bounded by competing demands to kill prey and conserve energy. Snakes possess mechanoreceptors within their ventral and dorsal skin that are used for detecting approaching predators and prey. This experiment sought to determine whether Boas (*Boa constrictor*) can sense a heartbeat in their prey. We hypothesized that Boas have the ability to detect the heartbeat of their prey and use this stimulus to meter the duration and pressure of constriction. We predicted that Boas would constrict with greater pressure and increased duration when constricting a rat with an artificial heartbeat than those constricting rats without a

heartbeat. We simulated a heartbeat by pumping water into a cuff from an endotracheal tube inserted into the thoracic cavity of a thawed and warmed rat. Constriction pressure was recorded from snakes constricting rats with and without a heartbeat. Preliminary data suggests that snakes respond to a heartbeat and will constrict rats with a heartbeat for greater duration and greater total pressure relative to snakes constricting rats with no heartbeat. Others have suggested that constricting snakes may kill their prey via circulatory arrest. Our results suggest that snakes may be capable of sensing this and will adjust constriction duration accordingly.

0722 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

Janis Hall, Rebeka Rand Merson

Rhode Island College, Providence, RI, United States

Genomic Context of Shark Aryl Hydrocarbon Receptors

In order to understand the regulation of genes encoding aryl hydrocarbon receptors (AHR), which are involved in numerous physiological processes and the response to persistent environmental chemical pollutants, we investigated AHR loci in the spiny dogfish shark, *Squalus acanthias*. Resources for molecular biology and evolution of chondrichthyans are scarce, so we screened a bacterial artificial chromosome (BAC) library, EST databases, and performed targeted PCR. BAC plasmids from AHR-positive clones were prepared and then probed for other AHRs. Sequences were also obtained by shotgun sequencing of selected BAC clones. Our results support that tandem duplication of AHR genes occurred prior to the divergence of the Class Chondrichthyes from the vertebrate lineage. To further investigate these genes and identify regulatory regions, a "genome walking" approach is underway. Supported by RI-INBRE grant P20RR-016457 from the National Institutes of Health National Center for Research Resources (NCRR), and a MDIBL New Investigator Award funded by ME-INBRE (P20RR-016463) and the NIEHS Center for Membrane Toxicity Studies (P30ES-00382820).

0212 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Brian Halstead, Glenn Wylie, Peter Coates, Michael Casazza

U.S. Geological Survey, Dixon, CA, United States

Bayesian Shared Frailty Models of Survival for Adult Giant Gartersnakes (*Thamnophis gigas*) in the Sacramento Valley of California

Knowledge of survival rates is an essential component of understanding a population's life history and conserving species. Small sample sizes typical of radio telemetry studies of survival are exacerbated when studying long-lived species with short-term studies, because most individuals are censored and provide little information about mortality. We used Bayesian shared frailty models to overcome some of these difficulties associated with estimating survival of the Giant Gartersnake (*Thamnophis gigas*), a rare snake precinctive to the Central Valley of California, USA, from radio telemetry data across 10 sites over 14 years. The basic hazard structure was best approximated by a first-order autoregressive model with high serial autocorrelation, which resulted in support for a constant hazard model as well. Annual estimated survival rate was 0.65 (95% CI = 0.55 - 0.75). Behaviorally-based seasonal differences in survival had some support from our data, with greatest survival rates during brumation and lower survival during emergence/mating (median hazard ratio (relative to brumation) = 3.68, 95% CI = 1.41 - 10.36), parturition (3.41, 1.27 - 7.55), and gestation (3.00, 1.04 - 7.10). Post-parturition survival did not differ from brumation or other seasons. The median standard deviation for the random site effect was 0.26 (95% CI = 0.01 - 0.85), indicating relatively little difference in baseline survival among sites. Individual and habitat characteristics had little effect on survival over the northern portion of the Giant Gartersnake's range. Shared frailty models are an effective method to borrow strength from multiple studies to generate robust inference at large scales.

0781 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Alison Hamilton, Paul Barber

University of California, Los Angeles, Los Angeles, CA, United States

Multi-locus Genetic Measures of Connectivity for Indo-Pacific Reef Fish from the Coral Triangle

The vast majority of marine species are sedentary or have limited mobility as adults, with local populations sustained by the recruitment of larvae from distant sources. Despite the obvious importance of larval dispersal to connectivity among populations, developing accurate estimates of connectivity based on direct observation of larvae is difficult or impossible. In recent years, molecular genetics has contributed significantly to understanding larval dispersal and connectivity because dispersal patterns can be

inferred by comparing patterns of genetic similarity among populations. Although some species show strong genetic differentiation among populations from different geographic regions, genetic uniformity over broad geographic ranges has been recovered for other species. Whether the recovered pattern of genetic uniformity reflects high levels of dispersal-and thus gene flow- or is an artifact of sampling is not apparent. To generate fine-scale estimates of connectivity among populations of reef species in the Coral Triangle region of the Indo-West Pacific we are using next generation sequencing methods to discover and generate sequence data for a large number (100+) of anonymous loci. Multi-locus genetic measures of connectivity generated through this approach will be integrated with predictive geospatial models of connectivity to test hypotheses associated with diversification in the center of marine biodiversity.

0780 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Alison Hamilton¹, George Zug³, Christopher Austin²

¹*University of California, Los Angeles, Los Angeles, CA, United States*, ²*Louisiana State University, Baton Rouge, LA, United States*, ³*Smithsonian Institution, National Museum of Natural History, Washington, DC, United States*

Endemism, Morphological Conservatism, and Evidence for Adaptive Diversification in a Clade of Lizards from Oceania

Theoretical and empirical work has provided increasing evidence for the role of ecology in speciation. Invasion of novel environments such as during colonization of an island are frequently accompanied by changes in morphology, and have been implicated in speciation. Morphological variation may suggest adaptive diversification, however, morphological variation must be related to underlying genetic variation to rule out stochastic, selectively neutral explanations for observed patterns and avoid improper inferences about the role of ecology in the diversification process. To test hypotheses concerning the role of ecology in speciation, we build a multilocus phylogeny of the *Emoia samoensis* group, a diverse radiation of skinks from the islands of the Pacific Ocean, and integrate this phylogenetic framework with interspecific variation in morphological traits likely to be involved in fitness. We find no evidence for sympatric speciation in this lineage, but do find strong support for the role of ecology in the diversification of this species group.

**0047 Fish Ecology, 555 AB, Sunday 11 July 2010; ASIH STOYE AWARD
ECOLOGY & ETHOLOGY**

Caroline Hammerschlag-Peyer

Florida International University, Miami, Florida, United States

Intraspecific Variation in Habitat Use in Two Coastal Fish Species

Decline of marine fisheries has become one of the most severe global environmental crises. In fishery management efforts, fish species are often treated as homogeneous units, thereby tacitly ignoring potential intraspecific variation within taxonomic groupings. We used acoustic telemetry and stable isotope analysis to examine movement patterns of 20 gray snapper (*Lutjanus griseus*) and 20 schoolmaster snapper (*L. apodus*) in a Bahamian tidal creek. In particular, we examined 1) if intraspecific variation existed in fish habitat use and movement patterns, 2) whether that variation was a function of body size, and 3) if there was evidence of specialization in habitat use among individuals. We found that movement varied substantially among individuals regardless of body size and that some individuals exhibited frequent, repeated, movements to certain areas of the creek. Our findings suggest the importance of incorporating intraspecific niche variation into the study of coastal fish populations, a source of variation that may be often overlooked in traditional fishery management plans.

0405 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Paul Hampton, Brad Moon

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

Morphological Contributors to Gape Size in Snakes

Maximum gape and its influence on ecology and evolution is often discussed in snake studies. However, gape is often estimated from a single morphological characteristic and no study has directly measured gape. We measured gape for 13 deceased adult *Crotalus atrox* by forcing the mouth on a metallic cone. At the presumed maximum we measured the intermandibular distance and the diameter of the cone at the corner of the mouth. We measured SVL then the soft tissue was removed using dermestid beetles. We measured 19 osteological characteristics thought to contribute to gape. All morphological variables were regressed against SVL. The residuals were then analyzed with stepwise regression and model fit was determined using Akaike Information Criterion. Overall, single-variable measurements were better fit models than multiple parameter models. Delta AICc values for osteological measurements suggest quadrate length is the best indicator of maximum gape given the available models. However, the Akaike weight was not particularly high and the evidence ratio for mandible length

suggests that it essentially has equal goodness of fit. This study is a foundation for future studies examining the form and function of gape in snakes.

0704 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Antony Harold, Iris Kemp

College of Charleston, Charleston, South Carolina, United States

Systematic Analysis of the *Polyipnus triphanos* Species Complex (Teleostei: Sternoptychidae)

The marine hatchetfish genus *Polyipnus* is a clade of over thirty species occurring circumglobally, mainly in the tropics and subtropics. The *P. triphanos* species complex contains a series of forms that are similar to *P. triphanos*, as originally described, but vary in pigmentation pattern as well as some meristic features. We present a systematic analysis of specimens from the complex occurring in the northern part of the collective range from off Taiwan eastwards to the Philippines. Observations on qualitative morphological features were made, with emphasis on the body pigmentation, photophores, and other meristic features. We also obtained a set of landmark-based morphometric measurements for use in bivariate and multivariate statistical analyses. Sheared principal components analysis was used to assess and quantify size-free variation in body shape. Our analysis indicates the presence of two distinct species in this northern area, one of them being *P. triphanos* sensu stricto and the other undescribed. Additional undescribed species are likely present to the south, especially around the Indonesian Archipelago and the Coral Sea.

0084 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Karsten Hartel

Museum of Comparative Zoology, Cambridge, MA, United States

Karel F. Liem – Collection Builder

Karel Liem is maybe best known as a teacher, a teacher who taught introductory biology to hundreds of undergraduates every year for decades. He also taught graduate students the finer points of functional morphology. But at heart his first love was basic anatomy and due to that he deeply cared for the library of specimens that he curated. Before he came to Harvard he was the Associate Curator of Vertebrate Anatomy at the Field Museum of Natural History where he even brought a full sized adult rhinoceros into the collection (much to the chagrin of museum administrators). At the Museum of Comparative Zoology he faced a daunting challenge with a collection that had not been brought up to modern standards since the days of Louis Agassiz. Within a year he had

written and received his first NSF collections grant that gutted the collection, installed new floors and lighting, and erected new modern shelving. In turn the renovation set the ball rolling for a series of six additional NSF grants over 20 years. Ultimately, these grants allowed the collection to be used by over three decades of students and researchers. In addition, Karel directed the growth of the collection to over 1.3 million specimens which was over three times the size of the MCZ collection when he took charge in 1972.

0142 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Emily Harvey, Derek Girman

Sonoma State University, Rohnert Park, CA, United States

Chemical Cues as a Mechanism of Reproductive Isolation in Pacific Newts

Pacific Newts are a group of salamanders whose distributions range from Southern Alaska to Southern California and include the Rough-Skinned Newt (*Taricha granulosa*), the Coastal California Newt (*Taricha torosa torosa*), and the Red-Bellied Newt (*Taricha rivularis*). Because all three species ranges overlap in the North Bay of California, nature has provided a unique opportunity to study the mechanisms of reproductive isolation among species of Pacific Newts. In this region it has been observed that these three species utilize similar breeding habitat at similar times. Previous studies have eliminated courtship behavior as an isolating mechanism, and have produced viable hybrids under laboratory conditions. It may be that chemical cues play a role in reproductive isolation. We used an olfactometer to determine whether male newts respond appropriately to various olfactory sources (conspecific, heterospecific, sex, blank) to suggest that chemosensory cues are used to attract or repel potential mates.

0763 Fish Systematics II, Ballroom D, Monday 12 July 2010

Justin Havird¹, Lawrence Page²

¹*Auburn University, Auburn, Alabama, United States*, ²*University of Florida, Gainesville, Florida, United States*

A New Species of *Lepidocephalichthys* (Teleostei: Cobitidae) with Unique Sexual Dimorphism and Relationships in Southern Lineages of Cobitidae

Loaches of the genus *Lepidocephalichthys* are small, spined cobitids that range from India to SE Asia, Borneo, and Java. In a recent taxonomic revision, *Lepidocephalichthys* (Teleostei:Cobitidae) was diagnosed as being unique among cobitids in having the 7-8th pectoral rays of mature males modified. Here, a new species of *Lepidocephalichthys* from Thailand is presented in which mature males have a unique pectoral fin modification.

This consists of a large (extending over ~75% of the fins) dorsally projecting, serrated flange and a ventrally projecting flange. The ventrally projecting structure is unique among cobitids. Mature males of the new species also have a dark, mid-lateral stripe while females and immature males have dark, mid-lateral spots. This sexual dichromatism was also seen in several other cobitid species examined. An expanded phylogenetic analysis of cobitids, including previously published sequences and new material including the new species, reinforces the monophyly of *Lepidocephalichthys*. The new species was also recovered as a monophyletic lineage within *Lepidocephalichthys*. Relationships within southern lineages of cobitids, and the unique habitat (agricultural fields) of the new species are discussed.

0408 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Holly Hawk, Larry Allen, Michael Franklin

California State University, Northridge, Northridge, CA, United States

Genetic Diversity of Current Populations of Giant Sea Bass, *Stereolepis gigas*

The giant sea bass, *Stereolepis gigas*, is the largest, reef-associated, bony fish found off the coast of California, growing to at least 2.2 m and 227 kg. This species is an apex predator with a distribution from Humboldt Bay into southern Baja California and up into the northern Sea of Cortez. Populations are concentrated south of Point Conception. In the last century, commercial and recreational fishing depleted giant sea bass stocks to the point that a moratorium from fishing this species was declared in 1982. Because it is no longer the target of fisheries, recent data suggests that a resurgence of the giant sea bass population may now be underway. Succeeding the severe decline in the abundance of *S. gigas*, we predict the current gene frequencies will reflect a loss in genetic variability within the recovering population as a result of a bottleneck event. The D-loop region from mtDNA and cytochrome-B are being sequenced to determine the haplotype and nucleotide/genetic diversity of populations off the coast of southern California and the Sea of Cortez. Samples have also been collected from archived specimens from the Natural History Museum of Los Angeles, as well as from new specimens through collaborative efforts with local fish landings. By determining the level of genetic variability in the existing population (stock) of giant sea bass, inferences can be made as to the impact of overexploitation and to what extent current populations should continue to be protected.

0533 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Dror Hawlena

Yale University, New Haven, CT, United States

Colorful Tails Fade When Lizards Adopt Less Risky Behaviors

Colorful tails that become cryptic during ontogeny are found in diverse taxa. Nevertheless, the evolutionary bases for this change remain debated. Recent work suggests that colorful tails, deflective displays and striped patterns may represent anti-predator mechanisms used by immature lizards to compensate for being more active and hence more vulnerable to predation (increased movement hypothesis =IMH). I challenged the generality of IMH by comparing foraging behavior and frequency of tail displays across five *Acanthodactylus* lizards that vary in fundamental life history traits, before and after the tail changed color. As these species underwent changes in tail coloration, they congruently adopted less risky behaviors and reduced the frequencies of tail displays. Contrary to expectation, in two species the hatchling risky behavior resulted not from increased movements but from longer stay in exposed microhabitats. I suggest that colorful tails and deflective tail displays are synergistic anti-predator mechanisms neonates use to minimize the fitness consequences of using various risky behaviors rather than increased movement alone.

0679 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; ASIH STORER ICHTHYOLOGY AWARD

Malorie Hayes

Southeastern Louisiana University, Hammond, LA, United States

Phylogeography of *Percina nigrofasciata*

The Blackbanded darter, *Percina nigrofasciata*, possesses one of the largest geographic ranges within *Percina*, occurring throughout the Gulf Coastal Plain. In 1956, a morphological study identified two subspecies within *P. nigrofasciata*: *P. nigrofasciata nigrofasciata*, *P. nigrofasciata raneyi*, and a zone of intergradation for populations in the Altamaha, Combahee, and Savannah River system below the fall line. In the same study, multiple "races" were distinguishable by drainage. The wide geographic range of *Percina nigrofasciata*, along with morphological distinctiveness provides an excellent opportunity to investigate phylogeographic relationships. A multilocus approach (cytochrome b, S7 intron-1, and RAG1 exon 3) was employed to examine genetic structure across the range of *P. nigrofasciata*. Over 100 specimens were sampled throughout the Gulf Coastal Plain. Bayesian and maximum parsimony analyses of the individual loci recovered two distinct clades of *P. nigrofasciata*. These two clades are strongly divided into eastern and western groups with the Choctawhatchee as a possible genetic barrier. However,

analyses of the mitochondrial DNA recovered *P. nigrofasciata* as paraphyletic, whereas this nuclear DNA sequences did not recover the same results. The taxonomic implications of these results will be discussed.

0427 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Lisa Hazard¹, David Morafka*², Scott Hillyard³

¹Montclair State University, Montclair, NJ, United States, ²California Academy of Sciences, San Francisco, CA*, United States, ³University of California, Los Angeles, Los Angeles, CA, United States

Dispersal and Survival of Neonate and Juvenile Desert Tortoises Following Release from Natal Pens

Post-release behaviors of headstarted tortoises could be affected by the length of time spent within the nursery before release. We compared dispersal behaviors of neonate (< 2 month) and juvenile (6-8 years) Desert Tortoises (*Gopherus agassizii*) following release from the pens at the Fort Irwin Study Site (National Training Center, Fort Irwin, CA). When released 75 m from their home pen (year 1), juveniles initially attempted to return to the pen, moved more frequently than neonates, and selected hibernation burrows with non-random orientations (facing SSE), while neonates dispersed away from the pen, moved less frequently, and quickly settled into randomly oriented hibernation burrows. No confirmed mortality occurred in the first month post-release. When released 500 m away from their home pen (year 2; no neonates were available), dispersal direction for juveniles was random with respect to the home pen. Predation rate was high, with seven of 16 tortoises killed over a six-week period; predation was apparently caused by a single raven. Predation risk was significantly affected by size; only tortoises with masses below 125 g were taken. Head-starting of tortoises to a larger size (>125 g) could result in higher survival rates. For older animals, manipulating release distance from the home pen could be used to promote greater dispersal (possibly reducing predation risk or disease transmission due to high population density) or, alternatively, to encourage animals to remain within a protected area if dispersal into unsuitable habitat is a possibility.

0196 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Stacy Heath, Aaron Schrey, Earl McCoy, Henry Mushinsky

University of South Florida, Tampa FL, United States

Florida Sand Skink Genetic Diversity is Altered Immediately After a Fire

The imperiled Florida Scrub is maintained by infrequent fire. Fire is known to alter abundances of species and can alter genetic diversity. The Florida Sand Skink (*Plestiodon reynoldsi*) is a sand-swimming lizard that occurs on Florida Scrub habitats. Our objective was to determine if genetic diversity of Florida Sand Skink local populations is altered immediately after a fire and to determine if fires of varying sizes would have varying effects. We screened seven microsatellite loci in Florida Sand Skinks collected from six enclosures in two burn units at Archbold Biological Station. We estimated genetic diversity and genetic differentiation both before and after a controlled fire. One burn unit had a low intensity fire that only affected the area within two enclosures, with one enclosure not burned. The other burn unit had a high intensity fire that burned the entire unit including the three enclosures and the surrounding area. We found fires altered genetic diversity and genetic differentiation from what was observed before the fire. There was no clear pattern linking fire size to the change in genetic diversity. Our results indicate that Florida Sand Skinks may move greater distances immediately after a fire, which changes the local population.

0788 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Robert Hegna¹, Ralph Saporito², Maureen Donnelly³

¹University of Jyväskylä, Jyväskylä, Finland, Finland, ²Old Dominion University, Norfolk, Virginia, United States, ³Florida International University, Miami, Florida, United States

Aposematism in the Dendrobatid Poison Frog *Oophaga pumilio*: The Importance of Contrasting Colors and Frog Density on Natural Predation

Organisms use a variety of strategies to defend themselves against predation. Some organisms advertise their defenses to predators with conspicuous signals, a phenomenon known as aposematism. Despite over 100 years of research investigating aposematism, there are many fundamental questions that have not been resolved, such as the importance of contrasting colors (pattern) in aposematic signals as well as the initial evolution of aposematism. Controversy currently exists over the importance of contrasting colors in the warning displays of aposematic organisms, and increased densities of organisms is a mechanism often employed to explain the initial evolution of aposematism. Brightly colored poison frogs contain an alkaloid-based chemical defense,

and it has been recently demonstrated that coloration in the dendrobatid frog *Oophaga pumilio* functions as an aposematic signal to natural predators. Herein we report the results of two field-based experiments designed to gain a better understanding of the importance of frog pattern and frog density on natural predation of *O. pumilio* in Costa Rica. We used polymer clay frog models to experimentally evaluate natural predation rates on *O. pumilio*. The results of our first experiment indicate that frog pattern does not influence predation, suggesting that contrasting patterns in *O. pumilio* do not influence the effectiveness of the aposematic signal. The results of our second experiment reveal that non-gregarious increases in frog density result in a decrease in natural predation, and provide some experimental evidence to suggest that increases in density may be a mechanism by which aposematic characters initially evolved in dendrobatid frogs.

0443 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Kory Heiken

San Clemente, California, United States

Diet of the Western Patch-nosed Snake (*Salvadora hexalepis*)

The Western Patch-nosed Snake (*Salvadora hexalepis*) is a diurnal predator of the racer ecomorph. It inhabits grasslands, chaparral, sagebrush plains, piñon-juniper woodland, and desert scrub throughout the southwestern United States, Baja California, and northwest Mexico. In total, 477 specimens of *S. hexalepis* were examined, and seventy-five (15.7%) contained stomach contents that were identifiable as a prey type (squamate ova, lizard, mammal, or insect). Of the specimens which had consumed identifiable prey, thirty (40.00%) had preyed upon squamate ova, twenty-nine (38.67%) upon lizards, seventeen (22.67%) upon mammals, and two (2.67%) upon insects. For twenty-four cases of lizard predation and fifteen cases of mammal predation, a taxonomic identity was determined. Nineteen (79.17%) of the taxonomically identified lizard predations were upon whiptail lizards of the genus *Aspidoscelis*. Fourteen (93.33%) of the taxonomically identified mammal predations were upon rodents of the family Heteromyidae. Significant differences between *S. hexalepis* which consumed squamate ova, lizards, and mammals were found in snout-vent length (a measure of body size) and head length (a measure of gape size). Significant geographic variation in diet was discovered between snakes inhabiting coastal California, the Sonoran Desert, and the Mojave and Great Basin Deserts.

0162 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Heather Heinz, Todd Jackman, Aaron Bauer

Villanova University, Villanova, Pennsylvania, United States

Phylogeography of a Wide-ranging African Gecko: Cryptic Species in the *Chondrodactylus turneri* complex (Squamata: Gekkonidae)

The *Pachydactylus* group is a speciose clade of African geckos, most of which are characterized by small, highly circumscribed distributional ranges corresponding to particular substrate types or geographic features. The most conspicuous exception to this generality is *Chondrodactylus turneri*, a large-bodied, broad-toed, climbing species that ranges from northern South Africa to Angola in the west and Tanzania in the east. Widespread species represent a challenge to biogeographers trying to explain patterns of speciation. We used DNA sequence data from the nuclear marker RAG-1 and the mitochondrial ND2 gene from 90+ individuals from throughout the species' range to evaluate whether *C. turneri* is really a widespread single species or if its anomalous distribution is an artifact of current taxonomy. There is clear substructure within *C. turneri* and deep divergences between putative conspecifics are as great as those between some sister species pairs in *Pachydactylus*. Although several subspecies of *C. turneri* are recognized by some authors, it appears as if these named units do not correspond to the major lineages we identified. We conclude that *C. turneri* is actually a composite of several cryptic species, each with a more restricted and biogeographically homogenous distribution.

0328 AES Stress Symposium, 551 AB, Sunday 11 July 2010

Jill Hendon, Eric Hoffmayer

University of Southern Mississippi-Gulf Coast Research Laboratory, Ocean Springs, MS, United States

The Effects of Capture and Handling Stress on Atlantic Sharpnose Sharks, *Rhizoprionodon terraenovae*: A Comparison of Single and Repeated Stressors

Studies on stress in vertebrates typically use single or repeated capture and handling protocols to initiate a stress response; however, the difference between the physiological effects of these two methods can be significant. This study investigated the effects of single and repeated capture and handling on the secondary stress response of Atlantic sharpnose sharks, *Rhizoprionodon terraenovae*, from the northern Gulf of Mexico. Male sharks were captured by rod and reel during the summer months of 2001 and 2002. Single sampled sharks (n=33) were reeled in at 0, 15, 30, 45, or 60 minutes after hooking, and were bled via caudal venipuncture. Repeatedly sampled sharks (n=10) were reeled

in immediately after hooking to obtain a time 0 (~1.3 min) blood sample, were released while still on the line, and sampled again at 15 minute intervals for 60 minutes. All sharks were measured (total length, cm), weighed (kg), and released after the final blood draw. The secondary stress parameters analyzed were plasma lactate, glucose, osmolality, and hematocrit. Repeatedly sampled sharks exhibited heightened levels, as compared to single sampled sharks, for lactate ($p < 0.05$), osmolality ($p < 0.05$), and glucose ($p > 0.05$) at all times except 0. Maximal concentration differences of 217.5%, 9.8%, and 41.6% occurred at time 60 for lactate, osmolality, and glucose levels respectively. Hematocrit levels were consistent for both stress protocols at all time points ($p > 0.05$). These data indicate that the stress protocol and duration affects the physiological response of Atlantic sharpnose sharks and needs to be considered when making comparisons.

0323 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Tom Herman, Steve Mockford, Lilianne Arsenault, Jennifer McNeil

Acadia University, Wolfville, Nova Scotia, Canada

The Headstarting Program for Blanding's Turtle (*Emydoidea blandingii*) in Nova Scotia: From Tenuous First Steps

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. Research on the ecology of Blanding's turtle in Nova Scotia conducted in the 1980's suggested low juvenile recruitment. Based on this information headstarting was adopted to bolster this recruitment. In the early 1990's two small scale headstarting experiments were conducted to provide headstarted turtles and to develop the needed husbandry. Of the 30 hatchlings headstarted and released in these early experiments at least five still survive in the wild. The headstarting program was extended and expanded in 2005 after a Population Viability Analysis estimated an extinction risk of 58% after 400 years. In 2006, 58 eggs were collected following oviposition and incubated at Oaklawn Farm Zoo. In 2008 this was expanded; 137 eggs were collected from the Kejumkujik National Park sub-population, which represents approximately 50% of its known reproductive output and 28% of the known reproductive output of Blanding's turtles in Nova Scotia overall.

0554 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Patricia Hernandez¹, Christopher Martin², Peter Wainwright², Dominique Adriaens³, M. Masschaele³, M. Dierick³

¹*George Washington University, Washington, DC, United States*, ²*University of California- Davis, Davis, CA, United States*, ³*Ghent University, Ghent, Belgium, Belgium*

Of Bulldogs and Bozos: Divergence in Size and Structure of Cranial Features within Incipient Species of Bahamian pupfish with Different Diets

Sympatric speciation has often resulted in significant morphological differentiation of trophic features. A young radiation of *Cyprinodon* species, characterized by distinct head and body shape, resides within hypersaline lakes in San Salvador, Bahamas. Not only are these incipient species morphologically distinct, our gut content analyses show they have distinct diets. These trophic morphs include a detritivore, a specialized scale feeder and a hard prey specialist. Moreover, another prospective morph shows a tendency towards a more piscivorous diet. Previous work describing cranial differences within these morphs examined only basic changes in head shape. To more carefully assess the specific morphological differences that characterize this Bahamian radiation we have dissected, cleared and stained, and micro-CT scanned individuals. The most significant differences were seen between the scale feeder and all other morphs. While some meristic characters (tooth number) underwent changes, much of the trophic divergence within this radiation was due to changes in continuous variables. For example, while all morphs contained the same basic divisions of the adductor mandibulae complex, the relative size and connectivity among divisions varied substantially. All divisions of the adductor mandibulae were significantly larger in the scale biting morph. Overall, scale specialists showed the most divergent morphology, suggesting that divergent selection for scale-biting might be stronger or act on a greater number of traits than selection for either piscivory or durophagy.

0402 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Maria Isabel Herrera Montes, T. Mitchell Aide

University of Puerto Rico, Rio Piedras, San Juan, Puerto Rico

The Effect of Anthropogenic Noise on the Calling Behavior of Anurans in Urban Areas in Puerto Rico

Most studies of the effects of noise on animal communities have focused on individual species and few have tried to understand the community level implications. Puerto Rico has high levels of anuran abundance and endemism. There is also a very high density of

highways, cars and noise. We evaluated car noise effects at three levels: community (species composition), species (activity hours), and individual (call structure). In 20 forests we compared two sites with different noise level: near (> 60dB) and far (<60dB) from the highway. All forest sites were similar in vegetation structure. In each site, we used automated recording devices that recorded one minute every 20 minutes for three consecutive days. A total of 1,920, one minute recording were analyzed for species presence. There was no affect of noise on the anuran community composition. Two possible explanations are: 1) little overlap between traffic noise and anuran calling activity, and 2) species maybe pre-adapted to high levels of background noise (e.g. high densities of call frogs). Although there was no community level effect, there was more calling activity at the far sites and at least one species (*E. coqui*) has increased the low frequency of the “co” note in sites near the highway. The results suggest that anthropogenic noise is a disturbance factor that can affect the calling behavior of anurans in urban areas in tropical regions.

**0690 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Susan Herrick

University of Connecticut, Storrs, CT, United States

Temporal Calling Patterns of Syntopic Ranid Frogs

Phenotypically similar species are hypothesized to adjust their behavior when they coexist to decrease competition. Pond-breeding frogs constitute an ideal system to address this hypothesis because multiple species may compete for noise-free periods to call for mates. American bullfrogs (*Rana catesbeiana*) and green frogs (*R. clamitans*) commonly co-occur in breeding ponds. Males of both species vocalize to defend territories and attract females. However, bullfrogs call more aggressively than green frogs and are expected to control access to the limiting acoustic resources. I predicted that green frogs increase chorusing activity in periods of bullfrog inactivity and that these patterns can be detected at both diel and seasonal scales. I used automated acoustic software to identify bullfrog and green frog vocalizations through two breeding seasons. Temporal partitioning occurs on a seasonal time scale. Bullfrog and green frog calling rates are both high early in the season in late May but then diverge. Bullfrog calling rate peaks in mid-June and drops sharply thereafter. In contrast, green frog calling falls to low levels in June but then rebounds when bullfrog calling declines, so that green frog calling reaches a second peak in late June and tapers off thereafter, ceasing in early August. There is no evident temporal partitioning on shorter time scales. Both species call most from midnight until 0600. However, the diel timing of bullfrog calling is predictable, whereas green frog calling is more variable. These results suggest green frogs are responding to reduced bullfrog activity by adjusting their calling effort.

0712 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

Sean Hersey, Rebeka Rand Merson

Rhode Island College, Providence, RI, United States

Functional Divergence Among Multiple Aryl Hydrocarbon Receptors in Sharks

The aryl hydrocarbon receptor (AHR) is a member of the basic helix-loop-helix Per-ARNT-Sim (bHLH-PAS) family of heterodimeric transcriptional regulators. AHR is a ligand activated transcription factor that regulates genes in response to persistent environmental pollutants such as dioxins and dioxin-like compounds. In addition, AHR has multiple roles in cell physiology. *Squalus acanthias* (spiny dogfish) expresses multiple AHR genes. AHR1, AHR2, and AHR3 were cloned and expressed as GFP fusion proteins in mammalian cells. Subcellular localization and response to PCB-126, a typical AHR ligand, was observed by fluorescence microscopy. We performed reporter gene assays to assess the ability of shark AHR1, AHR2, and AHR3 to activate an AHR response element-driven promoter in the presence of a typical ligand. AHR2 rapidly localizes to the nucleus in the presence of a typical AHR ligand and activates the gene reporter. AHR3 is constitutively nuclear regardless of the presence or absence of ligand and supports ligand-dependent reporter activation. AHR1 does not localize to the nucleus or induce expression of the same reporter in the presence of a typical ligand. This functional divergence among AHR1, AHR2, and AHR3 supports the hypothesis that multiple AHR genes present in early vertebrates have distinct functions and indicate partitioning of ligand-dependent and ligand-independent roles of AHR among these gene products. Supported by RI-INBRE grant P20RR-016457 from the National Institutes of Health National Center for Research Resources, and a MDIBL New Investigator Award funded by ME-INBRE (P20RR-016463) and the NIEHS Center for Membrane Toxicity Studies (P30ES-00382820).

0079 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Michelle Heupel¹, Colin Simpfendorfer², Danielle Knip², Andrew Chin², Jimmy White²

¹*School of Earth and Environmental Sciences, James Cook University, Townsville, Qld, Australia,* ²*Fishing and Fisheries Research Centre, School of Earth and Environmental Sciences, James Cook University, Townsville, Qld, Australia*

Spatial Ecology of Nearshore Elasmobranchs

Nearshore systems are commonly inhabited by a suite of elasmobranch species. Despite extensive data on the distribution and composition of coastal elasmobranchs, limited

attention has been given to examining how these species share habitat. This study examines the spatial utilisation of a coastal system by six elasmobranch species. Acoustic telemetry was used to monitor the presence and movements of pigeye, spottail, blacktip reef and scalloped hammerhead sharks in addition to giant shovelnose rays and whitespot guitarfish. Analysis of home range size, overlap of space use within the site and distribution of individuals and populations are examined to define relationships among these species. Preliminary analyses reveal that smaller shark species (pigeye, spottail, blacktip reef) have little overlap in spatial use and distribution. Giant shovelnose rays and whitespot guitarfish overlap in spatial use, but individuals of these species tend not to use the same regions and appear to show some segregation. Scalloped hammerheads showed the broadest movement of any species using the entire monitored region overlapping spatial use with all other species. With an elasmobranch community comprised of over 20 species, studies in Cleveland Bay, Qld reveal that inter-specific interactions occur and that at least some species appear to partition themselves within this habitat.

0197 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Dennis Higgs, Daniel Heath

University of Windsor, Windsor, Ontario, Canada

The Evolution of Hearing Specializations in Sciaenid Fishes

The ability to hear low frequency sounds is present in all known teleosts but many species have also evolved an expanded high frequency hearing range. While the evolutionary drivers behind this enhanced bandwidth have been widely discussed, little effort has been expended to directly test hypothesized evolutionary mechanisms. The family Sciaenidae - encompassing 270 species in 70 genera with a broad range of hearing specializations, habitats and environments - represents an ideal group to test evolutionary origins of high frequency specialization. Specifically, mapping hearing bandwidth onto a molecular phylogeny will determine the evolution of hearing specializations in the Sciaenidae. We first constructed a molecular phylogeny of the Sciaenidae and then mapped onto this new phylogeny swimbladder specializations known to affect hearing ability. A phylogeny were constructed using combined CO1 and 16s rRNA sequences from 32 sciaenid genera encompassing a global range of specimens. In addition, museum specimens were obtained from the 32 sciaenid genera for which sequence data were available to quantify swimbladder specializations as a proxy for presumed high frequency hearing ability. Existing databases were also examined to determine habitat characteristics of each species to test habitat-based hypotheses on the evolution of teleost hearing specializations. Based on our new phylogeny, swimbladder-based hearing specializations have evolved at least three times independently in the Sciaenidae. There was little evidence for a habitat-based driver for the evolution of specializations in this family but additional drivers are still being investigated.

0474 Herp Physiology, 556 AB, Monday 12 July 2010

Jacques Hill¹, Keith Geluso³, Steve Ricke⁴, Irene Hanning²

¹Field Museum of Natural History, Department of Zoology, Chicago, IL, United States,

²University of Arkansas, Food Science Center, Fayetteville, AR, United States,

³University of Nebraska at Kearney - Department of Biology, Kearney, NE, United States, ⁴University of Arkansas, Center for Food Safety IFSE and Department of Food Science, Fayetteville, AR, United States

Bacterial Diversity in the Gastrointestinal Tracts of Three Species of Anurans

We characterized bacterial diversity in the stomachs, small intestines, and large intestines of *Rana catesbeiana* (10 adults and 10 tadpoles), *Bufo woodhousei* (10 adults and 10 post-metamorphs), and *Rana blairi* (10 juveniles) using polymerase chain reaction/denaturing gradient gel electrophoresis (PCR/DGGE). Anuran specimens were collected from central Nebraska in August of 2009. Specimens of the same species were collected from the same locations. Individual organs contained from 0 to 33 bacterial species (mean 13.2). Within a species, microbial communities from the same organs varied considerably among individuals with similarity values ranging from 0 to 79%. Organ type appears to have affected bacterial diversity with large intestines showing the highest diversity compared to stomachs and small intestines. Larval *R. catesbeiana* guts contained relatively simple microbial communities (16 or fewer species) with high similarities among individuals while adults contained more diverse bacterial communities with low similarities. Thus life history stage seemed to have influenced microbial diversity. Presence or absence of digesta in an organ also affected microbial diversity and organs without digesta contained less diverse microbiota. Studies in humans and agriculturally important animals indicate that gastrointestinal tract (GIT) microbiota function in nutrient acquisition, immunity, and vitamin synthesis and microbiota probably have similar functions in anurans and other vertebrate ectotherms. Almost nothing is known about the diversity and function of GIT bacteria in reptiles and amphibians. We hypothesize that GIT microbiota can influence important life history traits such as growth rates, survival, and reproduction and that variation in GIT microbial communities could affect the fitness of individuals.

0409 Herp Conservation I, 556 AB, Thursday 8 July 2010

Jacques Hill III¹, David McLeod², Kyle Miller Hesed³, Shabnam Mohammadi⁴, Taksin Artchawakom⁵

¹Field Museum of Natural History, Chicago, Illinois, United States, ²Biodiversity Institute, Lawrence, Kansas, United States, ³University of Maryland, College Park, Maryland, United States, ⁴Old Dominion University, Norfolk, Virginia, United States, ⁵Sakaerat Environmental Research Station, Nakhon Rachasima, Thailand

Herpetofaunal Diversity at Sakaerat Environmental Research Station, Northeast Thailand: Revisiting a Historically Important Site

We studied the diversity and abundance of reptiles and amphibians at Sakaerat Environmental Research Station (SERS) in Northeast Thailand using drift fences with pitfall and funnel traps, road cruising, and visual searches during three periods from May 2004 to August 2007. We compared our results to herpetofaunal diversity data collected at SERS in the early 1970s. Our study recorded a total of 90 species of reptiles and amphibians, including 34 snakes, 29 lizards, 2 turtles, and 25 frogs. A study conducted approximately 40 years ago reported a total of 103 species comprising 48 snakes, 29 lizards, 2 turtles, and 24 frogs. Our results were very similar to those of the previous study, and most of the differences in species records between the two studies can be attributed to differences in sampling techniques and effort. We did not utilize leaf litter plots or aquatic sampling, which were used in the previous study. New records we reported at SERS include the snakes *Naja kaouthia* and *Coelognathus flavolineata*, the lizard *Riopa haroldyoungi*, and the frog *Limnonectes megastomias*. We failed to find the snakes *Cryptelytrops albolabris* and *Bungarus fasciatus* and the frog *Rhacophorus bimaculatus*, which were recorded at SERS 40 years ago. Our results indicate that protected areas like SERS can effectively conserve diversity of herpetofauna over long periods. Furthermore, our results suggest that even well-studied areas in Southeast Asia may be home to unrecognized diversity, and knowledge of these areas' biodiversity may increase from additional surveys.

0170 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010

Eric Hilton¹, Duane Stevenson²

¹Virginia Institute of Marine Science, Gloucester Point, VA, United States, ²NMFS, Alaska Fisheries Science Center, Seattle, WA, United States

Morphology and Developmental Osteology of the Prowfish *Zaprora silenus* (Zoarcoidei: Zaproridae), with Comparisons to Other Zoarcoid Fishes

The prowfish, *Zaprora silenus*, is the sole nominal member of the family Zaproridae. It is found in the waters of the North Pacific, from California through the Bering Sea and Sea of Okhotsk, to northern Japan. Past anatomical studies of this species have been based on relatively few specimens from a limited geographic range, and have not included cleared and stained specimens. We will present the results of a new study of the morphology of *Zaprora* based on a series of over one-hundred specimens, ranging in size from 9.8 to over 400 mm SL from throughout its range (California, Bering Sea, Hokkaido); preliminary results suggest little or no geographic variation in morphometric or meristic data. Among the zoarcoids, *Zaprora* is relatively "fish-like," in contrast to the elongate, eel-like body plan of most zoarcoids. We cleared and stained a series of larval and post-larval specimens (9.8 mm to 180 mm SL) to describe the ontogeny and anatomy of the skeleton. The axial skeleton shows an unusual pattern of development, with the neural and haemal arches and spines forming as exceptionally thin, elongate structures, except for those posterior to PU6, which are relatively thick. The uroneural is unique in having a jagged anterior margin. *Zaprora* has been interpreted as the sister-group of a clade containing Anarhichadidae, Stichaeidae, Pholidae and Scytalinidae based on the presence of anterior anal-fin spines. We will present a preliminary comparison of the skeleton of *Zaprora* to that of other zoarcoid fishes.

0118 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Matthew Hinderliter

The Nature Conservancy, Camp Shelby, MS, United States

Effects of Age, Size, and Burrow Quality on Survivability of Head-Started Gopher Tortoises (*Gopherus polyphemus*)

Previous telemetry studies of hatchling Gopher Tortoises have shown that 90 - 100% of the animals die within two years, and the lack of small burrows found during surveys on Camp Shelby (Mississippi) helps to support the idea that there is minimal recruitment occurring on base. To investigate what is happening to the young juvenile tortoises, a head-starting study was begun in 2006. Each year for the last four years,

hatchlings were obtained from natural nests or incubated eggs. Some of the hatchlings went into a predator-proof pen; others were released back to their natal burrow with radio-transmitters, along with older head-started tortoises that had been living in the pen. Objectives of the study are to compare cause and extent of mortality, growth, home range, burrow use and construction, and movement patterns. By monitoring juveniles over several years, we should be able to determine if and when there are size thresholds that make tortoises less susceptible to certain types of predation, if there are different behaviors that appear to increase survivorship, and if any trends emerge that reveal a fitness deficit related to habitat quality or genetic mixing. Preliminary results show that predation rates are only slightly higher in hatchlings compared to one and two-year-old tortoises. Ability to construct a better (i.e., longer) burrow appears to be more strongly linked to longevity than either age or size, although it is unclear why some tortoises either never dig at all or only dig shallow burrows (“pallets”).

0052 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Daniel Hocking, Kimberly Babbitt

University of New Hampshire, Durham, NH, United States

The Contribution of Woodland Salamanders to Ecosystem Functions

Our research focuses on the contributions of amphibians to ecosystem functions and services. Because many amphibians are relatively small and cryptic compared with other vertebrates, their potential contributions to ecosystems are often overlooked. However, amphibians can occur at exceptionally high densities and possess qualities that may make them key players in the trophic dynamics of forest ecosystems. For example, red-backed salamanders (*Plethodon cinereus*) have high energy conversion efficiencies, high calcium concentrations, and are a link between above- and below-ground food webs through their roles as invertebrate predators. To examine the role of red-backed salamanders, we created 10 plots and randomly assigned them as either control or salamander-depletion. Between May 2008 and August 2009, we removed 2,676 salamanders from the five depletion plots. This is an average of 1.70 salamanders removed per m². In fall 2009, we visited all plots without removing any additional salamanders. We counted 248 and 114 salamanders in the reference and depletion plots, respectively. This suggests that approximately 54% fewer salamanders currently inhabit the depletion plots. Within the plots, we examined how red-backed salamanders affect (1) leaf litter and fine wood decomposition rates, (2) nitrogen mineralization potential, (3) acorn germination, (4) oak sapling growth and survival, and (5) the amount of insect damage inflicted on oak sapling foliage. These ecosystem functions affect forest community structure and provide critical support for valuable ecosystem services.

0316 AES Conservation & Management, 552 AB, Friday 9 July 2010

Eric Hoffmayer¹, James Franks¹, Jennifer McKinney¹, Jill Hendon¹, William Driggers III²

¹The University of Southern Mississippi/Gulf Coast Research Laboratory, Ocean Springs, MS, United States, ²NOAA Fisheries, Mississippi Laboratories, Pascagoula, MS, United States

Advances in Whale Shark (*Rhincodon typus*) Research in the Northern Gulf of Mexico

Reports of whale sharks, *Rhincodon typus*, in the northern Gulf of Mexico date back to the 1930's; however, few studies have provided information beyond observational accounts. To address the lack of knowledge pertaining to the biology, distribution and movements of whale sharks in the western North Atlantic Ocean, the University of Southern Mississippi's Gulf Coast Research Laboratory initiated the Northern Gulf of Mexico Whale Shark Research Program in 2003. One of the program's primary objectives is to document the distribution of whale sharks in the northern Gulf of Mexico in collaboration with fishermen, helicopter pilots, offshore petroleum industry personnel and other researchers. To date, over 300 whale shark sightings have been recorded with approximately one third of those sightings relating to aggregations of up to 200 individuals. This research has revealed that whale sharks are relatively abundant in the northern Gulf of Mexico and their seasonal occurrence is highly predictable. Additionally, satellite tagging data and photo identifications have established connectivity between whale sharks in the northern Gulf of Mexico and the Caribbean Sea. The purpose of this presentation is to discuss what is now known about whale sharks in the northern Gulf of Mexico, current research efforts, and future directions of our study of these sharks.

0320 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Eric Hoffmayer¹, Jennifer McKinney¹, James Franks¹, Jill Hendon¹, Bruce Comyns¹, Susan Lowerre-Barbieri², Sarah Walters², Joel Bickford²

¹The University of Southern Mississippi/Gulf Coast Research Laboratory, Ocean Springs, MS, United States, ²Florida Fish and Wildlife Conservation Commission, St. Petersburg, FL, United States

Boys Gone Wild: Using Male Spotted Seatrout, *Cynoscion nebulosus*, Courtship Sounds to Map Spawning Habitat in Mississippi Coastal Waters

Spotted seatrout, *Cynoscion nebulosus*, is a highly prized saltwater recreational fish in the Gulf of Mexico. Given that they spawn in estuarine and nearshore waters and are highly

exploited, a critical need for sustainability is to assess and protect spawning habitat. The objective of this study was to use passive acoustics to identify locations of spotted seatrout spawning aggregations based on male courtship sounds. The following environmental parameters were also measured at sampling sites and were used to evaluate spawning habitat: temperature, salinity, dissolved oxygen, depth, flow, and bottom type. The acoustic survey was conducted within two Mississippi estuaries: Grand Bay (a pristine bay included in the National Estuarine Research Reserve) and Biloxi Bay (a heavily impacted bay) from May to September 2008 and 2009. Seatrout aggregations were heard at nearly three times as many locations in Grand Bay (n=93) compared to Biloxi Bay (n=24). In Biloxi Bay, salinity (>22 ppt) was significantly higher in locations where spotted seatrout aggregations were present, and a positive association with artificial structure was observed. In Grand Bay, stations containing aggregations were in significantly deeper water (> 2.5 m) than stations without aggregations, and aggregations were often associated with sandy bottom habitat. Additionally, the majority of spotted seatrout spawning aggregations in both estuaries were within close proximity (< 0.4 km) to steep bathymetric relief (1-2 m). This research needs to be expanded throughout Mississippi coastal waters to gain a better understanding of critical spotted seatrout spawning habitat.

0329 AES Conservation & Management, 552 AB, Friday 9 July 2010

Fiona Hogan¹, Steven Cadrin², Ken Oliveira³

¹University of Massachusetts School for Marine Science, Dartmouth, MA, United States, ²NOAA/UMass Cooperative Marine Education and Research Program, University of Massachusetts Dartmouth School for Marine Science and Technology, Dartmouth, MA, United States, ³University of Massachusetts Dartmouth, Dartmouth, MA, United States

The Use of Oxytetracycline Marked Vertebrae to Validate Age Determination of Winter Skate (*Leucoraja ocellata*)

Conservation of skate species is increasingly important for management of New England fisheries. Age validation is needed to improve stock assessments and the scientific basis of fishery management. To validate annual band deposition in winter skates, we injected oxytetracycline into live animals collected from commercial fishing vessels and afterwards maintained in the laboratory. The skates were fed daily to satiation and held up to one year. At the end of the study, we sacrificed the animals and microscopically examined sections of their vertebrae under ultraviolet light. On each vertebral section, we observed a single band after the oxytetracycline mark indicating the presence of an annulus, thereby supporting the use of vertebrae in aging of winter skate. The oxytetracycline-marked vertebrae were also used to evaluate back calculation models and examine the growth history of individual animals.

0229 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Lisa Hollensead¹, John Carlson², Dana Bethea², R. Dean Grubbs¹

¹Florida State University, Tallahassee, FL, United States, ²NOAA National Marine Fisheries Service, Panama City, FL, United States

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

Historically, the U.S. range of smalltooth sawfish stretched from North Carolina to Texas including the Gulf of Mexico. Due to fisheries bycatch, habitat loss, and a low productivity, the US population has declined leading to their inclusion on the U.S. Endangered Species Act in 2003. Necessary to their recovery is a description of critical habitat, mandated in the Smalltooth Sawfish Recovery Plan. Using passive acoustic telemetry and active tracking, precise delineation of smalltooth sawfish activity space and patterns of habitat use can be determined. Juvenile smalltooth sawfish less than 1 meter total length are fitted with dual-coded transmitters and tracked for given time periods while an array of acoustic receivers is anchored in and around Turner River, Mud Bay, and the Lopez River system within Everglades National Park for continuous monitoring. Of particular interest are difference in occurrence between dredge spoil islands and natural habitat. Preliminary data indicate juvenile smalltooth sawfish spend several days circling dredge spoil islands more than natural habitats. In 2009, nineteen juvenile smalltooth sawfish were captured either in Mud Bay or Turner River near dredge spoil islands with a high degree of site fidelity. Of those, five were recaptures. Four of these recaptures had been originally tagged in Mud Bay and returned back to the same mud flat.

0545 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Daniel Holt, Carol Johnston

Auburn University, Auburn, Alabama, United States

The Effect of Noise on Behavior and Acoustic Communication in the Blacktail Shiner (*Cyprinella venusta*)

Noise pollution is a serious problem that has increased dramatically with recent human development. Despite their seemingly quiet underwater habitat, freshwater fishes are not sheltered from elevated noise levels. Anthropogenic noise, along with natural noise sources including other organisms, waterfalls, rainfall, and water turbulence all contribute to a noisy aquatic environment. Higher noise levels can result in elevated hearing thresholds, and decrease the signal-to-noise ratio of acoustic signals. Because

many fishes use acoustic signals during critical life history stages (such as reproduction and territory defense), it is important to determine whether elevated noise levels affect behavior during these stages. We attempted to determine the effect of elevated noise levels on nest choice, acoustic communication, and reproductive and aggressive behaviors in *Cyprinella venusta*. To determine how noise affected nest choice, two underwater speakers were suspended over artificial crevice nests on opposite sides of a 1022 l tank. Band limited white noise was played from one speaker, while the other speaker remained silent. The amount of time spent, and number of aggressive and reproductive behaviors performed by males at the quiet nest was then compared to the noisy nest. To determine how elevated noise affected acoustic communication, trials during which the sounds and associated behaviors of *C. venusta* were recorded were performed in two tanks: one with elevated noise, and one with silence. Temporal and spectral acoustical parameters and behaviors were then compared between the two conditions to determine the effect of noise on sounds and behaviors.

0749 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Andrij Z. Horodysky¹, Richard W. Brill³, Michael L. Fine⁴, John A. Musick², Robert J. Latour²

¹Hampton University, Hampton, VA, United States, ²Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, United States, ³Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, MA, United States, ⁴Virginia Commonwealth University, Richmond, VA, United States

Acoustic Pressure and Particle Motion Thresholds in Six Sciaenid Fishes

Sciaenid fishes are important models of fish sound production, but investigations into their auditory abilities are limited to acoustic pressure measurements on five species. In this study, we used auditory brainstem response (ABR) to assess the pressure and particle acceleration thresholds of six sciaenid fishes commonly found in Chesapeake Bay, eastern USA: weakfish (*Cynoscion regalis*), spotted seatrout (*Cynoscion nebulosus*), Atlantic croaker (*Micropogonias undulatus*), red drum (*Sciaenops ocellatus*), spot (*Leiostomus xanthurus*) and northern kingfish (*Menticirrhus saxatilis*). Experimental subjects were presented with pure 10 ms tone bursts in 100 Hz steps from 100 Hz to 1.2 kHz using an airborne speaker. Sound stimuli, monitored with a hydrophone and geophone, contained both pressure and particle motion components. Sound pressure and particle acceleration thresholds varied significantly among species and between frequencies; audiograms were notably flatter for acceleration than pressure at low frequencies. Thresholds of species with diverticulae projecting anteriorly from their swim bladders (weakfish, spotted seatrout, and Atlantic croaker) were typically but not significantly lower than those of species lacking such projections (red drum, spot, northern kingfish). Sciaenids were most sensitive at low frequencies that overlap the peak frequencies of their vocalizations. Auditory thresholds of these species were used to estimate idealized propagation distances of sciaenid vocalizations in coastal and estuarine environments.

0736 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Christopher Howey, Willem Roosenburg

Ohio University, Athens, OH, United States

The Energetic Expenditures of the Black Kingsnake (*Lampropeltis getula nigra*) in Habitat Altered by Frequent Prescribed Burning

It is unclear how fire-induced habitat alterations affect the behavior and energetic expenditures of resident reptiles. Many previous studies have assumed that changes caused by prescribed fire (more open habitat) are beneficial to reptiles because it creates more basking habitat. However, if ecological costs (e.g., decreased food abundance and increased movement rates) of maintaining an elevated body temperature are too great, then reptiles may benefit by maintaining a lower (sub-optimal) body temperature. Therefore, the increased temperatures within a burned habitat could actually cause negative, indirect effects for reptiles. Abundance data may suggest that a reptile population appears to be healthy directly following an alteration of their habitat, but the true effects of the prescribed burn can only be determined by analyzing the indirect effects (i.e., energy expenditures of the animals, food abundances, predation intensity, movement rates, and availability of preferred thermal habitat). The objective of this project is to determine the effect of prescribed burning on reptile population dynamics and energy expenditure as influenced through changes in habitat quality relative to areas where fire was not used as a management strategy. Although this project has just recently begun, I am radio-tracking Black Kingsnakes (*Lampropeltis getula nigra*) and measuring energetic expenditures via doubly-labeled water. Energy expenditures are then correlated with changes in the environment (available habitat, prey, thermal habitat, body temperatures, and predation intensity). Each of these characteristics are also correlated with changes in body condition, movement rates, and reproductive success. All data collected to date will be presented.

0768 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

Lucy Howey¹, Bradley Wetherbee², Lance Jordan¹, Mahmood Shivji¹

¹*Nova Southeastern University, Guy Harvey Research Institute, Dania Beach, United States*, ²*University of Rhode Island, Kingston, RI, United States*

Movement Patterns and Habitat Utilization of Blue Sharks (*Prionace glauca*) in the Northwest Atlantic as Determined by Pop-up Satellite Tags

Blue sharks (*Prionace glauca*) are among the most abundant and widely distributed of all oceanic elasmobranchs. The fragmentary nature of blue shark life history information, including movement and migratory behavior, continues to limit management efforts

that require such data for stock assessment and sustainable catch modeling. To assist in obtaining a better understanding of blue shark movement in the northwest Atlantic, satellite telemetry was used to investigate habitat utilization and movements of individuals during the summer when the sharks form aggregations on the continental shelf off the Northeast United States, and during pelagic migrations. Thirty-one (26 male, 5 female) sharks were tagged with pop-up archival satellite transmitters. The transmitters reported data from a total of 1,656 combined days, yielding 74,163 depth and 74,125 temperature recordings. Tracked sharks exhibited two distinct movement patterns. During summer, the sharks remained within a restricted area south of Nantucket Island and occupied shallow depths (mean 8m). During fall, the sharks made directed offshore and southerly movements, with several sharks associating with waters east of Bermuda. During pelagic migrations, the sharks demonstrated markedly different habitat utilization, occupying much greater depths (mean 127m) and exhibiting clear diel depth patterns, not observed on the shelf. There were indications that the different demographic groups (immature females, mature and immature males) displayed different movement behavior. This study provides detailed information on habitat utilization and movement patterns of blue sharks in the northwest Atlantic, and underscores the need for further investigation of movement displayed by different demographic segments of the population.

0735 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

S. Tonia Hsieh

Temple University, Philadelphia, PA, United States

Does Dorsal Fin Coloration Correlate with Aggressive Behaviors in a "Terrestrial" Marine Blenny?

Although most fishes are obligatorily aquatic, the Pacific leaping blenny, *Alticus arnoldorum*, has taken terrestriality to an extreme. Found on the wave swept coastlines of the tropical Pacific Ocean, these blennies seldom submerge themselves underwater, feed and reproduce on land. Field observations have shown that they will also aggressively defend terrestrial territories. Territorial encounters frequently commence with head bobbing, followed by dorsal and pectoral fin flares. Further escalation results in acrobatic fights which can result in one or both blennies being knocked into the water. Interestingly, these blennies have an orange color tab on the anterior edge of the dorsal fin, which is visible only when the fin is extended. Furthermore, whereas the territorial individuals defend a limited region surrounding a rocky burrow and will stay with the burrow when the tide recedes, other blennies move with the tide and appear to be non-aggressive. This study had two goals: (1) to characterize the behavioral repertoire of these blennies; and (2) to determine if there is a correlation between dorsal fin coloration and territorial behavior. Fifteen minute focal point observations were performed for 165 individuals on the coastlines of Guam. Afterwards, the individual was captured and a photograph was taken of the fish with its dorsal fin extended beside a Macbeth

ColorChecker chart to enable quantification of dorsal fin coloration. Results show that male blennies spent considerably more time than females displaying, whereas females spent a greater proportion of time feeding. Behavioral correlations with fin coloration will also be discussed.

**0061 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT
PHYSIOLOGY, 555 AB, Friday 9 July 2010**

Xia Hua, John Wiens

Stony Brook University, Stony Brook, NY, United States

Latitudinal Variation in Speciation Mechanisms in Frogs

Speciation often has a strong geographical and environmental component, but the ecological factors that potentially underlie allopatric and parapatric speciation remain understudied. Two ecological mechanisms by which speciation may occur on geographic scales are allopatric speciation through niche conservatism and parapatric or allopatric speciation through niche divergence. A previous study on salamanders found a strong latitudinal pattern in the prevalence of these mechanisms, with niche conservatism dominating in temperate regions and niche divergence dominating in the tropics, and related this pattern to Janzen's hypothesis of greater climatic zonation between different elevations in the tropics. Here, we test for latitudinal patterns in speciation in a related but more diverse group of amphibians, the anurans. Using data from up to 79 sister-species pairs, we test for latitudinal variation in elevational and climatic overlap between sister species, and evaluate the frequency of speciation via niche conservatism versus niche divergence in relation to latitude. In contrast to salamanders, we find no tendency for greater niche divergence in the tropics or for greater niche conservatism in temperate regions. Although our results support the idea of greater climatic zonation in tropical regions, they show that this climatic pattern does not lead to straightforward relationships between speciation, latitude, and niche evolution.

0050 AES Morphology, 552 AB, Sunday 11 July 2010

Dan Huber¹, Danielle Noaker¹, Paul Anderson², Ilze Berzins³

¹University of Tampa, Tampa, FL, United States, ²Florida Aquarium Center for Conservation, Tampa, FL, United States, ³J.G. Shedd Aquarium, Chicago, IL, United States

Biomechanics of Spinal Deformities in Captive Sandtiger Sharks *Carcharias taurus*

The sandtiger shark *Carcharias taurus* is a popular exhibit specimen in public aquaria. However, captive *C. taurus* are prone to developing spinal deformities that often result in euthanasia. Biomechanical analyses of sections of vertebral columns and individual vertebrae from healthy and deformed *C. taurus* were conducted to characterize the mechanical basis of these skeletal deformities. Vertebral sections were subjected to bending tests, while individual vertebrae were subjected to compression tests and mineral content analyses. The flexural stiffness (resistance to bending) of vertebral columns from healthy animals was greater than that of deformed animals due to greater second moment of area, a structural property that measures the distribution of skeletal material away from the central axis of the vertebral column. The force required to buckle the vertebral column was greater in the healthy specimens as well. The compressive stiffness, yield strength, yield strain, and ultimate strength of vertebrae from healthy animals were greater than those from deformed animals. However, the compressive stiffness and ultimate strength of vertebrae from healthy specimens were still lower than those of most species for which data is available, suggesting an inherent predisposition for spinal deformity in captive settings where natural swimming behavior is constrained (increased swim-to-glide ratio, asymmetric swimming). This study is one portion of a collaborative investigation of husbandry practices, animal behavior, nutritional physiology, and spinal biomechanics of *C. taurus*, with the ultimate intention of developing better husbandry guidelines to improve captive animal health and reduce dependence on wild stocks for exhibit specimens.

Kristiina Hurme

University of Connecticut, Storrs, CT, United States

**Anti-predator Behavior in Schooling and Non-schooling Tadpoles (Anura,
Leptodactylidae)**

Tadpoles developing in temporary ponds must grow quickly to reach metamorphosis before the pond dries; these tadpoles must be more active and spend more time foraging than tadpoles of species developing in permanent ponds, but are also more susceptible to predation. Tadpole schooling may allow individuals to reduce predation risk by finding safety in numbers, and achieve foraging rates that would be too risky for individual tadpoles. While maximizing growth rates, schooling tadpoles might sacrifice their ability to escape from predators since individuals cannot maximize both growth rate and burst swimming speed. If tadpoles are unable to escape from predators, they may avoid capture by remaining inconspicuous within the selfish herd and avoiding detection. This strong selection for not being an “odd” individual can minimize variation in growth and behavior among individuals, and may result in stereotyped anti-predator behaviors. To determine if schooling tadpoles experience depressed anti-predator behavior, I performed predation trials with both schooling (*Leptodactylus insularum*) and non-schooling (*Physalaemus pustulosus*) leptodactylid tadpoles. For each predation trial, I recorded the activity levels of 10 tadpoles before and after the addition of a lethal insect predator. I found that schooling tadpoles exhibited significantly higher activity levels and were more vulnerable to predation than non-schooling tadpoles were. I will test to see if schooling tadpoles experience a higher encounter rate with predators, and have lower escape velocities than do non-schooling tadpoles. I will also test if non-schooling tadpoles exhibit greater spatial avoidance of predators than do schooling tadpoles.

0514 AES Ecology, 551AB, Thursday 8 July 2010

Nigel Hussey¹, Sheldon Dudley², Jeremy Cliff², Sabine Wintner², Jaclyn Brush¹, Aaron Fisk¹

¹University of Windsor, Ontario, Canada, ²KwaZulu-Natal Sharks Board / University of KwaZulu-Natal, Durban, South Africa

Documenting the Trophic Structure of the Shark Assemblage off Kwazulu-natal, South Africa Using Stable Isotopes

When considering that most sharks are apex predators, concern has been raised over their large scale removal and this effect on ecosystem structure, stability and function. Stomach content analysis has provided detailed insights into snapshot feeding habits and coarse resolution trophic level calculations, but tissue-integrated measures of trophic position and niche width of individual species within a shark assemblage remain largely unknown. Additionally, size based variation in trophic position of sharks is little understood. Here we report on the trophic structure of the shark assemblage off KwaZulu-Natal, South Africa, through the measurement of the isotopic composition ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$) of white muscle tissue. We document the $\delta^{15}\text{N}$ trophic structure for 17 species of sharks encompassing the principal 'large' shark families; Carcharhinidae, Sphyrnidae, Lamnidae and Odontaspidae, and include individuals from the families Triakidae, Alopiidae and Rhincodontidae. Furthermore, we present the range in $\delta^{13}\text{C}$ values of the shark assemblage using ^{13}C enrichment (coastal) and ^{13}C depletion (pelagic) as a measure of coarse resolution movement patterns. The fact that the stable isotopes of nitrogen and carbon are intrinsically linked will be discussed with reference to disentangling trophic position and movement patterns.

0483 Herp Physiology, 556 AB, Monday 12 July 2010

Deborah Hutchinson¹, Alan Savitzky², Akira Mori³, Gordon Burghardt⁴, Jerrold Meinwald⁵, Frank Schroeder⁶

¹Coastal Carolina University, Conway, SC, United States, ²Old Dominion University, Norfolk, VA, United States, ³Kyoto University, Sakyo, Kyoto, Japan, ⁴University of Tennessee, Knoxville, TN, United States, ⁵Cornell University, Ithaca, NY, United States, ⁶Boyce Thompson Institute, Cornell University, Ithaca, NY, United States

Recent Discoveries on the Sequestration of Defensive Steroids by *Rhabdophis tigrinus*

The Asian snake *Rhabdophis tigrinus* (Colubridae: Natricinae) possesses defensive structures known as nuchal glands in the dorsal skin of its neck that are used in antipredator displays. By performing feeding experiments, we demonstrated that *R.*

tigrinus accumulates cardiotoxic steroids (bufadienolides) in its nuchal glands by sequestering those compounds from ingested toads. Chemically defended mothers are able to provision bufadienolides to their offspring in utero, through deposition in yolk and by transfer into presumably shelled eggs late in gestation. We used oviposited eggs from bufadienolide-free mothers to test the feasibility of maternal provisioning of steroids across shelled eggs. We applied a solution of bufonid skin secretion to the surface of the eggs and found that bufadienolides penetrated the eggshells and accumulated in the nuchal glands of the embryos. The steroids identified from the nuchal gland fluid of *R. tigrinus* typically differ from those found in the skin secretions of toads. To test for modification of ingested steroids, we fed chromatographic fractions of toad toxins to hatchling *R. tigrinus* from a toad-free island. We collected samples of nuchal gland fluid several days after feeding and analyzed them by NMR- and mass spectroscopy and HPLC. We found that *R. tigrinus* is able to modify ingested bufadienolides in three ways: by ester hydrolysis, hydroxylation, and epimerization. These modifications are likely to affect the toxicity of the sequestered compounds, but in inconsistent ways, and may be more important in influencing uptake, transport, or storage of the toxins in the nuchal glands.

0543 AES Stress Symposium II, 551 AB, Sunday 11 July 2010

Michael Hyatt¹, Paul Anderson², Patrick O'Donnell³, Ilze Berzins⁴

¹Georgia Aquarium, Atlanta, GA, United States, ²The Florida Aquarium Center for Conservation, Tampa, FL, United States, ³Rookery Bay National Estuarine Research Reserve, Naples, FL, United States, ⁴John G. Shedd Aquarium, Chicago, IL, United States

Assessment and Comparison of Acid-Base Derangements from Capture and Handling Methods Among Three Species of Sharks: *Carcharhinus leucas*, *Negaprion brevirostris*, and *Sphyrna tiburo*

Blood gases were evaluated in three species of wild sharks (*Sphyrna tiburo*, *Negaprion brevirostris* and *Carcharhinus leucas*) in response to acute capture and handling stress.

Blood was sampled when first caught from either longline or gillnet, and again prior to release after handling, measuring and tagging. Blood was assayed for pH, partial pressure of carbon dioxide (pCO₂), bicarbonate (HCO₃), and lactate. Reference limits of the initial blood draw were established for each species, as well as the rate of change in pH ($\Delta\text{pH}/\Delta t$) and lactate ($\Delta\text{lac}/\Delta t$) from capture to release. ANOVA and Tukey's test were employed to detect species differences in these measures. pH in *C. leucas* (7.11 ± 0.03) (mean \pm SE) was significantly lower than in *S. tiburo* (7.24 ± 0.03); pCO₂ in *C. leucas* ($10.40 \text{ mmHg} \pm 0.60$) was significantly higher than in *N. brevirostris* ($7.87 \text{ mmHg} \pm 0.64$); HCO₃ in *N. brevirostris* ($3.30 \text{ mmol/L} \pm 0.31$) was significantly lower than in *S. tiburo* ($4.01 \text{ mmol/L} \pm 0.22$); and $\Delta\text{lac}/\Delta t$ in *S. tiburo* ($0.64 \text{ mmol/L/min} \pm 0.06$) was significantly higher than in *N. brevirostris* ($0.36 \text{ mmol/L/min} \pm 0.10$). *C. leucas* caught in gillnets suffered a greater degree of acidosis than on longlines, accompanied by a higher

lactate and pCO₂, suggestive of a mixed metabolic and respiratory acidosis. Discriminant analyses of pH, pCO₂ and lactate predicted capture method of *C. leucas* with high (84.6%) accuracy, but predicted behavioral release condition with less accuracy (64%); only pCO₂ was significantly lower in sharks graded with a higher ("good") condition.

0122 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Oliver Hyman¹, James P. Collins¹

¹Arizona State University, AZ, United States, ²Arizona State University, AZ, United States

Negative Influence of Phosphorus on Prevalence of the Frog Killing Pathogen, *Batrachochytrium dendrobatidis*

Global availability of biologically reactive forms of nitrogen (N) and phosphorus (P) has increased by at least two fold in the last century. These elements are often limiting nutrients in aquatic and terrestrial ecosystems and increases in N and P availability can influence ecosystem processes. New research has linked nutrient availability to infectious disease dynamics, especially in aquatic ecosystems. Many of these studies describe a positive relationship between N and P availability and infectious disease. We tested the relationship between N and P availability and an emerging infectious pathogen of amphibians, *Batrachochytrium dendrobatidis* (*Bd*). We sampled chorus frogs (*Pseudacris maculata*) for *Bd* at 20 ponds across the highlands of Arizona and tested for correlations between disease prevalence and concentrations of nitrate, ammonium, and phosphorus. All 20 ponds tested positive for the presence of *Bd*, and prevalence of infection varied from 2%-93%. Concentrations of nitrate and ammonium had no relationship to prevalence, but concentrations of phosphorus were negatively correlated with *Bd* prevalence. A laboratory study demonstrated a negative effect of P on *Bd* zoospore survival. These results contradict other studies showing increases in disease severity from increased nutrient availability and warrant further exploration into the effects of phosphorus on the dynamics *Bd* transmission.

0499 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Natalie Hyslop¹, Dirk Stevenson², John Macey³, Larry Carlile³, Chris Jenkins², Jeff Hostetler¹, Madan Oli¹

¹Department of Wildlife Ecology, The University of Florida, Gainesville, FL, United States, ²Project Orianna Ltd., Indigo Snake Initiative, Clayton, GA, United States, ³Fort Stewart Directorate of Public Works Fish and Wildlife Branch, United States Army, Fort Stewart, GA, United States

Population Ecology of *Drymarchon couperi* (Eastern Indigo Snake) in Georgia

Demographic data provide a basis for understanding the life history and ecology of species; however, little is known regarding the population ecology of most snake species, including the threatened Eastern Indigo Snake (*Drymarchon couperi*). We used 11 years of capture-mark-recapture (CMR) and 2.5 years of radiotelemetry data from southeastern Georgia, USA, in a CMR modeling framework to estimate apparent survival, capture and transition probabilities, and evaluate factors influencing these parameters. Using Cormack-Jolly-Seber (CJS) and multistate CMR, we constructed models representing a priori hypotheses concerning effects of intrinsic (sex, size) and extrinsic environmental factors (precipitation, site) on survival and capture probability. We also estimated population growth rate and proportional sensitivity to vital rates using a stage-structured matrix population model parameterized from estimates of stage-specific survival, transition probabilities, and reproductive parameters. The model-averaged estimated annual survival probability was 0.700 ± 0.030 and is comparable to that obtained from known fate analysis at the same site. Body size positively influenced survival, regardless of sex. There was no evidence that survival differed between sexes or season; however, capture probability differed seasonally by sex. There was also no evidence of effect of rainfall or site-specific differences in survival. Model averaged multistate estimate of annual adult survival was 0.738 ± 0.030 and 0.515 ± 0.189 for subadults, with an estimate of 0.998 ± 0.002 for transition probability. Population growth rate was approximately 1.02, suggestive of a stable or growing population, and was proportionally most sensitive to changes in adult survival rate, followed by juvenile survival.

0605 Herp Conservation III, Ballroom B, Sunday 11 July 2010

Matthew Igleski, Kirsten Nicholson

Central Michigan University, Mount Pleasant, MI, United States

What Environmental Variables Affect *Batrachochytrium dendrobatidis* Infection of Green Frogs (*Lithobates clamitans melanota*) in Michigan?

Due to a precipitous decline in amphibian populations, monitoring pathogens that affect amphibians has been a conservation priority. Information about location and impacts of pathogens, such as *Batrachochytrium dendrobatidis*, at a local scale is still being compiled. This study focused on determining if there was a presence of *B. dendrobatidis* in the Green Frog (*Lithobates clamitans melanota*) in Michigan, as well as examining if the prevalence of *B. dendrobatidis* infection would be influenced by environmental variables. This information is important to establish if environmentally influenced, physiological thresholds inhibit establishment of the fungus in temperate regions. Green Frogs had been documented as a resistant carrier of the fungus in other temperate region studies, but had not been sampled in Michigan. Sampling sites were haphazardly chosen throughout Michigan and visited during the summer of 2009. Several environmental variables were measured at each sampling site such as water temperature, conductivity, and pH. Skin swabs were collected and used to determine the presence of *B. dendrobatidis* on the skin using real-time quantitative Polymerase Chain Reaction. Nearly 500 samples from 33 sites in Michigan were collected. Most sites have returned positive samples, which suggests that the fungus is widespread in Michigan. The number of individuals infected and the level of infection will be used to determine if the environmental variables had an influence on *B. dendrobatidis*.

0284 Fish Conservation, Ballroom B, Friday 9 July 2010

Katriina Ilves¹, Andrea Quattrini², Loren Kellogg¹

¹*Academy of Natural Sciences, Philadelphia, PA, United States*, ²*Temple University, Philadelphia, PA, United States*

Assessing 50-year Change in Bahamian Reef Fish Assemblages

The last half-century has seen drastic changes in community composition in both marine and terrestrial biodiversity hotspots across the world. Many such changes have been attributed to direct human impacts, including pollution, habitat degradation, and hunting/fishing, as well as indirect causes such as climate change. The Caribbean Sea holds the greatest concentration of marine species in the Western Hemisphere. Prominent among these are >2000 fish species that are central players in Caribbean marine ecosystems. The Bahamas, like many Caribbean locations, is a popular tourist

destination, and has consequently experienced rapid development, particularly along coastlines. The historic Bahamian fish collections by former Academy of Natural Sciences curator James Böhlke and Charles Chaplin from the 1950s-1970s provide a set of baseline data of fish species diversity and distribution that is extremely rare in marine systems. With this knowledge of community composition during a relatively unimpacted period we can revisit exact localities and assess what changes have occurred over the last 30-60 years. In the spring and fall of 2006 four sites off the coast of New Providence Island, Bahamas were resampled using rotenone, with replicate sampling at three sites. These collections yielded over 5000 specimens, representing over 200 species. Rarefaction curves for the historical and current collections will be compared and univariate and multivariate analyses will be conducted to examine changes in community composition across sites, through time, and as related to environmental and life-history variables.

0689 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

Johanna Imhoff¹, Jason Romine², Chelsey Campbell¹, George Burgess¹

¹Florida Program for Shark Research, Florida Museum of Natural History, University of Florida, Gainesville, FL, United States, ²Columbia River Research Laboratory, WERC, USGS, Cook, WA, United States

Movements and Habitat Use of Juvenile Bull Sharks (*Carcharhinus leucas*) in the Indian River Lagoon System, FL, USA

The Indian River Lagoon System (IRL), Florida, USA, consisting of the Indian River, Banana River and Mosquito Lagoon, is known to be a nursery area for juvenile bull sharks (*Carcharhinus leucas*), but little is known about movements, habitat use, and residence time within this estuary. The northern Banana River is a refuge and closed to public access. We used passive acoustic telemetry methods to monitor the movements of juvenile bull sharks within this refuge and the adjoining IRL system. Since December 2008, 22 juvenile bull sharks (65-137 cm FL) have been tagged with Vemco V13 and V16T acoustic tags. Only one of the five sharks tagged in the refuge area has moved south out of the Banana River, into the Indian River proper. Once this animal entered Indian River it did not return to Banana River. Sharks that remained within the northern Banana River exhibited similar home range sizes. One of these sharks was found dead in February 2010 and is believed to have succumbed to unusually cold temperatures that occurred in January 2010. Sharks tagged in Indian River proper did not enter the Banana River and did not move north into Mosquito Lagoon. Three sharks tagged with V16T temperature sensing tags encountered temperatures of 18.7 - 25.2 °C with a mean of 21.7 °C.

0385 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Charles Innis¹, Eric Baitchman²

¹New England Aquarium, Boston, MA, United States, ²Zoo New England, Boston, MA, United States

Veterinary Contributions to Chelonian Head-Start Programs

Veterinarians may contribute to chelonian head-start programs in many ways. It is critical that infectious diseases are not introduced or translocated via the release of head-started turtles. As such, head-start programs must practice appropriate quarantine, isolation, disease screening, and diagnostic testing of captive turtles. In addition, programs should consider health screening of the source population to detect problems that may impact reproductive success, adult longevity, and hatchling survival. Veterinarians can provide advice on nutrition and husbandry of captive turtles, and provide medical care for ill individual turtles. Baseline medical data are lacking for many turtle species. Head-start programs offer an opportunity to obtain basic hematologic and plasma biochemical data, growth rates, dietary requirements, etc. Thorough post-mortem investigation, including histopathology and molecular diagnostics should be conducted for any head-start turtle that dies. Such investigations may reveal the cause of death, detect infectious pathogens that may have relevance to conspecifics, and detect other underlying problems (eg. evidence of a nutritional disorder). Finally, veterinarians can offer expertise in anesthetic and surgical techniques of chelonians, such as laparoscopic gender identification, passive integrated transponder tagging, etc.

0729 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Leigh Anne Isaac

University of Victoria, Victoria, BC, Canada

What are the Implications of Color Variation? Exploring Crypsis, Thermoregulation, and Behaviour in Dimorphic Populations of the Western Terrestrial Garter Snake, *Thamnophis elegans*

Color influences numerous aspects of the ecology of organisms, including foraging ability, communication, and defense against predators. Body color also influences the absorption and reflection of radiant energy, which contributes to thermoregulation of terrestrial ectotherms, such as snakes. If a snake's coloration confers thermoregulatory benefits that are linked with an increase in overall fitness, then, all else being equal, there should be strong selective pressure on color. But, colors that contribute to thermoregulation may conflict with other requirements, such as the ability to reduce

visibility to predators, which may also have potential implications on snake behaviour. I examined intraspecific differences in thermoregulation, crypsis, and behaviour in phenotypically distinct populations of the Western Terrestrial Garter Snake, *Thamnophis elegans*, across British Columbia, Canada, of light and dark *T. elegans*. I compared thermoregulation in outdoor enclosures, modeled crypsis from the perspective of potential predator types, and measured behavior in situ and in the laboratory for both color morphs. Overall, females maintained higher and less variable T_{bs} when gravid than nongravid in both colour morphs. Crypsis did not significantly vary between dark and light *T. elegans*. Snakes crawled faster at higher T_{bs} and dark *T. elegans* were generally faster. Light *T. elegans* had a significantly higher probability of moving when first detected in the field whereas dark *T. elegans* were more likely to move before capture. Both light and dark *T. elegans* exhibited some type of movement (e.g. twirling, thrashing) when held in the hand following capture.

0102 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Luciano Izzo¹, Gabriela Blasina², Daniel Figueroa¹

¹Laboratorio de Ictiología, Departamento de Ciencias Marinas, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata. Funes 3350 (7600), Mar del Plata, Argentina., Mar del Plata, Argentina, ²Concejo Nacional de Investigaciones Científicas y Técnicas (CONICET)., Mar del Plata, Argentina

Analysing the Feeding Strategy of *Bassanago albescens* (Barnard, 1923) in Waters of Argentina

Bassanago albescens inhabits the Argentine continental shelf between the 35 and 45°S, it presents a high biomass, enclosed environmental niche and benthic trophic habits. This species is caught as bycatch in trawling fisheries targeting Argentine hake, *Merluccius hubbsi*, and in next years, it can represent an interesting alternative before the collapse of the traditional fisheries. The present study analyzes the diet of *B. albescens* and determines its feeding strategy, from the analysis of the stomach contents. Samples used were obtained from research cruises conducted in two regions of the southwest Atlantic: south (43°S-51°S) and north (35°S-41°S). Total length and sex of each specimen were recorded, and it was observed that males are smaller than females. The importance of each prey, the feeding strategy and niche width contribution were determined for a total of 219 stomachs. The results showed that *B. albescens* have a wide food niche and it was composed by fishes, mollusks, crustaceans, equinoderms and polychaetes. In the present study, the diet of this species varies among regions. The squid, isopods, gammarid amphipods and teleosts were the mainly food items in south area. On the other hand, in north area the main preys ingested were the crabs, the ophiuroids, hyperiid amphipods and polychaetes. *Bassanago albescens* is a generalist predator although the dominant preys change along their geographical distribution. This pattern is a reflection of the plasticity to exploit peaks in prey abundance of this species, show an opportunist behavior.

0620 Herp Systematics, 551 AB, Monday 12 July 2010

Todd Jackman¹, Daniel Portik²

¹Villanova University, Villanova, PA, United States, ²University of California, Berkeley, Berkeley, CA, United States

The Development of Novel Nuclear Protein Coding Genes for Phylogeographic and Phylogenetic Studies

The use of nuclear DNA sequences in phylogenetic and phylogeographic studies has become nearly standard in herpetology. However, many of the commonly used nuclear DNA sequences do not have sufficient variation to make meaningful comparisons to mitochondrial DNA analyses. Using screening criteria that require both large and variable exons when comparing *Anolis* and *Gallus*, we have examined over seventy novel genes, developing primers and testing them in a wide variety of squamate taxa. Two markers (EXPH5 and KIF24) are highly variable and show promise at two levels. Below the species level, these markers have proven to be variable and informative in a large-scale phylogeographic study of two widespread species of African skinks. Above the species level, these markers, and others have been very useful in resolving phylogenies in two groups of Agamid lizards, cordylid lizards, and geckos. The general strategy we employed to find these genes is a promising approach toward finding large numbers of rapidly evolving nuclear protein coding loci in the future.

0802 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Laura Jackson, Kayla Basham, Mary White

Southeastern Louisiana University, Hammond LA, United States

Effects of Salinity on the Green Treefrog *Hyla cinerea*

Salinity levels in the Lake Pontchartrain Basin of southeastern Louisiana have been steadily rising over the past few decades. Previous research has demonstrated that such increases in salinity can act as a stressor to a variety of organisms, including plants and amphibians. A recent preliminary study showed that salinity levels over 6ppt resulted in a number of adverse affects on Green Treefrog eggs and larvae, including increased mortality, prolonged larval periods, and smaller size at metamorphosis. Although the effects of salinity on such life history characteristics have been studied, little is known about the cellular or biochemical effects of such stressors. We are studying the expression of a family of proteins often known as the heat shock proteins. This family of proteins includes members that are expressed in response to a variety of stressors including heat, salinity, and pH. The effects of increased heat and salinity on heat shock gene expression in *Hyla cinerea* embryos will be discussed.

0123 Roads Symposium II, Ballroom B, Saturday 10 July 2010

Scott Jackson

University of Massachusetts, Amherst, MA, United States

Outstanding Issues in the Use of Passage Structures for Amphibians and Reptiles

Over the past 20 years interest in the use of tunnel systems to facilitate movement of reptiles and amphibians across roads has steadily increased. It is not known how many of these structures have been constructed but it appears that few, so far, have been monitored to evaluate their effectiveness. As a result there remain many outstanding questions and issues that need to be investigated. How much light is needed within the tunnel? How important are open tops for providing light and moisture? How large should tunnels be and can smaller structures be used if they have open tops? Are amphibian and reptile tunnels effective for multi-lane highways? When using multiple tunnels what is the optimum distance between structures? Are fences parallel to the road effective or do they need to angle out away from the road? Do tunnels facilitate increased predation? Most of these questions can only be answered by a combination of controlled research studies and the monitoring of road and highway mitigation projects. What works well for one species may not work for another. It is important that we evaluate tunnel systems for a broad range of amphibians and reptiles in order to identify the most effective designs for multi-species projects. Careful consideration of the project objectives can also help provide answers to some of these questions.

0125 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Scott Jackson

University of Massachusetts, Amherst, MA, United States

Addressing Impacts of Road-Stream Crossing Structures on the Movement of Aquatic Organisms

As long linear ecosystems, rivers and streams are particularly vulnerable to fragmentation. There is growing concern about the role of road crossings - and especially culverts - in altering habitats and disrupting river and stream continuity. Most of the culverts currently in place were designed with the principal objective of moving water across a road alignment. Little consideration was given to fish and wildlife passage or other ecosystem processes such as natural hydrology, sediment transport, and the movement of woody debris. To address this issue will require more appropriate standards for road-stream crossing structures, different approaches to engineering and construction, field surveys to identify significant barriers to aquatic organism passage, and tools and approaches for setting priorities for culvert upgrade or replacement.

0068 Roads Symposium II, Ballroom B, Saturday 10 July 2010

Sandra L. Jacobson

USDA Forest Service, Bend, OR, United States

A Call to Action: Ten Steps to Take after the Symposium that Will Help Small Animals

The symposium highlights practical methods of reducing impacts to small animals from highways. Several of these methods are long-term fixes and will take consistent action and continued commitment to bring to fruition. However, immediate action items can be identified for participants to take home. Some of these action items are: 1) Identify cooperators with similar goals and objectives; 2) Identify local species of concern that may have been previously ignored; 3) Identify practices to implement in the short-term to reduce impacts; 4) Identify practices to implement in the long term; 5) Initiate a connectivity assessment that includes small animal movement and mortality concerns; 6) Integrate results with your State Wildlife Action Plan updates; 7) Identify highway projects on your State Transportation Improvement Program that might have threats or opportunities for small animals; 8) Identify people and resources that can be helpful in furthering knowledge and action on transportation ecology; 9) Innovate! The closing to the Symposium will incorporate lessons learned from the symposium speakers as well as insights found more broadly in the transportation ecology field.

0067 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Sandra L. Jacobson¹, Winston P. Smith²

¹USDA Forest Service, Bend, OR, United States, ²USDA Forest Service, Olympia, WA, United States

A Conceptual Framework for Assessing Barrier Effects to Small Animal Populations Using Variable Responses to Traffic Volume

Traffic volume (TV) can be a useful tool for predicting impacts to wildlife populations, but responses among wildlife taxa vary widely. We propose a conceptual framework to categorize four general responses to increasing traffic volume. Using behavioral responses regardless of taxonomic relationships should result in more appropriate mitigation measures for barrier effects to small animals. Non-Responders fail to detect or avoid lethal traffic, and attempt to cross highways regardless of traffic volume. Exemplified by invertebrates or lower vertebrates such as frogs or some snakes, complete barrier effects are the result of a probability of successful crossing of nearly

zero due to mortality as TV increases. Pausers detect danger as traffic volume increases, but have inappropriate and risk-increasing responses. Pausers include taxa in all vertebrate classes that exhibit responses such as crypsis, thanatosis, coiling in snakes, and simply stopping. Complete barrier effects as TV increases are both the result of high mortality as animals stop in the traffic lane, and can also be the result of avoidance at the edge of the road. Speeders increase their speed to exploit traffic gaps as TV increases, but further TV increases ultimately decrease the probability of successfully running gaps. Speeders include ungulates and rapidly-moving snakes. Barrier effects manifest both as a result of mortality and ultimately road avoidance. Avoiders are large mammals that avoid crossing attempts at fairly low TV or modify their temporal behavior to avoid traffic, thus they have the lowest mortality rates of the four groups.

0028 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Jochen A.G. Jaeger

Concordia University, Department of Geography, Planning and Environment, Montreal, Quebec, Canada

Is Road Bundling Beneficial? Modeling the Consequences of Road Network Configuration for Wildlife Populations

Roads increase wildlife mortality, reduce the amount and quality of habitat, and act as barriers to animal movement. Therefore, the monitoring systems for biodiversity and sustainable development in Switzerland have recently adopted an indicator of landscape fragmentation: The "effective mesh density" (effective number of meshes per 1000 km²) in Switzerland has increased by 230% during the last 120 years. How can this landscape change be assessed? I used a spatially explicit individual-based simulation model of population dynamics to (1) identify thresholds, to (2) assess how strongly the configuration of road networks modifies the thresholds, and to (3) identify characteristics of road configurations that make road networks less detrimental to animal populations. The results clearly supported the concept of bundling roads, i.e., several roads bundled close together, or an upgraded road with more traffic on it. Large un-fragmented parts of the landscape should be kept un-fragmented. The results also showed that the thresholds strongly depend on the behaviour of the animals at roads, e.g., the degree of road avoidance, which, in turn, depends on road characteristics such as traffic volume. Therefore, the German Federal Environment Agency has recently suggested to introduce region-specific limits to control landscape fragmentation and urban sprawl. This research aims at developing a network theory for road ecology and at designing less detrimental configurations for road networks. Empirical studies comparing landscapes with differing road network configurations should be conducted to test the model predictions, to improve the model, and to provide a better foundation for planning highway networks.

0218 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD

Kelsey James, David Ebert, Gregor Cailliet

Moss Landing Marine Laboratories, Moss Landing, CA, United States

Distribution and Reproductive Biology of the Starry Skate, *Raja stellulata*, from the California Coast

Coastal skate species worldwide are subject to targeted and incidental fishing pressures. Therefore, additional knowledge about their distribution and life histories is important for effective management. This study is the first to examine the reproductive biology of the starry skate, *Raja stellulata*. Skates were collected by trawl and longline along the coast of California from Bodega Bay to the Channel Islands from 2002 to 2009 on surveys conducted by the National Marine Fisheries Service (NMFS). Specimens were collected at depths from 60 to 147 m. A distribution map has been produced to characterize its depth and habitat utilization patterns. Specimens were measured (total length:TL), sexed, and macroscopically assigned a maturity status. Reproductive organs were weighed and measured during routine specimen dissections. In total, 78 females (15.1-75.5 cm TL) and 75 males (27.1-71.7 cm TL) were collected and analyzed. Females attained first maturity at 58.2 cm TL and 50% maturity at 63.6 cm TL; males attained first maturity at 46.0 cm TL and 50% maturity at 60.7 cm TL. The distribution and reproductive biology of *Raja stellulata* reported here, combined with ongoing research of the age and growth of this species, will help create necessary fisheries management strategies for this skate.

0231 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

Julieta Jañez, Raúl Zalazar, Dante Di Nucci, Martín Falzone

Temaiken Foundation, Escobar, Buenos Aires, Argentina

Preliminary Reference Blood Parameters for Southern Eagle Ray (*Myliobatis goodei*) in Captivity

Hematologic studies provide valuable data for animals in captivity and even when there is no information of a species in its natural environment. Information about blood reference parameters for skates and rays is scarce in the literature. The southern eagle ray *Myliobatis goodei* occurs off Mar del Plata throughout the year and was found as far south as 46°59'S. Little is known about the biology of this species in Argentina. We, therefore, initiated a preliminary study to achieve the first reference values about blood hematology and biochemistry for *M. goodei* in captivity. Blood samples from 19 southern eagle rays (10 females-9 males), maintained in the Temaiken Aquarium were obtained

without chemical immobilization. The blood and serum parameters values (mean± S.D.) for males and females were: hematocrit (25.00± 4.39; 24.90± 6.28)%, glucose (22.04±12.66; 14.91±11.90) mg/dl, cholesterol (116.99± 26.28; 124.93± 29.25) mg/dl, triglycerides (157.27± 52.08; 178.17± 67.75) mg/dl, aspartate aminotransferase (25.60± 17.72; 26.12± 19.69) U/l, alanine aminotransferase (25.50± 14.53; 11.35± 12.80) U/l, gamma-glutamyl transpeptidase (16.02± 9.85; 11.58± 9.35) U/l, lactate dehydrogenase (859.90± 478.70; 707.43± 586.68) U/l, pancreatic amylase (219.69± 72.93; 221.95± 79.96) U/l, total protein (5.91± 0.72; 6.45± 0.39) g/dl, albumin (2.29± 0.72; 3.66± 2.38) g/dl, urea (826.84± 140.41; 806.66± 147.47) mg/dl, creatinine (0.99± 0.39; 1.01± 0.58) mg/dl. Significant differences between sexes were detected only for alanine aminotransferase. This reference values will be useful for future evaluation of health status of southern eagle ray both wild and in captivity and mainly to aid in the management of this species in aquaria.

**0656 Fish Evolution, 555 AB, Saturday 10 July 2010; ASIH STOYE AWARD
GENERAL ICHTHYOLOGY**

Robert Javonillo

George Washington University, Washington, DC, United States

**A Supermatrix for Inference of Interrelationships among Characid Fishes
(Teleostei: Otophysi)**

Recently produced hypotheses for interrelationships among characid fishes rely upon either molecular or morphological data. These phylogenies agree in some aspects (e.g., monophyly of the “clade A” characids), but disagree in other regards (e.g., degree of relatedness between *Tetragonopterus* and *Stethaprion*, *Mimagoniates* and *Diapoma*). To address these inconsistencies while simultaneously resolving the position of the Characidae within the Characiformes, sources of new and published cladistic evidence were assembled in a supermatrix. The PhyLoTA Browser was used to survey GenBank release 172 for phylogenetically informative clusters of sequence data. Data added to GenBank subsequent to release 172 were also incorporated into downstream analyses. The largest data partition in terms of taxa (>300 terminals) consisted of a portion of the mitochondrial 16S gene, with 688 nucleotide positions (base pairs, bp). The second largest partition represented >150 species and 455 bp of the mitochondrial 12S gene. The third largest partition consisted of 135 species and 1247 bp of the nuclear RAG2 gene. Morphological data were extracted and updated from Mirande (2009, *Cladistics* 25: 574-613). Although the supermatrix consisted of more than 50% empty character cells (i.e., “missing data”), the distribution of informative characters allowed considerable phylogenetic resolution in supporting novel sets of phylogenetic relationships.

0054 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Benjamin Jellen, Robert Aldridge

Saint Louis University, Saint Louis, Missouri, United States

It Takes Two to Tango: Female Movement Facilitates Male Mate Location in Watersnakes (*Nerodia sipedon*)

For internally-fertilizing taxa to mate, members of the opposite sex must first locate one another. Therefore, animals have developed a number of methods with which to communicate. Snakes emit chemical signals (pheromones) informing conspecifics of their location and reproductive condition. Male snakes alter their movements during the mating period to increase their likelihood of encountering females (or their pheromonal trails) and this movement is typically viewed as the primary determinant in mate location. However, if males locate females using female pheromonal cues, female actions are likely also an important determinant. Hormone concentrations of reproductive female watersnakes (*Nerodia sipedon*) fluctuate throughout the mating period and peak shortly after shedding. Therefore, we wanted to determine if females alter their movements to facilitate male mate location during this period. We monitored the movement (daily distance moved, frequency, home range) of 28 free-ranging radio-equipped female *N. sipedon* throughout the 2007-2009 mating periods and related these movements to the shed cycle and male mate location. Female movement increased following shedding and females were more likely to be located by a male during this period. Female mean daily distance moved was related to how many males she was located by; her movement frequency, however, was not. We propose that females increase movement to broadcast their location and reproductive status over a greater area thus facilitating male mate location. Because increased movement is associated with increased costs (including mortality), females minimize these costs by increasing movement only during an abbreviated time in which they are most attractive.

0053 Herp Development, 556 AB, Sunday 11 July 2010

Benjamin Jellen¹, Sean Graham², Ryan Earley³, Robert Aldridge¹

¹*Saint Louis University, Saint Louis, Missouri, United States*, ²*Auburn University, Auburn, Alabama, United States*, ³*University of Alabama, Tuscaloosa, Alabama, United States*

Estradiol Varies Throughout the Shed Cycle and Influences Attractivity in Female Watersnakes (*Nerodia sipedon*)

Estrogen (e.g. 17 β -estradiol (E₂)) stimulates vitellogenesis, sexual behavior, and controls pheromone production in females. Because E₂ increases throughout vitellogenesis, its

role in attractivity (ability to attract males) may be masked in taxa whose mating period coincides with vitellogenesis. Thus, the relationship between estrous and sex steroids in snakes remains equivocal. Studies examining ophidian steroid hormones typically sample individuals monthly; however, this interval may not be sufficient to observe relatively brief, yet substantial, fluctuations in hormone levels. For example, females are attractive to males for a brief window (days) during the mating period and monthly sampling may miss hormone fluctuations associated with estrous. We sampled plasma E₂ of free-ranging adult female watersnakes (*Nerodia sipedon*) twice weekly during the 2008 and 2009 mating periods. Individuals were monitored daily and attractivity and stage in the shed cycle were recorded. Throughout the mating period, reproductive females experienced large E₂ fluctuations (up to 20-fold) coinciding with shedding and attractivity; non-reproductive females did not. Reproductive females had higher levels of E₂ and were located by more males than non-reproductive females. For females that attracted only one male (generally non-reproductive females), this occurred within 24 hrs of shedding. No female attracted a male prior to shedding during the mating period. We propose shedding enhances pheromone volatility in all females resulting in increased male mate location. However, in reproductive females, shedding also initiates an E₂ surge and these females maintain elevated levels of E₂ throughout the mating period facilitating male mate location.

0312 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Christopher Jenkins

Project Orianna, Clayton, GA, United States

The IUCN Viper Specialist Group: Viper Conservation on a Global Scale

Venomous reptiles are one of the most misunderstood and heavily persecuted groups of animals in the world. The majority of rare venomous snakes belong to the widespread family viperidae. There are over 225 species of vipers in the world distributed across all continents with the exception of Australia and Antarctica. Fourteen percent of vipers (32 species) are listed by the International Union for Conservation of Nature (IUCN) red list as Vulnerable, Endangered, or Critically Endangered. There are many threats that are common across viper species including direct human persecution, collection for the pet trade, habitat loss and fragmentation, and climate change. Despite being the most endangered of the large families of snakes no entity focused on the conservation of the entire taxon exists. To deal with this need, we have partnered with IUCN and viper specialists from around the world to develop a Viper Specialist Group. By forming a Specialist Group that can serve as a global voice for implementing viper conservation, we will have a much greater cumulative effect on the conservation of the viperidae as a whole. In this presentation I introduce the Viper Specialist Group including our Global Status Assessment of Vipers, a Viper Conservation Action Plan, and a series of focal initiatives including Project Orianna's efforts to conserve Eastern Diamondback Rattlesnakes.

0192 Fish Systematics II, Ballroom D, Monday 12 July 2010

Wilson Jere¹, Adrianus Konings², Jay Stauffer¹

¹Pennsylvania State University, University Park, PA, United States, ²Cichlid Press, El Paso, TX, United States

Two New Cichlid Species of the Genus *Mylochromis*, Lake Malaŵi, Africa

Two populations of the cichlid genus *Mylochromis* from Lake Malaŵi that resemble *Mylochromis incola* were examined. The first population occurs in intermediate habitats and was first recognized at Mumbo Island where some individuals were observed rolling over small pebbles in the same fashion as *Mylochromis labidodon*. The Mumbo Island population is diagnosed from *M. incola* by its shorter snout length (25 - 33 % HL vs. 39-46% SL) and shorter preorbital length (22-25% HL vs. 30-33% HL). The second population was observed at Boadzulu Island. The Boadzulu population is delimited from *M. incola* by its shorter lower jaw length (26-31% HL vs. 31-35% HL) and a longer distance between the posterior insertion of the dorsal fin to the posterior insertion of the anal fin (15-17 %SL vs. 12-14% SL). The preorbital head length distinguishes the Mumbo Island population (22-25% HL) and the Boadzulu Island population (26-40% HL).

0349 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010

Hwan Sung Ji, Kim Jin Koo

Pukyong National University, Busan, Korea, Republic of

Taxonomic Uncertainty of the Family Ophichthidae

The family Ophichthidae comprising 52 genera with about 290 species were recorded in the world. Ophichthidae were divided into two subfamilies, Myrophinae (11 genera) and Ophichthinae (41 genera), being characterized by the caudal fin rays (present in Myrophinae, absent in Ophichthinae) and gill opening (small vs. elongate). We investigated the molecular phylogenetic relationship of 10 ophichthid genera (*Echelus*, *Ophichthus*, *Ophisurus*, *Pisodonophis*, *Muraenichthys*, *Scolecenchelys*, *Brachysomophis*, *Xyrias*, *Myrichthys*, *Myrophis*) and two outgroups (*Anguilla japonica* and *Muraenesox cinereus*) using 983 bp of the mitochondrial DNA 12S rRNA sequences. The maximum likelihood tree showed the reciprocal monophyly of the subfamily Ophichthinae and the subfamily Myrophinae was supported by a 100% bootstrap value. However, *Muraenesox cinereus* of the family Muraenesocidae was located between the two subfamilies, suggesting non-monophyly of the family Ophichthidae. We also found the three species of the genus *Ophichthus* (*Ophichthus zophochir*, *Ophichthus serpentines*, *Ophichthus evermanni*) were clustered with the other genus *Pisodonophis*. For instance, *O. evermanni* was closely

clustered with *Pisodonophis cancrivorus*, requiring taxonomic review of the family Ophichthinae.

0676 Fish Systematics II, Ballroom D, Monday 12 July 2010

G. David Johnson¹, Hitoshi Ida¹, Jiro Sakaue¹, Takashi Asahida¹, Tetsuya Sado¹, Jun G. Inoue¹, Masaki Miya¹

¹NMNH, Smithsonian Institution, Washington, DC, United States, ²School of Marine Life Sciences, Kitazato University, Japan, ³Southern Marine laboratory, Korol, Palau, ⁴School of Marine Life Sciences, Kitasato University, Japan, ⁵Natural History Museum and Institute, Chiba, Japan, ⁶University College, London, United Kingdom, ⁷Natural History Museum and Institute, Chiba, United Kingdom

An Extraordinary Primitive Eel from Shallow Waters of Palau - New Family, Living Fossil?

A small eel, recently collected from a fringing reef cave in Palau, represents the most primitive Recent member of the Anguilliformes in a number of osteological features. It retains several bones that are either lacking or fused in other extant eels, most remarkable of these being separate premaxillae. It is uniquely specialized among anguilliforms in having collar-like elevations of the gill openings. Superficially, it most closely resembles members of the families Congridae and Anguillidae, however molecular sequence data place it with equal probability as the basal member of the basal family Synphobranchidae or as the sister group of all other Recent eels. Morphology unequivocally supports the latter hypothesis.

0419 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

Lisa Jones¹, William Driggers¹, Dana Bethea², Simon Gulak²

¹NOAA/NMFS Pascagoula Laboratory, Pascagoula, MS, United States, ²NOAA/NMFS Panama City Laboratory, Panama City, FL, United States

Reproductive Biology of the Cuban Dogfish (*Squalus cubensis*) in the Northern Gulf of Mexico.

In the northern Gulf of Mexico, the Cuban dogfish, *Squalus cubensis*, is the most commonly encountered squalid shark in deepwater trawl and longline catches; however, its reproductive biology remains almost completely unknown. To obtain basic reproductive data for *S. cubensis*, 72 males and 176 females were collected throughout the northern Gulf of Mexico while conducting fisheries-independent surveys and port sampling. The median STL at 50% maturity for males was 386 mm. All mature males,

regardless of date of capture, had semen present in the ductus deferentes and seminal vesicles. The median STL at 50% maturity for females was 464 mm. Ninety-two percent of all adult females captured were gravid, with brood sizes ranging from 1-4 (mean = 2.14, S.D. = 0.77). During mid-late fall, when the majority of samples were collected, embryos were observed in all stages of development, from blastodisc to term fetuses. During the same period, the diameter of the largest ovarian follicle ranged from 5 - 31 mm (mean = 14.96, S.D. = 5.12). The above data indicate that adult males are capable of reproducing throughout the year and the adult female segment of the population exhibits asynchronous reproduction with no resting stage.

0457 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Larreal Junior, Tito Barros, Enrique Quintero, Vanessa Blanquiceth, Gilson Rivas

Museo de Biología de la Universidad del Zulia, Maracaibo, Zulia state, Venezuela

Some Ecological Features of *Crocodylus acutus* in the River Santa Rosa and Negro Section, Municipality of Machiques of Perija, Zulia Venezuela and Handling of its Nesting in Controlled Incubation

Some reproductive aspects both in situ and ex situ of the American crocodile (*Crocodylus acutus*) were studied on two tributaries of Santa Ana River, Parroquia Río Negro, Municipio Machiques de Perijá, estado Zulia, Venezuela. During January and February of 2008 we searched several nests of *C. acutus* on both banks of the rivers. Two clutches were found on Río Negro (0.6 nests/km) and six in Santa Rosa (0.8 nests/km). At all sites we took environment characteristics around the areas where nests were found. A total of 256 eggs were obtained, an average of 32.4 eggs per clutch. Egg clutches were transferred for incubation ex situ in a temperature and humidity controlled room. The temperature of the incubated eggs was monitored twice. Incubation of the eggs were compared between complete clutches and half clutches, as well as both clutch sizes at three different depths. The average temperature of the eggs was 29.84 °C and the average of this variable was greater in the surface treatment (30.02 °C). Incubation time was between 93 to 98 days. The average hatching rate was 71.4%, the highest percentage of hatching success was obtained in the surface treatment (90.48%). No significant differences were observed in hatching percentage among the treatments of depth or full-versus half-clutches. The average biometric aspects of infants from nests found in the rivers Negro and Santa Rosa were: 25.19 and 26.8 cm (total length): 12.9 and 13.6 cm (standard length) and 53.2 and 67.9 g (weight) respectively.

0583 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Eric Juterbock

Ohio State University, Lima, OH, United States

Moisture Relations and Climbing Behavior in the Red-legged Salamander, *Plethodon shermani*

Among southern Appalachian plethodontid salamanders, species of the *Plethodon jordani* complex appear to be among the most consistent and frequent climbers on vegetation, where I have observed many feeding, being aggressive, courting, or just sitting. Since salamanders cannot control water loss through their skin, the risk of desiccation (vapor pressure deficit (VPD) measures water loss potential) should be greater above ground than in the leaf litter-ground surface environment, which raises questions concerning their use of elevated micro-habitats. I have previously reported on relationships between moisture and climbing behavior for *P. jordani* and now address such questions for *P. shermani*. Are Red-legged Salamanders more active when VPD is lower? Are they more likely to be up on vegetation at such times? Is either activity or climbing behavior less likely as the number of days without rainfall increases? Salamanders were observed at night, by headlamp, disturbed only by occasional photography, at Standing Indian Recreation Area, Nantahala National Forest, NC, USA, between August 2006 and September 2009. There was no significant relationship between the number of dry days (0-2) and VPD. The frequency of climbing behavior was correlated to VPD (lower VPD = more climbing); the activity level of the salamanders was not. Neither the frequency of climbing behavior, nor the number of active salamanders, was correlated to the number of dry days. Neither the activity level of the salamanders, nor the frequency of climbing behavior, was correlated with increasing time past sunset. These results are similar to those obtained for *P. jordani*.

0099 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

Ingrid Kaatz¹, Aaron Rice², Donald Stewart³

¹*none, Stamford CT, United States*, ²*Bioacoustics Research Program, Cornell Laboratory of Ornithology, Ithaca NY, United States*, ³*Dept. Environmental and Forest Biology, SUNY College of Environmental Science and Forestry, Syracuse NY, United States*

Are There Structural Design Limits for Pectoral Fin Spine Disturbance Stridulation in Catfishes?: Vocal Morphology Variation Within Superfamilies

Macro-evolutionary patterns among catfish taxa reveal secondary loss of vocal ability for pectoral spine stridulation. Comparing spine morphology of vocal and silent clades can provide insight into the evolutionary changes associated with vestigialization of the

vocal apparatus. The dorsal process ("DP") surface is the location of bony vocal ridges. DP design could be influenced by length limiting vocal ridge number, depth limiting maximum ridge length and thickness limiting process strength. We measured standard length, spine length, spine weight and DP dimensions (anterior-posterior length, depth, thickness) within superfamilies with outgroup comparisons (71 species, 23 families, 1-28 individuals per species). DP ranges were: 0.23 to 5.39 mm in silent and 0.75 to 10.31 mm in vocal for length; 0.29 - 2.45 mm in silent and 0.43 - 5.47 mm in vocal for depth; and 0.17 - 1.38 in silent and 0.18 - 2.64 mm in vocal for thickness. We employed STATISTICA 6.0 for ANOVA and regression analyses. PCA was effective for describing morphospace. All characters differed significantly between silent and vocal species for Siluroidei except body size. Doradoid (Aspredinidae, Doradidae, Auchenipteridae) vocal species (n = 5) had significantly greater DP length and spine weight than silent species (n = 3). Pimelodoid (Heptapteridae, Pimelodidae, Pseudopimelodidae) DP length for vocal species (n = 2) was significantly greater than for one silent species, and both were greater than one rarely or "weakly" vocal miniaturized species. We hypothesize that body size miniaturization does not lead to vocal ability loss while altered DP dimensions and surfaces can.

0333 AES GRUBER AWARD, 551 AB, Friday 9 July 2010

David Kacev¹, Rebecca Lewison¹, Andrew Bohonak¹, Daniel Cartamil³, John Hyde⁴, Russ Vetter⁴, Kevin Feldheim²

¹*San Diego State University, San Diego, CA, United States*, ²*Field Museum, Chicago, IL, United States*, ³*University of California, San Diego, La Jolla, CA, United States*, ⁴*South West Fisheries Science Center, La Jolla, CA, United States*

Exploring the Benefits of Spatial/Landscape Genetic Analysis in Shark Populations

Historically, many genetic studies have relied on standard F-statistics or appropriate analogs such as Φ_{st} to delineate population boundaries, and functionally interpret divergence among populations. Over the past decade, a variety of spatial and landscape genetic analyses have been developed that can provide a more accurate interpretation of current and historical biological processes. I will use isolation by distance (Euclidean and least cost path), isolation by resistance, various population assignment, and Bayesian population inference analyses on genetic data from coastal shark species. I will then compare these results with those from traditional F-statistics. These new analyses have the potential to broaden our understanding of connectivity and stock structure in shark populations. This additional information will help better inform population assessment analyses and provide utility in informing more effective management.

0404 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Kristine Kaiser, Douglas G. Scofield, Menemsha Alloush, Robin M. Jones, Susanne Marczak, Katherine Martineau, Mark A. Oliva, Peter M. Narins

UCLA, Los Angeles, CA, United States

Habitat Predicts Calling Response to Exogenous Noise in Neotropical Anurans

Effective communication requires receivers to be able to discern signals in the context of noise, both biotic and abiotic. Acoustic signalers have several mechanisms by which they may overcome natural noise in their environment, but as anthropogenic change affects an increasing number of habitats, how animals cope with the introduction of exogenous noise affects species' ability to persist. In most ecosystems, only a subset of frog species is associated with disturbed habitats; the ability of these species to overcome novel anthropogenic noise in their habitat suggests that habitat associations may be a good predictor of species' response to noise. We tested the hypothesis that anuran responses to exogenous noise were correlated with habitat associations. We predicted that species associated with disturbed habitats would be more likely to increase vocal output, e.g., call rate or call duration, in response to exogenous noise than would species which live in intact or forest habitats. We studied the species assemblage of vocalizing anurans at Las Cuevas Research Station, Belize, from June - August 2008. In general, we found that the more associated with disturbed habitat a species was, the more likely it was to increase vocal output in response to noise. Furthermore, habitat was a stronger determinant of similarity in species' responses than phylogenetic relatedness. For amphibians which attract mates vocally, the acoustic environment is almost as important as the physical environment if animals are to attract mates. Response to noise may predict ability to persist despite various other anthropogenically-induced stressors.

0206 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Stephen Kajiura, Lindsay Harris, Christine Bedore

Florida Atlantic University, Boca Raton, Florida, United States

Comparative Morphology of the Electrosensory System in Four Batoid Fishes

Elasmobranchs possess highly modified and complex sensory systems that aid in prey detection and localization. Lateral line mechanosensory and electrosensory capabilities in batoids are specialized to facilitate their dorso-ventrally compressed body form, which frequently prevents them from seeing potential prey items at the last stages of prey localization and capture. Electroreceptors are spatially distributed to a greater or lesser extent according to the various morphologies seen in this diverse group, and these differences may be attributed to the variety of ecological niches occupied by each species. This study quantified the distribution of electrosensory pores, as well illustrated

the distribution of ampullary clusters and canals in relation to pores in four families of batoid fishes common to the western Atlantic, each with a different lifestyle and habitat. The lesser electric ray (*Narcine brasiliensis*, family Narcinidae), the Atlantic stingray (*Dasyatis sabina*, family Dasyatidae), the yellow spotted stingray (*Urobatis jamaicensis*, family Urotrygonidae), and the cownose ray (*Rhinoptera bonasus*, family Rhinopteridae) demonstrated variation in both electroreceptor number and distribution. *R. bonasus* and *U. jamaicensis* possessed the greatest number of ventral electrosensory pores, while *N. brasiliensis* possessed the smallest number of ventral pores. All four representative families showed a similar number of electrosensory pores on the dorsal side that varied in distribution across the body surface. The patterns in pore number and distribution have potential implications in feeding ecology and habitat awareness.

0423 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Yoichiro Kanno¹, Jason Vokoun¹, Benjamin Letcher²

¹University of Connecticut, Storrs, CT, United States, ²Conte Anadromous Fish Research Center, USGS, Turners Falls, MA, United States

Fine-scale Population Genetics of Brook Trout Across Headwater Stream Networks in Connecticut

The spatial genetic structure was investigated for two selected brook trout populations inhabiting headwater stream networks in Connecticut. Brook trout was captured via electrofishing from continuous stream stretches (5-7km), and eight microsatellite loci were genotyped for over 1,000 individuals in the two stream systems. Spatial patterns were observed despite the fine spatial scale, spatially continuous fish distribution and in some cases the lack of obvious movement barriers. Genetic data were useful for examining the presence of cryptic population boundaries, permeability of in-stream structures (e.g., road crossings and natural falls), asymmetry of fish movement (upstream vs downstream direction), and reproductive success of stocked trout. Also, the influence of landscape variables (e.g., stream channel distance, gradient, and temperature) on the observed genetic patterns was examined. The information obtained from the genetic analyses was useful for better understanding population ecology of brook trout in headwater streams.

0348 Turtle Ecology & Conservation, 555 AB, Friday 9 July 2010

Alexandra Kanonik, Shahriar Rahman, Russell Burke

Hofstra University, Hempstead, NY, United States

Demographic Analysis of the Jamaica Bay Diamondback Terrapin Population: Implications for Survival in an Urban Habitat

Population studies can contribute essential information to the management of rare and endangered species. This is especially true for turtles, due to the fact that they are exceptionally long-lived. Diamondback terrapins (*Malaclemys terrapin*) are medium-sized turtles that occur in estuarine habitats along the North American east coast from Cape Cod, Massachusetts to the Gulf Coast of Texas (Butler et al. 2006). Information on the status of Diamondback terrapins is patchy throughout their range and many isolated populations may be suffering declines. I conducted a study on the status of nesting diamondback terrapins (*Malaclemys terrapin*) in Jamaica Bay, New York, in the summer of 2009. Jamaica Bay is an estuary located on the eastern edge of the Hudson River Bight, where studies on terrapin nesting ecology have been ongoing since 1998. Between the months of June and July I collected data on 383 female terrapins on the main nesting habitat on the island of Ruler's Bar. Seventy three per cent of these terrapins had been captured before. All captured female terrapins were reproductively mature and the majority of females sampled were in the size range of SPL 170-180mm. I compared the data I collected in 2009 with data from previous years. This is the first study of this kind for this population where demographic data was analyzed in order to understand the structure and status of *M. terrapin* in Jamaica Bay.

0472 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Les Kaufman

Boston University, Boston, MA, United States

Liem's Paradox: How a Jolly Iconoclast Unified Evolutionary Theories of Species Richness

The surprise in Liem's Paradox is that morphological specializations can broaden just as well as narrow a clade's adaptive potential. It thus offered a mechanistic basis for Simpson's bradytelic vs. tachytelic clades: a propensity for morphological innovation and adaptive radiation that depends upon a phenotype's constraint or release from response to remodeling selection. Genomics, chaos mathematics, and ecology bring forth a richness and explanatory power in macroevolutionary theory that seems inconsistent with Liem's own pixieish impatience with things too large for a fish tank or too small to see. I propose a synthesis of intrinsic and extrinsic drivers including determinants of morphological constraint, habitat grain, chaotic spatial patterning, and

geomorphology that together sculpt macroevolutionary patterns in tropical great lakes and coral reef fishes. Liem's skepticisms were at least partly feigned- he was fully aware of the import of his ideas.

0394 Fish Systematics I, Ballroom D, Monday 12 July 2010

Benjamin Keck, Thomas Near

Yale University, New Haven, CT, United States

Species Tree Estimation in a Clade with Multiple Instances of Mitochondrial Introgression

Currently there is a paradigm shift in phylogenetics from estimating gene trees and assuming they represent the species tree, to estimating species trees from datasets containing multiple alleles from multiple loci per species. Several programs (e.g., BEST, *BEAST, STEAC) to estimate species trees are available and these are considered to be superior to simple concatenation of data from multiple loci, but none are intended to deal with datasets from clades in which introgression of DNA among taxa has occurred. In *Nothonotus* darters (Percidae: Etheostomatinae) there are three species, of 20 described, that we have identified as possibly having introgressed mitochondrial genomes. We estimated species trees using different combinations of sequence data from one mitochondrial gene and 12 nuclear loci for 54 individuals representing all species of *Nothonotus*: one dataset containing all the sequence data, one excluding the mitochondrial data for only those taxa with putative introgressed mitochondrial genomes, and one with only nuclear data. We present a species tree that is both more resolved and has more nodes with significant support than any previous estimated phylogeny for *Nothonotus*. We compare the species trees estimated from three datasets and discuss a) the utility of mitochondrial data for estimating relationships in this and more inclusive clades and b) how the different species trees change phylogeographic hypotheses for *Nothonotus*.

0604 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Matthew G. Keevil¹, Ronald J. Brooks², Jacqueline D. Litzgus¹

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

Dispersal of Snapping Turtles and Painted Turtles: A Comparative Investigation of a Cryptic Life History Trait

Dispersal is an important aspect of animal life history and population ecology. Because of the longevity of turtles, events, such as dispersal, that may play an important role in their ecology, occur infrequently relative to the spatial and temporal scales of observational studies. Our project will use a multi-pronged comparative approach and long-term datasets to examine dispersal in Snapping Turtles (*Chelydra serpentina*) and Painted Turtles (*Chrysemys picta*) in Algonquin Provincial Park, Ontario. Based on literature reports of low Snapping Turtle mitochondrial control region genetic distances at large spatial scales, anecdotal observations, and previous analyses of the dataset, we predict higher rates and distances of dispersal for Snapping Turtles compared to Painted Turtles. Three types of data will be analyzed to test our prediction: microsatellite-based estimates of gene flow, demographics of turtles observed on roads, and mark-recapture data. The mark recapture analyses will be further subdivided into three approaches: 1) inferring dispersal from the discrepancy in juvenile survivorships estimated from recapture rates of marked juveniles compared to survivorships estimated from fecundity and adult recruitment, 2) proportion of recruited adults marked as hatchlings relative to unmarked recruits, and 3) proportion of marked hatchlings captured as adults at natal patches and distant patches. The extent to which recruitment within subpopulations depends on dispersal from other subpopulations is important for evaluating threats to population persistence by mortality sources in the intervening landscape. An understanding of dispersal dynamics is also critical for evaluating the role of dispersal in turtle life history and phylogeography.

0368 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Aimee Kemp, Matthew Palmer

Columbia University, New York, New York, United States

The Effects of the Invasive Shrub *Berberis thunbergii* and Exotic Earthworms on Salamander Populations and Leaf Litter Communities

Invasive species are transforming deciduous forest ecosystems throughout the world. In eastern North America the invasive shrub, *Berberis thunbergii* (Japanese Barberry) is spreading rapidly and competing with native vegetation for space and resources. Leaf

litter from *Berberis* causes changes in the chemical and biological composition of the surrounding soil which may influence the distribution of invasive earthworms. These invasions have pronounced effects on the leaf litter layer and may have significant impacts on forest herpetofauna such as terrestrial salamanders. We studied the effects that *Berberis* and exotic earthworm populations have on salamander populations and leaf litter arthropod communities at Black Rock Forest and the Hudson Highlands Nature Museum, both located in Orange County New York, USA from May until October 2009. By comparing paired plots dominated by native heath vegetation or *Berberis*, we found several significant impacts associated with the invasive shrub. In *Berberis*-dominated plots, salamander abundance was reduced (21 individuals in invaded sites versus 64 in native sites; primarily *Plethodon cinereus* and *Notophthalmus viridescens*) and the snout-vent length of *Plethodon cinereus* was significantly lower ($p < 0.05$). Soil pH was significantly higher ($p < 0.01$), and soil organic content ($p < 0.01$), leaf litter depth ($p < 0.001$), soil depth ($p < 0.001$), earthworm abundance ($p < 0.05$), and arthropod abundance ($p < 0.05$) were significantly lower in *Berberis*-dominated plots. These results demonstrate the widespread impacts that invasive plants such as *Berberis* can have on the leaf litter layer, and the consequences of this invasion on arthropod and salamander communities.

0791 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010; ASIH STOYE AWARD GENETICS, DEVELOPMENT & MORPHOLOGY

Christopher Kenaley

University of Washington, Seattle, WA, United States

My, What Loosejaws You Have: The Feeding Mechanics of an Enigmatic Clade of Deep-sea Dragonfishes (Stomiiformes: Stomiidae)

The Stomiidae, or dragonfishes, is comprised of over 280 pelagic, deep-sea species in 27 genera. Stomiid morphology is characterized by spectacular adaptations to life in dark, barren oceanic waters including enormous gapes and huge jaws bearing massive teeth. Species of three of the four genera of the monophyletic loosejaw clade of dragonfishes, *Photostomias*, *Malacosteus*, and *Aristostomias*, lack skin between the mandibular rami (i.e., have no floor to the mouth). The goal of this study is to develop a biomechanical model for jaw closing in these taxa that simulates bite force, speed, and the relative advantage of the loosejaw condition as it relates to these parameters. A comparative analysis of simulated jaw-closing mechanics of loosejaw taxa reveals a nearly two fold increase in jaw-closing velocity relative to outgroup taxa that have skin between the mandibular rami. These results demonstrate that a simulation approach to biomechanics can provide insight into the mysteries surrounding the functional morphology of deep-sea taxa.

0165 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Alicia Kennedy, Aaron Bauer

Villanova University, Villanova, PA, United States

A Late Quaternary Fossil Herpetofauna from Pindai Caves, New Caledonia: Insights into the Effect of Human Habitation on Island Herpetofaunas

Excavations in the Pindai Caves of New Caledonia, a large island in the South Pacific, have yielded a fossil assemblage rich in squamate remains. The fossiliferous deposits at Pindai Caves are restricted to six caves along the northwest coast of Grand Terre. The fossils examined in this study are from four of the caves and derived from degraded Barn Owl (*Tyto alba*) pellets. Radiocarbon dating suggests dates of 1370 to 5590 YBP spanning the deposits. As humans are thought to have reached New Caledonia about 2800 YBP, this assemblage provides a unique opportunity to examine the effect of humans on the herpetofauna of New Caledonia. Approximately 8000 squamate fossils, comprising chiefly of maxillae, dentaries, frontals, parietals, premaxillae, quadrates, pelvic bones, and vertebrae have been recovered from Pindai to date. All are attributable to Gekkota and Scincidae, with the diplodactylid gecko species *Bavayia* cf. *cyclura* and *Rhacodactylus trachyrhynchus* most common. While the New Caledonian avifauna experienced elevated extinction rates upon the arrival of humans in New Caledonia, the Pindai herpetofauna includes no obviously extinct species. However, *R. trachyrhynchus* is rare in the region today, being known from only a single recent specimen, and gekkonid geckos, which are widespread in coastal New Caledonia today, are lacking in our samples. Gekkonids may have been introduced as recently as ~235 years ago with the arrival of Europeans, but the arrival of Melanesians nearly 3000 years ago may have precipitated ecological changes that changed patterns of lizard abundance if not species composition.

0304 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Ryan Kerney¹, Zachary Lewis², James Hanken²

¹*Dalhousie University, Biology Dept., Halifax, NS B3H 4J1, Canada*, ²*Museum of Comparative Zoology and Dept. of Organismic and Evolutionary Biology, Harvard University, Cambridge, MA 02138, United States*

Lung Development in Lungless Salamanders!

Lungs have played a key role in the extraordinary adaptive diversification of terrestrial vertebrates. Yet, independent instances of lung loss have occurred within each of the three clades of living amphibians—Caudata, Anura and Gymnophiona. The morphological and molecular developmental pathways involved in lung loss remain

unexplored. However, growing understanding of the mechanisms of pulmonary development presents the opportunity to examine this issue in greater detail, beginning with morphological description. We compare lung morphogenesis in a lunged salamander (*Ambystoma mexicanum*) to the lungless plethodontid salamander *Plethodon cinereus*. Both species undergo similar early stages of pulmonary morphogenesis, but early lung buds and tracheal rudiments regress in later-stage *P. cinereus*. The presence of pulmonary vestiges in *P. cinereus* indicates that lung loss likely involves the disruption of proper lung growth or maintenance, and not the specification of pulmonary rudiments. Formation of vestigial lungs in *P. cinereus* suggests pleiotropic roles for the initial regulatory cascades of pulmonary specification, or possible conservation of essential inductive interactions between lung rudiments and surrounding tissues. These results have implications for both the evolution of lung loss and the developmental mechanics of lung development. Supported by NSF (EF-0334846, AmphibiaTree) to JH.

0645 Poster Session I, Exhibit Hall D, Friday 9 July 2010

David Kerstetter¹, Todd Gedamke², Brian Franks³, Steven Kessel³, Samuel Gruber³

¹*Nova Southeastern University Oceanographic Center, Dania Beach, FL, United States,*
²*NOAA Fisheries, Miami, FL, United States,* ³*Bimini Biological Field Station, Miami, FL, United States*

Pop-up Satellite Archival Tag (PSAT) Tagging of Two Lemon Sharks (*Negaprion brevirostris*) in the Florida Straits within an Acoustic Tagging Network

Little is known about the seasonal aggregations of lemon sharks off the southeastern Florida coast, but studies are underway to investigate the specific environmental cues that instigate the aggregation formation or the behavior of individuals within the aggregation. An acoustic telemetry system has been in place since early 2007 to monitor movement patterns, but this system will only record presence or absence of an individual. To facilitate the acoustic study and the investigation of habitat utilization, two lemon sharks were simultaneously tagged with acoustic transmitters and 10 d, high-resolution PSATs. This combination provides additional information on habitat utilization through the pairing of local behavior data with ambient environmental data from the acoustic system. The first PSAT transmitted after only a 7 d deployment, i.e., prior to the expected date. Analyses of the tag status data indicate that the “constant depth” trigger to the automatic release programming was activated. Although these depth data would normally suggest a mortality event, the acoustic system recorded hits between 21 receivers during an additional 480 d following PSAT release, indicating survival. The second PSAT transmitted data on schedule. Both tagged animals exhibited significant changes in behavior 3 d after release, with numerous, short-duration vertical movements during both day and night periods within a 50 m range

during the first 3 d and only 15 m during the remainder of the respective tracks. The use of electronic monitoring devices in combination should be used when possible to provide complementary data streams from difficult to tag organisms.

0677 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Steven Kessel¹, Samuel Gruber², Bryan Franks³, Rupert Perkins¹

¹Cardiff University, Cardiff, United Kingdom, ²University of Miami, Miami, Florida, United States, ³Bimini Biological Field Station, South Bimini, Bahamas

The Effect of 'Encounterability' on Lemon Shark (*Negaprion brevirostris*) Longline Catch per Unit Effort (CPUE)

Many assumptions are made in the analysis of longline catch data. The influence of these assumptions would likely create a variety of biases producing inaccurate results, which can form the foundation of fisheries management decisions. This study assessed the influence of lemon shark (*Negaprion brevirostris*) longline encounter rates over Catch Per Unit Effort (CPUE), at the Bimini Islands, Bahamas. Aerial survey data, collected from September 2007 - September 2008, was used in conjunction from historical *N. brevirostris* tracking data, comprising 21,562 tracking points, from 47 individuals over 15 years of research, to produce spatial distribution density maps in ArcGIS 9.2®. Longline set and *N. brevirostris* capture locations from 2005 - 2008 were then overlaid on the density maps to assess the relationship between encounter rates and CPUE. Results showed that CPUE significantly increased with decreasing proximity to areas of high spatial utilisation, with highest CPUE values directly associated with areas of highest *N. brevirostris* activity. Thus, since CPUE by location was found to be directly related to encounter rates, individual longlines exhibited different levels of fishing power. A weighting proportionate to average hook distance to high *N. brevirostris* spatial utilisation (>3 s.d.) was applied to the CPUE results, removing the significant influence of encounter rates over CPUE. Where possible, species specific encounterability should be factored in to longline based stock assessments for sharks, and should be considered essential for stock assessment comparisons between spatially dissimilar datasets.

0692 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

Steven Kessel¹, Samuel Gruber², Todd Gedamke⁵, Bryan Franks³, Demian Chapman⁴, David Kerstetter⁶, David Fugate⁷, Rupert Perkins¹

¹Cardiff University, Cardiff, United Kingdom, ²University of Miami, Miami, Florida, United States, ³Bimini Biological Field Station, South Bimini, Bahamas, ⁴Stony Brook University, Stony Brook, New York, United States, ⁵National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, Florida, United States, ⁶Nova Southeastern University, Dania Beach, Florida, United States, ⁷Florida Gulf Coast University, Fort Myers, Florida, United States

Influence of Water Temperature on Behaviour and Migration of Adult Lemon Shark (*Negaprion brevirostris*) Throughout the U.S. Eastern Seaboard

Large aggregating groups of adult lemon sharks (*Negaprion brevirostris*) are annually present off the coast of Jupiter, Florida, during the winter months. These aggregations are composed of individuals known to exhibit seasonal north - south migrations along U.S. eastern seaboard. Through a combination of passive acoustic telemetry, Pop-off Satellite Archival Tags (PSAT), temperature and current profilers, water temperature appeared to be the environmental cue correlated with the timing, duration and locations of many adult *N. brevirostris* seasonal behaviours. Adult *N. brevirostris* of the Jupiter aggregations appear to have a water temperature preference of ~23/24°C, which in turn determines the timing of the annual aggregation period and may well be the driving variable for both latitudinal and vertical depth movements. Archived depth and temperature profiles demonstrated that individual sharks adjusted their depth to remain in water with a temperature of ~24°C. Seasonal migrations north in the summer months and south in the winter months follow the annual changes in coastal water temperature, with the location of the winter aggregations in Jupiter located at the most southerly distribution of cooler water temperatures. Thermal preferences seem to dictate aggregating periods, latitudinal migrations, and vertical movements, indicating that temperature is a strong driving factor in both the annual and day to day distribution of mature *N. brevirostris* attending the seasonal aggregations.

0608 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

James Ketchum¹, Alex Hearn², Peter Klimley¹, Eduardo Espinoza³

¹University of California, Davis, Davis, CA, United States, ²Charles Darwin Foundation, Galapagos, Ecuador, ³Galapagos National Park, Galapagos, Ecuador

Diel and Seasonal Movements of Scalloped Hammerhead Sharks (*Sphyrna lewini*) in the Galapagos Marine Reserve

Sharks are present in great numbers at the Galapagos Marine Reserve (GMR), but little is known about their distribution, abundance and ecology, and illegal fishing is apparently causing their decline. We analyze movements of scalloped hammerheads in the GMR using ultrasonic receivers, examine diel and seasonal dynamics, and evaluate environmental factors. Eighteen scalloped hammerhead sharks were tagged with V16 coded pingers in July 2006 and detected at monitors in Darwin and Wolf (northern archipelago), but not at Gordon Rocks (central archipelago), between July 2006 and July 2007. Detections were more frequent during the day ($p < 0.001$) and a seasonal void occurred between March and May. The majority of sharks (60%) moved between Wolf and Darwin, and few displayed constant residency at a single island, but no significant differences in residency were found between islands ($p > 0.05$). The effect of current velocity on size of sharks at Darwin was noteworthy ($p < 0.05$), where hammerheads were larger there than at Wolf ($p < 0.05$). Based on log-survivorship functions movements were: 1) around island (absence < 18 hrs), 2) short-term excursions (absence > 18 hrs), 3) mid-term excursions (absence 5-11 days, Wolf; 10-20 days, Darwin), and 4) long-term excursions (absence 20-60 days, Darwin). Connectivity of sharks between islands with no preference of residence means that a large area encompassing both islands functions as prime habitat for hammerheads. Wolf may be the center of short foraging excursions and Darwin a 'stepping stone' for long-distance migration for larger hammerheads. This work constitutes baseline information for shark conservation in the GMR.

**0522 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010;
ASIH STOYE AWARD ECOLOGY & ETHOLOGY**

Sora Kim

University Of California, Santa Cruz, Santa Cruz, CA, United States

Insight to California White Shark (*Carcharodon carcharias*) Diet Composition and Individuality Using Stable Isotope Analysis

White sharks (*Carcharodon carcharias*) are top-level opportunistic predators. Various lines of evidence such as stomach contents, tooth morphology and coastal observations, suggest white sharks typically feed on pinnipeds off the California coast. However, the

complete breadth of white shark diet is unknown. We focus on white shark diet using a biogeochemical method, stable isotope analysis. Stable isotope ratios of carbon ($^{13}\text{C}/^{12}\text{C}$) and nitrogen ($^{15}\text{N}/^{14}\text{N}$) elucidate feeding patterns in birds, mammals, bony fish, and are gaining use in shark ecology. First, we established vertebrae-to-diet stable isotope discrimination factors for leopard sharks during a controlled experiment. We then applied this information to interpret stable isotope data from 15 white sharks caught off the California coast from 1936 to 2003. White shark vertebrae record diet in concentrically accreted growth bands. The $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of organic matter extracted from these bands allow us to track a shark's diet over its lifetime. Our results illustrate that the California white shark population has a generalized feeding structure rather than an exclusive focus on pinnipeds. The white shark $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values range widely (4‰ and 7‰, respectively). The data confirm that many individuals undergo an ontogenetic dietary shift, but the extent of this trophic switch varies among individuals. Additionally, isotopic patterns reveal individual specialists and generalists within the California white shark population. These dietary patterns persist even as pinniped populations increased after the passage of the Marine Mammal Protection Act in 1972.

0714 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Nicole Kime¹, Sandra Goutte², Michael Ryan²

¹Edgewood College, Madison, WI, United States, ²University of Texas at Austin, Austin, TX, United States

Arginine Vasotocin Influences Calling Behavior of Túngara Frogs (*Physalaemus pustulosus*) During Simulated Male-Male Interactions

The hormone arginine vasotocin (AVT) modulates various aspects of communication behavior in fish, amphibians, and reptiles. In anurans, it has been suggested that AVT influences motivation to produce advertisement calls as well as motor control of signal production. Given extensive prior work regarding the anatomy, physiology, and ecological context of calling behavior in túngara frogs, we have found this model system to be extremely useful for understanding how AVT influences calling behavior in interactions among males as well as the consequences of AVT-mediated call changes on a male's success in acquiring mates. Túngara frog advertisement calls consist of a "whine" that is critical for species recognition and one or more "chucks" that are produced in response to other males and which increase relative attractiveness to females but also increase risk of predation. In recent field studies, we demonstrated that treatment with AVT influences the production of whines and chucks and that AVT-induced call changes alter a male's attractiveness to females. Here, we extend these studies and report on laboratory experiments that investigate whether treatment with AVT influences the specificity of vocal responses to acoustic stimuli and the calling strategies that males use in interacting with other males. Our results demonstrate that AVT influences the production of chucks in response to auditory stimuli that a male receives from his environment and the acoustic characteristics of these signals. AVT-

mediated changes in vocal behavior can have important consequences for both the outcome of male-male interactions and female mate choice in complex acoustic environments.

0635 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Bruce Kingsbury, Chad Smith

Indiana -Purdue University, Fort Wayne, IN, United States

Overwintering Ecology of the Eastern Massasauga (*Sistrurus catenatus*) in Michigan

The Eastern Massasauga is a candidate species for listing as federally threatened. Understanding the specific habitats chosen for overwintering ("hibernation") and how those habitats are distributed in the landscape is crucial for developing successful management plans for the species. Although our knowledge regarding specific locations and structures used by snakes during overwintering is improving, it is often unclear why those locations are chosen, and very little is known about factors that may contribute to overwintering success. We report on the overwintering ecology of massasaugas from sites in the southeastern and northwestern Lower Peninsula of Michigan. The sites are very different physically and provide contrasts depicting both consistencies and variation in overwintering behavior. Where crayfish burrows are available (SE) they are used extensively, but alternatives (root mounds, stumps, mammal burrows and sphagnum hummocks) are utilized found where crayfish do not occur (NW). At each locality, snakes are hibernating beneath the water table, at least by late winter. Communal denning was limited in the SE site, while it was pervasive at the NW site. At both locations, hibernacula tended to be located outside of snake activity ranges and some snakes travelled large distances between summer activity centers and overwintering sites. Site fidelity was pervasive. We also collected data on groundwater chemistry, soil composition and ground temperature at known hibernacula and at control locations, and report on patterns derived from that data as well.

0623 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Bruce Kingsbury, Christopher Woodley

Indiana - Purdue University, Fort Wayne, IN, United States

The Effects of Prescribed Fire on a Population of Eastern Box Turtles (*Terrapene carolina*) in Southwest Michigan

We report here on an ongoing effort to understand how prescribed fire affects the Eastern Box Turtle (*Terrapene carolina*). We approached the issue by monitoring turtles using telemetry and mark-recapture at a site in southwest Michigan where prescribed fire is used annually. Burned individuals show varying degrees of resilience to their injuries, with some animals succumbing quickly and dying over a short period of time, while others adjusted their behavior and recovered over extended periods. Some severely injured females even remain reproductively active despite their injuries. This resilience to fire may be an adaptation to persist in areas subject to natural burns. Nevertheless, it is unlikely that the population studied can persist over extended periods with the current burn regime, given the cumulative effects of various stressors on the population, including low recruitment. Such an outcome is also likely the case in many sites across the Midwest. Consequently we need to find ways to minimize the impacts of fire in those cases where its use is deemed necessary. We found that turtles that have not emerged from hibernation are somewhat protected from damage, and so are also investigating means to predict time of emergence. Turtles and a set of their burrows are being monitored with iButton data loggers to identify thermal thresholds that might trigger when these ectotherms emerge. We will close our presentation with discussion of our findings on emergence.

0029 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Michael Kinney, Colin Simpfendorfer, Andrew Tobin

James Cook University, Townsville, Queensland, Australia

Reassessing a Purported Communal Shark Nursery in Cleveland Bay, Queensland Australia

While the concept of communal shark nursery areas was originally proposed in the literature nearly 20 years ago, relatively little is known about the ecological pressures affecting young sharks that inhabit such areas. This study seeks to reassess some of the assumptions characterizing communal nursery areas by exploring the ecological characteristics of juvenile sharks in Cleveland Bay, Queensland, Australia, which has been described in the literature as a communal nursery. Fisheries-independent sampling was carried out in the bay from January of 2008 to December of 2009. Sampling was stratified by depth and utilized two gear types targeting large and small sharks to

explore species' distribution and spatial usage throughout the bay. Analysis of catch and general dietary data provides the first indication of possible niche separation among sympatric shark species. In addition, the routine capture of large mature sharks in the shallow waters of the bay using baited long lines indicates that these shallow areas may not provide as much refuge from predation for juveniles as previously hypothesized. Results suggest that the spatial and dietary patterns of the several sympatric shark species utilizing Cleveland Bay as a nursery is more complex than previously assumed. The results of this study will help improve our understanding of shark nursery-area ecology and the links between juvenile and adult sections of the population, which will be essential for creating proper conservation and fisheries management strategies for shark populations.

0078 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Julia Kintsch¹, Patricia Cramer², Sandra L. Jacobson³

¹Freedom to Roam and ECO-resolutions, LLC, Denver, CO, United States, ²Utah State University, Logan, UT, United States, ³USDA Forest Service, Bend, OR, United States

Retrofitting Existing Structures to Facilitate Wildlife Passage

Hundreds of thousands of culverts, bridges and overpasses are currently part of the nation's transportation infrastructure and may have the potential to pass wildlife. With small modifications, many of these structures could be retrofit to provide greater permeability for wildlife in a cost-effective manner. If existing infrastructure elements can be retrofitted to pass wildlife, future construction costs for new wildlife crossings can be reduced and new construction can be prioritized to areas lacking sufficient crossings. We developed a standardized system for evaluating existing structures for their ability to pass terrestrial wildlife. Foundational to this system is the classification of species based on their responses to roads and crossing structures - behavior that is largely influenced by predator detection and avoidance strategies, as well as their capacity for locomotion. Practitioners are guided through an evaluation process to assess the characteristics of a given passage relative to the needs of the species movement guilds of interest to determine if the structure can be retrofit to accommodate those needs. Herpetofauna fall into two categories in our classification scheme. Mobile Small Fauna are characterized by their adaptability to a wide range of structure characteristics, including, in some cases, the use of passages with artificial substrate or ramps. Conversely, Low Mobility Fauna have stricter habitat needs, requiring consistent environmental conditions throughout a crossing structure. Due to their relatively small sizes, herpetofauna may be accommodated in a wide variety of structures as long as passage characteristics are carefully considered when designing retrofits.

0251 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

Jeff Kneebone¹, Gregory Skomal², John Chisholm²

¹*University of Massachusetts Dartmouth; School for Marine Science and Technology, New Bedford, Massachusetts, United States*, ²*Massachusetts Division of Marine Fisheries, New Bedford, Massachusetts, United States*

Spatial and Temporal Habitat Use and Movement Patterns of Neonatal and Juvenile Sand Tiger Sharks, *Carcharias taurus*, in a Massachusetts Estuary

In recent years, an increasing number of neonate and juvenile sand tiger sharks (*Carcharias taurus*) have been incidentally taken by fishermen in Plymouth, Kingston, Duxbury (PKD) Bay, a 10,200 acre tidal estuary located on the south shore of Massachusetts. There are indications that the strong seasonal presence (late spring to early fall) of sand tigers in this area is a relatively new phenomenon as local fishermen claim that they had never seen this species in large numbers until recently. We utilized passive acoustic telemetry to monitor seasonal residency, habitat use, site fidelity, and fine scale movements of 35 sand tigers (79 - 120 cm fork length; age 0 - 1) in PKD Bay. Sharks were tracked within PKD Bay for periods of 5 - 88 days during September - October, 2008 and June - October, 2009. All movement data are currently being analyzed to quantify spatial and temporal habitat use, however, preliminary analyses suggest that sharks display a high degree of site fidelity to several areas of PKD Bay. Outside PKD Bay, we documented broader regional movements throughout New England. Collectively, these data demonstrate that both PKD Bay and New England coastal waters serve as nursery and essential fish habitat (EFH) for neonatal and juvenile sand tiger sharks.

0175 AES GRUBER AWARD, 551 AB, Friday 9 July 2010

Danielle Knip¹, Michelle Heupel², Colin Simpfendorfer¹, James Moloney², Andrew Tobin¹

¹*Fishing and Fisheries Research Centre, School of Earth and Environmental Sciences, James Cook University, Townsville, Queensland, Australia*, ²*School of Earth and Environmental Sciences, James Cook University, Townsville, Queensland, Australia*

Site Fidelity and Habitat Use of Spottail Sharks (*Carcharhinus sorrah*) in a Tropical Nearshore Environment

Tropical nearshore environments contain regions of high productivity and often provide key habitat for many shark populations. This project examines the presence and movements of shark species in a nearshore region to define their use of space and dependence on coastal habitats. An array of fifty-six acoustic receivers deployed in

Cleveland Bay, north Queensland was used to monitor sharks within a tropical nearshore environment. Thirty spottail sharks (*Carcharhinus sorrah*) fitted with acoustic transmitters were monitored in 2009 and 2010. Spottail sharks displayed long-term use of this nearshore environment with some individuals continually present for more than 100 days. Individuals that remained within Cleveland Bay showed high levels of site fidelity to specific regions and consistent patterns were found in their use of space. Location of home ranges and distribution of spottail sharks within Cleveland Bay revealed segregation among individuals with some differences in behaviour between sexes. Spottail sharks are an important component of the commercial fishery in Queensland. Long-term presence and consistent use of nearshore regions suggests that Marine Protected Areas employed in these areas may provide some shelter from exploitation for spottail sharks. This research gives new insight into habitat use of spottail sharks and provides advice for potential management of these populations.

0198 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Jason Knouft¹, Lawrence Page²

¹*Saint Louis University, St. Louis, Missouri, United States*, ²*Florida Museum of Natural History, Gainesville, Florida, United States*

Assessing the Relationships Between Climate, Landscape, and Species Richness in North American Freshwater Fishes

Variation in species richness across broad geographic areas has been attributed to both historical effects (i.e., evolutionary history) and contemporary climate and landscape factors. We examined the relationship between contemporary climate and landscape variables and species richness among all species of North American freshwater fishes as well as within the seven most diverse families (Catostomidae, Centrarchidae, Cottidae, Cyprinidae, Ictaluridae, Percidae, and Salmonidae). Results indicate that contemporary climate, elevation, and variation in elevation are significant predictors of species richness to varying degrees in the total species data set as well as within families. However, total stream length and the diversity of stream order segments within a region do not explain significant components of the variation in species richness in any group. Results will be discussed in the context of predicted changes in climate as well as the regional conservation of freshwater taxa.

0227 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Brooks Kohli, Matthew White

Ohio University, Athens, OH, United States

Lack of Differentiation Suggests a Recent Range-wide Expansion of Muskellunge (*Esox masquinongy*)

The muskellunge (*Esox masquinongy*) is an important recreational species found in the Mississippi, Great Lakes, and Hudson drainages. Three subspecies have been recognized, Ohio, Great lakes, and Northern, corresponding to differences in color pattern. Although these are no longer considered valid, genetic differences have been observed among Ohio River, Great Lakes, and Upper Mississippi River populations. Considerable stocking has occurred from a number of local broodstock sources. We conducted a phylogeographic study of muskellunge from samples throughout its range. A preliminary analysis of 450bp of the mitochondrial control region has identified little variation. Two haplotypes are widely distributed; several rare haplotypes have local distributions. The three subspecies designations are not supported nor are the allozyme based clusters. Although stocking from multiple hatchery strains could result in some regional homogeneity, it would not explain the range-wide pattern observed. Our data suggest that the current muskellunge distribution reflects a recent expansion from a single refugium. The paucity of mtDNA sequence variation also suggests a bottleneck.

0133 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Matthew Kolmann¹, Daniel Huber², Mason Dean³, R. Dean Grubbs⁴

¹Florida State University, Tallahassee, FL, United States, ²University of Tampa, Tampa, FL, United States, ³University of California Irvine, Irvine, CA, United States, ⁴Florida State University Coastal and Marine Laboratory, St. Teresa, FL, United States

Ecomorphological Consequences of the Feeding Mechanism in the Cownose Ray

Controversy has arisen over the implication of the cownose ray, *Rhinoptera bonasus*, in hindering commercial shellfish recovery projects. Because of support for shellfish projects, a fishery was started for *R. bonasus* under the guise of predator control. Questions about the necessity of such a fishery were not adequately resolved and other investigations into the matter have been contradictory. Bite-force calculation will allow this researcher to accurately reconstruct the capabilities of this animal as a durophagous predator. Preliminary examination of the feeding mechanism in *R. bonasus* has discovered formidable jaw musculature, but one possibly limited by gape size. Investigations into gape limitation, meaning the ability of the ray to manipulate, crush,

and then engulf bivalve prey items will allow researchers to accurately diagnose whether the cownose is capable of consuming commercial bivalve species. An ontogenetic series of representative bivalve prey (oysters, scallops, and quahogs) will be obtained for use in determining the forces necessary to cause shell failure in each species. Forces at which the bivalve shells exhibited catastrophic failure will be compared to measured and theoretical bite force data gathered from the cownose rays. If cownose rays are not capable of consuming bivalves, this could potentially indicate that once a bivalve has reached a certain adult size, it is functionally beyond the predator's ability to ingest. A directed fishery for *Rhinoptera* could then be diverting resources from identifying and addressing real threats to bivalve abundances and endangering another species concurrently.

0688 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

Peter Konstantinidis

The Natural History Museum, London, United Kingdom

Osteology of the Ragfish, *Icosteus aenigmaticus* (Lockington)

The ragfish was first described by Lockington in 1880 as a possible member of the Blenniidae. It is now placed, as the sole member, in its own family, Icosteidae. The species occurs only in the North Pacific Ocean from California to Japan, where adults inhabit the bathypelagic zone while juveniles are frequently caught near the surface. There is a great difference in shape and anatomy between juveniles and adults, which can reach a maximum length of up to two meters. The species is characterized by more than 60 vertebrae, the lack of dorsal-, anal-, and pelvic-fin spines, prickles on all fin rays, the absence of the pelvic fin in adults, more than 17 principal caudal fin rays and scales which are only present along the lateral line. Anatomical characters are scarce and peculiar and have led to various speculations of the systematic position of *Icosteus* ranging from a 'prepercomorph' position to a close relationship to members of the Stromateoidei. The latter hypothetical relationship finds additional support through larval characters and molecular data. Here, I will present a detailed anatomical analysis of the skeleton of larval and juvenile *Icosteus* in order to shed some light on its phylogenetic relationship.

0233 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; ASIH STORER HERPETOLOGY AWARD

Chelsa Korfel

The Ohio State University, Ohio/Midwest, United States

Altitudinal Distribution of the Amphibian Fungus, *Batrachochytrium dendrobatidis*, in the Ecuadorian Andes

Chytridiomycosis, the amphibian disease associated with the pathogen *Batrachochytrium dendrobatidis* (*Bd*), continues to persist in amphibian populations throughout the world. Ongoing research is critical for understanding the dynamics of the disease and the continuing impacts on amphibian populations. Amphibian populations in the highlands of Ecuador have experienced dramatic declines and extirpations as a result of *Bd* infections, and research on the persistence and dynamics of enzootic *Bd* at these localities is essential to understand the full impact of this pathogen. *Gastrotheca pseustes*, an Andean species found in Ecuador and IUCN endangered (likely due to impacts of *Bd*) persists in reduced populations over a broad altitudinal and geographical gradient. In this study skin swabs were taken from tadpoles of this species at five sites (Jerez 2000m; Monay 2500m; Mazan 3000m; Chusalongo 3500m; and Tres Cruces 4000m) ranging in altitude from 2000-4100 m in Cajas National Park. Amphibian mouthparts were swabbed 10 times each with a different swab from each individual. Tadpoles were collected from several different pools at each site. Swabs were analyzed by PCR methods to detect the presence of *Bd* genetic material and to estimate the level of infection. Results of the altitudinal distribution of *Bd* in *G. pseustes* will be reported.

0238 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Amy Koske¹, Michelle Staudinger², Francis Juanes¹

¹*University of Massachusetts, Amherst, MA, United States*, ²*University of North Carolina, Wilmington, NC, United States*

Foraging Habits of Large Pelagic Predators in the Northwest Atlantic

The New England coastal shelf is a historic seasonal feeding ground for pelagic predators such as sharks and tunas, although their diets are still poorly known. Over recent decades, dolphinfish (*Coryphaena hippurus*) have increased exponentially in this area. This increase suggests that dolphinfish may be expanding their distribution pole ward, and have the potential to compete for regional prey resources. The aim of this study is to conduct a mass-based quantification of the food habits of large pelagic predators in the northwest Atlantic and to estimate potential overlap among species, particularly dolphinfish. We have collected stomachs of albacore tuna (*Thunnus*

alalunga), yellowfin tuna (*Thunnus albacares*), shortfin mako shark (*Isurus oxyrinchus*), thresher shark (*Alopias vulpinus*) and dolphinfish at recreational fishing tournaments from New Jersey to Massachusetts during the summers of 2007-2009. Initial analyses of stomach contents have determined that yellowfin consumed cephalopods (37%), fish (38%) and crustaceans (22%) in nearly equal amounts, albacore consumed a majority of crustaceans (38%) and cephalopods (42%), mako and thresher diets were composed primarily of bluefish (>60%), and dolphinfish diets concentrated primarily on squid (69%). Bluefish, shortfin squid and larval hermit crab appear to be the greatest potential sources of shark and tuna competition with dolphinfish in this region. Further results will detail predator feeding habits and provide an analysis of dietary overlap. Length data will be used to determine trophic niche breadths. This project will provide useful information on trophic ecology of these species in the northwest Atlantic necessary for informed management and regulation.

0597 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Adrienne Kovach, Kimberly Babbitt, Jennifer Walsh, Charlotte Gabrielsen

University of New Hampshire, Durham, New Hampshire, United States

Effects of Suburbanization on Genetic Structure and Connectivity of Vernal Pool-breeding Amphibians

Vernal pool-breeding amphibians are particularly vulnerable to the effects of habitat fragmentation and land use change, as they require both suitable wetland and forested upland habitat during their complex life cycles. Land use changes associated with suburbanization, including increases in the transportation infrastructure, may negatively impact both wetland and upland habitat quality, thereby impeding critical metapopulation processes, such as dispersal and recolonization of populations. We use a landscape genetic approach to identify the effects of environmental (water quality) and landscape (forest connectivity and road density) features on the genetic structure of the spotted salamander (*Ambystoma maculatum*) and wood frog (*Lithobates sylvaticus*). We conduct a comparative analysis of spotted salamanders and wood frogs from 44 ponds in 3 developed landscapes and 2 forested landscapes. Within each landscape, we estimated inter-pond connectivity using F_{ST} as a measure of gene flow for ponds separated by distances of 100 m – 5 km. We also used Bayesian clustering methods to identify genetically similar ponds and to estimate inter-pond migration rates in relation to landscape features and water quality variables. For spotted salamanders, we identified genetic barriers associated with Class 1, 2, 3 and residential roads and power line corridors in the developed landscapes and with elevation in the forested landscapes. We report preliminary results for wood frogs and discuss implications in light of differences in mobility of the two species. Our results suggest that suburbanization decreases the genetic connectivity of vernal pool-breeding amphibians and may negatively impact metapopulation dynamics over the long-term.

0598 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Kathryn Kovitvongsa, Phillip Lobel

Boston University, Boston, MA, United States

Toadfish Boatwhistle Call Diversity and the Error Associated with Different Acoustic Recording Methods

Toadfish (family Batrachoididae) are known as soniferous fishes due to their conspicuous boatwhistle courtship calls. However, only 5 out of 78 species' calls have been described in the literature. We add two more acoustic descriptions from two toadfishes on coral reefs in Belize (*Sanopus astrifer* and *Batrachoides gilberti*) and compare these to the well-known temperate species *Opsanus tau*. The Belizean species are the first recorded from tropical coral reefs. Both Belizean toadfishes were distinct from *O. tau* by producing multiple pulses per call as opposed to a single pulse call. The field study was conducted using both a hydrophone and the internal microphone of a point-and-shoot digital camera in an underwater housing. This led us to quantitatively compare recording modalities to determine if the inexpensive digital cameras in housings could record underwater sound accurately. Digital cameras were compared to a hydrophone system using simultaneous recordings during controlled playback of synthetic sounds. This determined accuracy for recording frequency, amplitude and temporal characteristics. Results indicated that digital cameras can be used for recording loud sounds known to be within the camera's frequency range, and for gross description of temporal patterning. However, due to temporal error introduced by the digital camera fish recordings cannot be precisely analyzed for pulse and interval durations which are necessary for interspecific comparisons. It was determined that a quality hydrophone is still the best tool for accurate underwater recordings and is necessary for comprehensive scientific description of sounds.

0759 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Cecilia Krahforst, Joseph Luczkovich, Mark Sprague, Charles Singhas, J.P. Walsh

East Carolina University, Greenville, NC, United States

Can the Fundamental Frequency of an Atlantic Croaker's Sound be Used to Determine Length or Sex in the Field?

Both sexes of Atlantic croaker (*Micropogonias undulatus*) have the ability to produce sounds beginning within the first year of life. Research has indicated that there is sexual dimorphism of gonads and sonic muscles, which indicates that there may be variants within acoustic structure. We recorded Atlantic croaker vocalizations of individuals

ranging from 40-250 mm TL in the laboratory to determine if sex and length varied with the fundamental frequency. Digital audio recorders were deployed at two sites in Pamlico Sound from June to November 2008, recording 10s audio files at 15 minute intervals. The fish community was sampled once a month at each site using trawls to compare with the passive acoustic recordings. Atlantic croaker were transported in a live well to an aquarium holding facility where they acclimated for a minimum of 24 hrs prior to acoustic recordings. Analyses revealed an inverse linear relationship between total length (TL, mm) and fundamental frequency (F_0 , Hz), where $TL=305.32-0.27(F_0)$ ($r^2=0.84$). There was no significant difference in fundamental frequency between the sexes. The linear regression equation was then used to estimate total length from the fundamental frequency of in-situ observations and compared to Atlantic croaker collected in the trawl. There was a significant difference between the mean lengths of Atlantic croaker in the trawl and mean lengths estimated from fundamental frequency ($p<0.0001$). We conclude the trawl is size-selective and underestimates the average length of fish. Therefore, the passive acoustic approach may provide an accurate size estimate for Atlantic croaker populations.

0179 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Kerry Kriger

SAVE THE FROGS!, Santa Cruz, CA, United States

SAVE THE FROGS! - Translating Science into Action

SAVE THE FROGS! is America's first and only public charity dedicated exclusively to amphibian conservation. Our mission is to protect amphibian populations and to promote a society that respects and appreciates nature and wildlife. Founded in May 2008, we have several active educational programs, including (1) teaching a free laboratory course on chytrid detection techniques to Latin American batrachologists; (2) coordinating the annual Save The Frogs Day events; (3) providing free educational materials and laboratory protocols to teachers and scientists via www.savethefrogs.com and www.salvemossapos.com; (4) giving presentations on amphibian extinctions in multiple languages to schools, universities, zoos, museums, businesses, and community groups; (5) creating public service announcements that have been posted in Washington, D.C., San Francisco and in five major U.S. airports; (6) providing an annual \$500 travel grant for a student to present at this conference. SAVE THE FROGS! also has active advocacy campaigns, such as working with restaurants to discontinue frog leg sales, and campaigning for the removal of invasive trout from critical Yellow-Legged Frog habitat. We accomplished all of the above on less than \$50,000. As funds permit, we will purchase land, lobby for mandatory disease testing on imported amphibians and for laws limiting the use of harmful pesticides, provide full Ph.D. scholarships, and an array of other urgently needed conservation actions. Our vision is a world in which not a single amphibian species is threatened with extinction. With your advice, your involvement and your financial support, we are 100% positive we can SAVE THE FROGS!

0219 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Kerry M. Kriger¹, Andrew J. Crawford², Alain Dubois³

¹SAVE THE FROGS!, Santa Cruz, CA, United States, ²Universidad de los Andes, Bogota, Colombia, ³Alytes, Paris, France

Batrachology: The Study of Amphibians

Batrachology is the study of amphibians. Most people use the term "herpetology", but this term signifies the study of amphibians *and* reptiles, two groups with extremely different evolutionary and life histories. Evolutionary biologists all agree that taxonomy should reflect natural groups (i.e. monophyletic clades), and thus the current polyphyletic concept of herpetology is incorrect and should be refined. Extant amphibians are monophyletic and form the sister group to all other tetrapods. As such, we request you sign the Batrachology Petition at www.savethefrogs.com/batrachology, and phase out future usage of the prefix "herpeto" when you are not referring to reptiles. With support from the batrachological community, this change in terminology can be implemented with as much ease and rapidity as have any of the changes in species names that have taken place in recent years.

0666 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Andrea Kroetz, Sean Powers

University of South Alabama/Dauphin Island Sea Lab, Dauphin Island, AL, United States

Functional Responses in Bonnethead (*Sphyrna tiburo*) and Atlantic Sharpnose (*Rhizoprionodon terraenovae*) Sharks to Varying Prey Densities

Several studies indicate that elasmobranchs are integral predators in marine ecosystems. However, there has been little investigation into how these fishes respond to changes in prey densities (i.e. functional response). As traditional management plans of elasmobranchs rely on detailed dietary information, a better understanding of functional responses is essential to future ecosystem management plans of these fishes. Bonnethead (*Sphyrna tiburo*) and Atlantic sharpnose (*Rhizoprionodon terraenovae*) sharks are small coastal shark species abundant in the northern Gulf of Mexico. Bonnetheads show specialized feeding on macroinvertebrates (e.g. blue crab) and exhibit schooling behavior, while Atlantic sharpnose sharks are piscivorous and generally more solitary foragers. This study will investigate the functional responses of individual *S. tiburo* and *R. terraenovae* to varying densities of their natural prey, blue crab (*Callinectes sapidus*) and Atlantic croaker (*Micropogonias undulates*), respectively. Results will be analyzed to determine if there is a difference in functional responses between species with different

prey specializations as well as varying aggregation behaviors. To investigate the effect of group size on these responses (i.e. numerical response), trials will be conducted with varying levels of individuals. These examinations will provide novel insight into the dynamics of predator-prey interactions involving elasmobranch predators, and thus further our understanding of the dynamical nature of top-down control in coastal marine ecosystems.

0057 Fish Systematics II, Ballroom D, Monday 12 July 2010

Kristen Kuhn, Thomas Near

Yale University, New Haven, CT, United States

Waiting for Resolution: An Example of Species Tree Inference in the Antarctic Fish Species Flock *Trematomus*

The biota of Antarctica is amazingly rich and highly endemic. Notothenioid fishes are a clade of acanthomorph teleost fishes containing approximately 129 species. The phylogenetics of notothenioid fishes has been extensively investigated through analyses of morphological characters, DNA sequences from mitochondrial genes, and single copy nuclear genes. These phylogenetics analyses have produced reasonably similar phylogenetic trees of notothenioids, however a number of phylogenetic questions remain. The nototheniid clade *Trematomus* is an example of a group where phylogenetic relationships remain unresolved. Here we revisit the phylogenetic relationships of *Trematomus* using both increased taxon sampling and an expanded data set which includes DNA sequences from two mitochondrial genes (ND2 and 16S rRNA) and ten single-copy nuclear genes to investigate strategies of species tree inference. The Bayesian phylogeny resulting from the analysis of the combined mitochondrial and nuclear gene datasets was well resolved. It contained more nodes supported with significant Bayesian posteriors than either the mitochondrial or nuclear gene phylogenies alone; demonstrating that the addition of nuclear gene sequence data to mitochondrial data can enhance phylogenetic resolution and node support.

0352 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010

Hyuck Joon Kwun, Jin Koo Kim

Pukyong National University, Busan, Korea, Republic of

One Undescribed Species of the Genus *Eulophias* (Perciformes: Stichaeidae) from Korea

Five specimens (70.7-160.7 mm SL) of *Eulophias* sp. were collected from the southern sea of Korea. Genus *Eulophias* belongs to the family Stichaeidae and distribute in Northwest Pacific. Only two species, *Eulophias tanneri* (type locality: Suruga gulf, Japan) and *Eulophias owashii* (Owashi off, Japan) have been recognized in the world, but no species have been recorded in Korea. *Eulophias* species are poorly-known and rare to date. *Eulophias* sp. has eel-like body shape, 19-23 dark blotches on body side and many dorsal fin spines and anal fin rays. Head of the largest specimen is rounded and its snout is blunt, but that of the other specimens are slightly pointed. Caudal fin rays are blended with posterior region of dorsal and anal fin rays. Pelvic fin is absent. Our specimens are similar to *Eulophias tanneri* and *Eulophias owashii* in having elongated body and dark blotches on body side. But *Eulophias* sp. is easily distinguished from *Eulophias tanneri* by the number of anal fin rays (102-104 in *Eulophias* sp. vs. 75 in *Eulophias tanneri*) and caudal fin rays (9-11 vs. 7). Our specimens are most similar to *Eulophias owashii*, but differed in the number of anal fin rays (102-104 in *Eulophias* sp. vs. 95 in *Eulophias owashii*) and pectoral fin length in head length (2.5-2.8 times vs. 3.6 times). More comparative specimens are needed for clarifying the taxonomic position of *Eulophias* sp. collected from Korea by means of morphology and genetics.

0573 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Peter Kyne, Joanna Stead, Jaime Leung, Mike Bennett

The University of Queensland, Brisbane, Queensland, Australia

Where You Are is What You Eat: Large-scale Spatial Variation in the Diet of a Demersal Elasmobranch Predator

Studies examining the stomach contents of elasmobranchs, and fishes in general, often provide a snapshot of diet in time and space. Temporal and spatial characteristics of sampled populations can influence dietary composition, as can sex and ontogeny, among other factors. The diet of a demersal predator, the eastern shovelnose ray *Aptychotrema rostrata* (Shaw, 1794) was examined and compared between three distinct geographic environments off southern Queensland, Australia, representing a range of bathymetric zones: (1) shallow estuarine waters of a large embayment (Moreton Bay; 3-8 m depth); (2) inshore coastal continental shelf waters (Wide Bay-Burnett region; 15-33 m); and, (3) offshore continental shelf waters (offshore of Moreton Bay; 41-102 m). There

were no differences in the diet between sexes within each sample, however, ontogenetic changes in diet were evident. The overall diet of this common predator differed between estuarine, coastal and offshore environments. Diet within the estuarine environment was dominated by decapod crustaceans, with teleost fishes of minor importance. Diet within the coastal environment was also dominated by decapod crustaceans, but teleost fishes were considerably more important. In the offshore environment, teleost fishes were the dominant prey category. The eastern shovelnose ray consumes a diversity of benthic prey, but its diet varies spatially, highlighting not only the generalist nature of the feeding ecology of the species, but also that elasmobranch dietary studies need to consider the spatial context of their results.

0094 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Friedrich Ladich

University of Vienna, Vienna, Austria

Ontogenetic Development of Acoustic Communication in Fishes

Investigating the potential ability of juvenile fishes to communicate acoustically requires considering the development of vocalization and hearing. The ontogeny of both processes was examined in three non-related species, namely the croaking gourami *Trichopsis vittata* (Osphronemidae), the squeaker catfish *Synodontis schoutedeni* (Mochokidae) and the Lusitanian toadfish *Halobatrachus didactylus* (Batrachoididae). Juveniles of all three species vocalized during agonistic behaviour and showed similar changes in sound characteristics despite possessing different sonic mechanisms. Dominant frequencies decreased, whereas sound pressure levels, pulse periods and sound duration (except in the toadfish) increased with growth. Generally, hearing sensitivities improved during development, but differences were observed between species. Croaking gouramis responded to sounds up to 5kHz in all stages. Auditory sensitivity increased in the high frequency range and the best hearing frequency shifted from 2.5 to 1.5kHz. In the squeaker catfish, hearing abilities increased up to 2kHz but showed a decrease at 5 and 6kHz. The Lusitanian toadfish showed the smallest changes of all three species. The best hearing sensitivity was found at 50Hz in all stages and hearing improved only at 100Hz, 800Hz and 1kHz. A comparison between audiograms and sound spectra within same-sized fish of the respective species revealed that the main energies of sounds were concentrated within the most sensitive frequencies. The comparison also showed that early-stage gourami and toadfish probably cannot detect conspecific sounds due to low sound levels and high hearing thresholds. Only the catfish is able to communicate acoustically at all stages of development due to its Weberian apparatus.

0803 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Lisa Cordes Landry, Kyle Piller

Southeastern Louisiana University, Hammond, LA, United States

Swimming to the Beat of a Different Drumm: Stock Structure of Red Drum (*Sciaenops ocellatus*) in Louisiana

Previous large scale population genetic studies of Red Drum, *Sciaenops ocellatus* (Sciaenidae), in the Gulf of Mexico found significant differentiation among populations across the northern Gulf of Mexico. We conducted a microgeographic study of genetic variation of Red Drum to specifically investigate genetic variation in Louisiana's waters. We examined genetic variation for 321 Red Drum individuals for 16 microsatellite loci using seven a priori delimited management zones. Multiple population genetic analyses reveal significant genetic differentiation between Lake Pontchartrain Basin populations (East of the Mississippi River), and all six management zones to the west. This result is interesting, especially considering previous molecular studies for other marine species have proposed that the Mississippi River outflow presents a barrier to gene flow in the Gulf of Mexico. Little variation was seen among all other populations (West of the Mississippi River) suggesting ongoing gene flow among these western populations.

0042 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Tom Langen

Clarkson University, Potsdam, NY, United States

Predictive Models of Reptile and Amphibian Road Mortality Hotspots or Connectivity Blockages in Extensive Road Networks

Road-kill and connectivity blockages caused by roads and road traffic can result in population declines of amphibians and reptiles. To implement an effective plan to reduce road-kill and restore connectivity at blockages, the entire regional road network should be assessed. The time and expense to adequately survey an extensive road network may be prohibitive to agencies, however, so there is a need for accurate and efficient models to prospectively identify the most promising locations for monitoring and mitigation. I review three general modeling methods to predict road-kill hotspots and connectivity blockages for amphibians and reptiles, and propose a procedure to create and validate predictive models that uses publically-available GIS data. I also explain some of the informational and logistical challenges to developing models that are useful for management agencies. I argue that predictive hotspot models are tools that are essential for effective and economical whole road-network survey and mitigation, and for planning new road routes that avoid areas of high road-kill risk or critical corridors for habitat and population connectivity. While such models have

already proven useful for mammals, they may be especially effective for reptiles and amphibians, which typically have road-kill hotspots or connectivity blockages that are short in length but severe in effect.

0046 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Alicia LaPorte, Dana Bethea

NOAA Fisheries SEFSC Panama City Laboratory, Panama City, FL, United States

Preliminary Analysis of the Diet of the Sandbar Shark, *Carcharhinus plumbeus*, from the South Atlantic and Gulf of Mexico, USA

The diet of the sandbar shark, *Carcharhinus plumbeus*, was examined from stomachs collected in the US south Atlantic Ocean and Gulf of Mexico on NOAA Fisheries observer-covered bottom longline fishing vessels from 2008-2009. We examined historical changes in diet and tested for differences in diet between water basins. Additionally, bait type, hook and haul information were used to eliminate the bias of bait in diet calculations. Preliminary analysis shows teleosts (mostly species associated with hard bottom) and cephalopods (mostly octopi) to be the two most important prey categories in the diet.

0667 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Joanna Larson

Harvard University, Cambridge, MA, United States

Eyelid Ossifications in *Aubria masako*

Amphibians are generally known for their reduced level of ossification in comparison to other tetrapods and fossil representatives. Some species like *Pyxicephalus*, *Lepidobatrachus* and *Ceratophrys* however, show signs of hyperossification, particularly in the skull. Cranial co-ossification also appears in several species of casque-headed tree frogs that use their heads to plug holes into which they climb for protection and some species of *Brachycephalus* are remarkable for the development of an ossified dorsal shield. Caecilians display interesting patterns of ossification among amphibians with their heavily ossified skulls and dermal scales, which are probably an adaptation to their fossorial lifestyle. I here report on a specimen of *Aubria masako*, a frog from central Africa, with numerous ossicles embedded in the eyelids. Additional specimens of *A. masako* and *A. subsigillata*, the other species within the genus, were x-rayed to determine whether similar ossicles were present. No other examples of this feature were found, although the number of available specimens is limited due to the rarity of these frogs.

This species is semi-fossorial and it is speculated that these ossicles may provide protection to the eyes as individuals burrow into the soil.

0056 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

George Lauder

Harvard University, Cambridge, MA, United States

Fish Biomechanics from Karel Liem to the Present

One of the key contributions of Karel F. Liem to the field of functional morphology came at a time when the European "holistic" view of morphology dominated the field. Karel, in a series of highly influential papers, emphasized the importance of experimental manipulation as a tool for understanding the relationship between form and function. In his remarkable 1970 paper on nandid feeding mechanisms, Karel used a variety of surgical modifications of the feeding apparatus coupled with high-speed movies to demonstrate experimentally the function of mechanical linkage systems in the head. This experimental approach caused some consternation among European colleagues whose holistic view of morphology did not allow for experimental manipulations as a means of testing functional hypotheses, but the passage of time has shown the great value inherent in Karel's experimental methodology. One modern manifestation of the experimental and manipulative approach to functional morphology pioneered by Karel is the development of simple robotic devices that allow us to modify and manipulate models of fish components to test hypotheses about the function of fish morphology. I will give some examples from our recent work on robotic pectoral and caudal fins and a robotic flapping foil model of swimming fish to illustrate how robotic tools are allowing new questions to be addressed in fish functional morphology. I am thankful that Karel was able to see in recent years the current wide adoption of his approach and the newest expressions of the experimental methods that he initiated in the early 1970s.

0399 SSAR SEIBERT CONSERVATION AWARD, 555 AB, Friday 9 July 2010

Jolene Laverty, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

Impact of Water-based Recreation on the Spatial Ecology of Stinkpot Turtles (*Sternotherus odoratus*) in an Ontario Park

Land-based recreation can have a negative impact on turtles, but little is known about the impacts of water-based recreation on turtles. Provincial parks are considered protected areas for species at risk, but parks also provide areas for recreational activities for people, and studies are needed to determine if human presence is impacting resident species at risk. The purpose of our project was to determine if water-based recreation is having an effect on the health and spatial ecology of Stinkpot Turtle (*Sternotherus odoratus*) populations in The Massasauga Provincial Park (The MPP). We predicted if human recreation was negatively affecting turtles, then 1) injuries and mortality would be higher in impacted than in non-impacted sites, and 2) home range sizes and movements would be greater in impacted sites as turtles try to avoid people. Data were collected from three replicates of each site treatment: impacted bays and non-impacted bays. Thirty-two females were radio tracked during the 2009 field season and locations recorded; ArcGIS was used to examine movements and estimate home range sizes. Incidences of injuries and adult mortality were higher at impacted sites. Although not statistically significant, the home range sizes and movements were greater in impacted than in non-impacted sites. In mid-summer, when human presence at the park was greatest, turtles had significantly larger home ranges in impacted compared to non-impacted sites. Our findings indicate that water-based recreation could be negatively impacting Stinkpot turtles in The MPP, but further study with larger sample sizes are needed to make conclusive statements.

0112 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT PHYSIOLOGY, 555 AB, Friday 9 July 2010

Lucinda Lawson

University of Chicago, Chicago, IL, United States

Historical Biogeography, Divergence Times, and Diversification Patterns in the *Hyperolius spinigularis* Complex: A Molecular, Morphological, and Spatial Investigation into Evolutionary History in East Africa

New species diverge and diversify as a function of intrinsic and extrinsic forces, and identifying these processes is imperative for understanding speciation. The highly-fragmented *Hyperolius spinigularis* species-complex of three closely related and poorly

resolved species (*H. spinigularis*, *H. tanneri*, *H. minutissimus*) is an excellent system to study patterns and processes of diversification due to the discrete and compact nature of their geographic distribution (endemic to the fragmented highlands of East Africa) and the fact that divergences in this group are minor yet stable, and thus the signal of selection can still be detected. In this study, I use multiple independent datasets to discern the evolutionary history of this group and to identify the processes that create and maintain lineage independence in spite of potential gene-flow and/or competition between adjacent populations. By combining a multi-locus molecular dataset with spatial information, environmental niche modeling, paleoclimate reconstructions, and morphological analyses, I determine the historical and contemporary processes underlying the diversification and maintenance of genetic and ecological diversity in this group. Species tree estimations support monophyly for each of the described taxa, and spatial reconstructions of ancestral distributions appear driven by vicariance, long distance dispersal, and local extinction. Species are significantly different in their environmental niche requirements, but not in morphology. The combined results of spatial, genetic, morphological, and environmental analyses imply that allopatric mechanisms including adaptation to divergent habitat requirements and competitive exclusion have created at least part of the diversity in this sky-island system.

0743 SSAR SEIBERT CONSERVATION AWARD, 555 AB, Friday 9 July 2010

Daniel Leavitt

Texas A&M University, College Station, TX, United States

***Sceloporus arenicolus*, an Endemic Lizard in an Endangered Ecosystem**

Factors known to influence the persistence in anthropogenically fragmented habitats include connectivity between habitat patches, patch size, and frequency of disturbance. We are studying how these factors associated with oil and gas development may affect the Dunes Sagebrush Lizard (*Sceloporus arenicolus*) and six other lizard species in the Mescalero-Monahans Shinnery-Sands Ecosystem of New Mexico and Texas. Our Before-After-Control-Intervention study design consists of replicated mark-recapture studies on 27 trapping grids in fragmented, non-fragmented, and to-be fragmented landscapes. The first year of sampling produced 1,781 captures in 12, 150 trap days. The Dunes Sagebrush Lizard was notably absent from many fragmented sites. Additionally we are finding evidence of differences in lizard community structure, species diversity, and demographics between fragmented and non-fragmented sites.

0436 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Alexander Lebron¹, Karen Warkentin²

¹Cornell University, Ithaca, NY/14850, United States, ²Boston University, Boston, MA/02215, United States

Induction, Acclimation, and Behavioral Phenotypes: Predator Cues Change Flight Initiation Distance in Hatchling Red-eyed Treefrogs

Behavioral responses to predators can be important for tadpole survival. Terrestrial embryos of red-eyed treefrogs, *Agalychis callidryas*, hatch prematurely to escape from egg predators. They enter the water less developed than full-term hatchlings, less behaviorally responsive, and more vulnerable to aquatic predators. Development in the water, however, is faster than in the egg, which might reduce the cost of hatching early, particularly if larvae can use cues from aquatic predators to improve their defenses. We measured flight initiation distance (FID) of *A. callidryas* larvae in response to an approaching model predator to assay antipredator behavior. We assessed effects of hatching age and brief acclimation or longer induction with predator cues on FID. Tadpoles were tested at six days, when spontaneous hatching peaks. We compared responses to cues from odonate, belostomatid, and poeciliid predators. Two days induction by belostomatid and odonate cues increased FID, while fish induction decreased FID, compared with predator-free controls. This suggests that *A. callidryas* tadpoles have predator-specific responses consistent with differences in predator foraging behavior. Newly hatched six-day-old tadpoles had FID similar to predator-naïve early-hatched tadpoles. Moreover, two days after early hatching a 30-min acclimation with odonate cues increased FID, but newly hatched tadpoles showed no such change. If enhanced sensitivity to predator cues confers a survival advantage, accelerated development in the water may give surviving early-hatched animals an advantage over late-hatching members of their age cohort, once all eggs have hatched. This could reduce the overall mortality cost of premature hatching.

0222 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010

Mao-Ying Lee¹, Thomas A. Munroe², Kwang-Tsao Shao¹

¹Laboratory of Fish Ecology and Evolution, Biodiversity Research Center, Academia Sinica, Nankang, Taipei, Taiwan, ²National Systematics Laboratory, NMFS/NOAA, Smithsonian Institution,, Washington, DC, United States

Evaluating the Taxonomic Status of Tonguefishes Tentatively Identified as *Symphurus microrhynchus*: Comparisons of Morphological and Molecular Data between Populations Collected off Taiwan and Vietnam

Symphurus microrhynchus (Weber), a small-sized tonguefish species (ca. 100 mm), is characterized by 12 caudal-fin rays, low meristic features, and a blind-side pigmentation pattern of small, pepper-dot melanophores. This species, known from relatively few specimens collected from marine waters usually shallower than 100 m, has been reported from widespread localities ranging from off East Africa, to Viet Nam, and the Indo-Australian archipelago. Recently, other specimens tentatively identified as this species have been collected off Japan, Taiwan and the Philippines. Based on morphological features, specimens identified as *S. microrhynchus* share overall similarities in meristic features, but detailed comparisons of specimens from different areas reveal minor differences in their meristic, morphometric and coloration features. It is difficult to determine whether these differences reflect the presence of a species complex, or are population level differences of a widespread species occurring throughout the entire region. During a recent (2009) expedition, 42 tonguefish specimens tentatively identified as *S. microrhynchus* were collected and preserved in alcohol from Nha Trang fish port, Vietnam. Comparisons of morphological characters between specimens of Vietnam and Taiwan reveal that they share similar meristic and morphometric characters, but specimens from Vietnamese are absent pepper-dot melanophores (present at Taiwanese specimens). We using DNA barcoding to understand better of relationships between populations from Vietnam and Taiwan. Also, molecular data will assist in determining the informative value of morphological and coloration characters presently for identifying these fishes, and help resolve questions about the taxonomic status of populations presently identified as *S. microrhynchus* in the future.

0006 Herp Systematics, 551 AB, Monday 12 July 2010

Edgar Lehr¹, Alessandro Catenazzi¹

¹Illinois Wesleyan University, Bloomington/Illinois, United States, ²University of California Berkeley, Berkeley/California, United States

Species Diversity of *Bryophryne* (Anura: Strabomantidae) in Peru

Terrestrial-breeding frogs of the genus *Bryophryne* live at elevations of 2350–4000 m in cloud forests and puna habitats in southern Peru (Regions of Cusco and Puno). Since its description in 2008, five species have been described or assigned to this genus, which currently comprises six species. Previously, one of the defining characters for *Bryophryne* was the absence of a tympanum, which was considered a synapomorphy. However our recent herpetological surveys in southern Peru (Region of Cusco), led to the discovery of additional undescribed species, including the second species that has a tympanum and males that call during the day. One striking aspect of this genus is the level of endemism and high beta diversity across the eastern slopes of the Andes in southern Peru. Species of *Bryophryne* seem to be separated by a combination of habitat preferences and elevational distribution from their congeners. Morphological convergences between *Bryophryne* and *Phrynopus* are obvious. Species of both genera lack finger and toe disks with marginal grooves, and the majority of the species lack a tympanum. Both genera are restricted to Peru and are known from high elevation in the Andes. The deep valley of the Rio Apurimac presumably serves as a biogeographic border separating *Phrynopus* of northern and southern central Peru from *Bryophryne* and *Psychrophrynella* of southern Peru and Bolivia. We describe the distribution, taxonomy, and ecology of the species of *Bryophryne*.

0173 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Lee Lemenager, Richard Tracy

University of Nevada, Reno, Nevada, United States

Comparison of Water Potential in Two Anuran Species, *Lithobates catesbeiana* and *Xenopus laevis*

The water potentials of the seat patches of anuran amphibians (North American Bullfrog, *Lithobates catesbeiana*; and African claw frog, *Xenopus laevis*) were inferred from experiments of water exchange between frogs and environments in which the water potential was controlled. Water exchanges of frogs placed in different sucrose solutions were inferred from changes in body mass measured gravimetrically. Rates of water exchange by frogs were plotted against the osmotic potentials of the sucrose solutions with which the frogs exchanged water, and the x-intercept of this graph was taken to be

the water potential of the seat patch of the frogs (the point at which the water potential of the environment is equal to the water potential of the seat patch). Seat patch water potentials were different from the water potentials of blood implying that these frogs have some control of water uptake not seen in more terrestrial frogs.

0796 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Christine Lener, Theodora Pinou

Western Connecticut State University, Danbury, Connecticut, United States

Sea Turtle Epibionts as Indicators of Migration Patterns

Satellite transmitters are typically used to study sea turtle migration patterns. The cost of such technology often prevents local communities from understanding the behavior of turtles nesting on community beaches. This study examines sea turtle epibionts collected from nesting satellite tracked female sea turtles, and discusses the validity of epibionts as indicators of turtle movement. Species diversity analysis and canonical correspondance analysis provide insight to the relationship between turtle habitat and behavior, and demonstrate how traditional methods of comparative natural history can provide novel approaches towards conservation plans of endangered vertebrates.

**0065 Herp Ecology & Systematics, Ballroom B., Thursday 8 July 2010; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Danielle Leopold

Stetson University, Deland, FL, United States

Foraging Success of *Nerodia fasciata* on Native and Exotic Fishes

Introduced fish species are now a major component of aquatic communities in Florida, however few studies have addressed how these species will impact other trophic levels. I examined differences in prey handling by banded water snakes (*Nerodia fasciata*) when fed either an exotic armored catfish (*Hoplosternum littorale*) or a native catfish species (*Ictalurus punctatus*). *Nerodia fasciata* (n=10) from Florida were used in videotaped trials and were randomly given either a native or an exotic catfish that weighed approximately 10% of the snake's mass. Ten to fourteen days later the same snake was offered the other prey species. I measured attack latency, handling time, number of strikes, the number of times each snake released and recaptured the prey, and whether the fish was consumed. *Nerodia fasciata* can safely consume *H. littorale*, however only 40% were consumed, compared to 90% of the native catfish. Of the *H. littorale* that were attacked but not consumed, 75% died within 1-3 days. Both the mean number of unsuccessful strikes and the mean handling time were significantly higher in trials with

the exotic catfish. There was no significant difference in mean attack latency times between native and exotic species. Armored catfish have a number of physiological (air breathing) and anatomical (locking spines, armor) traits that make them a difficult prey item. However *N. fasciata* apparently perceive them as a suitable food item. Furthermore their predation attempts may result in mortality of the exotic prey.

0787 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Eric Lewallen¹, Robert Pitman², Nathan Lovejoy¹

¹University of Toronto at Scarborough, Toronto, Ontario, Canada, ²NOAA Southwest Fisheries Science Center, San Diego, California, United States

The Relative Abundance and Distribution of Flyingfishes (Exocoetidae) in the Eastern Tropical Pacific

Flyingfishes (Exocoetidae) play an important role in epipelagic ecosystems of the eastern tropical Pacific (ETP). Yet, detailed analyses on the relative abundance and distribution of these fishes have not been conducted. Flyingfishes were collected by dipnet in the ETP during research cruises (SWFSC) from 1986 – 2007. In total, 28,326 individuals from 13 species were obtained. Here, we quantify the relative abundance of each species and describe the distribution pattern of each species in the ETP. Relative abundance and distribution of each size class, temporal variation, and correlations between oceanographic processes were also investigated. Our results suggest that size classes are not distributed evenly across the ETP suggesting age-specific habitat preference for each species. The extremely large dataset available for this research provides a unique opportunity to understand the epipelagic ichthyofauna in the ETP. When coupled with available data on marine mammals, seabirds, plankton and oceanography, this study will improve understanding of trophic dynamics in epipelagic ecosystems.

0187 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

James Liao

University of Florida, Gainesville, FL, United States

The Metabolic Cost of Trout Swimming in Vortical Flows

The energetics of swimming in salmonids has held the interest of fisheries biologists, ecologists and physiologists for many decades. Despite the prevalence of turbulence in riverine environments, almost all fish respiration work has taken place in smooth flows. In light of the emerging importance of vorticity in understanding fish locomotion, we measured the metabolic costs of swimming in vortical flows and compared them with

swimming in smooth flows. We recorded the MO₂ for ten juvenile rainbow trout (*Oncorhynchus mykiss*, 15 cm ± 0.6, 51.3 g ± 2.4) using intermittent flow respirometry. We found that trout entraining behind 5 cm diameter cylinders in flows of 4.5 body lengths per second consumed 26.7% less oxygen than trout swimming in the free stream flow (300 mg/kg/hr vs. 220 mg/kg/hr). Preliminary results suggest that fish that Karman gait in the vortex street show similar oxygen consumption rates as fish that position themselves in the bow wake in front of the cylinder and well as entraining to the side of the cylinder.

0096 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Yi-fu Lin¹, Di-Rong Chen¹, Te-En Lin², Sheng-Hai Wu¹

¹*Department of Life Sciences, National Chung-Hsing University, Taichung, Taiwan,*

²*Taiwan Endemic Species Research Institute, Nantou, Taiwan*

Seasonal and Daily Activity of the Yellow-margined Box Turtle (*Cuora flavomarginata*) in Yunlin, Taiwan

Information on activity patterns of wild animals is important to understand the processes of acquisition and allocation of resources as related to the physiological status of the animals and environmental conditions. The turtles we are studying are from two sources (turtles translocated a water reservoir construction site, and wild turtles in native habitats). We quantified seasonal activity pattern of turtles from recaptured individuals from September 2008 on. Turtles were active from April to November. Using motion/temperature-illuminance data loggers attached to turtle shells one week every month, we also recorded daily activity pattern and environment factors. Based on the data recorded on three turtles in seven occasions spanning three months (October 2009 to January 2010), we found that turtles were active between 06:00 and 18:00. They became inactive when temperature was below 20°C. Frequency of activity increased when the illuminance was above 10000 Lux.

0157 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

Jason S. Link, Robert J. Gamble, William J. Overholtz, Michael J. Fogarty, Katherine Sosebee

NOAA NMFS NEFSC, Woods Hole, MA, United States

What Would the Ocean Look Like without any Dogfish? Multimodel Inference from Simulations of the Northeast U.S. Large Marine Ecosystem

Spiny dogfish are one of the more ecologically important fish species in the NEUS LME. As such, much speculation exists regarding the hypotheses that dogfish notably compete with or eat other species of commercial importance. Central to much of this speculation is that spiny dogfish are keeping other commercially important stocks at depressed levels, and for those other stocks of interest to recover, dogfish will need to be largely reduced in abundance, if not functionally removed from the ecosystem. To explore the range of possibilities associated with and implied by this set of speculations, we ran several simulations using a range of models. The results from our multimodel simulations generally concurred: after removing or reducing dogfish from the models, most groundfish stocks did not show the anticipated drastic increases. Key prey of dogfish, including small pelagic fishes and squids, varied in their response. Only one major prey of dogfish, ctenophores consistently tended to show a clear, positive response suspected to be due to a release from predation pressure. Collectively our multimodel inference demonstrates the need to consider indirect responses due to the highly interconnected food web of the NEUS LME and that a binary predator-prey response is unlikely in such an ecosystem. We conclude that the potential for unintended consequences remains quite high from such virtual experiments as in these simulations. We thus recommend that scenarios such as these be considered *in silico* as part of a management strategy evaluation before ever being considered for further application *in situ*.

0155 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Jason S. Link, Brian E. Smith, David McElroy, Richard S. McBride, John Hauser, Katherine Sosebee

NOAA NMFS NEFSC, Woods Hole, MA, United States

The Trophic Role of Assorted Skate and Dogfish Species in the Northwest Atlantic Ecosystem

The trophic role of individual elasmobranch species has been explored for the northwest Atlantic, but rarely for a collective group of species. Here we combine more than 35 years of data to compare the relative and cumulative role of seven species of skate and

two species of dogfish in this ecosystem. The elasmobranch species included were the barndoor (*Dipturus laevis*), winter (*Leucoraja ocellata*), clearnose (*Raja eglanteria*), rosette (*Leucoraja garmani*), little (*Leucoraja erinacea*), smooth (*Malacoraja senta*), and thorny (*Amblyraja radiata*) skates, plus the smooth (*Mustelus canis*) and spiny (*Squalus acanthias*) dogfishes. Most of these nine species could be characterized as either benthivorous, piscivorous or a combination thereof in nature. Some were, surprisingly, even major predators of gelatinous zooplankton. Major determinants of diet were noted and largely corresponded to changes in predator size, season, or era of the time series; spatial considerations were less prominent as a diet determinant. The total amount of consumption by these stocks was substantial, in many years averaging over a quarter of a million metric tons, largely driven by the more abundant spiny dogfish and winter skate. Currently, these elasmobranchs collectively represent some of the most prominent piscivores and benthivores in this ecosystem. The amount of energy cumulatively removed by these elasmobranchs is notably more than for the major groups of teleost species, implying the importance of tracking the trophodynamics of these species. As the fish community of this ecosystem remains dynamic, it is highly probable that any changes therein will nexus through these elasmobranch species.

0417 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Robert Literman, Jennifer Neuwald, Nicole Valenzuela

Iowa State University, Ames, IA, United States

Differential Embryonic Mortality in Two Turtle Species with Different Sex Determination Pathways

The adaptive value and maintenance of environmental sex determination (ESD) is an intriguing question in biology with molecular, ecological, and evolutionary implications. To understand why this trait remains present throughout evolutionary time, we must uncover the fitness benefits that developmental plasticity imparts to organisms which utilize it. In this study we tested the hypothesis that eggs of animals with ESD are more capable of surviving in a variable environment than species with genotypic sex determination (GSD). We used a controlled comparative experimental design to study the embryonic mortality of two turtle species, the painted turtle *Chrysemys picta* which has temperature-dependent sex determination (TSD), and the GSD spiny softshell turtle *Apalone spinifera*. Eggs of each species were incubated under identical conditions at multiple constant and fluctuating temperature profiles. Differences in embryonic mortality rates of the TSD and GSD species under constant and fluctuating thermal regimes are discussed along with the possible evolutionary implications.

0527 Fish Ecology, 555 AB, Sunday 11 July 2010

Caitlyn Little, Devin Flawd, James Sulikowski

The University of New England, Biddeford, ME, United States

Movement Patterns of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Saco River, ME

The Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, is a large, anadromous fish that ranges along the eastern coast of North America from Labrador in Canada to Florida in the United States. Overfishing and habitat degradation during recent decades have severely depleted or extirpated several historic sturgeon populations. The decreasing population trends have prompted listing of the Atlantic sturgeon as a federal Species of Concern throughout its range in the United States. Over approximately the last 50 years, this species has been documented only in the Penobscot and Kennebec River complex in the state of Maine. Beginning in 2007 however, Atlantic sturgeon have been observed in the Saco River (the fourth largest river in Maine). In order to gain insight into the sudden appearance of this species in this river system, an acoustic array consisting of 10 VEMCO VR2W receivers was deployed in the spring of 2009. This array covers the area between the last dam seaward and the mouth of the river, a stretch of approximately six nautical miles. From May 2009 to November 2009, 34 sturgeon ranging from 94-188cm total length were captured using a 100m, 30cm stretched mesh gillnet. Total bottom soak time for this study was 12.45 hours. Acoustic transmitters were implanted in 21 captured specimens. Preliminary analysis of detections indicates that sturgeon may be displaying diurnal movement patterns within the river and that at least one of the tagged individuals has traveled the length of the lower portion of the river to the last seaward dam.

0612 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Jessie Livingston, Jim Gelsleichter

Department of Biology, University of North Florida, Jacksonville, Florida, United States

Preliminary Observations on Relaxin Receptor-like Activity in Male Sharks and Rays

The purpose of this study is to investigate potential roles for relaxin in regulating reproduction in male elasmobranchs. Relaxin is a 6kDa peptide hormone present in most vertebrate groups and is best known for its ability to stimulate remodeling of the female reproductive tract and birth canal during pregnancy and parturition. However, the function of this hormone in male vertebrates remains largely unclear. Prior research on the bonnethead shark, *Sphyrna tiburo*, has demonstrated that serum relaxin concentrations increase in this species during late spermatogenesis and the mating

period suggesting a role for relaxin in regulating processes such as spermiation, sperm transit through the male reproductive tract, and/or copulation. In this study, immunocytochemistry was used to detect relaxin receptor-like immunoreactivity in the reproductive tract of the male *S. tiburo* and a variety of other species including the Atlantic stingray *Dasyatis sabina* and the blacknose shark *Carcharhinus acronotus*. Preliminary results suggest that relaxin receptor-like activity is primarily localized to late stage and evacuated spermatocysts in the testis of male elasmobranchs, strongly supporting a role for this hormone in regulating some aspect of spermiation. Possible relationships between relaxin and cellular actions that would mediate sperm release, such as increased production of extracellular matrix-degrading enzymes, are considered. In addition, evidence of relaxin receptor-like immunoreactivity in other components of the reproductive tract, such as the epididymis and seminal vesicle, is presented.

0542 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Lisa Lobel¹, Devin Drown³, Paul Barber², Phillip Lobel¹

¹*Boston University, Boston, MA, United States*, ²*UCLA, Los Angeles, CA, United States*, ³*Washington State University, Pullman, WA, United States*

Determining Parentage of Damselfish Embryos Using Microsatellites Reveals Mate Selection Patterns

We investigated the mating system of the damselfish, *Abudefduf sordidus*, (Johnston Atoll, Central Pacific Ocean) using genetic markers. Since spawning was rarely observed, microsatellite markers were developed to address several questions regarding both male and female mate selection and reproduction. Offspring from 343 clutches in 208 nests collected over seven consecutive nesting cycles (within one mating season) were genotyped using six polymorphic microsatellite loci. A nest contained one to five clutches of embryos, found in discrete patches, during a given cycle. Paternal genotypes were constructed by identifying common alleles from combined offspring genotypes. In 280 of 343 clutches the offspring had genotypes consistent with paternity by the attendant male. In the remaining 63 (18%) clutches, some offspring displayed genotypes inconsistent with the paternal male, suggesting reproductive parasitism by sneaker males. Males used the same nest site repeatedly and only in some cases used two nest sites. Maternal genotypes in clutches with a single sire (N = 280) were identified based upon the fact that only two maternal alleles were present after subtracting the paternal genotype. Of the females (N = 195) identified, 65% spawned once during the seven cycles, while the remaining females spawned two to six times during the same period. In contrast, males (N = 37) received between two and 19 clutches during the study. When spawning, a female deposited all of her eggs with one male in one clutch. These genetic data revealed previously unknown patterns of mating and mate selection.

0469 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Phillip Lobel

Boston University, Boston, MA, United States

Searching for Evolutionary Novelties in Lac Tele, Congo: New Fishes and Giant Pythons

A highlight of discussion in Karel Liem's lab during the latter 1970's was the topic of explosive radiations among fishes adapted to novel habitats. Liem's interest in adaptive radiations based on morphological diversification was a stimulating subject between him and his first graduate student clan (Lauder, Levine, Ono and me). Prof. Liem (and my fellow students) provided the intellectual stimulus for my conducting 3 expeditions (1986, 1988, 2003) into the deep jungles of Congo, Africa in search of new fishes. The hope was to find another species flock in an isolated lake, in northern Peoples Republic of Congo. It turned out that this remote lake (Lac Tele) was also the rumored home of a mysterious giant animal as yet unknown to science (aka Mokele mBembe). We found a suite of fishes restricted to this lake but more impressively; we found an abundance of giant pythons. The lake is oval shaped, about 5 by 6 km. The bottom is widely layered in decaying leaf litter. Maximum depths ranged 3 to 5 m. We collected about 36 species belonging to 14 families. Fishes included 1 lungfish, 8 mormyrids, 6 characins, several silurids, 5 killfish, 2 anabantids, 1 channid, and 4 cichlids. Several of these fishes are undescribed and appear to be found only in Lac Tele. We also recorded native names and associated local folklore for various fishes. A conceptual model for gigantism in Lac Tele pythons is proposed based on the fluctuating lake habitat, abundant prey and minimal threats.

0489 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

James Locascio, Ernst Peebles, David Mann

College of Marine Science, St. Petersburg, Florida, United States

Quantitative Measurements of Black Drum Sound Production and Spawning

Long-term Acoustic Recording Systems (LARS) were used to document diel and seasonal patterns of sound production by spawning aggregations of black drum (*Pogonias cromis*) in estuarine canal systems of southwest Florida. Hydrophone array recordings were used to localize the position of calling black drum and estimate source levels. The temporal and quantitative relationship between egg production and sound production was examined from hourly collections of black drum eggs (1800 - 0400 hr) and simultaneous acoustic recordings made on two consecutive evenings, five times during the spawning season. Black drum sound production was strongly diel, beginning near dusk and lasting for several hours. Sound production occurred during

October through April and peaked in February-March, a pattern consistent with the documented spawning season of this species in the Gulf of Mexico. A total of 1,025 source level estimates were made from six different fish and averaged 165 dBRMS re: 1 μ Pa SPL (SD=1.0). Localization of consecutively produced calls by an individual indicated patterned swimming behavior. Acoustic communication range for black drum based on empirical data of source level, signal propagation, auditory sensitivity, and background levels was estimated at 33 - 108 m. Neither the timing nor quantity of sound production was correlated with egg production on a nightly basis. These results indicate that patterns in sound production are not useful for predicting patterns in egg production by black drum on a daily scale but do provide accurate characterization of spawning behavior on a seasonal basis.

0140 Fish Conservation, Ballroom B, Friday 9 July 2010

Ken Longenecker¹, Ross Langston²

¹Bishop Museum, Honolulu, Hawaii, United States, ²Windward Community College, Kaneohe, Hawaii, United States

Size Structure of Reef-Fish Populations Exploited by a Papua New Guinea Subsistence Community

As part of an effort to create a self-sustaining environmental conservation program at Kamiali, Papua New Guinea, we are generating baseline information on the marine portion of a 47,000-hectare wildlife management area. Here we use laser videogrammetry to describe the size structure of exploited reef-fish populations under traditional marine tenure. We generated size data for 17 species and found a typical individual in the exploited reef-fish community is 52% of its reported maximum length. In the subset of 10 species for which size at maturity is known, a typical individual is 99% of female reproductive size. Considering sex ratios (known for only four species) suggests an average 24% of a population is reproductively mature females. Residents of Kamiali routinely deny practicing conservation techniques, however several village characteristics are likely to promote sustainable fish populations. These include: exclusive harvesting rights, distance to commercial markets, and low-technology fishing methods. This information will be useful in guiding the village's future conservation efforts and to evaluate the effectiveness of those measures.

0721 NIA I, 556 AB, Saturday 10 July 2010; NIA BEST STUDENT PAPER AWARD

Nicolas Longrie, Johann Delcourt, Pascal Poncin, Pierre Vandewalle, Eric Parmentier

University of Liège, Liège, Belgium

Sound Production and Associated Behaviors in the Nile Tilapia, *Oreochromis niloticus* (Cichlidae)

Several cichlid species, from both Africa and South America where the family has known a big development, have been shown to have the ability to produce sound (*Tramitichromis intermedius*, *Pseudotropheus* spp., *Cichlasoma centrarchus*, ...). In the Nile Tilapia, *Oreochromis niloticus* (Linnaeus 1758), males are able to emit sound (pulse duration > 100 ms; frequency < 200Hz) in several behavioral contexts (territorial defence, courtship). Observations were made with the aim of determining the potential influence of the sex of an « intruder » on the territorial male's sound production, and to link the sound to specific behaviours within these contexts. Behaviours were studied in situations such as « Territorial Male - Male(s) », « TM - Female(s) ». *Oreochromis niloticus* females have also been studied, as they display strong territorial behaviors in certain contexts, during which sound production could occur (for example mouthbrooding).

0262 NIA I, 556 AB, Saturday 10 July 2010

Hernan Lopez-Fernandez¹

¹Royal Ontario Museum, Toronto/Ontario, Canada, ²University of Toronto, Toronto/Ontario, Canada

Timing and Patterns of Divergence in Neotropical Cichlid Fishes

Neotropical cichlids comprise more than 600 species with an enormous ecological, morphological and behavioral diversity. However, we know very little about the evolutionary processes responsible for the origin of the group. I use a molecular phylogeny of virtually all Neotropical cichlid lineages to estimate times of divergence and rates of diversification within the group. I combined data from recent fossil findings with dated geological events to estimate cichlid divergence times using Bayesian relaxed-clock methods. I use the resulting chronogram to test whether these patterns are compatible with processes of adaptive radiation. Neotropical cichlids appear to have originated in the Late Cretaceous between 90 and 130 Ma. The origin of the clades Geophagini, Cichlasomatini and Heroini corresponds with increased diversification rates about 100 Ma ago, supporting phylogenetic evidence that suggests they originated through ancient adaptive radiation. More recent episodes of accelerated diversification

may have occurred between the late Paleogene and early Miocene, especially during diversification of the mostly Central American amphiplophines clade. From the Late Cretaceous through the Miocene, South and Central America were repeatedly affected by climate changes, sea-level variations and major geological disruptions. This generalized environmental instability likely drove cichlid diversification by repeatedly imposing novel ecological demands. Morphological and ecological specialization probably became widespread during these ancient periods of rapid diversification. As illustrated by cichlids, studying timing and patterns of divergence in different groups of Neotropical fishes should build an integrated understanding of the historical conditions under which the richest freshwater fish fauna on the planet evolved.

0241 Fish Conservation, Ballroom B, Friday 9 July 2010

Benjamin D. Lorson, Jonathan A. Freedman, Jay R. Stauffer, Jr.

Pennsylvania State University, University Park, PA, United States

Distribution of Allegheny River Fishes Using a New Sampling Technique

Small benthic fishes have been under represented in historic sampling of medium to large rivers. Sampling techniques are the main reason for this as many of the historic sampling techniques do not target these fishes in deepwater habitats. The Allegheny River in northwest Pennsylvania contains many habitats that have not been able to be reached in historic sampling surveys. There are also many portions of this river that have never been sampled and much of the collection data are outdated. The electrified benthic trawl is a new sampling gear that allows the sampling of small benthic fishes in deepwater river habitats. A systematic sampling of the Allegheny River with an electrified benthic trawl allowed us to sample the diverse ichthyofauna inhabiting the mainstem of this river. We sampled 67 sites (286 trawls) and collected 10,333 fish representing 49 species. Benthic fishes (24 species) comprised 81.8% of the total catch and included 15 darter species (59.6% of the total catch). We collected eight species of special concern including four species of darters.

0392 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Robert Lovich¹, Chris Petersen², Priya Nanjappa³, Michael Lannoo⁴, Ernie Garcia⁵

¹*Naval Facilities Engineering Command, Southwest, San Diego, CA, United States,*

²*Naval Facilities Engineering Command, Atlantic, Norfolk, VA, United States,*

³*Association of Fish & Wildlife Agencies, Washington, DC 20001, United States,*

⁴*Indiana University School of Medicine, Terre Haute, IN, United States,* ⁵*Friends of PARC, Weaverville, CA, United States*

The DoD PARC Strategic Plan: Purpose, Strategies, and Implementation Opportunities

The Department of Defense (DoD) lands contain the highest number of endangered species and habitats when compared to any federal landowner in the United States. Likewise, the herpetofaunal diversity and abundance on DoD lands is equally remarkable. While herpetofauna on military lands have been studied, managed, and conserved with robust funding and resources, studies have been accomplished without the benefit of overarching guidance. Given the diversity of both the herpetofauna and habitats across DoD landscapes, consistent approaches are important for management, conservation, monitoring, and research. The DoD has joined with Partners in Amphibian and Reptile Conservation (PARC) to develop a strategic plan for herpetofauna. The Plan will create a framework for the implementation of effective herpetofaunal research, management, monitoring, and conservation on DoD lands. The Plan will guide science-based management of herpetofauna and their habitats, set conservation priorities and objectives, and provide the needed tools for ongoing management, education, and outreach. Complementing the success of the DoD Partners in Flight (PIF) Strategic Plan, which has improved the status of avian communities on DoD lands, the proposed Plan will similarly benefit herpetofauna while providing opportunities for increased partnership with the greater herpetological community. Specifically, the Plan will offer guidance for incorporating herpetofauna habitat management and conservation efforts into installation Integrated Natural Resource Management Plans. In addition, the DoD PARC Strategic Plan will help DoD justify its unique role of stewarding natural resources in the United States, while benefiting the national defense mission requirements.

0548 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Germán E. Lozano, Charles W. Olaya-Nieto

Universidad de Córdoba, Lórica, Córdoba, Colombia

Length-Weight Relationship of Common Snook (*Centropomus undecimalis*) in the Cispata Bay, Colombia

The common snook (*Centropomus undecimalis*) is a very important species in the fishery in the Cispata Bay, Colombia. In order to estimate its length-weight relationship 247 samples was collected. The sizes ranged between 28.0 and 88.0 cm in total length (TL) and the total weight (TW) between 110.0 and 8000.0 gram (g). The length-weight relationship was estimated with the equation $TW = a TL^b$. The equations estimates were: $TW = 0.002 TL^{3.43} (\pm 0.11)$, $TW = 0.009 TL^{3.05} (\pm 0.17)$ and $TW = 0.002 TL^{3.42} (\pm 0.16)$ with positive allometric growth coefficients, confidence intervals of 95% and high correlation coefficients (r) with values of 0.95, 0.94 y 0.97 for males, females and combined sexes, respectively. In March and June the smallest and highest condition factor were observed, respectively, and this values corresponding to combined sexes; while that the annual mean condition factor is highest for females. The condition factor is related with spawning of common snook, between March and October.

0778 Fish Systematics II, Ballroom D, Monday 12 July 2010

Ma. de Lourdes Lozano-Vilano¹, Justin Bagley²

¹*Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, Mexico,*

²*Brigham Young University, Provo, UT, United States*

New Species of Poeciliid Fish from Northern Mexico, with Comments about its Genus

It is reported a new species of poeciliid fish of genus *Heterandria*, was found in chanel from Allende, Coahuila, México. The new species is related with *Heterandria formosa*, that is not reported from México, is distributed in coast of North Carolina and Florida until Louisiana, USA, the new species and *Heterandria formosa* are similar in size, they are a pygmy species, are very small individuals, do not reach 3 cm, and some characteristics of coloration, like the bars in the body sides and the ocelo of the dorsal fin. They are different in dentition type, structure of the gonopodium, measurements and genetic studies. The same form *Heterandria formosa* y *H. sp.* are different of *Heterandria bimaculata* and *H. jonesii* of the South of México, in the size of body, gonopodium, and others morphological characteristics, as might be deemed to correspond to a new genus.

0616 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Emmet Allen Luck, Rachel Goodman

Hampden-Sydney College, Hampden-Sydney, VA, United States

Examining Geographic Variation in Sexual Size Dimorphism in the Lizard, *Anolis carolinensis*

We examined whether populations of the lizard *Anolis carolinensis* vary in degree of sexual size dimorphism (SSD) across several populations in the southeastern United States. Many animals exhibit SSD that may be related to male competition, female fertility or young-carrying capacity, and differences in the ecology of the sexes. Lizards in the genus *Anolis* have served as a model species for understanding niche use, habitat partitioning, and convergent evolution of body size and form. Studies of *Anolis* species have indicated that males and females may occupy different niches that may contribute to SSD. Since temperature, precipitation, and habitat complexity vary over the range of *A. carolinensis*, we predicted that SSD may also vary among populations across the range. In 2006 and 2007, 627 lizards were collected from 19 populations across the southeastern United States. Mass, body and tail length measurements were taken on live specimens. All lizards were humanely euthanized and preserved in formalin. We measured maximum head width and maximum diameter of fore- and hind-limbs on preserved specimens using digital calipers. Lizards were x-rayed, and morphological measurements (length of head, spine, femur, tibia, and interlimb length) were taken from digital images of radiographs using ImageJ computer software. We combined measurements from live animals and preserved specimens to analyze how males and females differ in body size and shape, and how these relationships differ among populations. Degree of SSD was compared among populations along with climatic data, latitude, and longitude to examine any climatic or geographic trends in SSD.

0596 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Kyle Luckenbill

Academy of Natural Sciences, Philadelphia, PA, United States

Lundberg: A Retrospective Through Figures

John Lundberg has made significant contributions to the advancement of the study of systematics over his long career. His list of publications speaks for itself and the figures from his work speak just as loudly. After working with John you soon realize that the only thing more satisfying to him than finding a new character or resolving a phylogenetic relationship is finding the most visually pleasing and informative way to present it. Over his career the art of creating figures has changed a great deal. He has gone from slides to digital photography, press-on letters to Adobe Illustrator, film

radiographs to digital radiographs and CT scans, printed media to web publications, and he has embraced every advancement. We will look at his work from his early days as a student to more recent work involving more advanced technology and new ways of presenting information visually.

0539 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Joseph Luczkovich, Mark Sprague

East Carolina University, Greenville, NC, United States

Sounds of Fishes: How Much Can Be Learned about the Behavior, Ecology, Evolution and Fisheries Management from Listening to Fishes?

Fishes hear and produce a variety of sounds that allow them to interpret their environment as well as communicate with their conspecifics. Species-specific sounds are associated with predator avoidance, territory defense, reproduction, swimming, and feeding. Males make advertisement sounds to communicate their readiness to spawn, especially in the Families Sciaenidae, Gadidae, Holocentridae and Batrachoididae. Predator-prey interactions are acoustically mediated in some fishes. Playback studies with bottlenose dolphins (*Tursiops truncatus*) show that dolphins orient toward the sounds of fishes, and dolphin vocalizations cause silver perch (*Bairdiella chrysoura*, Sciaenidae), longspine squirrelfish (*Holocentrus rufus*, Holocentridae) and gulf toadfish (*Opsanus beta*, Batrachoididae) stop producing sounds. Sounds provide information on the behavior, species, sex, and size of the individual. Some female fishes may utilize sound to assess male fitness, suggesting sound characteristics (dominant frequency, pulse patterns, and loudness) are traits under selection pressure. Mate selection based on sounds and acoustic competition between males has been documented in the Batrachoididae. In sympatric species of the genus *Cynoscion* (Sciaenidae), the dominant frequency is a function of fish size, but the pulsing patterns produced by *C. regalis* are distinct from *C. nebulosus*, suggesting it could be an important cue for females during mate choice. There appears to be spatial and temporal differences in the calling sites for these sympatric congeners, thus supporting the hypothesis of acoustic competition. Because of these variations in sound characteristics, biologists can now identify spawning habitats, infer behavior patterns, and use the sounds of fishes as “natural acoustic tag” in fisheries management.

0144 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Marco Lugli

University of Parma, Parma, Italy

Ambient Noise and Shelter Acoustics Explain the Low-frequency Communication in Mediterranean Gobies

Many soniferous teleosts using stones or other types of submerged objects for reproduction live in very shallow environments characterized by high background noise levels and short-range propagation of low frequencies. Yet, the use of low frequency sounds for communication is widespread among these fishes. This puzzling fact has remained unexplained for decades, with no convincing explanation being offered for the paradox. The present study examines the relationships between ambient noise spectrum, shelter resonance and main sound frequencies among nine species of Mediterranean gobies reproducing under stones and shells in very shallow freshwater (stream, vegetated spring), brackish (two lagoons) and marine (sandy/rocky sea shores) habitats. Ambient noise spectra of these habitats featured a low-frequency quiet window centered at 100 Hz (stream, sandy/rocky shore), or at 200 Hz (spring, brackish lagoon). The main frequencies of the species' sound matched the frequency band of the quiet window in the ambient noise typical of their own habitat. Natural shelters (flat stones, shells of several bivalve species) amplified the sound frequencies mainly in the range 100-150 Hz. Gain was higher for stones than for shells. The joint effect of hollow acoustics and the quiet window determined a remarkable increase of the S/N ratio at lower frequencies, thereby explaining the low frequency acoustic communication by these gobies.

0633 Fish Evolution, 555 AB, Saturday 10 July 2010; ASIH STOYE AWARD GENERAL ICHTHYOLOGY

Daniel Lumbantobing¹

¹*The George Washington University, Washington, DC, United States*, ²*Smithsonian Institution, Washington, DC, United States*

Recognition and Relationships of Areas of Endemism in South East Asia based on the *Rasbora sumatrana* Species Group (Teleostei; Cyprinidae)

The *Rasbora sumatrana* species group is one of the most diverse and widespread yet problematic taxa in the freshwater genus *Rasbora*. Its species are superficially similar and therefore have been ignored taxonomically. In a phylogenetic analysis of the genus using morphological characters, the *R. sumatrana* species group is paraphyletic: some species are sister to the monophyletic *R. caudimaculata* species group; the two groups are now classified together. The *R. sumatrana* species group is a clade supported by three

synapomorphies: (1) triangular basicaudal blotch; (2) 25–26 pored lateral line scales; and (3) medial ramus of pelvic girdle without anterior process. Twenty-five species, including 9 undescribed, are recognized in the species group, herein further classified in 4 species complexes: (1) *R. caudimaculata* complex; (2) *R. elegans* complex; (3) *R. sumatrana* complex; and (4) *R. volzii* complex. New species and species complexes are identified using differences in body color patterns (black midlateral stripe, basicaudal blotch, and caudal pigmentation) and osteological characters (basihyal and urohyal shape). A cladogram of each complex is reconstructed using morphological characters. Within the *R. sumatrana* complex, all species are allopatric, and some are sympatric with species of the other complexes. Based on distribution of the four species complexes and of other *Rashora* species, 20 endemic areas are recognized in South East Asia. The relationships of the areas are inferred by generating areagrams of each complex and examining them for general patterns. These patterns are interpreted with respect to the geological and biological history of South East Asia.

0521 Plenary, Ballroom A, Thursday 8 July 2010

John Lundberg

Academy of Natural Sciences, Philadelphia, PA, United States

Authentic American Cryptoichthyology

The nearly 1200 species of modern North American freshwater fishes are well delimited and properly named. Late Cretaceous and Cenozoic fossils add dozens more named and informative freshwater fishes to the emerging continental assemblage. Together, these are the known knowns. The North American ichthyofauna had complex phylogenetic, temporal and biogeographic origins, and its inventory is not done – there are unknown unknowns. Some gnarly fish problems have been recently cracked but we still confront long-standing puzzles: cryptically fuzzy species boundaries; unresolved rogue taxa within clades; endemic clades with uncertain but likely distant extralimital or deep phylogenetic reach. We commonly have new encounters with previously unseen fossil fishes and, uncommonly, someone finds a previously undetected living species. These are the better known and the lesser known unknowns. The discoveries and puzzles that ichthyologists love best are those with novel or unexpected or uncertain or unimagined results. Prominent and obscure real examples will illustrate the points, some with the generous assistance of a few good, intrepid ichthyological explorers and colleagues.

0080 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Paula Mabee, Wasila Dahdul

University of South Dakota, Vermillion, SD, United States

New Tools for the Study of Development and Evolution of the Fish Skeleton

Skeletal variation across fishes is widely recognized as resulting from evolutionary changes in underlying genetic and developmental factors. Although relatively little is known about these factors across fishes, a wealth of knowledge of genetics and development has been accumulated for the model organism zebrafish. Because developmental processes are highly conserved even across very distantly related organisms, this knowledge can potentially be leveraged for understanding the evolution of skeletal diversity. As a proof of concept, we extracted the comparative morphological data from ostariophysan fishes in concert with initiating an anatomy ontology for fishes, the Teleost Anatomy Ontology (TAO). TAO was built with community input and used for annotation of images and evolutionary phenotypes. In the Phenoscape Knowledgebase (kb.phenoscape.org) the annotated evolutionary data are combined with similarly structured data from zebrafish genetics and mutant phenotypes (from zfin.org). Using the reasoning enabled by the underlying ontology-based structure, we inferred a set of candidate genes including *eda*, *edar*, and *brpf1* for morphological characteristics of catfishes (e.g. loss of scales and absence of basihyal element). Ongoing in situ hybridizations will determine whether the predicted tissue-specific expression patterns of these candidate loci in *Ictalurus punctatus* and other catfishes match those predicted from zebrafish. This in turn will test the broad-scale usefulness of the Phenoscape Knowledgebase for devo-evo predictions. The Phenoscape KB has facilities for browsing, sorting, and collating morphological systematic data that allows unprecedented access to a rich collection of data by developmental and evolutionary biologists.

0150 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Laura Macesic¹, Erin Blevins², Dana Mulvaney¹

¹*Florida Atlantic University, Boca Raton, Florida, United States*, ²*Harvard University, Cambridge, Massachusetts, United States*

Pectoral and Pelvic Fin Coupling During Augmented Punting in the Freshwater Stingray, *Potamotrygon hystrix*

Punting, a form of aquatic locomotion performed by stingrays and hippos alike, involves depressing paired limbs into the substrate, then pushing off and gliding until the next limb depression cycle. In batoids (skates and rays), punting is performed either entirely with the pelvic fins (true punting), or in concert with the pectoral fins,

(augmented punting), as is seen in the freshwater stingray, *Potomotrygon hystrix*. We used high-speed video to quantify the motor patterns of the pectoral and pelvic fins during punting to test whether the fins acted synchronously to generate a uniform thrust vector. We filmed ventrally to quantify pelvic fin punting cycles and laterally to quantify the maximum and minimum amplitude of each pectoral undulation (i.e. crest and trough of each wave). We found that the start and end of each pelvic cycle coupled with both the maximum and minimum amplitude of a single pectoral undulation within individuals ($n=4$; $p<0.05$, $p<0.01$, respectively). Moreover, the minimum amplitude, likely the thrust generating portion of the wave, coincided with the end of the pelvic fin thrust for all rays ($p<0.01$). This may be an efficient thrust generator, as pectoral undulation could add to the thrust generated by the pelvic fins. Timing of maximum pectoral fin amplitude was not consistent among the rays ($p=0.64$). Pectoral fin undulation frequency during punting (mean= $2.25\text{Hz}\pm 0.56\text{SD}$) was similar to previously published values during swimming for the blue-spot stingray (mean= $2.32\text{Hz}\pm 0.42\text{SD}$), which suggests that the pectoral fin motor pattern may be fixed regardless of the type of locomotion being performed.

0710 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Suzanne Macey¹, Andrew Myers², J. Alan Clark¹

¹Fordham University, Bronx, NY, United States, ²SUNY ESF, Syracuse, NY, United States

Hot Spots: Nest-site Selection in Bog Turtles (*Glyptemys muhlenbergii*) and the Implications for Management

The bog turtle (*Glyptemys muhlenbergii*) is a federally-threatened species, primarily because the early successional wet-meadow/fen habitat bog turtles require is increasingly rare. However, little is known about bog turtle nesting habitat requirements and preferences. Understanding nesting microhabitat conditions is important because such conditions may not only determine the survival of turtle embryos, but may also determine the sex of individuals if bog turtles have temperature-dependant sex determination. I will examine the hypotheses that (1) female bog turtles preferentially nest in areas with reduced woody and invasive vegetative cover and height; (2) selected sites are warmer than random points within nesting range; and (3) warmer nests have a higher hatching success rate. An understanding of the relationship between vegetative cover, nest temperature, and nest success will provide insight into understanding maternal nest-site selection in the bog turtle as well as relevant data for improving the preservation and management of nesting habitat.

0334 AES GRUBER AWARD, 551 AB, Friday 9 July 2010

Anabela Maia, Cheryl Wilga

University of Rhode Island, Kingston, RI, United States

Comparative Anatomy of Bamboo Shark and Spiny Dogfish Dorsal Fins

The dorsal fin anatomy of benthic white-spotted bamboo sharks *Chiloscyllium plagiosum* and benthopelagic spiny dogfish *Squalus acanthias* reflects their swimming habits. Differences are apparent in external and internal anatomy. Bamboo sharks have a larger second dorsal fin area and proportionally more muscle extending into both dorsal fins than spiny dogfish. Skeletal elements are composed of a variable number of basals and radials that are almost indistinguishable and lack a clear arrangement in spiny dogfish. In contrast, bamboo sharks have a single row of multiple plate-like elongated basals followed by a row of shorter radials that fans out into the fin web. Between each basal and radial lays a cartilaginous pad, indicating a movable joint. Bamboo fin muscle bundles are discrete and correspond with the radials. Spiny dogfish fin muscles have a more compact structure and lack discrete bundles. Dorsal fin complexity in spiny dogfish is increased by the presence of an anterior spine. The spines are wrapped in thick collagen fibers pointing posteriorly, which insert into the skin near the middle portion of the fin base. Similar bundles of collagen fibers run in the opposite orientation from the middle to the end of the fin base. The collagen fibers appear to make the fin more rigid but also create bending planes in the middle of the fin. Dorsal fin bending in dogfish may play a role in stabilizing forces, while the complex structure of bamboo shark fins imparts greater mobility to redirect thrust forces, as corroborated by kinematic analyses.

0145 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Maria Claudia Malabarba¹, Luiz R. Malabarba², Cecília del Papa³

¹*Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, RS, Brazil*, ²*Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil*, ³*CONICET, Universidad Nacional de Salta, Buenos Aires, Argentina*

A New Species of *Gymnogeophagus* (Perciformes: Cichlidae), from the Eocene Lumbreira Formation in Argentina

A new cichlid referable to the extant genus *Gymnogeophagus* is described from the Eocene Lumbreira Formation of the Salta Group, northwestern Argentina. The fossil species of *Gymnogeophagus* presents the synapomorphies that support the genus: absence of supraneurals and a presence of a forward spine in the first dorsal pterygiophore. We

further tested its relationships using a matrix of 136 morphological characters for geophagines, of whose only 48 characters (35.3%) were observable in the fossil, and found this cichlid in a clade containing the other two *Gymnogeophagus* species included in the analysis. Two additional characters used herein (the number of vertebrae and the sexually dimorphic dorsal fin) places the fossil species as sister group to *G. gymnogenys* clade, that contains all mouth breeder species of the genus. The existence of an early to middle Eocene aged species presenting the synapomorphies and the appearance of a modern genus requires the acceptance of an extensive differentiation from the basal cichlid lineages. Extant *Gymnogeophagus* species are restricted to the La Plata drainage and a few coastal drainages of southern Brazil and Uruguay. The occurrence of an Eocene fossil in the geographical area corresponding to the present distribution of the genus suggests the patterns of distribution and endemism of the Neotropical fish fauna have a very old history in the continent.

0058 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Stefano Malavasi¹, Gianluca Polgar², Giacomo Cipolato¹, Vyton Georgalas¹, Jennifer Clack³, Patrizia Torricelli¹

¹University Ca' Foscari- Dep. Environmental Sciences, Venice, Italy, ²Univeristy La Sapienza- Dep. Animal and Human Biology, Rome, Italy, ³University Museum of Zoology, Cambridge, United Kingdom

Sound Production in a Mudskipper (*Periophthalmodon septemradiatus*): Implications for the Study of Evolutionary Convergence Related to the Vertebrate Water-Land Transition

Mudskippers are fishes (Teleostei: Gobiidae: Oxudercinae) which exhibit extreme adaptations to an amphibious lifestyle; nonetheless, previous observations failed to demonstrate the presence of acoustic communication. The use of appropriate laboratory conditions and equipment allowed to record agonistic sounds during dyadic male-male aggressive encounters in a mudskipper species (*Periophthalmodon septemradiatus*). Preliminary analyses revealed that sounds were emitted when out of water and mainly transmitted through the wet substrate. Calls were significantly associated with aggressive visual displays. Both sexes were soniferous, showing very similar call structure. Sounds were organised in complex bouts, mostly composed of different combinations of pulsatile units and tonal segments, whose acoustical properties were assessed and analysed. Pulsatile units were broad band, low frequency (below 100 Hz) and highly damped oscillations well below 300 ms in duration; while tonal segments were continuous sine waves, showing a mean fundamental frequency around 160 Hz and mean duration of about 400 ms. The analysis of intraspecific variability revealed that most acoustical properties were highly dynamic, due to the high level of within individual variability, with the exception of the fundamental frequency of tonal segments, that could contain and convey some degree of individual information. These results both showed how exposed wet substrates and physical interfaces facilitated

acoustical communication during the mudskippers' transition from water to land; and offered new insights for the study of analogous transitions of the ancestors of all terrestrial vertebrates.

0425 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Aleksandra Maljkovic, Isabelle Côté

Simon Fraser University, Burnaby, BC, Canada

Trophic Niche Width Collapse in a Reef-Associated Shark: The Double Whammy Effect of Fisheries on Shark Prey Populations

Fishing, as a pervasive agent of change in marine ecosystems, is thought to alter the trophic relationships of species in defined food webs, although evidence supporting this is generally weak. As large-bodied predators at or near to the top of food webs, sharks are likely to incorporate matter from a wide variety of trophic networks, and the isotopic signatures of their tissues may therefore serve as indicators of trophic restructuring over gradients of environmental or anthropogenic change. We used stable isotope analysis of muscle tissue to define the trophic niche widths of Caribbean reef sharks (*Carcharhinus perezi*) in $\delta^{13}\text{C}$ - $\delta^{15}\text{N}$ niche space. Reef sharks, as well as species representing model trophic guilds, were sampled at six sites over a gradient of fishing pressure in the Bahamas. We show that the trophic niche width of reef sharks inhabiting heavily fished sites has collapsed by >70% relative to sharks inhabiting lightly fished reefs. This pattern of change is due not only to the removal of high trophic level fisheries targets, but also to the collapse of the trophic niches of sympatric species in fished systems. Our results corroborate the suggestion that fisheries indirectly impact populations of non-target species, and highlight the need for holistic ecosystem-based management strategies to conserve marine resources.

0468 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Lisa Mangiamele, Sabrina Burmeister

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

Neural Mechanisms of Female Preferences for Complex Advertisement Calls in Túngara Frogs (*Physalaemus pustulosus*)

Females exhibit behavioral preferences for mating with males of their own species, and they often prefer conspecific males displaying elaborate sexual signals to males with simpler signals. Directional female behavioral preferences may be influenced by neural preferences, wherein elaborate signals are more attractive because they stimulate female

sensory systems more than simpler signals. To test this hypothesis, we studied how male acoustic signals of varying complexity and attractiveness are represented in the female túngara frog brain. Túngara frog males produce a “whine” advertisement call to attract females to mate, and they can increase the complexity of their whine by adding 1 – 6 broad spectrum call components known as “chucks.” Females strongly prefer whines with chucks to the simpler whine. We exposed female túngara frogs to one of three acoustic stimuli: no sound, whine, and whine + 3 chucks. We measured the expression of the neural activity-dependent gene, *egr-1*, in the ascending auditory pathway and several forebrain auditory targets. Our data show that the magnitude of the neural response to all conspecific calls, regardless of their complexity, is similar, suggesting that the female brain does not have a neural preference for elaborate male signals. However, when we used a habituation paradigm to ask whether the auditory system distinguishes complex from simple calls, we found that the two were indeed perceived as different. Although our results fail to show neural selectivity for female-preferred signals, this work represents an important contribution towards understanding the neural mechanisms underlying call discrimination.

0459 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

David Mann¹, Phillip Lobel², Andrew Solow¹

¹University of South Florida, St. Petersburg, FL, United States, ²Boston University, Boston, MA, United States, ³Woods Hole Oceanographic Institution, Woods Hole, MA, United States

Local Spawning Synchrony in the Soniferous Damselfish, *Dascyllus albisella*

Damselfishes show a broad spectrum of reproductive synchrony, but it has been difficult to quantify since they reproduce continuously, as opposed to seasonally. A measure of synchrony was developed based on a correlation between spawning time series and used in randomization test to test for within-site reproductive synchrony of the damselfish, *Dascyllus albisella*, at Johnston Atoll, Central Pacific Ocean. Reproductive synchronization was localized to groups of fish on the order of 10-20 m. Reproduction was not synchronized at larger scales where groups were not contiguous. Estimates of acoustic communication distance, which suggests that communication range is limited by background noise, are consistent with these ranges of reproductive synchronization.

Angela Marion, Dean Leavitt, Tod Reeder

San Diego State University, San Diego, CA, United States

**Phylogenetic Relationships Among the Alligator Lizards (Anguinae:
Gerrhonotinae): A Multi-locus DNA Sequence Approach**

The phylogenetic relationships among the alligator lizards of the anguid subfamily Gerrhonotinae have been addressed by morphology, allozymes, and mitochondrial DNA sequence data with discordant results. Using multi-locus nuclear DNA sequence data and coalescent approaches to species-tree building, we are investigating the evolutionary relationships among gerrhonotine lizards. Specifically, we evaluate whether phylogenetic analyses of these new nuDNA data (3 loci) are consistent with our unpublished mtDNA that suggest *Abronia* and *Mesaspis*, sister genera in previous published hypotheses, are in fact non-monophyletic with respect to one another. Analyses of the individual nuDNA loci and mtDNA each support the monophyly of *Elgaria*, *Gerrhonotus*, and *Barisia*, as well as a clade containing *Abronia* and *Mesaspis* (but neither is monophyletic). Also, the mtDNA strongly supports *Coloptychon* as the sister taxon of *Gerrhonotus*. The interrelationships among these clades in the separate nuDNA analyses are weak and incongruent. Combined analysis of the nuDNA and mtDNA strongly support the interrelationships among the gerrhonotine genera: (*Elgaria* ((*Coloptychon*+*Gerrhonotus*) (*Barisia* ("Abronia"/"Mesaspis")))). The non-monophyly of *Abronia* is surprising given the many apomorphic features members possess, many of which are associated with its arboreal ecology. Also, these new molecular data seem to provide strong support for *Elgaria* being the sister taxon of all remaining gerrhonotines instead of *Coloptychon*, as suggested by previous morphological studies.

0723 AES Stress Symposium I, 551 AB, Sunday 11 July 2010; AES GRUBER AWARD

Heather Marshall¹, Lyndsay Field¹, Achankeng Afiadata¹, Chugey Sepulveda², Greg Skomal³, Diego Bernal¹

¹*University of Massachusetts Dartmouth, Dartmouth, MA, United States*, ²*Pfleger Institute of Environmental Research, Oceanside, CA, United States*, ³*Massachusetts Division of Marine Fisheries, Martha's Vineyard, MA, United States*

Molecular and Biochemical Stress-response in the Blood of Longline Captured Pelagic Sharks

Assessments of worldwide longline fisheries reveal that sharks constitute a large portion of bycatch for this gear type. A combination of recently enacted fishing regulations along and the low economic value of these catches, results in a large percentage of incidentally captured sharks being released. To date, little information exists on the rates of post-release survival for many shark species, and thus the full impact of longline fisheries on shark populations cannot be fully estimated. Recent studies have addressed the possibility of using biochemical profiles of secondary haematological stress parameters to predict post-release survivorship, yet little is known about interspecific differences in these indicators. This study sought to compare electrolytes (Na⁺, Cl⁻, Mg²⁺, Ca²⁺, and K⁺), metabolites (glucose and lactate), hematocrit, and heat shock protein 70 (HSP70) parameters between eight species of longline captured sharks (n = 151). Statistical comparison of parameters was conducted according to species, family, and ecological classification. Data reveal species-specific parameter differences in response to longline capture, as well as differences by family (i.e., Lamnidae versus Carcharhinidae) and ecological (i.e., oceanic versus coastal) classification. Results suggest that differences in locomotive and respiratory adaptations between study species bring about differences in stress-response by these sharks to longline capture. This study is the first to report a haematological secondary stress response assessment for such a large number of pelagic shark species, and lays the groundwork for developing species-specific indices for predicting post-release survivorship of longline caught sharks.

0141 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Jennifer Martin, Eric Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, United States

Distribution of Taeniosomous Lampridiformes in Australian and New Zealand Waters

The families Stylephoridae, Lophotidae, Radiicephalidae, Trachipteridae and Regalecidae form the taeniosomous Lampridiformes, a putatively monophyletic group characterized in part by having extremely elongate bodies. These are rare, mesopelagic fishes that occur in all oceans. Observations of museum specimens, supplemented by museum records for certain taxa (e.g., Stylephoridae), were used to determine the distributions of the taeniosomes in Australian and New Zealand waters. Adult holdings were originally collected as beach wash-ups and from fishery-dependent and independent surveys. Specimens were identified to the lowest taxonomic level (typically species-level, except for within *Trachipterus*). Larval and juvenile identification, however, was particularly problematic and misidentifications in museum collections were common. In several collections, flatfish larvae from family Bothidae were misidentified as *Trachipterus* spp., and in one instance a juvenile *Radiicephalus* was misidentified as Lophotidae. Therefore, larval and juvenile distributions are based on original observations of specimens. Interestingly, the trachipterid genus *Zu* was discovered as larvae in collections from the Coral Sea near the Great Barrier Reef. Near-shore larval distribution of these typically open-water fishes is discussed. Collectively, nine genera from all five taeniosome families are distributed throughout Australian and New Zealand waters. These specimens include a new geographic record for the previously misidentified specimen of *Radiicephalus* from New Zealand. Improper identifications of specimens are likely to mislead biodiversity and biogeographic assessments for these rare fishes.

0373 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Karen Maruska¹, Timothy Tricas²

¹*Stanford University, Stanford, CA, United States*, ²*University of Hawaii at Manoa, Honolulu, HI, United States*

Acoustic Communication in the Hawaiian Sergeant Damselfish

Acoustic communication is important for social behaviors in many fishes, but studies that consider its role from both sender and receiver perspectives within a single species are limited. Here we used an integrative approach to examine behavioral contexts of sound production, hearing ability, and the effects of neuromodulators on auditory

perception in the Hawaiian sergeant damselfish *Abudefduf abdominalis*. Behavioral observations and sound recordings in the wild show that the Hawaiian sergeant produces low frequency, low intensity sounds during territorial and reproductive behaviors, which are used for close-range communication. Auditory evoked potentials and single-neuron recordings in the hindbrain and midbrain show that hearing ability closely matches the intensity, temporal, and spectral characteristics of their natural sounds. However, auditory neurons in the brain were more sensitive to playbacks of complex natural sounds than to tone bursts of a single frequency, highlighting the importance of using biologically relevant natural stimuli to test hearing abilities in fishes. Midbrain neurons were also more sensitive to playbacks of complex natural sounds compared to hindbrain neurons, which implicates the midbrain as an important feature-detecting center. The neuromodulator gonadotropin-releasing hormone (GnRH) was also abundant in the midbrain auditory torus semicircularis, and exogenous GnRH application to this region caused primarily inhibitory effects on auditory-evoked spike rates, which may function to fine-tune context dependent auditory processing. These data demonstrate how examination of sound production, hearing ability, and internal cues that influence acoustic communication can provide important information on how fishes use sound to communicate in their natural environment.

0159 Herp Physiology, 556 AB, Monday 12 July 2010

Glenn Marvin

University of North Alabama, Florence, AL, United States

Recovery of Swimming Performance after Tail Loss Varies with Body Size in a Desmognathine Salamander

Few studies have examined the locomotor cost of tail autotomy in salamanders. I examined whether the recovery of swimming performance after tail loss varies with body size in the Black-bellied Salamander (*Desmognathus quadramaculatus*). Maximal swimming performance (burst speed: mean = 0.83 m/s prior to tail loss) was significantly reduced after tail autotomy. With the loss of about 65% of tail length, burst speed declined about 50%. Thus, tail loss was costly for this primarily aquatic species in terms of a reduction in maximal locomotor performance. I measured the recovery of burst speed for individuals of different body size (42-106 mm SVL) as they regenerated their tails. After the regeneration of 50% of the tail length that was lost, post-autotomy speeds were not significantly different from pre-autotomy speeds. The time required for this amount of tail length regeneration (about 63-124 days) increased significantly with body size. Thus, the locomotor cost of tail loss may be greater for larger individuals. This may be related to a greater propensity for biting prior to tail autotomy (and a longer time required for autotomy) in larger individuals.

0025 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Simone Masin, Gentile Francesco Ficetola, Luciana Bottoni

Università degli Studi Milano Bicocca Dipartimento di Scienze Ambientali, Milano, Italy

Head-starting European Pond Turtle (*Emys orbicularis*) for Reintroduction: Patterns of Growth Rate

Some study suggests that, in a controlled environment, newborn European Pond turtles show a different growth pattern from those of other emidyd turtles. Mitrus and Zemanek (1999) suggest that newborns *E. orbicularis* feed and grow very little immediately after hatch and their growth rate accelerate only after the fourth month. Head-starting is often used to increase the survival in species of conservation concern in reintroduction and management projects. A limited growth rate might have important consequences on the usefulness of head-starting for conservation projects. In our study, we head-started a group of 12 *Emys orbicularis galloitalica* hatchlings from captive reproductions for 8 months in a controlled environment. Newborns were tagged with microchips and kept in an aqua-terrarium equipped with UV-b light tubes. Water temperature was kept at 25 C° and a basking site at 30C° was provided; hatchlings were first fed small fresh items, then shifted to larger preys (small fishes, earthworms, crickets, mealworms). Chopped vegetal matter was added to the diet of the animals after the first month of life. The animals were measured and weighed weekly. The growth patterns of the group we studied showed no slowness in the first three months of life, all hatchlings accepted readily small food items. Hatchlings were subsequently released in a reintroduction project. The survival rate of released individuals was 67% after 2 years. Our results suggest that a short period of head-starting can be a successful approach in *E. orbicularis*, enhancing growth rate and survival.

0537 Fish Community Ecology, 555 AB, Monday 12 July 2010

Heather D. Masonjones¹, Emily Rose²

¹University of Tampa, Tampa, FL, United States, ²Texas A & M University, College Station, TX, United States

Population Estimates and Movement Trends of Syngnathid Fishes in a Tampa, FL Seagrass Community

Due to their tendency towards low mobility and high site fidelity, syngnathid fishes (pipefishes/seahorses) potentially make excellent candidates for population estimates through mark-recapture techniques. This 13-month study (August-August, 2008-09) was designed to compare two methods of estimation, the Lincoln-Peterson and Schnabel

techniques, measuring short term changes in population size. Both assume closed populations, which based on their biology, should be a reasonable assumption for syngnathids. However, to verify closed populations, movement patterns between three sites (roughly 200m apart) within the larger site located in a small bay off the South Tampa peninsula were investigated. On each census date, fish were collected by pushnet from a 150m² area of seagrass from each of the three sites. Each was marked with latex dye under the skin, photographed for body size and reproductive condition estimation, and returned the same day. Using both estimation methods, population sizes varied widely between sites and over time, indicating that the population is not as stable as assumed based on their biology. In addition, 19% of recaptured animals moved between sites, indicating that each site does not in fact comprise a closed population. This varied between pipefish and seahorses, however, with seahorses displaying complete site fidelity and pipefish moving frequently between sites. Pipefish movement between sites was consistent across the year, indicating that migration between sites does not appear to be a seasonal event. These results suggest that methods of population estimation for pipefish, at least, should be based on open, and not closed, populations.

0464 General Ichthyology, Ballroom B, Friday 9 July 2010

Ivan Mateo¹, Edward Durbin², Richard Appeldoorn³, Aaron Adams⁴, Francis Juanes¹

¹*University Rhode Island, Kingston, RI, United States*, ²*Graduate School Oceanography, Narragansett, RI, United States*, ³*University Puerto Rico, Mayaguez, PR, Puerto Rico*, ⁴*Mote Marine Lab, Pine Island, FL, United States*, ⁵*University Massachusetts-Amherst, Amherst, MA, United States*

Assessing the Role of Mangroves as Nurseries for French Grunt and Schoolmaster through Otolith Elemental Fingerprints

Juvenile French grunt and schoolmaster were captured in mangrove and seagrass stations in St. Croix and Puerto Rico in 2006 and 2007 to determine if fish juvenile areas can be discriminated by otolith chemistry. Concentrations of 13 elements were determined in 0-group fish otoliths using (LA-ICPMS). ($\delta^{18}\text{O}$) and ($\delta^{13}\text{C}$) stable isotopes in otoliths were also analyzed. Multi-elemental signatures for both species differed significantly (MANOVA $p < 0.001$) among mangrove and seagrass stations within both Islands. Furthermore, concentrations of six elements (Sr, Ba, Cu, Mg, Co, Na) and ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$) for both species within each year differed significantly among mangrove and seagrass stations within Islands (ANOVA $p < 0.001$). Classification success for French grunt and schoolmaster juvenile stations within St. Croix across years ranged from 87-92% and from 76-77%, respectively, whereas in Puerto Rico, for French grunts and schoolmaster for the two years ranged from 80-84% and 84-87%, respectively. Classification success between mangrove and seagrass habitats (stations combined) in Puerto Rico for French grunt ranged from 84-91%, and for schoolmaster ranged from 94-99%. In St. Croix, classification success for French grunt was 95-96%, and for

schoolmaster was 86-89%. The percentage of the French grunt subadults collected from fore-reef stations in St Croix, identified as having resided as juveniles in mangrove habitats in 2006 and 2007, was 40% and 68 % while for Puerto Rico, it was 70% and 74%. By contrast for schoolmaster almost 100% of all fish in both islands resided as juveniles in mangrove habitats across years.

0748 Fish Community Ecology, 555 AB, Monday 12 July 2010

Richard Matheson, Theodore Switzer, Robert McMichael, Keith Fischer

Florida Fish and Wildlife Research Institute, St. Petersburg, FL, United States

Zoogeographic and Bathymetric Gradients in Demersal Fish Community Structure on the West Florida Shelf

The continental shelf off the west coast of the Florida peninsula, the West Florida Shelf, supports a diverse ichthyofauna which, in turn, supports some of the most valuable fisheries in the United States. Despite these facts, the zoogeography and ecology of this fauna have received relatively little attention from researchers. We add to the knowledge of this fauna by analyzing data from trawl samples collected during 2008 and 2009. Our survey was funded by the Southeast Area Monitoring and Assessment Program and was conducted in depths ranging from 9 to 110 m from just north of Cape Romano, latitude 26° N, to Mobile Bay, approximately 30°N and 88°W. Preliminary sampling was conducted in 2008, and a full annual survey was conducted in 2009. The latter survey consisted of summer and fall cruises, and each cruise made approximately 40 trawl sets in each of three sampling zones, for a total of approximately 120 sets per season. We use multivariate community analyses to explore zoogeographic and bathymetric community structure among these samples and relate these patterns to other parameters (e.g., temperature and salinity) collected with each trawl sample. Finally, we discuss the distribution and abundance of some of the prominent members of this fauna, including numerical dominants, such as *Lagodon rhomboides* and *Syacium papillosum*, and economically valuable species such as various sciaenids, lutjanids, and serranids.

0345 AES Ecology, 551 AB, Thursday 8 July 2010

Philip Matich, Michael Heithaus, Craig Layman

Florida International University, Miami, FL, United States

Contrasting Patterns of Individual Specialization and Trophic Coupling in Two Marine Apex Predators

Top predators are often assumed to be dietary generalists and, by feeding on prey from multiple basal nutrient sources, serve to couple distinct food web modules. Yet, there is increasing evidence that individual dietary specialization may be critical to trophic dynamics of predator populations. Individual specialization is well-documented in teleosts, birds, and mammals, but little is known about dietary specialization in highly mobile top predator taxa in marine habitats. Using stable isotope analysis of body tissues with different turnover rates, the dietary patterns of bull sharks (*Carcharhinus leucas*) and tiger sharks (*Galeocerdo cuvier*) were investigated to assess dietary specialization. Tiger sharks were largely dietary generalists, but the bull shark population was characterized by a wide trophic niche with many specialized individuals. These differences in individual dietary specialization suggest that marine apex predators may fill very different functional roles in coupling or compartmentalizing distinct food webs depending on ecosystem context, and resource availability, competition, and the spatial patterns of food webs appear to be important factors driving trends in individual dietary specialization. Our study suggests that individual specialization may be an important feature of trophic dynamics of non-mammalian marine top predators and should be explicitly considered in studies of marine communities.

0207 NIA II, 551 AB, Monday 12 July 2010

Emmanuel Maxime

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

Phylogenetic Position of *Gymnotus inaequilabiatus* (Valenciennes, 1847) Using Osteological Data from Computed Tomography

Gymnotus inaequilabiatus from the Rio Paraná of Argentina and Brazil is the largest bodied species of the genus growing to one meter. This nominal species has been regarded as a member of the *G. carapo* species group but the phylogenetic position and even the limits of the species remain poorly known. Here I report osteological data from the CT scans of the c. 200 year-old holotype analyzed using Mimics software package to delineate the 3D configuration of bony elements in the oral jaws, neurocranium, suspensorium, and branchial basket. Each bone was manually isolated by delimiting their boundaries using slices recalculated in all three planes: sagittal, coronal, and axial,

from an original dataset composed of n=1,107 (65 μ m) sections. These data were examined in a phylogenetic context and used, in addition with other characters of the external morphology, to hypothesize the putative position of the species within the genus. *Gymnotus inaequilabiatus* is concluded to be more closely related to *G. tigre* than to *G. carapo*, based on osteological characters. This interpretation is also supported by characters more readily observed of the external phenotype (pigmentation, laterosensory canals), and conventional radiography (vertebral counts). These results support the conclusion that the assemblage of *Gymnotus* species in the Paran basin is not monophyletic.

0510 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Amy Maynard, Jocelyne Dolce, Cheryl Wilga

University of Rhode Island, Kingston, RI, United States

Biomechanics of Ventilation in Smoothhounds, *Mustelus canis*, and Spinydogfish, *Squalus acanthias*

Gill slit length, inter-gill slit spacing, and the number of gill slits over the pectoral fin differ among shark species. The goal of this study was to determine whether the morphological difference in the length of the fifth gill slit between dusky smoothhounds (shorter) and spiny dogfish (longer) is associated with a functional difference in ventilation at rest and swimming. The kinematics of the branchial arches and gill slits and associated pressure was quantified using sonomicrometry crystals and pressure transducers. During resting ventilation, smoothhounds move the gill arches at greater peak distances and have longer cycle durations than dogfish during resting and swimming. Smoothhounds open the fifth gill slit before the others and also close the gill slits earlier when resting compared to dogfish. Smoothhounds, however, open the slits later and for a longer duration during swimming than resting. Smoothhounds generate less suction pressure during resting than dogfish, while the opposite occurs for swimming. Smoothhounds open the fifth gill slit before the others, thus they appear to use the fifth gill slit as an exit valve to prevent pooling of water in the pharynx in swimming as well as resting. The longer duration of gill slit opening and lower subambient pressures when swimming compared to resting indicates that smoothhounds use ram assisted suction ventilation during swimming. Dogfish appear to modulate kinematics to achieve similar pressures at rest and during swimming.

0449 Fish Systematics II, Ballroom D, Monday 12 July 2010

Mauricio De la Maza-Benignos¹, Ma de Lourdes Lozano-Vilano²

¹WWF-Chihuahuan Desert Program, Chihuahua, Chihuahua, Mexico, ²FCB, UANL, San Nicolas de los Garza, Nuevo León, Mexico

A Systematic Revision of the *Herichthys* Genus, with One New Genus and Three New Species Endemic to the Panuco-Tamesí River Basin, Mexico

The authors describe a new genus along with three new species of cichlids based on chromatic, morphometric and meristic characters: one from the Rio El Salto in San Luis Potosi, Mexico characterized by the dorsal fin is set back with respect to the snout tip; one from Rio Tamasopo in San Luis Potosi, characterized by a very long caudal peduncle and a shallow body; and the last one from Laguna Azteca, Hidalgo, Mexico characterized by very small eyes, and dorsal, pectoral and ventral fins set forward with respect to the snout tip, and a short lower jaw. A re-description of *Herichthys pantostictus* (Taylor and Miller, 1983) and *H. labridens* (Pellegrin, 1903), a review of *H. bartoni* (Bean 1892) and *H. steindachneri* (Jordan y Snyder, 1900) and a zoogeographic dispersal and evolutionary theory for the subgenus are also presented.

0447 Fish Conservation, Ballroom B, Friday 9 July 2010

Mauricio De la Maza-Benignos¹, Lilia Vela-Valladares³, Ma. de Lourdes Lozano-Vilano², Ma. Elena García-Ramírez², Jürgen Hoth Von Der Maden¹, José Alfredo Rodríguez-Pineda¹

¹WWF-Chihuahuan Desert Program, Chihuahua, Chihuahua, Mexico, ²UANL, San Nicolas de los Garza, Nuevo Leon, Mexico, ³Amigos del Pandeño, A.C., Julimes, Chihuahua, Mexico

A Holistic Approach to Freshwater Ecosystems Conservation: The *Cyprinodon julimes* Case Study

"Pandeño-de-los-Pando" is home to the endemic Julimes pupfish (*Cyprinodon julimes*) considered to be among the vertebrates that live at the highest temperatures on the planet. This spring is about 200 m² in size and located in the Conchos River Basin, Chihuahua, Mexico. It is among several springs impacted by increasing pumping that depletes the local groundwater supply. In the context of a full scale IRBM-Program, the initiative to conserve a viable pupfish population, developed into a demonstration project which considers socioeconomic, biologic, taxonomic, ecologic, behavioral, hydrologic, legal and administrative framework leading to a holistic understanding of a system within an initiative that proves that conservation is compatible with and beneficial to economic and social development of a region. The objectives were to secure

a viable population of the endangered pupfish, develop legal and administrative framework authorizing environmental flows, and establish the spring and surroundings as protected area. Studies to understand the relation between habitat utilization and physicochemical variables determining the needs of the fish; the hydrology of the system; as well as to support water rights acquisition were conducted. It was determined that temperature drives tempo-spatial displacements of the fish. That 70-80 L/sec in water rights ultimately needed to be secured. In 2009 50 L/sec. were secured on a voluntary basis. The "Pandeño" is an example of social-bio-hydraulic/hydrologic-adaptive-management-initiative involving simple research and calculations that yielded large benefits in terms of conservation and decreased groundwater pumping. In sum a framework that functionally combines conservation together with social and economic imperatives.

0186 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Michael McCallister, Ryan Ford, Christina Walker, Yaira Aponte-Osborne, Jim Gelsleichter

University of North Florida, Jacksonville, FL, United States

Use of Two Northeast Florida Estuaries as Shark Nursery Habitat: Preliminary Data from a Longline Survey

The use of nearshore and estuarine waters as Essential Fish Habitat is well documented throughout the literature. EFH plays a crucial role in the life-history of the species that utilize a given area. For many elasmobranch species these locations include nearshore and estuarine waters that serve as nursery habitat where sharks are born and/or juveniles spend the early part of their life. Examination of the literature shows the presence of shark nurseries in most major estuaries along the Atlantic and Gulf Coasts of the United States, however, there is a noticeable gap in data from the Northeast region of Florida. To identify and characterize shark nursery habitat in estuarine waters of Northeast Florida, a long term longline survey was initiated in May of 2009. A total of 96 longlines were set in Nassau and Cumberland Sounds from June 2009 - November 2009 and 199 elasmobranchs were caught. A total of 12 different elasmobranch species were collected, including 8 species of shark, 3 species of ray, and 1 species of skate. Preliminary data show that these two estuaries are utilized by multiple species of elasmobranchs. This is an ongoing survey and future work will be done to identify specific species that use these waters as a nursery, the spatial boundaries of the nursery, temporal variation in habitat use, and the influence of prey abundance and predation risk on specific habitat use within these estuaries.

0586 AES Ecology, 551 AB, Thursday 8 July 2010

Heather McCann¹, Nigel Hussey¹, Aaron Fisk¹, Sabine Wintner², Jeremy Cliff², Sheldon Dudley², Brian Fryer¹

¹Great Lakes Institute of Environmental Research, University of Windsor, Windsor, Ontario, Canada, ²KwaZulu-Natal Sharks Board, Umhlanga Rocks, South Africa, ³Biomedical Resource Unit, University of KwaZulu-Natal, Durban, South Africa

Microchemistry of White Shark (*Carcharodon carcharias*) Vertebrae: A Potential Tool to Examine Life-History Strategies?

The microchemistry of biomineralized structures, such as fish otoliths, is becoming an important tool to elucidate life-history characteristics of marine animals over ontogeny. The corpus calcareum of shark vertebrae grows incrementally preserving a seasonal microchemistry signal (summer / winter) over the lifetime of the animal, similar to fish otoliths. The microchemistry of white shark (*Carcharodon carcharias*) vertebrae may provide an additional ecological tool to aid in understanding individual life history patterns. I present baseline elemental concentration profiles for several sharks of varying age, size and sex sampled from beach protection nets in KwaZulu-Natal, South Africa. The potential of laser ablation inductively coupled mass spectrometry (LA-ICP-MS) to analyze vertebrae microchemistry is assessed. A suite of elements (ranging in concentration from a few ppb to 1000s of ppm) were quantified using LA-ICP-MS in continuous transects along the corpus calcareum. Barium levels varied across growth bands suggesting ontogenetic movement between nutrient rich upwelling areas and non-nutrient rich areas. A number of non-essential elements (e.g., uranium, lead) also varied across growth bands and may provide insights into ontogenetic migration and depth profiles of individual sharks. A number of essential elements (zinc, copper...) of the embryonic component of the vertebrae were enriched compared to after birth and increased with age to levels approaching those in the embryonic sections. These preliminary results show that a range of elements have suitable detection limits to aid in determining life-history patterns.

0379 Herp Morphology, 556 AB, Sunday 11 July 2010

Jacob McCartney, Nathan Kley

Stony Brook University, Stony Brook, NY, United States

Morphometric Analysis of Intracolumnar Variation in Vertebral Morphology in Snakes

Vertebral intracolumnar variability (i.e., the serial morphological variation observed along the entire length of the vertebral column) is an important but remarkably

understudied aspect of snake biology. Any attempted study of systematics or functional morphology that focuses on these bony elements is very difficult without a better understanding of the variation present both within and between species. In order to establish a basis for such studies, intracolumnar variation in a number of snakes was quantified through the use of osteometrics. The sample was carefully chosen to maximize phylogenetic and ecological differences between snakes, and 22 measurements were chosen to maximize repeatability while potentially providing useful information, particularly with respect to functional questions. The resulting data show considerable variation in several of the metrics throughout the vertebral column of individual snakes. This variation is remarkably conserved among terrestrial snakes. This implies either that terrestrial snakes in general have similar functional constraints, regardless of differences in ecology and behavior, or that snakes are constrained by phylogeny and/or development to particular morphologies. Despite this conservatism, examination of ratios, including some that have been used previously in the literature to distinguish snakes systematically or ecologically, reveals subtle differences. Ratios may in fact be useful for differentiating between multiple taxa within discrete fossil assemblages, with the caveat that some overlap may occur, particularly considering variation in the column.

0317 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

David McElroy¹, Joe Bizzarro², Nancy Kohler³

¹National Marine Fisheries Service, Woods Hole, MA, United States, ²University of Washington, Seattle, WA, United States, ³National Marine Fisheries Service, Narragansett, RI, United States

A Review of Selected Methods of Studying Food Habits and Trophic Ecology with Particular Reference to Elasmobranchs

Diet and feeding ecology studies are fundamental to our knowledge of inter-specific relationships and patterns of abundance that govern marine ecosystems. Food habits data are also critical for understanding the life-history and habitat requirements of species. This information is particularly valuable for elasmobranchs as they typically feed at high trophic levels and are long-lived. As ecological-based approaches to resource management have gained acceptance; increased focus, new technologies, and different analytic methods have come to bear in feeding studies. We review data collection and analytical topics with a focus on ones that are debated and exhibit inconsistencies in their application. We offer recommendations on issues such as increasing taxonomic resolution and accounting for alterations due to sample preservation, limiting bias related to sampling gear and other factors, and analytical subjects including data transformations, appropriate grouping of data, sample size sufficiency, and scaling for size. Various indices for quantifying the diet, ecological metrics for comparisons, multivariate ordination, and methods of testing significance are compared using example data. Comparisons utilize published studies as well as dietary

data sets for species with both narrow and broad foraging patterns. It is suggested that dietary analysis should be made using number, mass, and occurrence data separately; as each metric provides a different type of information, some of which is lost when combined. Overall, data collection and analysis techniques selected in diet studies will often vary depending on the objectives of the authors, but some methods suggested herein can be utilized to create greater consistency among studies.

**0268 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010;
ASIH STOYE AWARD ECOLOGY & ETHOLOGY**

Patrick McGrath

Virginia Institute of Marine Science, Gloucester Point, VA, United States

The Diet of Longnose Gar, an Apex Predator in the Tidal Waters of Virginia, USA

Chesapeake Bay is the largest estuary in the United States and comprises vast areas of polyhaline to freshwater, tidal fish habitat. These areas are nursery grounds that provide protection from large ocean predators while supporting an abundance of prey for estuarine dependent fishes. However, a few large piscivorous species, such as longnose gar (*Lepisosteus osseus*), are abundant in fresh and brackish nurseries and the impact of their predation is poorly understood. This study aimed to characterize the diet of longnose gar from tidal rivers in Virginia. The top five prey items were white perch, menhaden, *Fundulus* spp., Atlantic croaker, and spot. Percent weight and number indicated that both marine and anadromous fishes (%W = 59.4%, %N = 56.5%) and resident fishes (%W = 40.6%, %N = 43.5%) were equally important in the diet of longnose gar. The diet varied with the seasonal prey fish assemblages, longnose gar length, and salinity, reinforcing the categorization of the species as an opportunistic predator. The constant influx of anadromous or coastal spawning fishes appears to be an important prey source for longnose gar in the upper estuaries of Chesapeake Bay.

0276 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Allison McHale

NOAA Fisheries Service, Gloucester, MA, United States

Tricky Business -- Managing Monkfish in the Face of Uncertainty

How does one manage one of New England's most valuable fishery resources in light of little scientific information? It is a difficult job that the New England Fishery Management Council (NMFS) and NOAA's National Marine Fisheries Service (NMFS)

have been tackling for the last 10 years. An explanation of why monkfish is considered a data-poor species will be provided and how this has impacted the management of this species. In addition, a brief management history will be presented that focuses on management approaches taken by the NEFMC and NMFS to account for and address this uncertainty, including lessons learned options for future management. Time permitting, comparisons may be drawn with other data poor fish stocks in the Northeastern United States, such as the Northeast skate fishery.

0511 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Kenneth McKaye¹, Mary Shawa¹, Troy Townsend¹

¹Malawi Office of President and Cabinet, Lilongwe, Malawi, ²World Wide Fund for Nature, Helsinki, Finland, ³HEEED Malawi, Monkey Bay, Malawi

Biological Control by Cichlid Fishes of Snail Vectors of the Human Disease Bilharzia: Conservation of Cichlids Might Reduce HIV/AIDS in Malawi

Karel Liem once bantered “if cichlids reduced AIDS-- they would catch granting agencies and the world’s attention!” Work initially stimulated by Karel’s interest in the cichlid feeding biology has demonstrated that overfishing and deforestation in the Lake Malawi ecoregion is linked to an increase in the intermediate freshwater snail host for schistosomiasis, *Bulinus nyassanus* and, perhaps, HIV/AIDS along Lake Malawi shores. Various studies indicate that bilharzia infections increase the risk of infection with HIV. “Furthermore, they support the idea that control programs for schistosomiasis and perhaps other parasitic worm infections may also be useful in helping to reduce the spread of HIV/AIDS in developing countries where helminths are endemic.” (Chenine 2008). Research sponsored by Malawi’s Office of President and Cabinet has demonstrated that, until recently, cichlid predators of these snails have been decreasing in number due to over-fishing, while the vectors have increased. Also this work has demonstrated that the vector snails prefer fine substrate, which has increased-due to extensive deforestation over the past twenty years. Encouragingly, during the past two years, no-fishing zones have been established to reduce disease, and the villagers have been treated extensively with bilharzia drug, Praziquantel. Numbers of snail feeding fishes have increased, numbers of snail vectors have decreased dramatically, and the number of infected snails collected by the research team has dropped to zero. Increased awareness of the relationship between environmental degradation, cichlids and human diseases such as bilharzia and HIV/AIDS has resulted in increased conservation awareness and action by the Government of Malawi.

0296 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Jonathan McKenzie, Christopher Schieble, Martin O'Connell

University of New Orleans, New Orleans, LA, United States

Habitat Use by Immature Lemon Sharks (*Negaprion brevirostris*) at the Chandeleur Islands, Louisiana

We examined immature lemon shark (*Negaprion brevirostris*) habitat use at the Chandeleur Islands, Louisiana between May and August 2009. A total of 56 sharks were collected, tagged, and measured (28 males; 28 females, fork length range = 600 to 1770 mm). For each shark habitat and environmental variables were also recorded. Sharks were grouped into three size/age classes (neonates < 640 mm, YOY < 900 mm, and juveniles < 900 mm). There were no significant differences (ANOVA, $p > 0.05$) between males and females for any environmental variables. There were also no significant differences ($p > 0.05$) in substrate preference among the size classes. However there was a significant difference ($p < 0.001$) among size classes in regard to depth. The smaller two size classes preferred shallower habitats than the largest size class. We attached SPOT 5 satellite tags to the dorsal fin of six juvenile *N. brevirostris* (4 males; 2 females; fork length range = 1100 - 1770 mm) in an effort to determine habitat preference on a larger scale. Data recovered from the tags indicated that these sharks stayed in the area throughout the summer, remaining near the islands and rarely moving to deeper offshore habitats. In the future, we will be calculating growth rate from recaptured lemon sharks with PIT tags and pursuing genetic analyses to determine the extent of polyandry and site fidelity in this nursery habitat.

0176 Fish Conservation, Ballroom B, Friday 9 July 2010; ASIH STOYE AWARD CONSERVATION

Jennifer McKinney¹

¹*Gulf Coast Research Laboratory, Ocean Springs, MS, United States*, ²*Department of Coastal Studies- University of Southern Mississippi, Hattiesburg, MS, United States*

Predicting Whale Shark, *Rhincodon typus*, Distribution in the Northern Gulf of Mexico

Whale sharks, *Rhincodon typus*, have a circumglobal distribution and are thought to be highly migratory. Due to their protected status, understanding critical habitat is essential for proper management. The goal of this study was to describe the probable distribution of whale sharks in the northern Gulf of Mexico using the Maximum Entropy (MaxEnt) modeling algorithm for species distribution. This study also aimed to determine inter-annual variability and compare the effects of aggregation presence on

the probability distribution. Models built on presence only localities (PRS) and weighted by aggregation size (WTD) were compared for the temporal period of June to September of 2008 and 2009. Input variables included: distance features and remotely sensed sea surface temperature, chlorophyll concentrations, sea surface height anomalies, and bathymetry. Cross-validation procedures were used to calculate the mean area under the receiver operating characteristic curve (AUC), a measure of model performance. Mean AUC values ranged from 0.828 - 0.984, indicating strong performance in all models, with significantly higher values for WTD ($p < 0.001$). There were observable spatial variations in the predicted distributions amongst year and model type. Distance to continental shelf edge, petroleum platforms and the Mississippi Delta were the predominant contributors. This correlation may be due to the presence of a potential food source (upwelling along the shelf edge and high riverine output) for these foraging filter feeders or structural/landmark recognition (petroleum platforms and bathymetric features) for migrant animals. Knowing the critical habitat for these animals could aid in the development of effective protection strategies.

0189 General Ichthyology, Ballroom B, Friday 9 July 2010

Paul McLaughlin, Ken Oliveira

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

The Effects of *Anguillicola crassus* Infection on Silver Phase Male American Eels (*Anguilla rostrata*)

Originally endemic to the continent of Asia, the nematode *Anguillicola crassus* has become established in North America over the past two decades. Upon ingestion of an infected intermediate or paratenic host by the eel, the parasite burrows through the wall of the swim bladder eventually reaching the lumen where the parasite feeds on blood. Damage caused by the parasite's movement includes swelling, fibrosis, and in some cases loss of swim bladder function. The eel spends the first 6-20 years of life in a primarily benthic existence where the parasite's impact may not be noticed. Upon approaching maturity, the eel undergoes a metamorphosis to the silver stage and begins an extensive pelagic migration to the Sargasso Sea to spawn. It is at this time that the effects of the parasite may become a considerable detriment to migration. In this study, we examined the effects of *Anguillicola crassus* infection on the host eel's metabolism (Active & Resting), Cost of Transport, hematological parameters (RBC Count, hemoglobin concentration, hematocrit and ferritin concentration), and swim bladder characteristics (% body volume). Preliminary analysis thus far have only revealed significant reductions in hematocrit and increase in swim-bladder volume. The infection does not appear to be affecting other blood parameters or eel metabolism. Further review will determine if the parasite is affecting the eel's ability to make an extended migration at depth.

0651 Fish Systematics I, Ballroom D, Monday 12 July 2010

Caleb McMahan, Chris Boeckman, Chris Murray, Aaron Geheber, Kyle Piller

Southeastern Louisiana University, Hammond, Louisiana, United States

Systematics of Cichlid Fishes of the Genus *Vieja*

Numerous phylogenetic studies of New World cichlids have recovered the genus *Vieja* as a paraphyletic group. As a result, several taxonomic changes have been recommended for species within this genus based on only a handful of representative species. We conducted a comprehensive phylogenetic study of *Vieja* using complete taxon sampling of the genus, as well as the inclusion of other closely related species and genera. Our study included both mitochondrial (cyt b) and nuclear DNA (S7 intron-1) sequences and Bayesian and Maximum Parsimony analyses. The results are largely congruent with those of other studies and also failed to support the monophyly of *Vieja*. Inclusion of all of the taxa in the genus resulted in a more comprehensive representation of the evolutionary relationships among the fishes in this group. Furthermore, these results suggest that *Vieja* is in need of taxonomic revision. Additionally, data will be presented regarding our ongoing studies of morphological variation within select species groups within the genus.

0484 Herp Conservation I, 556AB, Thursday 8 July 2010

Taegan McMahan¹, Neal Halstead¹, Steve Johnson², John Romansic¹, Patrick Crumrine³, Raoul Boughton⁴, Lynn Martin¹, Jason Rohr¹

¹*University of South Florida, Tampa, Florida, United States*, ²*University of Florida, Wimauma, Florida, United States*, ³*Rowan University, Glassboro, NJ, United States*, ⁴*Archibald Biological Station, Florida, United States*

Chlorothalonil: An Immunomodulatory and Deadly Fungicide to Amphibians

Agrochemicals have been implicated in amphibian declines, but most tested agrochemicals do not kill amphibians at concentrations found commonly in the environment. However, many of the ~100,000 registered chemicals have not been thoroughly tested on amphibians. One understudied pesticide is chlorothalonil, the most commonly used synthetic fungicide in the U.S. We reared *Rana sphenocephala* and *Osteopilus septentrionalis* in outdoor mesocosms for five weeks in the presence or absence of one and two times the expected environmental concentration (EEC; 164 µg/L) of chlorothalonil. The EEC was associated with 99.5% and 97.8% mortality of *R. sphenocephala* and *O. septentrionalis*, respectively, and 2x the EEC caused 100% mortality. We then conducted three static renewal, dose-response experiments on *O. septentrionalis*, *Hyla squirella*, *H. cinerea*, and *R. sphenocephala*. The EEC of chlorothalonil caused 100%

mortality of all species within 24 hours, half the EEC killed 100% of *R. sphenoccephala*, and the lowest concentration tested, 0.0164 µg/L, caused significant mortality. The dose-response was non-monotonic, with only low and high concentrations causing significant mortality, these concentrations were also associated with elevated Corticosterone. Additionally, chlorothalonil concentration was negatively associated with liver health and numbers of immune cells in the liver (<16.4 µg/L). Given that chlorothalonil: killed nearly every tadpole at the EEC, caused significant mortality four orders of magnitude below the EEC, induced immunosuppression at environmentally common concentrations, and has been regularly detected at or below the EEC where amphibian are going extinct, chlorothalonil exposure has the potential to directly and indirectly cause amphibian declines.

0432 AES Ecology, 551 AB, Thursday 8 July 2010

Bailey McMeans¹, Michael Art², Aaron Fisk¹

¹University of Windsor, Windsor, Ontario, Canada, ²Environment Canada, Burlington, Ontario, Canada

The Feeding Behavior of Greenland Sharks Based on Stable Isotope and Fatty Acid Analysis of Multiple Tissues

The Greenland shark (*Somniosus microcephalus*) is one of only two sharks that inhabit seasonally ice-covered waters. However, few data exist regarding their feeding behavior and potential role in marine ecosystems. Greenland sharks consume a variety of prey taxa and likely have slow tissue turnover due to their large size and slow growth. Thus, investigating important energy sources and temporal patterns of feeding behavior in Greenland sharks using stomach contents and chemical tracers is potentially problematic. The objective of the present study was to analyze multiple Greenland shark tissues with different turnover times (i.e. muscle, liver, red blood cells, blood plasma) for stable nitrogen ($\delta^{15}\text{N}$) and carbon ($\delta^{13}\text{C}$) isotopes and fatty acids (FA) to investigate seasonal patterns in feeding behavior. Regarding $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$, no differences were observed in any tissue between open-water and ice-cover, indicating that neither trophic position nor carbon sources of Greenland sharks differed with season. Diet breadth, indicated by coefficients of variation, were also similar between seasons within each tissue, further supporting the lack of seasonal diet differences in Greenland sharks. Fatty acid profiles of Greenland sharks differed between tissues, but not between seasons. However, blood plasma FA profiles were similar to blubber FA profiles of ringed seals (*Pusa hispida*), indicating recent consumption of marine mammal by Greenland sharks. The use of multiple tissues in the present study was useful for indicating that Greenland sharks do not differentially feed between seasons and that marine mammals are likely an important energy source to Greenland sharks.

0433 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Bailey McMeans¹, Jill Olin¹, George Benz²

¹University of Windsor, Windsor, Ontario, Canada, ²Middle Tennessee State University, Murfreesboro, TN, United States

Stable Isotope Comparisons Between Embryos and Mothers of a Placentotrophic Shark Species

Fisheries management, conservation and ecological concerns have prompted considerable efforts to better understand the early life history of sharks. Stable nitrogen ($\delta^{15}\text{N}$) and carbon ($\delta^{13}\text{C}$) isotopes of Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, embryos and mothers were analyzed. Embryos were generally enriched in ^{15}N in all studied tissue relative to their mothers' tissue, with mean differences between mother and embryo $\delta^{15}\text{N}$ (i.e. $\Delta\delta^{15}\text{N}$) being 1.4‰ for muscle, 1.7‰ for liver and 1.1‰ for cartilage. Embryo muscle and liver were enriched in ^{13}C (both $\Delta\delta^{13}\text{C}$ means = 1.5‰) and embryo cartilage was depleted ($\Delta\delta^{13}\text{C}$ mean = -1.0‰) relative to corresponding maternal tissues. While differences in $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ between mothers and their embryos were significant, muscle $\delta^{15}\text{N}$ values indicated embryos to be within the range of values expected if they occupied a similar trophic position as their respective mothers. Positive linear relationships existed between embryo total length (TL) and $\Delta\delta^{15}\text{N}$ for muscle and liver and embryo TL and $\Delta\delta^{13}\text{C}$ for muscle, with those associations possibly resulting from physiological differences between smaller and larger embryos or differences associated with the known embryonic nutrition shift (yolk feeding to placental feeding) that occurs during the gestation of this placentatrophic species. Together these results suggest that at birth, the $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values of *R. terraenovae* are likely higher than somewhat older neonates whose postpartum feeding habits have restructured their isotope profiles to reflect their postembryonic diet.

0454 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Tamara McPeck, Michelle Boone

Miami University, Oxford, OH, United States

Effects of Pesticides and Competition on Spotted Salamander (*Ambystoma maculatum*) Metamorphosis and Overwinter Survival

Pesticides are considered to be a risk to amphibians, but their impact on salamander species is poorly understood. Pools that spotted salamanders rely upon for reproduction are being threatened by contamination with common pesticides such as the herbicide atrazine and the insecticide carbaryl. This study aims to determine how metamorphosis in spotted salamanders is affected by exposure to pesticides at different levels of

competition. Additionally, I will investigate how alterations in metamorphosis due to pesticide exposure may alter growth and survival in the terrestrial environment. Salamander egg masses were collected in Oxford, Ohio. After hatching, larvae were reared in mesocosms until metamorphosis at a density of 10 or 30. I exposed larvae to pesticide concentrations that are considered to be sublethal to salamander larvae, represent realistic exposure concentrations in the environment, and can affect the aquatic food web. Salamanders' time to metamorphosis, SVL, and mass at metamorphosis were monitored; additionally, we monitored the phytoplankton and zooplankton communities. After metamorphosis, juveniles were reared in terrestrial enclosures until the following spring. Mass and SVL measurements of juveniles will be taken this spring. Current results from this experiment have shown that competition and both pesticides decreased mass at metamorphosis. Competition and the insecticide reduced SVL at metamorphosis and increased time to metamorphosis. Furthermore, I hypothesize that these impacts on metamorphosis will impact terrestrial growth and survival. Understanding how pesticides may affect amphibians in the larval and juvenile stages will help determine which amphibian life-stage is at greatest risk to contaminants.

0354 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

Paola A. Mejia Falla¹, Enric Cortés², Fernando A. Zapata³, Andrés F. Navia⁴

¹Fundación colombiana para la investigación y conservación de tiburones y rayas, SQUALUS, Cali, Valle del Cauca, Colombia, ²NOAA-NMFS, Panama City, Florida, United States, ³Grupo de Investigación en Ecología de Arrecifes Coralinos, Departamento de Biología, Universidad del Valle, Cali, Valle del Cauca, Colombia, ⁴Grupo de Investigación en Ecología Animal, Departamento de Biología, Universidad del Valle, Cali, Valle del Cauca, Colombia

Reproductive Biology of the Round Stingray *Urotrygon rogersi* in the Pacific Coast of Colombia

We studied reproductive aspects of 1158 individuals of the round stingray *Urotrygon rogersi*. Specimens were obtained from the artisanal shrimp fishery operating in the Colombian Pacific Coast between March 2006 and March 2009. Females reached greater maximum total length (TL) and weight (37.4 cm and 293 g) than males (32.5 cm and 160 g). Sex ratio of adult males vs. females was 1:1.4 and that of embryos, 1:1. Clasper length increased rapidly between 20.0 and 22.0 cm TL. The smallest mature male measured 20.2 cm TL and the largest immature individual 21.9 cm TL. First maturity was reached at 61.5% of maximum length (TL_{max}), and TL₅₀ was estimated to be 26.2 cm. Uterus width increased between 22.0 and 23.0 cm TL. The smallest maturing individual measured 18.0 cm TL. The size at first maturity was 54.5% of TL_{max} and TL₅₀ was estimated at 25.8 cm. Embryos were found in females > 20.4 cm TL and maximum fecundity was three embryos per female (mode=1). A statistically significant relationship between fecundity and maternal size was found. The high percentage of mature individuals in the area and the low number and presence of embryos of all sizes during all months suggest that: 1)

parturition in *U. rogersi* is not seasonal, but rather occurs throughout the year; 2) there is a trade-off between fecundity and length of reproductive cycle; and 3) the study sites are important nursery and reproductive areas for *Urotrygon rogersi*.

0403 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Waldiney Mello

Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil

Preliminary Results on the Cranial Anatomy of Rare Hammerhead Sharks (Elasmobranchii: Sphyrnidae): How it Can Change the Relationships within the Family

The hammerhead sharks are grouped in the family Sphyrnidae, which comprises 8 living nominal species: *Sphyrna lewini*, *S. tudes*, *S. tiburo*, *S. zygaena*, *S. mokarran*, *S. corona*, *S. media*, *S. couardi* and *Eusphyra blochii*. This family is largely fished worldwide, however it is poorly known, having taxonomical and phylogenetical controversies. Besides the characteristic lateral expanded head, studies on the internal anatomy of this region have been neglected. Certain species, such as *S. media*, *S. couardi* and *E. blochii* are especially represented by few exemplars in scientific collections, when compared to the others. The difficulties in avoid damages in specimens seems to delayed and limited the studies on the internal anatomy of hammerhead sharks, even more on rare species. I have been solving this problem using more sensitive digital x-rays, and also mammography. The present work discusses the preliminary results on the cranial anatomy of the rare cited Sphyrnidae species in scientific collections, and shows how it can change what is poorly known about the interrelationships among hammerhead sharks. This involves to show some new cranial characters to be used, for the first time, in phylogenetical studies within the family Sphyrnidae. This would help to elucidate the controversial relationships among the hammerhead sharks, as well as to study new important cranial characters.

0575 AES Morphology, 552 AB, Sunday 11 July 2010

Waldiney Mello

Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil

Hammerhead Sharks (Elasmobranchii: Sphyrnidae) from the Indo-Pacific: More Species Than it Seems?

Among sharks, the Carcharhiniformes comprises more than 55% of all living species. In this order, the family Sphyrnidae, which includes all the hammerhead sharks, is

characterized by the presence of a laterally expanded head forming the cephalofoil. Between all the 8 living species in this family, *Sphyrna lewini* is distinguished for its largest occurrence, which is cosmopolitan, and *Eusphyrna blochii* is recognized for being the only endemic species of Sphyrnidae. Both species occurs in the Indo-Pacific ocean, and their internal anatomy were studied especially concerning the head. Differences in the anatomy of the cephalofoil were found among exemplars of each studied species. I will discuss the preliminary results on the cranial anatomy in these two species, questioning if there are just different subpopulations of *S. lewini* and *E. blochii*, based on new cranial characters. This includes to show some peculiar characters between the subpopulations of *S. lewini* and *E. blochi* in the Indo-Pacific ocean. The preliminary results on the internal and external morphologies suggests, at least, 3 subpopulations of *S. lewini* and 2 of *E. blochii* in the Indo-Pacific. The Indic ocean is showed as a distinguished region to study morphological patterns that were never described in hammerheadsharks, suggesting two possibilities: different subpopulations or more species than was thought.

0701 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556 AB, Friday 9 July 2010

Sabine Melzer, Phil Bishop

University of Otago, Dunedin, New Zealand

Skin Secretions of *Leiopelma pakeka* as a Potential Mechanism Against Rat Predation

The secretion of defensive chemicals onto the skin is a widely used mechanism for predator defence in anurans. Secretions often consist of a potent mixture of bioactive peptides with cytotoxic or neurotoxic effects, which may aid in predator deterrence. In New Zealand, introduced rodents have been suggested as one of the main drivers for the historical declines and extinctions of endemic *Leiopelma* species. This study demonstrates that the skin secretions of *L. pakeka* can lyse rat erythrocytes successfully and were effective in deterring rats from ingesting secretion-covered food. When offered a choice, rats displayed a significant preference for food pellets coated with water over those covered in frog skin secretions. Direct oral exposure to the secretions has no significant effects on water or food intake of rats. In addition, video analysis showed that there was no significant difference in the proportions of time rats spent grooming, rising on the hind legs, motionless or investigating associated with exposure to the secretions. This study provides new insight into the defensive function of leiopelmatid skin secretions as a defence mechanism against predation. The functional significance of the often highly complex defensive strategies utilised by anurans are discussed with specific reference to the endemic New Zealand fauna.

0703 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Sabine Melzer, Phil Bishop

University of Otago, Dunedin, New Zealand

Differential Polymorphism in Cutaneous Glands of Archaic *Leiopelma* species

Endemic New Zealand frogs of the genus *Leiopelma* are from a basal lineage of extant anurans that release defensive secretions onto their skin when disturbed. Here, I characterize the gross anatomy and microscopic structure of the skin of *L. archeyi*, *L. hochstetteri* and *L. pakeka* using stereoscopic, light and transmission electron microscopy. The terrestrial *L. archeyi* and *L. pakeka* possess polymorphic granular glands, categorized as I and II, based on their frequency and morphological traits, whereas the semi-aquatic *L. hochstetteri* lacks type I glands. This is the first report of differential polymorphism in anurans of the same genus and could be interpreted as an adaptation to different physiological or ecological needs of these species. However, species within this ancient genus share similar general gland morphology with other anurans, namely, a secretory unit containing storage granules ensheathed by myoepithelial cells. Type I glands are ellipsoid, large and contain a homogeneous mass of electron-dense granules ($1.8 \pm 0.08 \mu\text{m}$ in diameter). Type II glands are round and contain larger heterogeneous granules ($4.06 \pm 0.16 \mu\text{m}$) of varying densities. Exposure to noradrenaline causes the contraction of myoepithelial cells, resulting in bulk discharge of type I glands through the epidermal duct onto the skin surface. Differential release of secretions from polymorphic glands may be indicative of their functional specialisation in antipredatory or regulative roles.

0060 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Tricia Meredith¹, Anne Hansen¹

¹*Florida Atlantic University, Boca Raton, FL, United States*, ²*University of Colorado Denver, Anschutz Medical Campus, Aurora, CO, United States*

Olfactory Hemi-bulb Organization in the Elasmobranch Brain

Olfactory cues are detected by olfactory receptor neurons (ORNs). The information is conveyed via the olfactory nerve to the olfactory bulb (OB), the first relay station in the brain. The axons of the ORNs make contact with mitral cells in glomeruli. In teleost fishes, both tracing and electro-physiological studies showed that the teleost OB is divided into separate functional zones that process different types of odorants with no suggestion of somatotopy. While the OB in teleosts has a round shape, the OB of elasmobranchs is a long structure that lies parallel to the olfactory lamellae. In some elasmobranchs, the OB is physically partitioned into "hemi-bulbs", either as two distinct hemi-bulbs or as a succession of connected swellings along the OB. The functional significance of these hemi-bulbs is not fully understood. The present study examined the

organization of the OBs in two elasmobranch species, the Atlantic stingray (*Dasyatis sabina*) and the bluntnose stingray (*D. say*) to test the hypothesis that axons projecting from the olfactory epithelium to the OB in elasmobranchs exhibit a somatotopic arrangement. We injected various fluorescent tracers into the OBs to retrogradely label ORNs in the epithelium; and into the olfactory epithelium to anterogradely label the OBs. Our results suggest that the distribution of glomeruli in the OB is different from that in teleosts and that glomeruli receive projections from three to four olfactory lamellae situated immediately adjacent to these glomeruli. This suggests a somatotopic arrangement of the elasmobranch OB, which may be unique among vertebrates.

0390 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

George Meszaros¹, Alison Yasick², Michael Walton²

¹John Carroll University, University Heights, Ohio, United States, ²Cleveland State University, Cleveland, Ohio, United States

The Effects of Embeddedness on Habitat Selection of Aquatic Macroinvertebrates and Plethodontid Salamanders

The effects of urbanization are a major challenge for river systems in Northeast Ohio. An increase in impervious surface area adjacent to headwater streams alters the streamflow regime, which in turn alters channel morphology thereby increasing in-stream sedimentation. As a result the interstitial spaces between the rocks in the streambed become filled with sediment and thus embedded. These spaces represent important habitat for the Northern two-lined salamander *Eurycea bislineata* and aquatic macroinvertebrates. It is hypothesized that an increase in in-stream embeddedness will have a negative impact on both salamander and macroinvertebrate populations. In order to test this twenty replicates of two treatments, unembedded and partially embedded, were made and placed in pairs in selected riffle zones of Haskell Run, a first order stream in Peninsula, Ohio. Sampling was done weekly using a kick seine; organisms collected from each treatment were counted and identified to family. Using a two-tailed T-test, *Eurycea bislineata* showed a significant preference for the unembedded treatments (p-value=0.0003). Among families of macroinvertebrates, only the Baetidae elicited a significant preference for unembedded treatments (p-value=0.037). One explanation for this is that salamanders have greater mobility within a stream, which allowed them to be more selective in their choice of habitat as opposed to the macroinvertebrates. These results have important implications for the conservation of stream ecosystems. Salamanders, such as *E. bislineata*, are a vital part of these ecosystems, and new and greener methods of development must be explored and implemented in order to preserve them.

**0456 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; ASIH STORER
HERPETOLOGY AWARD**

Lisa Regula Meyer

Kent State University, Kent, Ohio, United States

**The Impact of *Typha angustifolia* and *Phragmites australis* Invasions in
Wetlands on Behavior of Larval and Adult *Rana clamitans***

Invasive plants often have chemical components to which many native amphibians are naïve, and change the structure of the entire habitat by rapidly establishing a dominance of a single species, thus reducing habitat complexity. Invasive plants threaten amphibians and other wetland organisms, more so than they threaten fully terrestrial organisms for a number of reasons. This study compares the behavior of *Rana clamitans* tadpoles in a swim T-maze when presented with the invasive plants *Typha angustifolia* or *Phragmites australis*, the native plant *Juncus effusus*, or no plant. Individuals were caught in ponds without the plants in question, and are assumed to be naïve to chemical cues from these plants. The ability to recognize and avoid unknown and possibly dangerous chemicals would be advantageous to larval amphibians, which are sensitive to numerous chemical and physical factors. The behavior of adults caught from similarly non-invaded ponds was also investigated using a 1-meter diameter arena with one third each *T. angustifolia*, *P. australis* and native plant mix. Samples of plant communities were obtained from the shores of previously studied wetlands, which have been used for three years of data collection on invasive plants. Differences in behavior based upon different plant communities may prove important for amphibians, especially if there is significant difference between invaded and non-invaded plant communities. Despite the preservation of total wetland area via no-net-loss policies, if the preserved wetlands are dominated by invasive plants, the net effect for amphibians may be negligible.

0160 Amphibian Ecology, 551 AB, Monday 12 July 2010

Matt Michel

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

**Spatial Dependence of Phenotype-Environment Associations for Tadpoles in
Natural Ponds**

Within natural habitats, phenotypes are shaped by many environmental factors. Consequently, environmental heterogeneity can promote phenotypic divergence. However, because environments exhibit heterogeneity at different spatial scales, phenotypic divergence should also exhibit such scale-dependence. Using hierarchical linear models, I determined how multiple environmental factors at two spatial scales

affected the morphology of wood frog (*Rana sylvatica*) tadpoles collected from natural ponds. Among ponds, predation risk and tadpole density were strong predictors of tadpole morphology, while within ponds, other environmental variables such as water depth and leaf litter were more important. Spatial analyses revealed that water depth and leaf litter, but not predation risk or tadpole density, exhibited heterogeneous spatial distributions within ponds, suggesting that spatial properties of environmental variables influence the scale at which they shape phenotypes. These results emphasize the importance of considering phenotype-environment associations across multiple spatial scales.

0668 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Kathy Michell

New York Center for Turtle Rehabilitation and Conservation, Inc., Narrowsburg, NY, United States

Use of Radio-telemetry and Recapture to Determine the Success of Head-started Wood Turtles in New York

Three cohorts of head-started wood turtles (*Glyptemys insculpta*) hatched in 1994, 1998 and 1999 were radio-tracked for two years each. Six turtles were released as one year olds, four as two year olds, all with a minimum weight of 130g and equipped with an ATS (Advanced Telemetry Systems) 357 transmitter weighing 3.8-3.9g. To attain this pre-release weight without the shell abnormalities sometimes associated with rapid growth, the "Michell Method" was developed; maintaining the hatchlings on a moist peat moss substrate with incandescent lighting at a temperature of 22-26°C and feeding only softened Reptomin® to avoid food preferences. Reptomin® was found to be a balanced diet for the species. Juveniles were placed in a predator proof outdoor acclimation enclosure in the spring preceding their release. Three different release locations were used in the 1.5 km study stream at known wood turtle hibernacula. Regardless of release location, all 10 turtles migrated to a portion of the stream adjacent to a meadow dominated by goldenrod, fern, stinging nettle, alder, multiflora rose and winterberry prior to the end of their second year in the wild. During the two years each turtle was tracked survivorship was 100% (n=10) for both the one and two year old turtles. Spring emergence surveys are conducted in the meadow and recapture observations made of the head-started turtles which are now adult or nearly adult and are identified by individual notching.

0083 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Slawomir Mitrus

Opole University, Opole, Poland

Body Size of Several Years Old European Pond turtles - Wild and Headstarted Ones

In Poland headstarting programs of the European pond turtle *Emys orbicularis* are carried on since mid 80s 20st century. In 2006 I made an attempt to evaluate efficiency headstarting program in central Poland. I was capturing turtles during four field trips from May to August. Individual turtles were captured by dip netting, four to six consecutive days on each field trip. I captured e.g. 8 turtles hatched in 1999 (3 headstarted and 5 "wild" = not taken to artificial rearing) - in 2000 64 headstarted turtles were marked by marginal scute notching and released to natural habitats; additionally other 52 "wild" individuals hatched in the same season were marked. In 2006 the three headstarted turtles had mean straight carapace length (SCL) 139.07 mm (SD=6.38) and mean plastron length (PL) 126.48 mm (SD=3.11); the five "wild" ones SCL=146.38 mm (SD=4.07) and PL = 137.08 (SD=5.57) [Mann-Whitney U-test, for SCL: U=3, p=0.18; for PL U=0, p=0.025]. After hatching there were no differences in size of the turtles [for the five later headstarted SCL=27.10 (SD=0.70), PL=24.57 (SD=1.03), for "wild" ones SCL=26.28 (SD=1.12), PL=23.96 (SD=1.00) [U-test, for SCL: U=5, p=0.46; for PL U=6, p=0.65]. The probe is small, but this sound alarming that the "wild" turtles were bigger (PL) than "heasterted" ones. However, in Poland headstarting is considered well-tried technique, and headstarting programs are still carried on without probes to evaluate their efficiency.

0034 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Masaki Miya¹, Theodore W. Pietsch², James W. Orr³, Takashi P. Satoh⁴, Hsuan-Ching Ho⁵, Rachel Arnold², Andrew M. Shedlock⁶, Mitsuomi Shimazaki⁷, Mamoru Yabe⁷, Mutsumi Nishida⁴

¹Natural History Museum and Institute, Chiba, Japan, ²University of Washington, Seattle, United States, ³National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, United States, ⁴Ocean Research Institute, The University of Tokyo, Tokyo, Japan, ⁵National Taiwan Ocean University, Keelung, Taiwan, ⁶Museum of Comparative Zoology, Harvard University, Cambridge, United States, ⁷Hokkaido University, Hakodate, Japan

Evolutionary History of Anglerfishes (Teleostei: Lophiiformes): A Mitogenomic Perspective

The teleost order Lophiiformes comprise approximately 325 living species placed in 67 genera, 18 families, and five suborders. Although several attempts to establish phylogenetic relationships using morphology have been made, a detailed molecular approach has heretofore not been possible because of the lack of fresh material for DNA extraction. Also incompleteness of the fossil record across all of the Lophiiformes makes it difficult to interpret evolutionary history of these fishes. In this study we assembled whole mitochondrial genome (mitogenome) sequences from 39 lophiiforms representing all five suborders and 17 of the 18 families. Unambiguously aligned sequences of the 14,611 nucleotide positions from the total of 77 species were subjected to partitioned maximum likelihood analysis and all of the higher taxa (including the order itself) were confidently recovered as monophyletic with the exception of the Thaumatoichthyidae (*Lasiognathus* was deeply nested within the Oneirodidae). The mitogenomic trees strongly support the most basal and an apical positions of the Lophioidei and a clade comprising Chaunacoidei + Ceratioidei, respectively, although alternative phylogenetic positions of the remaining two suborders (Antennarioidei and Ogcocephaloidei) with respect to the above two lineages are statistically indistinguishable. A relaxed molecular-clock Bayesian analysis of the divergence times suggests that all of the subordinal diversifications have occurred during the early to mid Cretaceous (100–130 Myr ago) and estimated per-net clade net diversification rates are highest for the deep-sea Ceratioidei that exhibit remarkable specialization in morphology and ecology including extreme sexual dimorphism and male sexual parasitism.

0172 Herp Morphology, 556 AB, Sunday 11 July 2010

Shabnam Mohammadi, Alan Savitzky, Krista McCoy

Old Dominion University, Norfolk, VA, United States

A Comparison of Adrenal Glands in Toad Eating and Non-toad Eating Snakes

Toads are chemically defended by bufadienolides, a class of cardiotoxic steroids lethal to most predators, including many snakes. Bufadienolides bind to Na⁺K⁺-ATPase, inhibiting their ability to transport ions. In cardiocytes, this inhibition causes arrhythmia and severely increased contraction strength, which, if prolonged, leads to death. However, several snakes are resistant to bufadienolides and consume toads with no ill effects. Adrenal glands produce hormones that are important for the maintenance of Na⁺K⁺-ATPase, and therefore play an important role in countering the negative effects of bufadienolides. Indeed, the toad-eating specialist *Heterodon platirhinos* has been known to possess enlarged, and sexually dimorphic, adrenal glands. We hypothesize that toad-eating snakes have modified adrenal glands that play a role in the snakes' resistance to bufadienolides and that sexual dimorphism in adrenal gland size is a general characteristic of bufophagous snakes. We use phylogenetically independent samples to investigate adrenal morphology in bufophagous and non-bufophagous. We compare adrenal size, corrected for body size, among species. We find that the allometric relationship between adrenal mass and body size is significantly different in bufophagous and non-bufophagous snakes across phylogenetically independent lineages. We also compare the tissue ratios in the adrenal glands histologically, we are currently analyzing this data.

0308 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Hin-Kiu Mok¹, Kai-Yun Tsai¹, Pai-Ho Chiu¹, Eric Parmentier², Michael Fine³

¹National Sun Yat-sen University, Kaohsiung, Taiwan, ²University of Liege, Liege, Belgium, ³Virginia Commonwealth Univ., Richmond, VA, United States

Convergent Evolution for Sound Production with a Putative Slow Muscle in a Perciform Fish *Glaucosoma buergeri* (Glaucosomatidae)

Little is known about evolution of swimbladder sound production in fishes. Until recently all examples were presumed to utilize fast muscles that drive the swimbladder to produce sound as a forced but rapidly-damping response; a muscle contraction rate of 200 times/s will generate a sound with a fundamental frequency of 200 Hz. Recently, slow muscles have been demonstrated in a carapid fish, and they likely occur in many ophidiiform fishes. These muscles slowly extend the anterior swimbladder by stretching a swimbladder fenestra until the bladder snaps back exciting sound production. Sound pulses but not sound frequency is related to muscle contraction rate. Here we describe

sounds produced by a similar but phylogenetically-unrelated mechanism in a perciform fish. A pair of extrinsic sonic muscles originates on the pterotic bones and inserts on the anterodorsal swimbladder just forward of a stretchable swimbladder fenestra. A fan-shaped tendon, from the 9th vertebra that attaches to the bladder just forward of the fenestra, will be stretched along with the bladder by muscle contraction. Strain energy stored in the tendon will cause the anterior bladder to recoil upon muscle relaxation. Sound pulses consist of two parts: a short low-amplitude one followed by a longer-duration higher amplitude part that decays exponentially. We suggest that the first part of the call is caused by sonic muscle contraction (cocking) and the second (release) is forced by strain energy in the stretched tendon, which would also drive the exponentially-decaying sound pulse.

0063 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Carmen G. Montana¹, Craig A. Layman¹, Kirk O. Winemiller¹

¹Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station/Texas, United States, ²Florida International University. Department of Biological Sciences, Miami/Florida, United States

Seasonality and Gape Width Structures Predator-prey Interactions in Neotropical Piscivores

Multiple factors influence dietary choices of Neotropical piscivores. We examined how seasonal prey abundance and gape limitations may provide ultimate constraints on preferred prey. We examined diets of four large piscivorous species (*Cichla temensis*, *C. orinocensis*, *Boulengerella cuvieri* and *B. lucius*) from the Cinaruco, La Guardia, and Ventuari rivers in Venezuela throughout the wet-dry season hydrological cycle across multiple years. The four piscivores consumed a phylogenetically and morphologically diverse group of fishes, reflecting the overall diversity of fish species in these rivers (>300 species). At the start of the falling water period, all four piscivores consumed large prey, especially the abundant, migratory, benthivorous fishes of the genus *Semaprochilodus*. *Cichla* tended to eat large prey, about 50% of their body length; whereas *Boulengerella* exploited smaller prey (~ 20% body length). Prey/predator body size ratios were relatively low (0.11 - 0.20), and decreased as water level dropped during the annual flood cycle. Prey availability likely drives this seasonal decline in ratios.

0709 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

Eric Montie¹, Maria Wilson², Kenneth Mann³, David Mann¹

¹College of Marine Science, University of South Florida, St. Petersburg, FL, United States, ²Department of Biological Sciences, Aarhus University, Aarhus C, Denmark, ³Department of Orthopedic Surgery, Upstate Medical University, Syracuse, New York, United States

Micro Computed Tomography and Three Dimensional Reconstructions of the Acousticolateralis System in the Gulf Menhaden, an Ultrasound-detecting Clupeid

The mechanism of ultrasound detection in Alosinae has puzzled scientists over the last 15 years, but the acousticolateralis system has been thought to function in detecting these sounds. We used volume reconstructions derived from micro-computed tomography (CT) images to compare the head anatomy of a clupeid that can detect ultrasound, the Gulf menhaden (*Brevoortia patronus*), and a species that cannot, the scaled sardine (*Harengula jaguana*). One Gulf menhaden and one scaled sardine were scanned in air using a micro Computed Tomography (micro-CT) scanner. Isotropic voxel reconstructions were obtained for the scaled sardine (20 micron) and menhaden (16 micron). Segmentation and three-dimensional (3D) reconstructions of micro-CT images were performed using AMIRA. The imaging data indicated a more elaborate channeling of the lateral line system overlying the bullae in the Gulf menhaden. Comparison of 3D reconstructions of scaled sardine and gulf menhaden showed obvious anatomical differences. These distinctions included the shape of the two bullae, the orientation of the bulla and utricle, and the positioning of the bulla and lateral recess relative to the body surface. In the gulf menhaden, the rostral body of each bulla was positioned ventral to the utricle, rather than the anterior positioning observed in the scaled sardine. Furthermore, in the gulf menhaden, the distances of the bulla and lateral recess to the body surface were much shorter than the distances in the scaled sardine. These anatomical differences may play a role in allowing gulf menhaden to detect ultrasound.

0672 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Misty Montie¹, Christopher Koenig², Felicia Coleman², David Mann¹

¹College of Marine Science, University of South Florida, Saint Petersburg, FL, United States, ²Coastal and Marine Laboratory, Florida State University, Saint Teresa Beach, FL, United States

In Situ Sound Production of Red Grouper (*Epinephelus morio*) on the West Florida Shelf

Red grouper (*Epinephelus morio*) are long-lived, commercially important, soniferous fish belonging to the family Epinephelidae. Found throughout the western North Atlantic and Gulf of Mexico, they are protogynous hermaphrodites, and peak spawning occurs from March through May. Unlike many grouper species, red grouper do not form large spawning aggregations; rather, they form small polygynous groups, and remain in relatively close proximity to rocky depressions excavated in the sandy bottom by males. While extensive life-history information exists, largely from fishery catches, little is known about sound production or behavior of red grouper in their natural environment. Passive acoustic recordings combined with simultaneous digital video recordings were used to investigate sonic activity and behavior of red grouper on two marine reserves on the West Florida Shelf. Red grouper were found to produce a unique series of low-frequency (180 Hz peak) pulses, consisting of 1-4 brief (0.15s) broadband pulses and a 0.5-2s down-swept "buzz"; occasionally these were followed by a rapid series of 10-50 broadband pulses. Sound production was observed throughout the day and night, but most occurred between sunrise and sunset, with a noticeable increase during late afternoon. Behaviors associated with sound production included territorial displays and courtship interactions, indicating that sound production is likely related to spawning activity, and passive acoustic monitoring could be an effective tool for red grouper management and conservation efforts.

0040 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Kevin Moody¹, Dennis Durbin², Steve Earsom²

¹FHWA, Atlanta, GA, United States, ²FHWA, Washington DC, United States

Green and Gray Infrastructure: Communications that Make a Difference

The Federal Highway Administration (FHWA) has some direct influence, and much indirect influence, on interactions between surface transportation infrastructure and natural and human environments. The FHWA funds, authorizes, and permits certain highway projects; identifies and deploys technologies that enhance highway system reliability and safety, and influences institutional research and development of best

practices and design criteria. And yet the FHWA finds itself in a constant struggle to ensure that it integrates myriad societal values, such as sustainable populations of wildlife and ecosystems, into its' practices and programs. In recent years, the FHWA led multi-stakeholder efforts to institutionalize the integration of multiple values into planning, design, and decision-making. These include the "Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects," a primer on collaborative problem solving written by and for diverse audiences interested in addressing environmental concerns associated with infrastructure and other governmental actions; and, "Literature Synthesis of the Effects of Roads and Vehicles on Amphibians and Reptiles" by Andrews et al. 2006, which facilitates the transfer of ecological impact information into transportation planning, design, and decision-making. The FHWA recognizes the substantial need for a guide or "cookbook" that describes what local environmental information is most useful and relevant for transportation decision-making, when and to whom to communicate it, and how the information should be framed for effective and efficient application. This paper coaches subject-matter experts so they can effectively and efficiently communicate the information perceived as most useful and relevant to transportation and decision makers and decision support staff.

0588 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Brad Moon, Paul Hampton

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

Respiratory Water Loss During Rattling in Rattlesnakes

Rattling is energetically demanding for rattlesnakes. The snakes increase their ventilation rates to support the energetic demand of rattling. Hence, respiratory water lost is probably increased during rattling compared to resting. This respiratory water loss could be important in desert species such as the western diamond-backed rattlesnake, *Crotalus atrox*. However, respiratory water loss during rattling has not yet been measured. In this study, we use a mass flow meter to measure air flow rates and a water vapor analyzer to measure respiratory water loss at rest and during 15-min bouts of rattling in western diamond-backed rattlesnakes. To determine rates of water loss, we measured air flow rates and excurrent water vapor density, and subtracted the water vapor density of the incurrent air. During the rattling bouts, the snakes appeared to reach steady levels respiratory water loss. Resting incurs low levels of respiratory water loss, averaging approximately 0.25 mg/g snake/hr, and that rattling incurs about two to five times more water loss. Coupled with infrequent and brief use of rattling, these relatively low levels of water loss probably do not cause any significant dehydration in the snakes.

0126 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Clinton Moran, Lara Ferry-Graham

Moss Landing Marine Laboratories, Moss Landing, CA, United States

Jaw Kinematics During Scraping in *Girella nigricans* (Kyphosidae)

Marine herbivory is common in fishes that inhabit tropical waters but is rare at temperate latitudes. Despite the abundance of herbivorous diet items at temperate latitudes, only a few families of fish are able to utilize this food source. Herbivorous foods are considered low quality diet items as they are chemically defended, securely attached, and poorly digested. A novel jaw joint called the intramandibular jaw joint has independently arisen in several lineages and is thought to assist in procurement of such diet items by creating a large, flat tooth bearing surface. We are investigating the kinematics of several features integral to herbivorous feeding, including the intramandibular joint, in *Girella nigricans* (Kyphosidae). High speed video of *G. nigricans* was recorded at 250 frames/sec while the fish scraped a gelatin block. Mean kinematic profiles we created for cranial elevation, lower jaw depression, opercular flexion, premaxillary rotation, and flexion of the intramandibular joint. Linear excursion of the premaxilla and gape distance were also recorded. Angular excursion of the premaxilla, lower jaw and cranium along with gape distance appeared to all reach a maximum in synchrony, around 0.1 seconds. Unlike suction feeding fish, there appeared to be little linear excursion of the premaxilla. Bending at the intramandibular joint was noted when biting at the food source and served to enlarge the gape. We have yet to determine if this bending is actively controlled by the fish or is a passive response to the substrate to which the herbivorous diet item is attached.

0237 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Cristiano Moreira

Universidade Federal de São Paulo, Diadema, SP, Brazil

What a Great Nose You Have: Sexual Dimorphism of Olfactory Structures in Hypoptopomatine Fishes (Siluriformes, Loricariidae)

The catfish family Loricariidae is one of the largest freshwater fish families, and as expected presents a vast array of morphological and behavioral diversification. The presence of secondary sexual dimorphic structures in loricariids is well documented and include modifications such as the elongation of fins in males (e.g. *Chaetostoma jegui*), different arrangements and shapes of odontodes in males (e.g. *Hemipsilichthys*), fleshy snout tentacles in the species of the genus *Ancistrus*, and development of the lower lip in a few genera of the subfamily Loricariinae. Examination of the olfactory structures of

males and females of several species of the loricariid subfamily Hypoptopomatinae revealed a surprising sexual dimorphism unknown for freshwater fishes. Males of this subfamily, with a few exceptions, have the olfactory organs larger and deeper than of the females. Lamellae of males' olfactory rosettes are longer and more numerous than that of females. The dorsal margin of the lamellae in males has a distinct knob on its median region, while in females the dorsal margin is straight. The olfactory-related areas of the brain are also sexually dimorphic, with the olfactory bulbs larger and deeper in males than in females. The function of these modifications in males is unknown, however, it possibly plays an important role in mate finding/selection.

0236 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

Cristiano Moreira¹, Richard Vari²

¹*Universidade Federal de São Paulo, Diadema, SP, Brazil*, ²*National Museum of Natural History - Smithsonian Institution, Washington, DC, United States*

Cephalic Laterosensory System of Hatchetfishes (Characiformes: Gasteropelecidae)

The species of the genera *Carnegiella*, *Gasteropelecus*, and *Thorachocharax* are among the most peculiar fishes within the order Characiformes with highly developed coracoids and associated expanded musculature. Although a few studies have documented their capacity to accurately detect and locate potential prey items on the water surface, no study to date attempted to identify the morphological modifications associated with this ability. In the present study we describe modifications of the laterosensory system on the head of the species of this family. The frontal has two longitudinal crests that create two elongate skin-covered depressions on each side of the head. The medial chamber extends along the entire frontal and a portion of the parietal, while the lateral chamber is shorter and located dorsal to the orbit. These chambers are connected by a foramen through the longitudinal crest separating them, but are isolated from all other laterosensory canals with the exception anteriorly of nasal canal. The two chambers are apparently homologous with the supraorbital canal of other characiforms. Associated with these expanded chambers are two large perpendicular neuromasts in the median chamber and one in the lateral chamber. It appears that these modifications serve as tympana enabling gasteroplecids to rapidly pinpoint the location of potential prey items.

0203 AES Conservation & Management, 552 AB, Friday 9 July 2010

Alexia Morgan¹, Mike Allen¹, Enric Cortés², Colin Simpfendorfer³, George Burgess¹

¹University of Florida, Gainesville, FL, United States, ²NOAA/NMFS, Panama City, FL, United States, ³James Cook University, Townsville, Queensland, Australia

Population Assessment of the Dusky Shark in the Western North Atlantic Ocean Using an Age-structured Model

An age-structured model was used to assess the effects of fishing on population trends for the dusky shark (*Carcharhinus obscurus*) off the east coast of the USA. This model included age-specific vulnerability to fishing, maturity and growth schedules, and a Beverton and Holt stock recruit equation. Results of the base case-scenarios, and sensitivity analyses indicated that the population of dusky sharks in the western North Atlantic Ocean is between 9 and 50% of virgin biomass in 2006. Model results showed that the impacts of fishing already imposed on the dusky shark combined with the continued bycatch of this species, will be difficult to overcome even with the implementation of time/area closures, gear modifications and/or catch and discards being reduced for another 20 years. Recent publications have shown that the Maximum Sustainable Yield (MSY) for dusky sharks may be well above 50% of the virgin biomass, suggesting this species is currently overfished even in the most optimistic scenarios, and will require long-term targets for recovery to sustainable levels.

0462 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Amanda Moss, David Rostal

Georgia Southern University, Statesboro, GA, United States

Use of Ultrasound, X-ray, and Oxytocin to Determine Reproductive State of Female *Trachemys s. scripta* not Collected at the Nesting Site

Traditionally, projects involving use of oxytocin in female turtles have utilized time consuming and labor intensive capture methods such as drift fencing with pit-fall or bucket traps. Palpation has been used as a method for detection of calcified eggs, though it lends no information on existence of follicles or less calcified eggs. Here, we set out to determine if x-ray and ultrasound could aid in determining reproductive state of females not captured at or near the nesting site. Ninety female *Trachemys s. scripta* were collected from two sites in southeastern Georgia from February to August 2009 through dip-netting and hoop-trapping. Females were ultrasounded to observe follicle and/or egg presence. State of reproductive development was designated in four categories: (1) no follicular or egg development, (2) follicles present, (3) eggs and follicles

present, (4) only eggs present. Females categorized as either 3 or 4 were brought to the lab for x-ray. Only category 4 females (N=20) were injected with oxytocin (20IU/kg). Ultrasound proved effective in identifying ovarian follicles and all stages of egg development. X-ray was effective in identifying eggs in 71% of females observed as gravid using ultrasound. Oxytocin was effective in less than 50% of females known to have oviductal eggs based on ultrasound. Ultrasound and x-ray combined can provide more accurate reproductive data without the need for oxytocin or trapping at the nesting site. Females caught away from the nesting site may not be physiologically ready to nest and therefore may not be responsive to oxytocin.

**0461 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT
PHYSIOLOGY, 555 AB, Friday 9 July 2010**

Amanda Moss¹, David Rostal¹, Thane Wibbels²

¹Georgia Southern University, Statesboro, GA, United States, ²University of Alabama Birmingham, Birmingham, AL, United States

**Annual Reproductive Cycles of Male and Female Yellow-bellied Sliders
(*Trachemys s. scripta*) from Two Populations in Georgia Exposed to Different
Water Temperature Regimes**

In recent decades, hormone levels have been measured in a wide range of reptilian species including turtles. Seasonal fluctuations in reproductive hormones (such as testosterone and estradiol) provide insight to how species have adapted to variable environmental factors. In this study, we set out to (1) determine the annual hormonal cycles of male and female *Trachemys s. scripta* and (2) examine effects of water temperature on reproductive cycles in this species. Turtles from two sample sites in southeastern Georgia were examined: George L. Smith (GLS) and Magnolia Springs (MS) state parks. The water temperature at GLS (consisting of a large, man-made pond with slow moving currents regulated by a dam) is influenced mainly by ambient temperatures with large fluctuations in summer and winter temperatures. The water temperature at MS (which consists of a spring fed pond flowing into a slow moving stream) remains relatively constant year round due to spring water effluent. Turtles were captured either by hoop-trapping (primarily at GLS) or dip-netting (primarily at MS) from January 2009 through February 2010. Hormone levels were measured through radioimmunoassay. In females, follicle and egg development was observed through use of ultrasound and x-ray. Males exhibited biphasic peaks of testosterone at both sample sites while females exhibited distinct differences in timing of follicle development, egg production, and hormone peaks at each site. Examination of the effects of water temperature on reproductive cycles in this species can lead to a better understanding of how environmental conditions influence reproduction in turtles.

0481 Amphibian Ecology 551 AB, Monday 12 July 2010

Cy Mott¹, Cy Mott², Michael Steffen³, Michael Steffen⁴

¹Cooperative Wildlife Research Lab, Southern Illinois University, Carbondale, Illinois, United States, ²Watershed Studies Institute and Department of Biological Sciences, Murray State University, Murray, Kentucky, United States, ³Department of Biology, Southern Illinois University, Carbondale, Illinois, United States, ⁴Department of Biological Sciences, University of Tulsa, Tulsa, Oklahoma, United States

Ecological Consequences of Nonlethal Injury for a Larval Amphibian Intraguild Predator

The consumption of potential competitors, or intraguild predation (IGP), is widespread among larval amphibians and contributes to local extirpation, morphological differentiation, and behavioral divergence among sympatric congeners. Theoretical and empirical treatments of IGP, however, commonly regard the phenomenon as an "all-or-nothing" event in which individuals either successfully consume or do not attempt to consume competitors. These approaches do not acknowledge the frequency and ecological impact of unsuccessful predation attempts resulting in nonlethal injuries, despite the potential reduction in competitive ability that injuries may impose. In assessing the consequences of injuries inflicted among intraguild competitors, we first recorded in situ injury prevalence among *Ambystoma opacum*, *A. tigrinum*, and *A. maculatum* through larval ontogeny. Using a combination of laboratory and field methods, we also evaluated the influence of conspecific injuries among top predators (*A. opacum*) by observing patterns of microhabitat selection, size, behavior, and diet among injured and uninjured individuals. During pairwise laboratory observations of agonistic behavior, larvae wounded during previous contests were less aggressive and more likely to be targeted by healthy larvae in subsequent encounters. In natural pond communities, injury frequency and severity increased steadily through ontogeny. Injured larvae were typically smaller in size and occupied benthic and riparian microhabitats, while larger, uninjured individuals inhabited zones at the pond surface and in the water column. Dietary analyses are currently ongoing. Our results to date indicate that nonlethal injury among intraguild competitors results in considerable behavioral and morphological consequences that may compromise an individual's competitive ability.

0479 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Cy Mott, Howard Whiteman

Watershed Studies Institute and Department of Biological Sciences, Murray State University, Murray, Kentucky, United States

Facultative Paedomorphosis and Kin Aggression in a Larval Salamander

Kin selection in larval amphibians typically occurs as reduced aggression among related individuals, and such relationships are hypothesized to increase inclusive fitness by facilitating relatives' survival to metamorphosis. However, some salamander species exhibit facultative paedomorphosis, a strategy in which larvae may either metamorphose into terrestrial adults or remain in ponds as branchiate, reproductively mature adults. Under such circumstances, reduced aggression toward kin by larvae that become paedomorphic may ultimately confer ecological costs rather than benefits. By reducing aggression towards kin, paedomorphic larvae may facilitate persistence of lifelong competitors if kin also become paedomorphs and shared resources are limiting. Whether larvae reduce aggression towards relatives may therefore depend on individual developmental trajectories, with future metamorphs being less aggressive toward kin than future paedomorphs. To determine how kin aggression varies among larvae with divergent developmental strategies, we are observing agonistic interactions among related and unrelated *Ambystoma talpoideum* throughout ontogeny in laboratory populations. We are also recording frequency of injury, growth, survival, and microhabitat selection among kin:kin and kin:non-kin treatments to determine how these aspects of larval ecology are impacted by relatedness and aggression. By repeatedly examining aggression through ontogeny among larvae developing into metamorphic or paedomorphic adults, we will evaluate if kin aggression is influenced by the costs and benefits associated with alternate developmental pathways.

0097 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Philip Motta

University of South Florida, Tampa, Florida, United States

Simplicity and Conservation of the Selachian Feeding Bauplan

The selachian feeding bauplan demonstrates a remarkable conservation of form throughout phylogeny, and when compared to that of bony fishes, is notable in its mechanical and constructional simplicity. Various lineages of selachians have, through subtle changes in motor patterns and muscular insertions, effected novel feeding mechanisms. Similarly, relatively minor changes in cranial morphology result in some of the most successful suction-feeding fishes. Filter-feeding, albeit relatively rare compared to bony fishes, is only noteworthy in its structural modifications in the whale shark.

Durophagy is most pronounced by modification of the dentition and simple changes in lever arms as well as muscle size and motor patterns. Dental replacement patterns and tooth biomechanics reveal apparently over-engineered morphology with respect to cutting ability, and polyphyodonty within the sharks might primarily serve to keep sharp teeth in the functional position. Relatively high bite force in some sharks appears to contradict the studies on tooth biomechanics, and high bite force may indicate differential selection throughout ontogeny. A growing body of data, indicate that sharks and rays have maintained a structurally simple yet effective feeding mechanism, with relatively minor evolutionary changes resulting in diversification of their feeding biology. This diversification, although not rivaling the bony fishes, has in part resulted in the success of this group.

0745 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Peter Muelleman, Chad Montgomery

Truman State University, Kirksville, MO, United States

Trailing of Maternal Chemical Cues by Neonate Timber Rattlesnakes, *Crotalus horridus*

Chemical cues are important aspects in the life history of many animals. Snakes utilize chemical cues for foraging, post-envenomation tracking and reproduction. Recent studies have indicated that some snakes, namely temperate pit-vipers, engage in more social behaviors than previously thought, mostly mediated by chemical cues. The goals of this study were to determine if neonate timber rattlesnakes preferentially use the chemical trail of their own mother to locate a suitable hibernaculum as opposed to the trails of other conspecifics with the use of radiotelemetry. We also looked at the status, demographics and size of the study population in northern Missouri. Over the course of two study seasons 43 individuals were marked. Two neonates were tracked from time of birth to the ingress of the hibernaculum and were documented to use the same hibernaculum as their mother.

0450 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Kerry Muldoon

Hofstra University, Hempstead, NY, United States

Post-emergence Movement and Survivorship of Diamondback Terrapin (*Malaclemys terrapin*) Hatchlings at Jamaica Bay Wildlife Refuge, New York

As with most turtle species, diamondback terrapin hatchling life history is poorly known and only a few short term studies and anecdotal notes exist regarding hatchling movements, salinity tolerance, microhabitat use and overwintering locations. I investigated terrapin hatchling movements after emergence, identified environmental factors associated with hatchling movements, and measured hatchling survivorship. I installed 11 drift fences and associated pitfall traps in six locations at Jamaica Bay Wildlife Refuge, New York, in fall 2006, spring 2007, fall 2007, and spring 2008. I checked traps daily during activity seasons, measured, marked, and photographed each hatchling. I captured 324 live hatchlings, 95 of these were recaptured at least once, and I found 42 dead hatchlings. More than 80% of dead hatchlings were found on nights with less than 50% lunar illumination. Over 50% of fall hatchlings were moving away from the water, at least 18 hatchlings overwintered terrestrially outside of the nest, and 62% decreased in size overwintering. The length of time between fall capture and spring recapture ranged from 183 - 276 days. Over 50% of spring hatchlings moved towards water. I found a weak but significant relationship between the number of hatchlings captured and higher air temperatures, but no relationship between hatchling movement and wind and precipitation. Future work will include management plans that identify and protect terrestrial overwintering habitat.

0018 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Erin Muths¹, Rick Scherer², Brad Lambert³

¹U.S.G.S., Fort Collins, CO, United States, ²Colorado State University, Fort Collins, CO, United States, ³Colorado Natural Heritage Program, Fort Collins, CO, United States

Evidence for Skipped Breeding Opportunities in Female Toads and Unbiased Survival Estimates

Estimates of demographic parameters for females, in many organisms, are sparse. This is particularly worrisome as more and more species are faced with high extinction probabilities and conservation increasingly depends on actions dictated by complex predictive models that require accurate estimates of demographic parameters for each sex and species. Our study assesses demographic parameters, specifically temporary

emigration and survival, for females, a class that has been difficult to investigate historically because of lack of data. Amphibians provide a particularly good example because there is global concern about amphibian decline yet most demographic parameter estimates are based on data from males, which we show can lead to erroneous conclusions. Using multi-state open robust design model on 10 years of capture-recapture data from boreal toads (*Bufo boreas*) we provide evidence for the occurrence of skipped breeding opportunities (i.e., temporary emigration) in females. We show that the transition from breeder to non-breeder is obligate and the probability of a non-breeder remaining a non-breeder is 64%, thus temporary emigration is first-order Markovian, where breeding probability is dependent on the previous year's activity. With temporary emigration accounted for, we estimated between-year female survival at 87%.

0010 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Kenneth Nagy¹, Scott Hillard¹, Brian Henen², Michael Tuma³, David Morafka⁴

¹University of California, Los Angeles, California, United States, ²Marine Corps Air Ground Combat Center, Twentynine Palms, California, United States, ³SWCA Environmental Consultants, South Pasadena, California, United States, ⁴Deceased, San Francisco, California, United States

Desert Tortoise Head-starting Research in California

Populations of the Threatened Desert Tortoise (*Gopherus agassizii*) continue to decline in the western Mojave Desert despite years of federal and state protection. Recruitment of young apparently is near zero, likely due to heavy predation pressure. We are studying ways to increase recruitment by protecting nests, eggs, hatchlings and young juveniles inside large, natural habitat, predator-resistant hatchery/nurseries on three military bases. Local wild females are placed temporarily inside enclosures to lay eggs. Improvements in handling gravid females and in protecting nests from rodents and ants have increased nesting/laying success and hatching success. Controlled irrigation experiments that mimic rainfall in a "good" year have increased juvenile survivorship and have enhanced juvenile growth rates. The increased availability of green wildflower foods and drinking opportunities resulting from one to three small, carefully-timed irrigation events allowed juveniles to grow two to three times faster than control tortoises receiving only natural rainfall. Several release experiments have revealed that survivorship of the smaller and younger juveniles was low, predation being the major cause of death. These experiments suggest that juveniles larger than about 110 mm MCL (midline carapace length) have much higher survivorship after release. This size could be reached in as little as six to eight years in irrigated enclosures. Efforts to evaluate possible vertical transmission of diseases (mother to egg, especially Mycoplasma-caused Upper Respiratory Tract Disease) have been unsuccessful due to scarcity of sick wild females locally. We are monitoring survivorship, and eventually reproduction, in released juveniles at one site.

0428 Roads Symposium II, Ballroom B, Saturday 10 July 2010

Priya Nanjappa¹, Ron Sutherland², Margaret Trani Griep³, Kyle Barrett⁴

¹*Association of Fish and Wildlife Agencies, Washington, DC, United States*, ²*Duke University, Durham, NC, United States*, ³*U.S. Forest Service, Tallahassee, FL, United States*, ⁴*University of Georgia, Athens, GA, United States*

Moving Targets: Linking Priority Conservation Area Schemes and Climate Assessments for Proactive Planning and Integrated Ecosystem Connectivity

Most biologists agree that the largest challenges for wildlife conservation worldwide are habitat loss and fragmentation, yet it is clear that development and urbanization are unlikely to slow in the near term. As a result, many efforts have been initiated to identify priority conservation areas, ranging from taxon-specific schemes such as Audubon's Important Bird Areas (IBAs), to landscape-scale programs such as The Nature Conservancy's Ecoregional Assessments (ERAs) and the Department of the Interior's new Landscape Conservation Cooperatives (LCCs). Such efforts can focus habitat protection and restoration resources, and assist development and transportation professionals in proactive planning endeavors. Continued expansion of human populations coupled with climate change has caused conservation practitioners and transportation planners alike to consider options for maintaining long-term connectivity as current corridors (both wildlife and human) are modified. Partners in Amphibian and Reptile Conservation (PARC) has recently initiated efforts to enhance ecosystem connectivity, including 1) developing criteria to identify priority conservation areas, and 2) deriving climate vulnerability models for select herpetofauna. Although amphibians and reptiles are the target species, their diverse ecologies allow them to serve as proxies for high biodiversity areas or co-occurring taxa. Resulting Geographic Information Systems (GIS) layers will be used to overlay with other existing priority conservation areas data, road development plans, local human population growth projections, and climate vulnerability models to anticipate demands for transportation projects and to map focal areas for maximizing connectivity and minimizing conflict. These tools provide cost-saving incentives for proactive planning by reducing unexpected biological assessments or mitigation.

0566 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

Lisa Naples¹, Natalie Mylniczenko², Trevor Zachariah³, Forrest Young⁴

¹John G Shedd Aquarium, Chicago, Illinois, United States, ²Disney's Animal Kingdom, Orlando, Florida, United States, ³Chicago Zoological and Aquatic Animal Residency, Chicago Illinois, United States, ⁴Dynasty Marine Associates, Marathon, Florida, United States

The Influence of Venipuncture Site on Secondary Blood Physiological Values During Elasmobranch Health and Stress Investigations

It is important when evaluating hematologic parameters and establishing reference values to recognize any differences in regards to the collection site. Following the evaluation and comparison of hematocrit values from two venipuncture sites in captive and wild sharks, the current study was developed. As significant changes in the acid-base balance of elasmobranchs can occur during handling or transportation, blood gas assessment within minutes of collection is essential to provide information regarding immediate physiological stressors. This information can be applied to stress assessment and the limitation of morbidity and mortality during capture situations. The current study was developed to 1) evaluate baseline blood gas values of a captive population of elasmobranchs ranging from benthic to pelagic species, 2) to evaluate the use of a portable clinical analyzer boat-side during elasmobranch capture, and 3) to compare two commonly used blood collection sites in an effort to determine differences between the two. Pelagic, intermediate and benthic elasmobranchs at the John G Shedd Aquarium were immobilized for health screens. In addition, wild pelagic elasmobranch species were hook and line caught in the coastal waters of Florida several miles within the Keys during normal collecting trips for Dynasty Marine Associates. Wild caught animals were immediately brought boat-side, netted and manually restrained. Blood was obtained from the ventral tail artery and within 30 seconds from the dorsal sinus. Samples were immediately processed with the I-STAT (Heska, Fort Collins, CO 80525) portable clinical analyzer to run standard blood gas panels. Statistical comparisons were made for collection site, gender, and captivity status.

0072 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Andrés Felipe Navia¹, Enric Cortés², Paola Andrea Mejía-Falla³

¹Fundación Colombiana para la Investigación y Conservación de Tiburones y Rayas, SQUALUS, Cali, Valle del Cauca, Colombia, ²NOAA-NMFS, Panama City, FL, United States, ³Grupo de Investigación en Ecología Animal, Departamento de Biología, Universidad del Valle, Cali, Valle del Cauca, Colombia

Topological Analysis of the Ecological Importance of Elasmobranch Fishes: The Gulf of Tortugas Food Web, Colombian Pacific Ocean, as a Case Study

We built a trophic network based on a matrix of interspecific trophic relationships to assess the role of elasmobranch fishes in shaping community structure of the Gulf of Tortugas in the Colombian Pacific Ocean. We analyzed diet similarities to define trophic components (nodes)-rather than taxonomical groups-in the network. We evaluated the ecological function of species through topological analysis of their structural importance in trophic networks by applying one local and several mesoscale network indices and assessed the role of elasmobranchs in the set of keystone species for system stability using the "key player" problem approach. We found that elasmobranchs do not play an important ecological role in propagating direct or indirect effects through the system owing to the low and intermediate values of the node degree, centrality and topological importance indices. Only one elasmobranch node (*Mustelus* spp. and *Dasyatis* spp.) was included in the keystone species complex identified, contributing only 5% of the spread of effects in the network. Results from our study suggest that elasmobranchs at intermediate trophic levels-commonly referred to as "mesopredators"-are not so important in complex coastal ecosystems because their removal does not result in drastic changes in the structure of the trophic network.

0391 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Farzaneh Nazari-Serengeh

Payame Noor University of Lorestan, 68158-348, Khorramabad, Lorestan, Iran, Islamic Republic of

Influences of Climate Gradient to Geographic Variation on Spermatogenesis Timing of *Cyrtopodion scabrum*

Spermatogenesis is a complicated process that different and various factors influence and control it. Based on climatic condition we collected many male specimens of *Cyrtopodion scabrum* in three latitudes (during biological activity) that different in climate condition. Removed testis and for histological survey H & E technique were used. Our results show three phase of spermatogenesis (Active, Transitional and Silent) during

biological activity those differences in three latitudes. In three latitudes spermatogenesis timing of three phases are different, and timing of activity spermatogenesis in low elevation population started earlier than higher population.

0401 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Farzaneh Nazari-Serengeh

Payame Noor University of Lorestan, 68158-348 Khorramabad, Lorestan, Iran, Islamic Republic of

Sexual Dimorphism in the *Cyrtopodion scabrum* (Reptilia: Gekkonidae)

I collected 33 specimens of *Cyrtopodion scabrum* (F= 15; M=18) from western Iran, Khorramabad City, Lorestan Provinces. For sexual dimorphism I work on 11 characters. For analysis of my data t-test and PCA were used. In first, all male have femoral pores and this factor is main factor for dimorphism between male and female of *C. scabrum*. Moreover, one of interesting point in results presented here is that the male specimens in all characters (excepted ear diameter) show lower values when compared to females. In some important characters such as interlimb space, the males significantly are longer than females. Sexual selection as well fecundity selection strongly occurred for male specimens. In this case, interlimbs space significantly selected for male specimens. In general, male specimens of *C. scabrum* have larger body and head size than their female counterparts.

0681 Fish Systematics I, Ballroom D, Monday 12 July 2010

Thomas Near¹, Matthew Niemiller¹

¹*Yale University, New Haven, CT, United States*, ²*University of Tennessee, Knoxville, TN, United States*

Phylogenetics and Diversification of Amblyopsid Cavefishes (Teleostei: Percopsiformes)

The North American endemic Amblyopsidae contain species that utilize troglodytic habitats, as well as a surface dwelling species and a facultative troglodyte. Previous hypotheses have proposed a sequence of specialization to cave habitats that follows from a surface dwelling ancestor to troglodyte species that are found only in underground aquatic habitats, with the facultative troglodyte condition representing an intermediate stage to remarkable adaptations associated with cave-dwelling troglodytic species. Phylogenetic relationships and patterns of character evolution in traits associated with troglodytic species were explored using a time-calibrated species tree

inferred from a DNA sequence dataset sampled from nine nuclear genes. Divergence times were estimated using ages implied in the fossil record of Percopsiformes. Analysis of character evolution on the phylogeny supports a hypothesis of multiple transitions to troglodytic habitats in Amblyopsidae.

0285 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Ana Cecilia Negrete¹, Rodolfo Raigoza¹, Alejandro Areanas²

¹Xcaret Park, Quintana Roo, Mexico, ²Flora Fauna y Cultura de México A.C., Quintana Roo, Mexico

Green Sea Turtle (*Chelonia mydas*) Headstarting Program at Xcaret Park Quintana Roo, Mexico

Xcaret Park is located in Quintana Roo State, 60km south Cancun City. The green sea turtle (*Chelonia mydas*) head starting program has been developed since 1993 with the main purpose of arousing awareness and educating our visitors about this species. Annually, around 200 hundred hatchlings born on X'cachel Beach are kept in captivity and at the end of this period those juveniles are released during a ceremony with a strong educational backup. Since 1993 the program had released 2143 juveniles with the participation of 8000 children and the attendance of 45000 tourists. The hatchlings are kept in four concrete made pools and 24 hours sea water flow. During this period, the turtles are fed with fresh and processed food and get day physical exams in order to diminish disease occurrence. Once a week they get measured and weighed to record growth rates. Since 1998, 36 reports have been received of head started juveniles of this program from Akumal bay, Campeche State, Cuba, Barbados, Bahamas and Florida and we have recorded 17 sightings of nesting females of both, living tag and head starting program after 11 years of extensive follow up. One of those seventeen sea turtles was confirmed to be a head started animal. Besides this, the program has allowed us to develop husbandry techniques in captivity where behavior, immunology and diagnostic techniques for *Fibropapiloma* and ulcerative dermatitis (SCUD) have been studied.

0372 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Jessica Nelson

National Aquarium Institute, Baltimore, MD, United States

Trends in Reproduction of Dendrobatid Frogs at the National Aquarium

In light of the global amphibian crisis, we need to be aware of factors that might affect the many in- and ex-situ amphibian breeding and reintroduction projects. Understanding the captive care and survivability of egg clutches and tadpoles is important for maximizing these conservation efforts. Detailed reproductive records of the amphibian collection in the Rain Forest exhibit at the National Aquarium, Baltimore have been kept since August 2006. Trends in clutch size, fertility, and survival, and tadpole survival are evaluated among species and breeding groups. Trends in the occurrence of spindly leg are of special interest as it is still unknown what causes this malformation in tadpoles and it is a persistent issue in captive collections.

0303 Herp Conservation III, Ballroom B, Sunday 11 July 2010

Lorin Neuman-Lee, Karen Gaines, Stephen Mullin

Eastern Illinois University, Charleston, IL, United States

Estradiol Levels in Watersnakes (Colubridae: *Nerodia*) During Gestation as a Function of Exposure to Ingested Atrazine

Low levels of the pesticide atrazine have recently been linked to feminization in amphibians when exposed during development. One proposed mechanism that explains this effect is the induction of the enzyme aromatase, which elevates estradiol levels. We tested this hypothesis using Northern Watersnakes, *Nerodia sipedon*, which are suitable models for examining the effects of atrazine on viviparous organisms that are naturally exposed to this contaminant through ingestion of their main food source, fish. For the duration of their gestation, we exposed gravid female snakes to one of four treatment doses of atrazine through food ingestion. We collected blood samples from each subject on a weekly basis. We isolated estradiol from each blood sample using solid phase extraction, and we analyzed estradiol concentrations using a magnetic particle enzyme-linked immunosorbant assay. We discuss our results with an emphasis on the long-term effects on female fitness and, in particular, offspring viability. Our research can lead to an improved understanding of how estradiol levels are affected throughout pregnancy when atrazine exposure occurs through regular dietary intake.

**0789 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010; ASIH
STOYE AWARD GENERAL ICHTHYOLOGY**

Heather Neun

Saint Louis University, Saint Louis, Missouri, United States

**Morphological Variation in the Yaqui Sucker, *Catostomus bernardini*, (Family
Catostomidae)**

Remote and often inaccessible areas present the opportunity for discovery of patterns of geographic variation in species and prospective new species. The Yaqui Sucker, *Catostomus bernardini*, occur naturally in some of the most remote areas of North America in rivers and streams of the Sierra Madre Occidental. In this investigation geographic variation was examined across river drainages for *C. bernardini* (5 drainages) from northwestern Mexico for body, head, lip, and fin shape using a morphometric approach. A series of 44 truss landmark measurements were completed for 251 *C. bernardini* from throughout their ranges. Scale and fin ray counts were documented as well. All individuals were sexed to account for potential sexual dimorphism and eliminate this variance from shape variation. Shape differences and variation was examined using sheared Principle Components Analysis (PCA). As demonstrated in many previous studies sheared PCA eliminates size from axes beyond the first to better estimate shape variation in and across populations. Results of these analyses will be discussed.

0451 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

Steven Newman¹, Richard Handy¹, Samuel Gruber²

¹*University of Plymouth, Plymouth, United Kingdom*, ²*University of Miami, Florida, United States*

Inter-annual Variation in Lemon Shark Feeding Ecology at Bimini Bahamas

Stomach contents of juvenile, nursery bound lemon sharks, *Negaprion brevirostris*, were sampled concurrently with prey communities over three consecutive years in a highly enclosed nursery (North Sound) with limited to low immigration and emigration rates. Stomach contents were collected from 240 of 432 lemon sharks captured (56 %), and diet described from 420 items. Yellowfin mojarra, *Gerres cinereus*, were the main prey, although they were less important in the diet of lemon sharks in 2001 (58 %IRI - Index of Relative Importance, 69 %IRI 2000, 78 %IRI 2002). This reflected lower abundance and biomass of mojarra in the environment. Dietary composition differed significantly with year (Chi² P < 0.05, using pooled categories) with variability due to an increase in the consumption of a wider range of prey in 2001. In 2001 lemon sharks also exhibited

increased diet breadth and reduced dietary overlap with other years, and consumed on average smaller teleost prey although this was not significant (Kruskal-Wallis $P = 0.07$). Prey preference estimates using residual Chi-square and %IRI revealed lemon sharks predominantly fed opportunistically, with some species-specific preferences. Inter-annual variation in lemon shark dietary composition in the North Sound appears to reflect prey communities. Therefore, recent development near this nursery may pose a threat, with anthropogenic impacts on fish communities likely to affect lemon shark diet, and ultimately growth and survival.

0293 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Kirsten Nicholson, [John Phillips](#)

Central Michigan University, Mt. Pleasant, MI, United States

Evolution and Biogeography of the Anoles of Gorgona Island, Colombia

Gorgona Island is an island located 50 km off the Pacific coast of Colombia and is home to five species of anoles: *A. chocorum*, *A. biporcatus*, *A. gorgonae*, *A. medemi*, *A. princeps*. Few studies have been conducted on these species, and none have conducted molecular analyses to investigate their phylogenetic relationships to mainland anoles. Two of these species are endemic to the island (*A. gorgonae* and *A. medemi*), while the other three are present on the mainland in purportedly identical form. We collected samples from all species to investigate their phylogenetic placement among anoles, as well as to examine their biogeographic relationships. Our single *A. chocorum* sample could not be amplified, but the other four species were supported phylogenetically as predicted from the literature: *A. biporcatus* was sister to other mainland *A. biporcatus*; *A. gorgonae* was nested within the punctatus clade of Dactyloid anoles, *A. medemi* was mostly closely related to *A. fuscoauratus*, and *A. princeps* was nested within the latifrons clade of Dactyloid anoles. Rigorous node dating analyses are in progress but are made difficult by the lack of sound geologic reference data or fossils of non-extant species. However, examination of branch lengths as a proxy for relative dates suggests that *A. gorgonae* colonized the island well before the other species, although it remains unclear if all species colonized the island before or after separation from the mainland. We expect to have relative dates for the relevant nodes by meeting time.

0154 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

John Niedzwiecki, Elizabeth Schriener

Belmont University, Nashville, TN, United States

The Effect of Predation Threat on Asymmetric Intraspecific Competition in the Streamside Salamander, *Ambystoma barbouri*

Predation can play an important role in lessening the effects competition. *Ambystoma barbouri* experience intense intraspecific competition. In other ambystomatids, size plays an important role in intraspecific competition, leading to asymmetric competition, and presumably increased variation in time to metamorphosis. In this experiment, we asked if asymmetric competition occurs in *A. barbouri*, whether that competition is through interference or scramble, and whether the presence of a predator could reduce the asymmetry of this completion. We raised *A. barbouri* larvae in 3 treatment groups: isolated, grouped fed-separately, and grouped fed-together, both in the presence and absences of predator chemical cues. After measuring the growth rate of the larvae over two weeks, we saw significant differences in the differences in coefficient of variation among the treatments, indicating the presence of asymmetric competition, and possible roles for both scramble and interference competition. Predation seemed to dampen asymmetry in grouped larvae, though possibly acting differently on each type of completion.

0518 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Stephen Norton

Centralia College, Centralia, WA, United States

Ontogenetic Changes in Diet and Prey Handling by Two Snail-Punching Cottid Fishes

Unlike the crushing jaws of many other molluscivorous fishes, *Asemichthys taylori* and *Radulinus boleoides* (Scorpaeniformes: Cottidae) have evolved a minimalist strategy to circumvent the defenses of gastropods and bivalves. Teeth on the vomer punch a hole into the shell; this provides access by digestive enzymes. However, not all mollusks are punched. Some, such as limpets and scallops, are digested without punching. Approximately 30% of operculate gastropods are unpunched; half of these emerge from the feces alive. I will present an analysis of ontogenetic changes in prey selection (type and size) and prey handling (punched vs. unpunched, alive vs. dead) for these two predators. Individuals were collected bimonthly from two sites in the San Juan Islands, WA by hand net while scuba diving. Each fish was held in an individual container for 48 hours and their feces collected; after 48 hours, fish were returned to the field. Prey remains in feces were identified to taxonomic groups. Hard-shelled prey (gastropods,

bivalves, hermit crabs) were measured and examined for evidence of punching and for survival. Both cottids demonstrated ontogenetic changes in diet; bivalves and gastropods were a consistent diet element. Quantile regression analyses indicate that the minimum size of gastropod prey was constant as predator size increased. The maximum shell size increased as predator size increased, except for *Alvania* spp., the most common gastropod genus. Unpunched gastropods were slightly smaller than were punched individuals. Therefore, unpunched prey do not appear to be too tough, but must represent errors during prey processing.

0750 AES GRUBER AWARD, 551 AB, Friday 9 July 2010

Andrew Nosal¹, Nicholas Wegner¹, Daniel Cartamil¹, Edward Kisfaludy¹, Mark Royer², Marcus Taylor³, Jeffrey Graham¹

¹*Scripps Institution of Oceanography, La Jolla, California, United States*, ²*University of North Carolina - Wilmington, Wilmington, North Carolina, United States*, ³*University of Hawai'i - Hilo, Hilo, Hawai'i, United States*

Movement Patterns of Leopard Sharks (*Triakis semifasciata*) along the Open Coast of San Diego County, California

Each year, hundreds of leopard sharks (*Triakis semifasciata*) aggregate in shallow waters at the head of La Jolla Submarine Canyon at the southern end of La Jolla Shores Beach. Despite growing public interest and the thriving eco-tourism industry surrounding "Leopard Shark City," the ecological significance of this phenomenon and its underlying mechanisms remain poorly understood. Work to date indicates these sharks are mostly pregnant females, with no males and very few juveniles observed. The males aggregate 12 km north in deeper waters off Del Mar, CA, just inshore of a small kelp forest. In July 2009, 12 females (in La Jolla) and 10 males (in Del Mar) were surgically implanted with coded acoustic transmitters and monitored by a coastal receiver array spanning from Del Mar, CA to the USA-Mexico border. Both sexes exhibit strong fidelity to their respective capture sites, often dispersing at night. Active tracking shows females travel up to 1.5 km offshore at night and make sustained dives to >50 m. Some nights when aggregating females did not disperse coincided with California grunion runs. In early autumn, half of the passively tracked females departed northward along the coast, surpassing the northernmost receiver in Del Mar. One shark was captured 70 km north off San Clemente Pier. The remaining sharks departed southward around Thanksgiving, following a string of leopard shark killings by a bull California sea lion. A portion of these sharks is expected to return in 2010. Males continue to be detected intermittently in the Del Mar vicinity.

0728 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Justin Nowakowski¹, Natalie Hyslop², James Watling³, Maureen Donnelly¹

¹Florida International University, Miami, FL, United States, ²University of Florida, Gainesville, FL, United States, ³Washington University in St. Louis, St. Louis, MO, United States

Influence of Matrix Type on Aquatic Vertebrate Communities in Cypress Domes

Many community models now explicitly consider spatial structure. Among these spatially complex models are metacommunity models that consider patterns and processes occurring at the local-community and regional (or metacommunity) scales. We conducted a study of assemblages of aquatic vertebrates in a network of cypress domes surrounded by two dominant matrix types in Big Cypress National Preserve. This landscape represents a natural experiment that allowed us to examine community patterns in light of metacommunity predictions and the degree to which observed patterns differed by matrix type. The two matrix types, pine rockland and cypress prairie, differ in hydroperiod and therefore in connectivity for aquatic organisms. These hydrologically imposed differences in dispersal opportunity allowed for investigation of the effects of decreased connectivity on local community similarity. Observed patterns of local community composition differed significantly between matrix types as did the relative strength of spatial and environmental variables in explaining beta-diversity.

0235 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Ann O'Connell¹, Martin O'Connell², Chris Schieble³

¹University of New Orleans, New Orleans, LA, United States, ²University of New Orleans, New Orleans, LA, United States, ³University of New Orleans, New Orleans, LA, United States

Lake Pontchartrain Fish Assemblages Four Years after Hurricanes Katrina and Rita

In 2006, we assessed the impacts on fishes of the 2005 hurricanes and the pumping of New Orleans floodwaters into Lake Pontchartrain. At the time there were concerns that floodwaters contained damaging amounts of toxins. Our short-term results suggested no change in near shore fish assemblages (beach seine collections) but a slight decline in the diversity of benthic fishes (trawl collections). To assess possible long-term changes, we compared monthly collections taken prior to the hurricanes (2000-2003, 2005) with collections taken after (2006-2009). Benthic fish assemblages exhibited the most post-hurricane changes with significant (ANOSIM, two-way crossed, $p < 0.05$)

pre/post assemblage changes occurring in five of twelve months examined: March, April, June, July, and August. Global R values for these differences, though, were all markedly low ($R < 0.221$) suggesting that pre/post assemblage changes were not especially drastic. In all five months, bay anchovies (*Anchoa mitchilli*) and Atlantic croaker (*Micropogonias undulatus*) were more numerous after the hurricanes, while fewer Gulf menhaden (*Brevoortia patronus*) were collected in post-hurricane trawls. Pre/post beach seine and gillnet collections only yielded one month each of significant differences, again with relatively low global R values: November beach seines (ANOSIM, two-way crossed, $R = 0.319$, $p < 0.01$), April gillnets (ANOSIM, two-way crossed, $R = 0.275$, $p < 0.01$). These results suggest that four years after the hurricanes, Lake Pontchartrain fish assemblages have mostly recovered. While the two most common species (*A. mitchilli* and *M. undulatus*) actually increased, concerns exist about possible declines in *B. patronus* populations.

0295 Fish Community Ecology, 555 AB, Monday 12 July 2010

Martin O'Connell, O. Thomas Lorenz

University of New Orleans, New Orleans, LA, United States

A Second Cichlid Species in Louisiana: The Cusp of Invasional Meltdown?

Invasional meltdown occurs when the presence of one invading species facilitates subsequent invasions by other species. As an established non-native species destabilizes a native ecosystem, the disruption facilitates the success of other non-native invaders. The non-native Rio Grande cichlid (*Herichthys cyanoguttatus*) has been established in the canals of the Greater New Orleans Metropolitan Area (GNOMA) for over a quarter century and continues to expand. For example, since the 2005 hurricanes *H. cyanoguttatus* has expanded its range south across the Mississippi River. While we have documented its deleterious effect on native fishes in the GNOMA, *H. cyanoguttatus* may now also be acting as the initiator of invasional meltdown by facilitating another, more dangerous species to become established. In December 2008, specimens of an unknown tilapia hybrid (*Oreochromis* sp.) were collected near Port Sulphur approximately 75 km southeast of New Orleans. Because of the damage escaped tilapia have caused to native fishes worldwide, the Louisiana Department of Wildlife and Fisheries responded rapidly to this discovery with an eradication effort. In the subsequent collection of rotenoned specimens, tilapia dominated both biomass and numbers of fishes in freshwater habitats around Port Sulphur. Along with the tilapia, numerous specimens of *H. cyanoguttatus* were also collected even though Port Sulphur is 60 km southeast of the previously known southern extent of this species. Efforts are being made to better understand how these two non-native cichlid species may be influencing each other's establishment and further dispersal.

0684 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Cynthia O'Rourke, Tamra Mendelson

University of Maryland in Baltimore County (UMBC), Baltimore, Maryland, United States

Mating Environment Changes over the Course of the Nuptial Season in the Fantail Darter, *Etheostoma flabellare*

The mating environment is sometimes compared to an economic market, in which the costs and benefits of mating vary across a lifetime. Accumulating empirical evidence indicates that animals may alter their mating behavior to reflect their own histories and this changing environment. We sought here to investigate whether such an environment may exist for *Etheostoma flabellare*, a fish species with a promiscuous mating system and male parental care. In this study, fish were collected at three points during the nuptial season from a single stream (Meadow Branch - Carroll County, Maryland.) Dissections revealed a steadily declining adult sex ratio, from 1:1 (female:male) early in the season to 2:1 late in the season. Though scarcer late in the season, males were on average significantly larger late in the season, while the same was not true of females. Mean egg mass peaked mid-season, but was most reliably predictable by body mass early in the season. The slope of the relationship between body mass and egg mass also changed over the course of the season; an increase in female body size predicted the greatest increase in egg mass at mid-season. All of these results reflect a variable mating environment that, if replicated across the range of dispersal, may select for adaptively flexible mating behavior in the fantail darter.

0687 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556 AB, Friday 9 July 2010

Michel Ohmer¹, Sarah Herbert¹, Richard Speare², Phil Bishop¹

¹*University of Otago, Dunedin, Otago, New Zealand*, ²*James Cook University, Townsville, Australia*

Chytridiomycosis in Threatened New Zealand Frogs (*Leiopelma* spp.): Susceptibility and Implications for Management

The spread of chytridiomycosis, an emerging infectious disease caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), is one of many threats facing amphibians worldwide. In New Zealand, both threatened native (*Leiopelma* spp.) and widespread introduced (*Litoria* spp.) anuran species have been found infected with *Bd*. In addition, rapid and progressive declines in conjunction with *Bd* detection in wild populations of one native species indicate this pathogen may be a threatening process. In order to

comprehend the impacts of *Bd* on New Zealand's native anuran fauna, we assessed the susceptibility of two native species, *Le. pakeka* and *Le. hochstetteri*, to chytridiomycosis. *Bd*-naïve individuals were exposed to a virulent New Zealand-isolate of *Bd*, and their infection status monitored using quantitative real-time PCR. Both species demonstrated low susceptibility and all individuals cleared *Bd* infection (*Le. hochstetteri* by week 11, *Le. pakeka* by week 15). While both species became infected, zoospore load was so low that *Bd* was not detected consistently each week. Furthermore, no frogs demonstrated clinical signs of chytridiomycosis. *Le. archeyi* similarly demonstrated low susceptibility in a previous study, indicating a genus-wide trend. Our findings suggest that the risk of *Bd* for Leiopelmatids in captive populations is low. However, care needs to be taken when extrapolating the results obtained in the laboratory to wild populations because both biotic and abiotic factors can affect morbidity and mortality due to *Bd*. Thus, rigorous field trials are the next step along the pathway to reintroducing protected populations of *Leiopelma* into areas containing *Bd*-infected *Litoria* populations.

0568 Fish Life History, 551 AB, Friday 9 July 2010

Charles W. Olaya-Nieto¹, Fredys F. Segura-Guevara¹, Glenys Tordecilla-Petro¹

¹Universidad de Córdoba, Lórica, Córdoba, Colombia, ²Institución Educativa Román Chica Olaya, Lórica, Córdoba, Colombia

Reproductive Biology of *Dorada Brycon sinuensis* in the Sinu River Basin, Colombia

The Dorada (*Brycon sinuensis* Dahl, 1955) is a reophilic and endemic fish that occurs in the Sinu river basin, and one of the species most affected by the construction of Urra's dam, due to the interruption of their migration toward maturation and spawning areas upstream water of Urra's dam. In order to study its reproductive biology, individuals with total length (TL) ranged between 18.5 y 67.0 cm and total weight (TW) ranged between 68.0 y 6448.0 g were collected. The gonads were placed in Gilson solution, the Vazzoler scale was applicated and sexual proportion, maturity index, the length at first maturity, oocytes's diameter, spawning season and fecundity were estimated. The sexual proportion female: male was 1.9:1, length at first maturity was estimated in 51.1, 42.0 y 43.8 cm TL for females, males and combined sexes, respectively, oocytes's diameter were 1247 ±176 μ and fecundity was estimated in 314340 ±174554 oocytes. Spawning season of Dorada is extended from February to December as a possible response to the construction of the Urra's hydroelectric, meaning that the species has adapted to the new hydrological conditions in the Sinu river basin since 2000, when the Urra's hydroelectric began to generate electricity.

0369 AES Ecology, 551 AB, Thursday 8 July 2010

Jill Olin¹, Nigel Hussey², Michelle Heupel³, Colin Simpfendorfer³, Gregg Poulakis⁴, Aaron Fisk¹

¹GLIER, University of Windsor, Windsor, ON, Canada, ²School of Oceans Sciences, College of Natural Sciences, Bangor University, Menai Bridge, Anglesey, United Kingdom, ³School of Earth and Environmental Sciences, James Cook University, Townsville, QLD, Australia, ⁴Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Port Charlotte, FL, United States

Maternal Investment Confounds Stable Isotope Interpretation in Young Individuals

Ontogenetic shifts in diet are common and are often assessed using stable isotopes of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$). However, when considering neonate individuals, interpretation of stable isotope composition is confounded as viviparous species are born isotopically enriched compared to their mothers. To address this, values of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ were measured in the liver and muscle of neonate and young-of-the-year bull (*Carcharhinus leucas*) and Atlantic sharpnose (*Rhizoprionodon terraenovae*) sharks and related to age using umbilical scar stage, a unique characteristic among fishes. Values of $\delta^{13}\text{C}$ in tissues of both species, and $\delta^{15}\text{N}$ in muscle of Atlantic sharpnose, declined with age, exceeding the enrichment documented between embryos and their mothers. Decline in stable isotopes was: more evident in Atlantic sharpnose compared to bull sharks, delayed to late scar stages in bull sharks, and greater in liver compared with muscle; highlighting that species-specific life history and tissue characteristics significantly influence maternal isotopic loss. Consideration of maternal investment is necessary in any study using stable isotopes of young individuals, as there is great potential to overestimate trophic position and incorrectly assign carbon source.

0066 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Cristina Oliveira¹, Luiz Malabarba², John Burns³, Irani Quagio-Grassiotto⁴

¹Universidade Estadual de Santa Cruz, Ilhéus, Bahia, Brazil, ²Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil, ³George Washington University, Washington DC, United States, ⁴Universidade Estadual Paulista-Júlio de Mesquita Filho, Botucatu, São Paulo, Brazil

Phylogeny of the Inseminating Compsurins Based on Sperm Ultrastructure (Teleostei: Characidae: Cheirodontinae)

Spermatozoa of Characiformes display great variability in their anatomy and organelle shape and location. Sperm ultrastructure of inseminating species is notably more diverse

than that of externally fertilized taxa. Sperm ultrastructure is described in seven inseminating cheirodontines of the tribe Compsurini (*Acinocheirodon melanogramma*, *Compsura heterura*, *Macropsobrycon uruguayanae*, *Kolpotocheirodon theloura*, "*Odontostilbe*" *dialeptura*, "*Odontostilbe*" *mitoptera* and *Saccoderma hastatus*), and four externally fertilized species, three belonging to the tribe Cheirodontini (*Cheirodon interruptus*, *Serrapinnus calliurus*, and *Serrapinnus heterodon*) and one incertae sedis species in Cheirodontinae (*Odontostilbe pequirá*). Testes were prepared for both scanning and transmission electronic microscopy using standard techniques. A data matrix was constructed using 12 characters from sperm ultrastructure. Hypotheses of character evolution in sperm morphology are discussed based on the resulting phylogeny. Aquasperm of the externally fertilized species show vesicles in the midpiece that are clearly distinct from those of other characiforms. Although the introsperm of *Kolpotocheirodon* resemble aquasperm, they are nonetheless differentiated from the aquasperm of the externally fertilized species. The introsperm of the remaining inseminating species showed several changes mostly related to sperm elongation. A single hypothesis of relationships was obtained for the inseminating species, demonstrating that analyses based on sperm ultrastructural characters further contribute to the recognition of the Compsurini as monophyletic, as well as allowing hypotheses on the relationships among the included taxa.

0224 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Tacyana P. R. Oliveira¹, Friedrich Ladich¹, Daniel Abed-Navandi¹

¹Universidade Federal da Paraíba, João Pessoa, Brazil, ²University of Vienna, Vienna, Austria, ³Aqua-Terra Zoo Vienna, Vienna, Austria

Sound Production, Hearing Abilities and Acoustic Communication in the Longsnout Seahorse *Hippocampus reidi*

Seahorses produce sounds in different behavioural contexts, but information on the sound characteristics and hearing ability of this fish group is scarce. This study assessed the acoustic behaviour of *Hippocampus reidi* by analysing sound production in four different contexts (acclimation, feeding, handling, courtship) and by determining hearing sensitivity with the auditory evoked potential recording technique. Seahorses produced two distinct sounds: short clicks during feeding and courtship, and continuous growling sounds in distress situations when the animals were handheld. Main energies of clicks were concentrated at 530Hz (feeding), whereas main energy of growls were at 115Hz. Auditory sensitivity was between 50Hz and 1500Hz based on the sound pressure level and particle acceleration level. We also determined thresholds to conspecific sounds. Baseline thresholds measured under quiet laboratory conditions showed best hearing sensitivity at 50Hz (mean hearing threshold: 92dB re 1 μ Pa and 55dB re 1 μ m/s²). Ambient noise recorded in the Barra de Mamanguape estuary (NE Brazil) did not affect hearing sensitivity. Comparisons between sound spectra and auditory thresholds revealed that main energies of growling sounds (but not of clicks)

were correlated to the maximum auditory sensitivity of *H. reidi* and that acoustic communication is not masked by ambient noise in the field.

0804 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Steven Oliver

Worcester State College, Worcester, MA, United States

Direct Mate Choice for Simultaneous Acoustic and Visual Courtship Displays in a Pomacentrid Fish, *Dascyllus albisella*

Acoustic signals are well established as key components of mate selection in terrestrial species, but not in aquatic species. It has long been known that damselfish (Pomacentridae) use a combined visual and acoustic display in their courtship, but the role (if any) of the acoustic component in mate-choice has not been quantitatively defined. The aim of this study was to determine, for *Dascyllus albisella*, which male traits, if any, were correlated with mating success of males and if the acoustic component of the signal advertised the quality of the displaying male. Observations made over ten reproductive cycles showed that female mate choices were not random and that male mating success was correlated with courtship rate (a visual and acoustic cue), male size, and the number of neighboring females, but not with male morphological traits, territory quality, or acoustic call structure. Our results suggest that females choose mates based on a condition-dependent trait (courtship rate) that advertises quality of paternal care, which supports good parent models of sexual selection, thereby demonstrating the importance of the combined acoustic/visual display for sexual selection in fishes.

0201 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Christina Olson, Karen H. Beard

Utah State University, Logan, UT, United States

Diet of the Cuban Greenhouse Frog in Hawaii

This research is motivated by the recent introduction of the Cuban terrestrial greenhouse frog, *Eleutherodactylus planirostris*, to Hawaii. Studies from other invaded habitats suggest that *E. planirostris* may consume and potentially reduce Hawaiian endemic invertebrates. To examine its potential impacts on endemic invertebrates, we conducted a stomach content analysis of 427 frogs from 10 study sites on the Island of Hawaii. At each site, we also collected invertebrates with three different sampling schemes: leaf litter collection, sticky traps, and foliage vacuuming, to determine if its diet is representative of the available resources in the environment. Dominant prey items

consisted of Hymenoptera: Formicidae (32.4%), Acari (19.2%), and Collembola (17.4%). Non-native invertebrate orders comprised 43.2% of their diet (Amphipoda, Isopoda, and Hymenoptera: Formicidae). The invertebrate orders containing endemic species most threatened by the invasion include Acari (mites), Aranae (spiders), Collembola (springtails), and Psocoptera (booklice), which each comprised greater than 2% of their diet. *Eleutherodactylus planirostris* consumed proportionally more Aranae, Chilopoda, Hemiptera: Heteroptera, and Hymenoptera: Formicidae than was available in the environment and consumed proportionally less Acari, Diptera, Hymenoptera, and Thysanoptera. Mean prey items consumed per frog was 17.6, and a maximum number of items consumed by one individual was 134 items. This indicates that *E. planirostris*, in high densities, may reduce native Hawaiian invertebrates in invaded habitats.

0321 General Ichthyology, Ballroom B, Friday 9 July 2010

James Orr, Amelia Whitcomb, Duane Stevenson, David Somerton

Alaska Fisheries Science Center, RACE Division, Seattle, WA, United States

An Intimate Affair: Reproductive Parasitism of Snailfishes on Golden King Crabs

Liparid snailfishes of the genus *Careproctus* have long been known to lay eggs within the carapace of lithodid king crabs. We used molecular techniques in an attempt to identify the species of snailfishes involved in this mode of reproduction in the Aleutian Islands of Alaska. Tissue samples from four genera and 11 species of snailfishes commonly found in the eastern Aleutian Islands were sequenced to serve as references. All were readily identified by unique COI sequences. One hundred tightly agglutinated clusters of eggs were extracted from crabs caught in the eastern Aleutian Islands during golden king crab (*Lithodes aequispinus*) processing operations in Dutch Harbor, Alaska. DNA sequences were obtained for 10-15 eggs from each of nine clusters containing eyed embryos, and were matched with sequences generated from adult reference specimens. Eggs of three species of snailfishes (*Careproctus rastrinus*, *C. colletti*, and *C. furcellus*) were identified among clusters. Several of the egg clusters contained multiple species of *Careproctus*, and eggs of all three species were found within one cluster. These results indicate that multiple individuals, and in fact multiple species, of snailfishes may deposit eggs simultaneously in the carapace of a single crab.

0629 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Guillermo Orti

George Washington University, Washington, DC, United States

DeepFin Research Coordination Network and the Tree of Life of all “Fishes”

As the funding for this research coordination network enters its last year, a summary of the accomplishments and the future directions of this effort are presented. An additional round of the Student Exchange Program is being advertised for the Fall semester of 2010. Online resources for ongoing and future projects in fish systematics are emphasized. A major effort to make fish phylogenies readily available for researchers and the public is underway using the web portal at www.deepfin.org.

0805 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Jan W. M. Osse, J. G. M. Van den Boogaart

Wageningen University and Research Centre, Wageningen, Netherlands

Structure and Function of the Larval Finfold

Larvae of air-breathing fishes use countercurrent flow in hypoxic environments located in a capillary network just below the skin surface on the yolk and fins. Other proposed functions of the larval median finfold are mixing perivitelline fluid in embryos, providing space for the fin rays to develop, or contributing to undulatory swimming – these functions may change during ontogeny. The finfold is generally resorbed in larvae <10 mm long. This raises the question of the adaptive significance of this complex structure, taking into account that, in most cases, resources for growth in early larvae are limited. Structure and function of the larval finfold were studied on laboratory-reared carp and zebrafish larvae using standard light- and electron microscopy, and Nomarski differential interference optics to measure the actinotrichia, the supporting rods of the finfold. The construction of the finfold causes it to camber during lateral bending of the larval body during swimming. Deformation of the finfold was observed during free swimming using high speed video and artificial bending of the larval body. Actinotrichia support and restrict camber, thus increasing stiffness of the finfold so that the mass of the accelerated water due to the force developed in the swimming muscles is increased, enabling fast escape and feeding movements. Changes in diameter of actinotrichia during larval growth in carp closely follow changes in swimming style. So, the seemingly weak structure of this finfold will contribute to larval survival. Experimental verification will be accomplished with mutant zebrafish larvae that lack a finfold.

0070 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Clint Otto, Gary Roloff

Department of Fisheries and Wildlife, East Lansing, MI, United States

Do Repeated Cover Object Searches Cause Localized Extinction of Red-backed Salamanders?

Natural cover object (NCO) searches are commonly used to collect population data on terrestrial salamanders, with study sites often visited multiple times in a field season. Researchers have noted that repeated NCO searches along transects may degrade salamander habitat, however, the extent to which this influences population vital rates has not been rigorously explored. We test the hypothesis that repeated NCO searches causes temporary extinction of red-backed salamanders, *Plethodon cinereus*, along surveyed transects within a single field season. We control for the effect of Julian date on salamander occurrence by comparing occupancy probabilities for transects that were repeatedly disturbed to undisturbed, adjacent transects sampled during the same time period. We construct a small set of occupancy models to investigate how micro-habitat quality is associated with initial site occupancy and extinction probabilities, after accounting for salamander imperfect detection. We utilize our results to determine the optimal number of times a site should be visited with the goal of maximizing detection probability while minimizing observer-induced extinction.

0299 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Chouly Ou¹, Carmen Montana¹, Kirk Winemiller¹, Solida Putrea²

¹Texas A&M University, College Station, Texas, United States, ²Inland Fisheries Research and Development Institute, Phnom Penh, Cambodia

Fish Diversity Survey in Northeastern Cambodia's Mekong and 3S Rivers

The Mekong River is the largest in Southeast Asia and contains over 1,200 fish species, of which about 500 have been recorded from Cambodia. In Cambodia, the Mekong River delivers water to and receives water from the Tonle Sap, a huge, shallow lake that supports the most productive inland fishery in the world. The Mekong River and its major tributaries, the Sekong, Sesan and Srepok rivers in northeastern Cambodia, have been identified as critical areas for biodiversity conservation. A preliminary survey was conducted in January 2010 in this region to document fish diversity. Large fishes were purchased from sellers at landing sites, and small fishes were collected using seine nets, dip nets and cast nets. One hundred and forty seven species belonging to twenty seven families were identified from the survey. Cyprinidae was the most species-rich family, followed by Bagridae, Pangasiidae, Siluridae, Balitoridae, Cobitidae, Sisoridae, Channidae, Clariidae, Mastacembelidae, Osphronemidae, Ambassidae, Noptopteridae,

Soleidae, Tetraodontidae, Amblycipitidae, Anabantidae, Anguillidae, Ariidae, Belontiidae, Cynoglossidae, Datnioididae, Eleotridae, Hemiramphidae, Pristolepidae, Sciaenidae and Synbranchidae. At least five species of Balitoridae, four of Cobitidae and two of Cyprinidae (*Rasbora* spp.) appear to be undescribed. The Sesan River, which has a regulated hydrology due to the operation of dams in Vietnam, had the fewest species, and the mainstem Mekong yielded the most species. Further research will examine the relationships between hydrology, fish assemblage structure and food web ecology in these rivers.

0671 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Patrick Owen, Ryan Smith

The Ohio State University at Lima, Lima, OH, United States

Field Observations of Amplexus Calls in American Toads (*Bufo americanus*)

The most common calls used by male American toads are advertisement calls. These indicate position to females and to rival males. A call of uncertain function, the “amplexus call”, has been previously documented from amplexed males. While the advertisement call of the American toad consists of a long musical trill, the amplexus call is a long series of low volume clicks. Given that the amplexus call has only been recorded from captive toads, it has been suggested that it is aberrant. We made field observations of American toad choruses at the Lippincott Bird Sanctuary in Lima, Ohio, USA during March and April of 2006 and 2007. Amplexus calls were recorded at low volume using a microphone held close to the toad, and they also were detected via a hydrophone suspended close to the toad under the water. Properties of the calls were similar to those previously reported from a laboratory environment. We observed males using amplexus calls in two different contexts. First, we recorded several instances of males in amplexus giving the call. Additionally, we recorded a number of unamplexed males giving the call. This suggests that “amplexus call” may not be the most appropriate name for this vocalization and that it may also function as a mating or aggressive signal. Our work confirms that this call is not an aberrant vocalization, and we are currently investigating its behavioral context.

**0167 Fish Ecology, 555 AB, Sunday 11 July 2010; ASIH STOYE AWARD
ECOLOGY & ETHOLOGY**

Hannah Owens

University of Kansas, Lawrence, Kansas, United States

**Predicting the Distribution of the Coelacanths *Latimeria chalumnae* and
*Latimeria menadoensis***

In 1998, a second species of coelacanth, *Latimeria menadoensis*, was discovered off the north coast of Sulawesi, Indonesia, expanding the known distribution of the genus from Madagascar and the east coast of Africa to encompass the Indian Ocean basin. This study seeks to generate hypotheses for additional sites in the Indian Ocean where coelacanths might be found using ecological niche modeling. Coelacanth specimen locality information was collected from museum records and submersible sightings. These data were then combined with environmental data from a variety of sources into a Geographic Information System and analyzed using both the Genetic Algorithm for Rule-set Production (GARP) and the maximum entropy algorithm Maxent. The resulting models were then used to generate maps of the occurrence likelihood of coelacanths throughout the Indian Ocean and potential habitat suitability for the genus worldwide. My findings suggest that the range of the coelacanths could extend beyond their currently described distribution, a hypothesis that merits further investigation.

0194 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Lawrence Page¹, Jason Knouff²

¹Florida Museum of Natural History, Gainesville, Florida, United States, ²Saint Louis University, St. Louis, Missouri, United States

Geographic Variation in Species Richness of North American Freshwater Fishes

Data on biological distributions are fundamental to protecting biodiversity, predicting impacts of climate change, and interpreting evolutionary and ecological patterns and processes. North America has the largest number of freshwater fish species of any temperate region in the world, and it is widely acknowledged that this diversity is highest in the southeastern United States. Most investigators have attributed this southeastern nucleus of species richness to a combination of high landscape heterogeneity, geological stability, and immense size of the Mississippi River basin. Given these seemingly robust explanations, it is surprising that over half (53%) of the North American freshwater fish families do not have their greatest species richness in the southeastern United States. We addressed several questions related to geographic

variation in species richness. Where precisely is the greatest number of species? Which families contribute, and in what proportion, to that richness? Are there major secondary hotspots? What are the conservation implications of the distribution of species richness? How has the recent surge of species descriptions of freshwater fishes affected our results?

0501 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Erin (Misty) Paig-Tran¹, James Strother², Adam Summers¹

¹University of Washington, Seattle, WA, United States, ²University of California at Irvine, Irvine, CA, United States

Go with the Flow: Estimation of Gill Raker Permeability in Suspension Feeding Elasmobranchs

Cartilaginous filter feeders have four very different types of gill raker morphologies. Considering these morphological differences, one may also hypothesize that the movement of water through the buccal cavities and the mechanisms of particle sequestration would also be markedly different. Anatomical comparisons of the raker morphology and permeability measurements of the entire gill structures were performed on three intact, preserved neonatal *Rhincodon typus*, two *Mobula munkiana*, and one *Mobula japonica* using a gravimetric/monometer system pattached to a pump at a constant flow rate of 114 mL/sec. We calculated the extrinsic permeability of their buccal cavities using the equation: $R = \Delta P/Q$, where R was the resistance through the gill structure, P is the pressure estimated by measuring the change in water height of the manometer when the shark was attached to the manometer and Q is the constant flow rate of our pump. Results indicated that the three neonatal whale sharks and three mobula permeability measurements have very little extrinsic resistance through their buccal cavity (R ranged between 0.88 to 6.01 Pa/mL/s in *Rhincodon typus* and 0.89 to 6.78 Pa/mL/s for the two mobula species) when flow rate was constant. Although the pore size of the gill rakers are small in both neonatal whale sharks and mobulas (~1000 μ m), their gill rakers/filtering pads lay flush to the epibranchials instead of protruding into the buccal cavity at an angle that is perpendicular to water flow, which may account for the low measured resistances.

0490 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Erika Parker¹, Boyd Kynard²

¹US Geological Survey, Conte Anadromous Fish Research Center, Turners Falls, MA, United States, ²BK-Riverfish, LLC, Amherst, MA, United States

Effect of Rearing Temperature on the Onset and Duration of Dispersal of Early Life Stages of Shortnose Sturgeon (*Acipenser brevirostrum* Lesueur 1818)

The objective of this study was to determine the effect of three temperature regimes on the timing and pattern of downstream dispersal of shortnose sturgeon (*Acipenser brevirostrum*) larvae. Tests were conducted in artificial stream tanks with three replicates at each of three temperatures, 10°, 15°, and 20°C. Fish were introduced to experimental tanks immediately upon hatching, and their movements were monitored day and night with video cameras. Rearing fish at 10°C caused development to slow and delayed the onset of dispersal. Fish in the 10°C group had a single peak of dispersal lasting 8 days. Increasing the temperature (15 and 20°C) caused fish to begin dispersing at a younger age (in days after hatch), but also produced a dispersal with multiple peaks. Fish were all at or close to the beginning of the larval life stage (i.e. beginning exogenous feeding) and were all morphologically similar when they began dispersing, regardless of temperature. Fish in the 15 and 20°C treatments required a similar number of degree-days to become larvae, but fish in the 15°C group took more degree-days to begin dispersal than fish in the 20°C group. Fish in the 10°C group took many more degree-days both to become larvae and to initiate dispersal than fish in the other two groups. These results show development and dispersal of shortnose sturgeon early life stages can be influenced by river temperature, and anthropogenic impacts that alter river temperature regimes have the potential to affect sturgeon dispersal patterns.

0297 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Eric Parmentier¹, David Mann², Loïc Kéver¹, Michael Fine³

¹Université de Liège, Liège, Belgium, ²University of South Florida, St Petersburg, FL, United States, ³Virginia Commonwealth University, Richmond, VA, United States

Diversity in the Sound Production Mechanism in Ophidiiformes

Cusk-eels *Ophidion rochei* and *Ophidion marginatum* inhabit sandy shallow bottoms in which they bury during the day. At dusk, they leave their shelter to chase and produce vocal choruses. Both species make sounds mainly at dusk. These sounds were recorded and first morphological studies were realised on the sound producing apparatus in both species to understand the mechanism. The sound producing apparatus presents in both species many particularities: antagonistic sonic muscles, pivoting first neural spine

(neural rocker), ribs forming osseous plates that cover the swimbladder, development of unusual hard pieces (rocker bone or cap) in front of the swimbladder that shows also at its caudal part an internal cone-like shape with elastic membranes at both extremities. However, the system of both species presents also huge morphological difference that could explain the differences in the recorded sounds. The sounds consist in trains of 6 to 40 pulses in both species, having a duration of ca. 13 ms in *O. marginatum* and 25 ms in *O. rochei*. These pulses are emitted at a frequency of 12 in *O. rochei* to 30 Hz in *O. marginatum* showing these pulses result from the contraction of slow muscles. It implies that, unlike most fishes having fast muscles, muscle contraction rate does not indicate the sound frequency. The main frequency is around 1,100 Hz in *O. marginatum* and between 200 and 400 Hz in *O. rochei*. This study proposes hypotheses dealing with the functional mechanism of these unusual sound producing mechanisms.

0531 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Kristene Parsons, Tracey Sutton, Jack Musick

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

Shark Assemblage Structure in the Chesapeake Bight

The role and importance of the Chesapeake Bight region as essential fish habitat for several species of sharks is well represented in primary literature and US fisheries management plans. Diverse assemblages of shark taxa utilize the Chesapeake Bay and adjacent coasts at various stages throughout their lives. As top predators in most of the environments where they occur, sharks are key to maintaining healthy, diverse ecosystems. The estuarine waters of the Chesapeake Bay are exposed to extreme ranges in temperature and salinity, and consequently the environmental suitability of the Bay is spatially and temporally restricted to select taxa. By identifying shark assemblages in the Chesapeake Bight region we aim to: 1) provide spatial and temporal profiles of assemblage structures, 2) identify environmental factors that influence assemblage composition, and 3) provide a tool for measuring the effects of climate change on highly migratory species in the Mid-Atlantic. Shark assemblage structures were inferred from VIMS fishery-independent longline catch data. Fifteen species were represented in Bay and coastal waters between 1996 and 2009, dominated by sandbar (62%) Atlantic sharpnose (16%) and smooth dogfish (11%). Analyses revealed seasonal variations in Bay and coastal assemblage structures, and possible contributing factors as well as local impacts will be discussed. This information is essential for further investigations into climate change effects on shark migration phenology in the Chesapeake Bight, and is useful data for ecosystem-based approaches to marine resource management.

0711 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Leilani Pasicolan, William Crampton

UCF, Orlando, Florida, United States

Morphological Adaptations to Hypoxia in the Electric Fish Genus *Brachyhypopomus*

Many tropical aquatic environments worldwide are characterized by intermittent or prolonged hypoxia (low dissolved oxygen). Nevertheless, many tropical freshwater fishes are able to inhabit these challenging environments via a range of morphological, physiological and behavioral adaptations. *Brachyhypopomus* is a diverse monophyletic genus of weakly electric fishes represented by 28 species distributed from Argentina to Costa Rica. 18 species occur exclusively in normoxic habitats, six species occur exclusively in seasonally hypoxic habitats (floodplains of large tropical rivers or permanent swampy habitats), and four species occur in both seasonally hypoxic and normoxic environments. These habitat distributions offer the opportunity to explore both species- and population-level variation in adaptive responses to hypoxia. DO is known to be a good predictor of gill size in fishes, and preliminary studies show that species of *Brachyhypopomus* found in seasonally hypoxic habitats have larger gills than those found in normoxic habitats. Across all species in the genus (and among populations of the four eurytopic species), ANOVA was used to correlate total gill filament length (as a metric of gill size standardized for body size) with habitat (normoxic vs. seasonally hypoxic). In addition, Discriminant Function Analysis (DFA) using multiple gill metrics was utilized to compare species and populations in the context of habitat. Preliminary results indicate a strong correlation between gill size and oxygen-habitat among species, even when the effects of phylogenetic ancestry are taken into account using the comparative method. These results further support the hypothesis that large gill size is an adaptive response to seasonal hypoxia.

0318 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Ketan Patel, George Harper, Patrick Huddleston, Lincoln Riley

Hendrix College, Conway, Arkansas, United States

Coral Snake Mimicry in the Southcentral US: Are Milksnakes really Mimics?

Batesian mimicry, the resemblance of a harmless species (the mimic) to a distasteful or dangerous species (the model) that protects the mimic from predators, is an example of evolution by natural selection. A test of Batesian mimicry is whether predators avoid the mimic in areas where the model is present (sympatry), but do not avoid the mimic in areas where the model is absent (allopatry). We tested whether milksnakes (*Lampropeltis triangulum*) are mimics of the Texas coral snake (*Micrurus tener*). To do this, we

constructed clay replicas that had: red, black and yellow bands similar to *L. triangulum amaura*, found in Arkansas, Louisiana and Texas, or brown similar to many snakes found in similar areas. We paired one banded replica and one brown replica (doublets). We placed ten doublets in a transect; ten transects in areas of sympatry (in Louisiana) and ten transects in areas of allopatry (western and northwestern Arkansas). Replicas were left in the field for four weeks to allow predators to attack them. Results show that predators in allopatry attacked the mimetic replicas at a rate of random expectation. In sympatry, there was a strong, but not statistically significant ($P = 0.06$), trend to avoid the mimetic replicas. Our results in allopatry match our expectation, but the lack of significant avoidance in sympatry prevents us from declaring that *L. triangulum* is, in fact, a coral snake mimic. Additional studies are needed to establish whether *L. triangulum* in the south-central U.S. are mimics of *M. tener*.

0516 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

James Paterson¹, Brad Steinberg², Jacqueline Litzgus¹

¹Laurentian University, Sudbury, Canada, ²Algonquin Park, Whitney, Canada

Spatial Ecology and Habitat Selection in a Northern Population of Snapping Turtles (*Chelydra serpentina*)

Central to our understanding of animal ecology is habitat use and resource selection. By comparing habitat use to habitat availability, preferences for specific habitats may become evident, and this information is important for creating management plans for species at risk. We examined habitat selection and spatial ecology in a northern population of Snapping Turtles (*Chelydra serpentina*) in Algonquin Provincial Park, Ontario. Snapping Turtles were recently listed as a Species of Special Concern in Canada, and data on their spatial ecology are needed to inform recovery planning. Radio telemetry was used to follow 11 turtles from May 2009 to present. Average daily distances travelled varied widely among individuals from 23-179 m/day (mean = 78, SE = 15), but were greater in females than in males. In addition, annual home ranges varied widely from 0.1-330 ha (mean = 60, SE = 30), although there was no difference between the sexes. Comparisons of habitat use and availability will be carried out using the distance-based method and ArcGIS software at two spatial scales: selection of a home range from the population range, and selection of habitat within the home range. Studying local populations of widely distributed generalist species allows recognition of important habitat characteristics preferred by these organisms, and allows comparisons of geographic differences among populations. Studies on habitat selection are important for identifying critical habitat for at-risk species, as well as for answering questions about life history evolution.

0520 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

James Paterson¹, Brad Steinberg², Jacqueline Litzgus¹

¹Laurentian University, Sudbury, Canada, ²Algonquin Park, Whitney, Canada

Comparisons of Hatchling Survivorship and Spatial Ecology between Two Sympatric Turtle Species

Management plans should incorporate vital statistics and habitat requirements for all life stages. However, until recently, technological limitations and the cryptic nature of hatchling turtles have constrained our understanding of their ecology. We monitored the survivorship and movements of 21 hatchling Blanding's Turtles (*Emydoidea blandingii*) and 24 Wood Turtles (*Glyptemys insculpta*) during the fall of 2009 as part of a one-year telemetry study of hatchling turtles in Algonquin Provincial Park, Ontario. Turtles were captured as they emerged from nests in the fall, outfitted with radio-transmitters, and tracked every 1-3 days from late August to 15 October 2009, at which time all turtles were at overwintering sites. The mortality rate was high in both species, with only 33% of Blanding's Turtles, and only 13% of Wood Turtles surviving the autumn. Predation was the primary source of mortality for both species. Wood Turtles moved directly to adjacent creek habitat, while Blanding's Turtles either moved to the nearest wetland or remained terrestrial. The differences in distances travelled may be related to the distance between nests and aquatic habitats, and decreasing ambient air temperatures in September. Blanding's Turtles that remained in upland habitat for overwintering (n = 4) were likely exposed to subfreezing temperatures. Differences in habitat use between adult and hatchling life stages have huge implications for management strategies for these at-risk species. Our data contribute to the understanding of the basic ecology of hatchling turtles in the wild, one of the previously missing links in the natural history of freshwater turtles.

0589 Herp Conservation II, Ballroom B, Sunday 11 July 2010

David Paulson, Paul Sievert

University of Massachusetts: Department of Natural Resources Conservation, Amherst, MA, United States

An Experimental Test of Tunnel Size and Position on Passage of Painted Turtles (*Chrysemys picta*)

Roads are long linear features on the landscape that impact wildlife and their habitats. Among all forms of wildlife, turtles are one of the most negatively affected by roads. Wildlife biologists and civil engineers have developed and implemented design measures to mitigate the negative effects associated with roads. One common approach

used to reduce road mortality and to facilitate movement of turtles is to construct a road passage structure. We examined the relative effectiveness of experimental passages for freshwater turtles. Structures were evaluated with respect to how their height, width, and position (at or below-grade), influenced the movements of painted turtles. A total of 190 turtles were exposed to the experiential trials and their behavior was characterized by 3 response variables (Total time to complete the trial, Total hesitations observed, and Success based on no hesitations and completion of the trial in less than 120 minutes). We concluded that painted turtles exposed to below-grade tunnels were less hesitant and traveled faster through them as the tunnel size increased from 0.6 m x 0.6 m to 1.2 m x 1.2 m. The 1.2 m x 1.2 m tunnel size overall proved to be the size with the fewest hesitations observed, fastest total times, and highest success rate.

0092 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Ryan Peek, Jennifer Dever

University of San Francisco, San Francisco, CA, United States

Landscape Genetics of Foothill Yellow-legged Frogs (*Rana boylei*) in Regulated and Unregulated Rivers: Assessing Connectivity and Genetic Fragmentation

The stream breeding frog *Rana boylei*, is experiencing range wide population declines. Because this species inhabits rivers in the foothills of California, these frogs are directly and indirectly affected by anthropogenic impacts such as regulation, recreation, development, and agricultural activities. Such impacts can fragment the riverine landscape and reduce the connectivity within and among frog populations. We hypothesize that *R. boylei* populations in watersheds containing dams (regulated) will have lower genetic diversity and riverscape connectivity compared with watersheds without dams (unregulated). Six different rivers in the Sierra Nevada are being compared, pairing similar-sized regulated and unregulated rivers in adjacent watersheds. Genetic structure within and among regulated and unregulated watersheds will be characterized and compared using mitochondrial DNA (mtDNA) to estimate gene flow and random amplified polymorphic DNA (RAPD) to estimate genetic diversity. Three random primers from the Ready-to-Go RAPD Analysis Kit are being used to generate RAPD profiles. Additionally, a quantitative GIS-based analysis of site heterogeneity and riverscape connectivity will be conducted using landscape features and frog distribution patterns. Comparisons with data on gene flow and levels of genetic subdivision within and among frog populations will be discussed. Preliminary results indicate significant differences in population structure between regulated and unregulated streams.

0584 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Mark Sabaj Pérez

Academy of Natural Sciences, Philadelphia, PA, United States

John Lundberg: The Man Behind the Whiskers

Number of fishes named in honor of John Lundberg: 6. Chance that the patronym is a catfish: 2 in 3. Numbers of species, genera/subgenera, and families/subfamilies, respectively, of fishes described by Lundberg: 37, 12, 3. Chance that those taxa are extinct: 1 in 3. Chance that those taxa are in synonymy: 1 in 25. Number of publications authored/co-authored by Lundberg: 81. Number of different co-authors: 135. Number of "Calhamazon" Expeditions funded by NSF: 3. Number of "Calhamazon" trawls and specimens collected, respectively: 1,826 and 100,168. Minimum number of km and cubic meters, respectively, of water trawled: 1,930 and 5,791,557. Number of masters, doctoral and postdoctoral students, respectively, advised by Lundberg: 3, 13, 3. Chances that those students have trawled with Lundberg: 1 in 2. Approximate age of fossil "titanoglanis", the world's largest known catfish that was discovered by Lundberg: 45,000,000. Factor by which this exceeds the number of years "titanoglanis" has remained an informal MS name: 3,461,538. Approximate number of New World freshwater catfishes: 2000. Number of New World freshwater catfishes with direct phylogenetic ties to African catfishes: 1. Factor by which this is exceeded by the number of engines and transmissions, respectively, that have been in the discoverer's 1991 Toyota pick-up: 2, 2.

0168 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Derek Perry¹, Greg Skomal¹

¹*University of Massachusetts-Dartmouth School for Marine Science and Technology, New Bedford, MA, United States*, ²*Massachusetts Division of Marine Fisheries, New Bedford, MA, United States*

Feeding Ecology of Smooth Dogfish, *Mustelus canis*, in Buzzards Bay, Massachusetts

Cape Cod, Massachusetts is generally regarded as a natural barrier to the northern range of smooth dogfish, *Mustelus canis*, although they have been observed farther north. This study was designed to characterize and quantify the food habits of smooth dogfish in the northern portion of its range where there is significant spatial overlap with relatively high densities of American lobster, *Homarus americanus*. According to the Lobster Stock Assessment Committee, the natural mortality of lobsters has increased for the Southern New England Stock. Smooth dogfish, coupled with other predators, may have led to the drastic decline in local abundance of lobster over the last decade in southern New

England. Samples were collected from a longline survey and inshore trawl surveys. Analysis of 247 dogfish stomachs found the diet of the smooth dogfish consisted mostly of crustaceans. The most important prey species by percent mass were; Atlantic rock and Jonah crabs, *Cancer* spp (40%), lobster (16%), spider crabs, *Libinia* spp (14%) and mantis shrimp, *Squilla empusa* (9%). Analysis suggests that larger smooth dogfish may be a major predator of the American lobster, especially in the fall. Many of the lobsters found in the diet consisted of only claws and legs. These are appendages that the lobster is capable of autotomizing and later regenerating. Non-lethal predation may lessen the smooth dogfish's potential impact on lobster mortality.

0183 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Derek Perry, Greg Skomal

*University of Massachusetts-Dartmouth School for Marine Science and Technology,
New Bedford, MA, United States*

Seasonal Variation in Smooth Dogfish, *Mustelus canis*, Catch and Diet from a Longline Survey in Buzzards Bay, Massachusetts

This study was designed to characterize and quantify the feeding ecology of smooth dogfish in the northern portion of their range. The survey was conducted from May through October of 2008 in Buzzards Bay, Massachusetts. Longlines were set with 50 hooks and soaked for one hour. A total of twelve random stratified stations were sampled each month within three depth strata; 0-10 m, 11-20 m, and >21 m. A non-lethal stomach eversion technique was used to extract diet samples. Preliminary analysis of the 242 dogfish collected found CPUE was greatest in the earlier months of the survey largely due to the abundance of male smooth dogfish. The sex ratio was dominated by males in May and June and then shifted toward females in the summer months. A dramatic decrease in the number of males occurred in July which coincided with peak water temperatures within the bay during the same period. Most of the catch consisted of mature individuals, with 96% of males and 64% of females being above size at first maturity. The diet of the smooth dogfish consisted mostly of crustaceans. In the spring, crustaceans accounted for 71% of the diet by percent Geometric Index of Importance (%GII), 90% GII in the summer and 87% in the fall. Rock crab, *Cancer irroratus*, was the most important prey species in the spring (30% GII) and summer (31% GII) seasons. Lobster, *Homarus americanus*, was the most important prey species in the fall (21% GII).

0569 Herp Physiology, 556 AB, Monday 12 July 2010

Charles Peterson

Hofstra University, Hempstead, NY, United States

Salinity Tolerance of Hatchling Diamondback Terrapins

The diamondback terrapin (*Malaclemys terrapin*) is nearly unique among non-chelonioid chelonians in its exclusive use of estuarine and marine habitats. The physiological and behavioral characteristics underlying their unusual salt tolerance are incompletely understood. In particular, little is known of the ontogeny of salinity tolerance, but surface-area-to-volume relationships suggest that hatchling terrapins should be especially vulnerable to salt-loading, osmotic stress and dehydration. I report preliminary data from a comparative common-garden experiment intended to gauge the salinity tolerance of hatchling terrapins and identify putative adaptations. Identically-incubated hatchlings of *Malaclemys* and two close freshwater-restricted relatives (*Graptemys geographica* and *Trachemys scripta*) were raised in water containing 0, 1, 9, 18, 27, and 36 (seawater) ppt ocean salt. Given a choice, naïve map turtles and sliders showed a clear preference for more dilute water, but terrapins did not. Terrapins enjoyed higher survivorship in saline water, but even so we were unable to successfully raise hatchling terrapins in even half-strength seawater (18ppt). Data will be also presented on captive growth rates of survivors over 17 months and resting metabolic rates (oxygen consumption, to assess potential metabolic costs of osmoregulation). Implications of the results for terrapin ecology will be discussed.

0190 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Catherine Phillips¹, Carol Johnston¹

¹*U.S. Fish and Wildlife Service, San Marcos, Texas, United States*, ²*Auburn University, Auburn, Alabama, United States*

Sneaky Songs - Sound Production by *Cyprinella galactura* with Alternative Mating Strategies

Acoustic signals were recorded during low level agonistic behavior (chases) associated with sneaking in three small male *Cyprinella galactura*. Sneaker males produced calls that consisted of three distinct call types with signal components similar to those dominant males produced during the same context. However, sneaker signals more closely resembled dominant male courtship signals in the important signal variable pulse rate. It is possible that sneaker male *C. galactura* are chasing females for courtship since they are not actively defending a territory.

0209 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Josh Pierce¹, Craig Rudolph¹, Dan Saenz¹, Robert Wagner²

¹USDA Forest Service Southern Research Station, Nacogdoches, TX, United States,

²Quantitative Ecological Services, Rosepine, LA, United States

A Reintroduction Experiment with the Louisiana Pine Snake (*Pituophis ruthveni*) in Bienville Parish, Louisiana

Ongoing surveys suggest that the Louisiana Pine Snake (*Pituophis ruthveni*) is declining; and currently occupied habitat is limited to a few small, isolated blocks of degraded and fragmented habitat. Research suggests that the species requires frequently burned sites with a well developed herbaceous understory capable of supporting populations of its primary prey, Baird's Pocket Gopher (*Geomys breviceps*). Recent changes in management practices on U. S. Forest Service lands have resulted in restoration of substantial blocks of suitable habitat, which are now available for reintroduction. A captive population consisting of 100+ individuals has been established from wild-caught snakes from Bienville Parish, LA. A reintroduction site has been located on the Catahoula District of the Kisatchie National Forest, which is thought to be unoccupied due to past fire suppression. We plan to breed captives and release 50% of available animals (~30-40) as neonates immediately following post-natal shed, while the remaining snakes will be head-started and released the following March. Snakes will be released at a density that crudely approximates the estimated recruitment density of a natural population. Automated pit tag readers and canine detection will be used to monitor the reintroduction site. Production of neonates and release of young will be repeated annually until a viable population is established or it is concluded that further releases are not likely to result in establishment of a population.

0675 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Kyle Piller¹, Devin Bloom¹

¹Southeastern Louisiana University, Hammond, LA, United States, ²University of Toronto, Scarborough, Ontario, Canada

Diversification of New World Silversides (Atherinopsidae: Tribe Menidiini)

The Tribe Menidiini consists of four genera of silverside fishes (*Chirostoma*, *Labidesthes*, *Poblana*, and *Menidia*) that are distributed throughout North America. *Chirostoma* is the most diverse genus in the Tribe consisting of approximately 23 species in Central Mexico. In addition to being the most speciose, *Chirostoma* is also the most morphologically diverse. The overall objective of this study was to investigate diversification within the Tribe Menidiini, specifically focusing on the diversity of

Chirostoma. We built on our previous work by generating a multilocus phylogeny (mtDNA and nDNA) of Menidiini and then conducting multiple diversification analyses to investigate the patterns and processes of diversification. Results from the Bayesian phylogenetic analysis are largely congruent with our previous mitochondrial study. In addition, the diversification analyses suggest that there was a significant increase in diversification early in the history of the Menidiine clade and a more recent radiation event for the Central Mexican Lakes clade of *Chirostoma* (Lakes Chapala, Patzcuaro, and Zirahuén).

**0109 Herp Physiology, 556 AB, Monday 12 July 2010; ASIH STOYE AWARD
PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY**

Nicholas Pollock

California Polytechnic State University, San Luis Obispo, CA, United States

Role of Host Preference and Testosterone in the Host-Parasite Relationship of the Western Fence Lizard (*Sceloporus occidentalis*) and Western Black-Legged Tick (*Ixodes pacificus*)

In many species, males have higher ectoparasite loads than females. My study aim was to use Western fence lizards (*Sceloporus occidentalis*) and Western black-legged ticks (*Ixodes pacificus*) to test the hypothesis that ticks prefer male lizards over female lizards. I first aimed to determine if ticks prefer male over female lizards and thus, choose their host prior to attachment. I exposed male and female lizard pairs to 100 tick larvae, allowing the ticks to choose their hosts. The ticks were quantified as they fed to repletion and dropped off. No significant differences were observed in the number of ticks that attached to male and female lizards, which suggests that ticks do not exhibit preference for male hosts and there must be another explanation for higher ectoparasite loads in males. I then tested the hypothesis that higher circulating testosterone concentrations in male lizards cause them to have higher tick loads. To examine this hypothesis I implanted male lizards with either testosterone or blank implants in the field. The testosterone-treated males had significantly higher tick loads compared to the control males. I also conducted a host choice study in the lab between testosterone-treated and control males, and found that ticks do not exhibit a preference for testosterone-treated males. These results suggest that male lizards are infested more heavily than females, especially during times of the year when circulating testosterone concentrations are high, because testosterone alters their behaviors such that they are exposed to more ticks.

0049 AES Ecology, 551 AB, Thursday 8 July 2010

Carlos Polo¹, Felipe Galván², Seth Newsome³, Angélica Barrera⁴

¹Universidad Nacional Autónoma de México, Distrito Federal, Mexico, ²Centro Interdisciplinario de Ciencias Marinas, La Paz, Baja California Sur, Mexico, ³University of Wyoming, Laramie, Wyoming, United States, ⁴Centro de Investigaciones Biológicas del Noroeste, La Paz, Baja California Sur, Mexico

Examining Ontogenetic Trophic Shifts in *Alopias superciliosus* Via $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Analysis of Muscle and Vertebrae

The bigeye thresher shark *Alopias superciliosus* has a worldwide distribution in coastal and oceanic waters of tropical and subtropical seas, however, little is known about the ecology of this shark. Here we examine ontogenetic shifts in the diet of *A. superciliosus* via carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) stable isotope analysis of muscle and vertebrae. A total of 37 muscle and 37 vertebrae were analyzed. Mean (\pm SD) $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in muscle were -15.2 ($\pm 0.2\text{‰}$) and 14.5‰ ($\pm 0.2\text{‰}$) respectively; mean $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in vertebrae were -16.7‰ ($\pm 0.6\text{‰}$) and $+10.1\text{‰}$ ($\pm 0.3\text{‰}$) respectively. We found no significant sex-related differences in mean C or N isotope values, but adult males had significantly higher muscle $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values than juveniles. This pattern suggests that adult males forage more often in coastal habitats and on higher trophic level prey than juveniles, whereas lower muscle $\delta^{13}\text{C}$ values in juveniles indicate they migrate from coastal to oceanic waters. We found no significant ontogenetic related differences in $\delta^{15}\text{N}$ for females, suggesting that they forage in similar habitats and on prey that occupies a similar trophic level throughout their life. Lastly, a comparison of tissue types from the same individual shows that $\delta^{15}\text{N}$ values in muscle is on average 4.4‰ ($\pm 0.1\text{‰}$) higher than vertebrae; muscle $\delta^{13}\text{C}$ is also higher than vertebrae by 1.5‰ ($\pm 0.2\text{‰}$). Tissue-specific differences in isotope values likely relate to differences in their amino acid composition and the observation that shark muscle contains a high concentration of ^{15}N -depleted urea.

0395 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Marianne Porter, Joshua Sturm, John Long

Vassar College, Poughkeepsie, NY, United States

Vertebral Column Strain of *Squalus acanthias*

Dynamically bending vertebral columns behave as springs, storing and returning elastic energy. In bony fishes, the structural source of the elastic energy is thought to be the intervertebral joints. Vertebrae are modeled as infinitely rigid spacers connecting the joints. However, by treating the vertebrae as elements with infinite stiffness, their possible contribution to the overall elastic behavior of the vertebral column is ignored.

We model the joints and vertebrae together as a series of Kelvin-Voigt viscoelastic elements. We measured axial strain of the joints and vertebrae during dynamic bending of an in vitro 10-vertebrae preparation to determine the relative mechanical contributions of each element to the behavior of the column. We tested vertebral columns from six *Squalus acanthias* using segments of ten centra. Dynamic testing frequencies ranged from 0.25 to 3.0 Hz at various curvatures. Displacement of the joint and centra were measured using sonomicrometry crystals placed bilaterally on the vertebral column at the cranial and caudal surfaces of the central joint and on the centra. During mechanical tests, vertebral column preparations were submerged in elasmobranch Ringers in an environmental chamber. We found differences in joint and centrum strain with varying curvatures and frequencies. Given the high level of centra strain, relative to that of joints in some cases, we speculate that as joints increase their stiffness, E (MPa), with increasing bending frequency, they approach the E of the centra and thus engage them as coupled springs. This work was supported by NSF DBI-0442269 and IOS-0922605.

0410 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Gregg Poulakis, Philip Stevens, Amy Timmers

Florida Fish & Wildlife Conservation Commission, Fish & Wildlife Research Institute, Charlotte Harbor Field Laboratory, Port Charlotte, FL, United States

Distribution and Habitat Use of Juvenile Smalltooth Sawfish, *Pristis pectinata*, in the Charlotte Harbor Estuarine System, Florida

Although endangered smalltooth sawfish (*Pristis pectinata*) are known to use estuaries during their first 2-3 years, little is known about their life history and ecology while in their juvenile habitat. The purpose of this project was to monitor sawfish in the Charlotte Harbor estuarine system to characterize sawfish seasonality, recruitment, habitat use, and health. During the five year study, we captured sawfish in 1.4% of our random 183-m haul seines and in 14.6% of samples that were non-randomly set. Sawfish stretched total lengths ranged from 671 to 2,172 mm (n = 137; mean = 1,248 mm). Sawfish were captured in all months; most commonly between February and September. Captures of neonates with rostral sheaths allowed estimation of the size range at birth (690-807 mm) and confirms the protracted timing of parturition (November-July) inferred from length frequency data. Although extensive sampling occurred throughout the estuarine system, most sawfish were captured near the mouths of the three major rivers. Five specific locations ('hotspots') were identified as having higher catch rates. Logistic regression models identified various combinations of water depth, water temperature, dissolved oxygen, and salinity as influencing the probability of catching a sawfish. Electivity analysis showed that sawfish had an affinity for water < 1 m deep, water > 30°C, moderate to high dissolved oxygen levels (> 6 mg l⁻¹), and salinities between 18 and 30 psu. Higher catch rates of larger sawfish (> 1 yr old) were associated with shoreline habitats with overhanging vegetation (e.g., red mangroves).

0411 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Gregg Poulakis, Philip Stevens, Amy Timmers, Christopher Stafford

*Florida Fish & Wildlife Conservation Commission, Fish & Wildlife Research Institute,
Charlotte Harbor Field Laboratory, Port Charlotte, FL, United States*

Movements of Juvenile Smalltooth Sawfish, *Pristis pectinata*, in the Charlotte Harbor Estuarine System, Florida

The movements of endangered juvenile (< 3 yr old) smalltooth sawfish (*Pristis pectinata*) were monitored during a drought between September 2007 and December 2009 using 33 acoustic listening stations in the tidal Caloosahatchee River, Florida. Movements of 23 sawfish were monitored along the main stem of the river and in 13 backwater habitats (natural mangrove-lined creeks, semi-natural creeks, seawall-lined canals). The daily activity space was 0.7 km, which is similar to other demersal ray species. There was no evidence that sawfish left the river and returned; they remained in the river under a wide range of environmental conditions. Three-fourths (74%) of the sawfish used backwater habitats. Generalized additive models and linear regression found that the distribution of sawfish was significantly related to 90-day lagged salinity; sawfish moved upriver with increasing salinity. When regressed separately for two size classes, the linear relationship between mean river position and salinity was stronger for < 1 yr old sawfish (60 day lag) than for larger sawfish (120 day lag). The lags apparent in the regressions could have occurred for at least three reasons: juvenile sawfish (1) may be more tolerant of changes in salinity than other elasmobranchs; (2) may have strong affinities for specific sites or areas of the river and remain there until conditions change enough for them to respond by relocating; (3) respond to indirect effects of salinity, such as the redistribution of prey populations that are known to exhibit similar distribution responses to lagged environmental changes.

0199 Fish Community Ecology, 555 AB, Monday 12 July 2010

Helen Poulos¹, Barry Chernoff¹, Pamela Fuller¹, David Butman¹

¹Wesleyan University, Middletown, CT, United States, ²USGS, Gainesville, FL, United States, ³Yale School of Forestry and Environmental Studies, New Haven, CT, United States

Potential Habitat Modeling of Four Aquatic Invasive Fish (*Channa argus*, *Cyprinella lutrensis*, *Neogobius melanostoma*, and *Hypophthalmichthys molitrix*) in the Continental US

Aquatic invasive species pose major ecological and economic threats to waterways worldwide through the displacement of native species and alteration of hydrologic cycles. Modeling the potential spread of alien aquatics through spatially explicit mapping is an increasingly important tool for risk analysis and rapid response. Habitat modeling provides the opportunity for identifying the key environmental variables influencing species distributions. We compared three presence-only modeling methods to predict the potential US distributions of *Channa argus*, *Cyprinella lutrensis*, *Neogobius melanostoma*, and *Hypophthalmichthys molitrix* using maximum entropy (Maxent), the genetic algorithm for rule set prediction (GARP), and support vector machines (SVM). We used inventory records from the USGS nonindigenous aquatic species database and a geographic information system of 70 raster climatic and environmental variables to produce spatially explicit maps for each species. Maxent and SVM produced higher accuracy predictions than GARP. Aquifer permeability, baseflow index, elevation, and mean annual precipitation were the key variables influencing fish distribution patterns. Results from this study provide insights into which locations and environmental conditions may promote the future spread of invasive fish in the US.

0200 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Antonella Preti, Candan Soykan, Heidi Dewar, Suzanne Kohin

NOAA Fisheries, Southwest Fisheries Science Center, La Jolla, CA, United States

Comparative Feeding Ecology of Shortfin Mako, Blue and Common Thresher Sharks in the California Current, 2002-2008

This study describes the feeding ecology of three pelagic shark species in the California Current. Contents of shortfin mako (*Isurus oxyrinchus*), blue (*Prionace glauca*) and common thresher (*Alopias vulpinus*) shark stomachs sampled from 2002-2008 were identified to the lowest taxonomic level and analyzed using univariate (Geometric Index of Importance [GII], Shannon and Simpson diversity, Sorensen, and Morisita-Horn overlap indices) and multivariate (regression trees, cluster, and discriminant analysis)

methods. Stomachs of 330 mako sharks ranging from 53 to 248 cm fork length (FL) were examined; 238 contained 43 prey taxa. Jumbo squid (*Dosidicus gigas*, GII=46.0) and Pacific saury (*Cololabis saira*, GII=25.5) were the most important prey. Stomachs of 158 blue sharks ranging from 76 to 248 cm FL were examined; 114 contained 38 prey taxa. Jumbo (GII=33.9) and *Gonatus* spp. squids (GII=33.6) were the most important prey. Of 225 thresher sharks sampled, ranging from 108 to 228 cm FL, 157 stomachs contained 18 prey taxa. Northern anchovy (*Engraulis mordax*, GII=68.4) and Pacific sardine (*Sardinops sagax*, GII=48.5) were the most important prey. Blue and mako shark diets were most similar, while dietary overlap was lowest between blue and thresher sharks. Inter-annual variation in diet was greatest for blue sharks. Overall, mako sharks have the most diverse diet feeding on a range of teleosts and cephalopods; blue sharks generally prefer cephalopods; threshers are more specialized feeding primarily on coastal pelagic teleosts. Despite similarities in life history characteristics and spatial and temporal overlap, diets of the three species are distinct.

0414 NIA II, 551AB, Monday 12 July 2010

Francisco Provenzano

Instituto de Zoología y Ecología Tropical, UCV, Caracas, Venezuela

The Preopercular Laterosensory Canal in Loricariidae (Teleostei: Siluriformes)

Schaefer (1988) performed an analysis of the homology and evolution of the bones of the opercular series between loricarioid catfishes. In that work he used the path and the pores of the branches of the laterosensory canal as a tool to establish the homology and nomenclature of bony elements. Since that time a remarkable number of new species of loricariids have been described. Also new information about the anatomy of the species of this family has been published. Finally, some hypotheses of phylogenetic relationships among species or genera of the family Loricariidae have been proposed. This work reviewed and analyzed specimens of species in the Loricariidae family that includes representatives of the subfamilies: Lithogeninae, Neoplecostominae, Hypoptopomatinae, Loricariinae, Hypostominae, Ancistrinae and Delturinae. The results indicate that path patterns and the pores of preopercular canal are similar and consistent with those presented by Schaefer (1988). Species in the subfamilies Loricariinae and Hypoptopomatinae shows the greatest variation in the path of preopercular canal and in the form of the bones that carry sections of this canal. A proposal about on the evolution of preopercular canal between loricariids shows concordance with the hypotheses of phylogenetic relationships for the subfamilies and "tribes" of the family Loricariidae.

0271 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Holly Puglis, Michelle Boone

Miami University, Oxford, OH, United States

The Effects of Terrestrial Buffer Zones on Amphibians in Public Green Spaces

A leading cause of amphibian declines is habitat degradation and destruction. Golf courses and other managed green spaces, could serve as refuge for amphibians and other wildlife if managed in ways consistent with natural habitat. Simple management techniques, such as leaving unmown buffer zone around ponds, may help mitigate the effects of habitat loss for some species. In a series of field studies, we explored the effects of grassy buffer zones on two species of larval amphibian and on the overwinter survival of one species. We reared cricket frog tadpoles through metamorphosis and green frog tadpoles through one summer in golf course ponds with and without grassy buffer zones to determine the effects of the buffer on survival, time to metamorphosis and size at metamorphosis (cricket frogs) and survival, developmental stage and mass at the end of the study (green frogs). In some golf courses, cricket frogs had greater survival and mass at metamorphosis when reared in ponds with buffer zones. Green frogs experienced lower survival but greater mass and developmental stage when reared in ponds with buffer zones on some golf courses. We also conducted a habitat choice study to determine if cricket frogs prefer unmown grassy habitat or mown grassy habitat. Cricket frogs preferred unmown habitat, but this result was marginally significant. Our results indicate that public green spaces can offer suitable habitat for some amphibians and also that terrestrial buffer zones may not need to surround the entire pond.

0381 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Jennifer Purrenhage, Kimberly Babbitt

University of New Hampshire, Durham, NH, United States

Influences of Aquatic and Terrestrial Habitat and Adult Demographics on Juvenile Recruitment in Vernal Pool-Breeding Amphibians

Vernal pool-breeding amphibians are particularly vulnerable to population decline and extinction because of the unpredictable nature of vernal pool hydroperiods, as well as the generally limited protection of vernal pools and adjacent upland habitat. The complex life histories of these species increase their vulnerability to habitat alteration and necessitate that conservation planning considers both their aquatic and terrestrial habitat requirements. One major threat to vernal pool-breeding amphibians is the encroachment of forestry practices (e.g., clearcutting) on vernal pools across the landscape. Forested terrestrial buffers surrounding pools may provide some protection

for vernal pool-dependent species; however, there are few studies to date testing the efficacy of forest buffers. From 2004 through 2009, we monitored populations of two important vernal pool-associated species - wood frogs (*Rana sylvaticus*) and spotted salamanders (*Ambystoma maculatum*) - at 11 vernal pools in central Maine, following a standard drift fence and pitfall trap protocol. Pools were assigned to one of three forested buffer treatments: 30-m buffer, 100-m buffer, and >1000-m buffer (reference) pools. Specifically, we explored population-level (sex ratio, population size, and juvenile recruitment) effects of forested buffer treatments over time, and we examined environmental (e.g., hydroperiod) and demographic (e.g., adult population size) factors potentially influencing juvenile recruitment of wood frogs and spotted salamanders. Here we present findings from our six-year study, including the relative influences of terrestrial forested buffer treatments, hydroperiod, and adult population demography on juvenile recruitment, and offer initial recommendations of conservation priorities for vernal pool-breeding amphibians.

0009 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Robert Pyron¹, Frank Burbrink¹

¹*Stony Brook University, Stony Brook, NY, United States*, ²*The College of Staten Island/CUNY, Staten Island, NY, United States*

Niche Evolution and Systematics of the Common Kingsnake (*Lampropeltis getula*)

Based on a recent range-wide phylogeographic analysis, we evaluate patterns of niche evolution in geographic lineages of the *Lampropeltis getula* group. We find strong evidence for the influence of both niche conservatism and divergence driving lineage formation on relatively recent phylogenetic time scales. In light of this differentiation, we present a systematic revision, finding support for the recognition of five distinct species. We provide diagnoses based on mitochondrial DNA evidence, morphological variation, ecological niche modeling, and historical precedence. Each species bears the name of the nominate subspecies found primarily within the range of each phylogeographic lineage: the Eastern lineage (*Lampropeltis getula*, Eastern Kingsnake), the Mississippi lineage (*L. nigra*, Black Kingsnake), the Central lineage (*L. holbrooki*, Speckled Kingsnake), the Desert lineage (*L. splendida*, Desert Kingsnake), and the Western lineage (*L. californiae*, California Kingsnake). Interestingly, all of these taxa had previously been described or recognized as distinct species, in some cases for up to 101 years (e.g., *L. californiae*), before being demoted to subspecies. Increasingly detailed genetic information from phylogeographic analyses will likely continue to have a strong impact on traditional taxonomy for many groups.

0107 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Irani Quagio-Grassiotto¹, MSc Clarianna Baicere-Silva², Katiane Ferreira³, Naercio Menezes³, Ricardo Benine¹, Luiz Malabarba⁴

¹Universidade Estadual Paulista-UNESP, Botucatu, SP, Brazil, ²Universidade de Campinas-UNICAMP, Campinas, SP, Brazil, ³Museu de Zoologia da Universidade de São Paulo-MZUSP, São Paulo, SP, Brazil, ⁴Universidade Federal do Rio Grande do Sul-UFRGS, Porto Alegre, RS, Brazil

Spermatic Characteristics in Some Representatives of the Subfamily Stevardiinae (Teleostei: Characiformes) and Their Phylogenetic Implications

The phylogenetic relationships among the members of the subfamily Stevardiinae (sensu Mirande, 2009) are primarily based on morphological characters and molecular data. Other characters, such as spermiogenesis and sperm structure can provide phylogenetic signals and are potentially useful for cladistic analysis. In order to know the spermatic characteristics of members of Clade A characids (sensu Malabarba & Weitzman, 2003), testes of the genera *Boehlkea*, *Bryconacidnus*, *Bryconamericus*, *Ceratobranchia*, *Caiapobrycon*, *Creagrutus*, *Cyanocharax*, *Hemibrycon*, *Hypobrycon*, *Knodus*, *Odontostoechus*, *Piabarchus*, *Piabina*, and *Rhinobrycon* were prepared and analyzed under Transmission Electron Microscopy. The specimens were collected or mainly obtained from zoological collections. In all species analyzed a variation of Type I spermiogenesis was obtained in which nuclear rotation is equal or minor than 10° resulting in a lateral position of the double nuclear fossa and flagellum. The sperm nuclei are slightly elongate toward the flagellar axis, the proximal centriole is partially inside the nuclear fossa and anterior and oblique to the distal, and the midpiece is short and strongly asymmetric. The fact that the species herein analyzed and others also belonging to Clade A, from which the spermatic characteristics are known, share the same characteristics strongly indicates that this clade is monophyletic. The great similarity of the sperm structure suggests that the 17 taxa included in Clade A are more related among themselves than with the other Stevardiinae, and constitutes a more basal subgroup within this subfamily.

0717 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Elizabeth Quimba, Dee Denver, Fredric Janzen

Oregon State University, Corvallis, OR, United States

Molecular Phylogeography of the Western Hognose Snake (*Heterodon nasicus*)

Heterodon nasicus (western hognose snake) is broadly distributed from southeastern Alberta, Canada to northern Mexico. The currently recognized subspecies (*H. n. nasicus*,

H. n. kennerlyi, and *H. n. gloydi*), designation, based on morphological characters, has not been reassessed with modern molecular methods. The use of molecular tools will help to clarify the taxonomic status and population relationships of this broadly-distributed snake. Understanding evolutionary relationships among, and genetic variation within, *H. nasicus* populations will provide important conservation information, as this species is endangered or threatened in various parts of its range. This study will test for concordance in previous morphology based systematic assessments (Eckerman 1997; Chiszar et al 2003) against that of the proposed mitochondrial DNA sequence analysis. The secondary goal will be to assess how populations are genetically structured and to determine the regional historical forces responsible for the current distribution of the species. We anticipate that southern populations will be more genetically distinct than northern populations as a result of expansions northward into areas heavily impacted by the retreat of glaciers approximately 10,000 years ago. Furthermore, we predict *H. nasicus* dispersed northward and subsequently eastward, coinciding with the Holocene Climatic Optimum and the Xerothermic period of grassland invasion. If this pattern of dispersal is apparent, phylogenetic analyses will show eastern populations to be the most derived.

0113 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Abdul Rahim², Ahmed Khan¹

¹Salahif, Muscat, Oman, ²University of Karachi, Karachi, Pakistan

Conservation Status and Tagging Programs of Green Turtles on the Makran Coast at Daran Beach, Jiwani, Pakistan

The population of sea turtles in Pakistan coast are decreasing year by year due to poaching, incidental catch by the fishing gears like illegal way of fishing (bottom Trawlers), non use of TED in fishing trawlers, degradation of feeding grounds and erosion of nesting beaches. The WWF-Pakistan Wetlands Program (PWP) started conservation and management activities of sea turtle around 2007 to 2010, trained the coastal community for flippers tagging of sea turtles at Daran Village, Jiwani. The tagging revealed the mystery of migrations and the location of foraging areas of sea turtles in Pakistani coast. Green turtle can nest at Daran beach but for feeding purposes it migrate to Oman, Iran and other neighboring countries. For the conservation of sea turtles, PWP is working with Daran Wetlands Village Conservation Community since 2007. The turtle nesting was recorded from 2007 to 2010 and total number of hatchlings which emerged was 8261, 16177 eggs were recorded and 2580 nests were protected. The site team mounted eight satellite transmitters and carried out a flipper tagging program on green turtles at Daran beach. Local community members have tagged more than fifty marine turtles. The Daran people got trained for protection of turtle nests in their natural condition by putting wire mesh enclosures around them and later release the hatchlings. Pakistan wetlands Program also introduced the

alternate energy model (Solar and Wind) for Daran community and running community primary school as community development initiatives.

0418 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Shahriar Rahman¹, Alexandra Kanonik², Russell Burke²

¹*Brooklyn College City University of New York, Brooklyn, New York, United States,*

²*Hofstra University, Hempstead, New York, United States*

Evaluating Nest Protectors for Turtle Conservation: Unintended Consequences for the *Malaclemys terrapin* Hatchlings?

Turtles are declining all over the world at alarming rates, and nest predation is one of the common threats to many species. Many conservationists depend on nest protectors/nest predator excluders to protect nests from predation. Various nest protector designs are used (e.g. wire mesh cages, plastic cages) and most of them are very successful against nest predators (e.g. raccoons, fox, crows, feral dogs). However, there are potentially negative impacts of nest protectors. Standard nest protectors may affect the incubation temperature of turtle eggs, which is potentially important because embryological development can be profoundly influenced by incubation temperature. Even a subtle change in incubation temperature caused by nest protectors can affect the sex ratio, growth, development, behavior and fitness of turtle hatchlings. In summer of 2009, I conducted an experiment at Jamaica Bay, New York, evaluating nest protectors of three different designs. I located 48 diamondback terrapin (*Malaclemys terrapin*) nests and reburied them in pairs. In each pair one nest was protected and other was left uncovered. Miniature temperature loggers were placed in all of the nests to record temperature for every hour June to August. Loggers were recovered in the fall and all the hatchlings were measured. Initial results indicate a significant difference in incubation temperature between the nests with metal box protectors and nest without protectors. The study will be continued in the summer of 2010 with larger sample.

0574 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Jason Ramsay, Cheryl Wilga

University of Rhode Island, Kingston, RI, United States

Function of the Jaw Adductor Muscles During Suction and Biting in Bamboo Sharks

The preorbitalis (PO) of orectolobiform sharks, such as white-spotted bamboo sharks *Chiloscyllium plagiosum*, interconnects the cranium and lower jaw and is thought to assist

the quadratomandibularis (QM) during jaw adduction by elevating the lower jaw during the compressive phase of feeding. However, the hyoidmandibular ligament in *C. plagiosum*, present in most Orectolobiformes, couples lower jaw and hyoid depression, yet constrains PO function. Elevation of the lower jaw also elevates the hyoid due to the ligament connection, and may result in backflow of water and prey in the buccal cavity during the compressive phase. Hyoid, upper and lower jaw kinematics, fascicle shortening and motor activity in the QM and PO and buccal pressure were recorded simultaneously during suction capture and processing bites. During suction capture, active PO shortening begins after jaw closure simultaneously with the onset of hyoid elevation. During biting, active QM and PO shortening begins at peak gape and coincides with jaw closure. Jaw closure during suction capture is entirely due to upper jaw protrusion actuated by the QM while the PO elevates the jaws and indirectly elevates the hyoid during the recovery phase as water is expelled through the gill slits. During a bite, the PO functions in jaw closure contributing to a more forceful bite. All orectolobiform species use suction to capture prey, yet not all feed on hard or tough prey, indicating that PO function in this group may have evolved in response to suction feeding, while modulation of PO function allowed a semi-durophagous lifestyle.

0707 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Daniel Reeves, Rebeka Rand Merson

Rhode Island College, Providence, RI, United States

Developmental Expression of AHR in the Little Skate

An orphan receptor, the aryl hydrocarbon receptor (AHR) appears to play regulatory roles in numerous biological functions. Compelling evidence for roles of AHR in regulating cell differentiation and vascular architecture is demonstrated in mammals. We are developing approaches to use individual AHR genes of elasmobranchs to tease apart the numerous functions of the one mammalian AHR. To better understand the AHR's role in embryonic development, we are using the little skate (*Leucoraja erinacea*) model. Developmental expression of AHR was assessed using in situ hybridization with specific probes for AHR in whole skate embryos at several stages. Increasing our knowledge of the function of AHR in skates will further our ability to study the roles of the human AHR itself, and advance understanding of the role of AHR in development and teratogenesis. Supported by RI-INBRE grant P20RR-016457 from the National Institutes of Health National Center for Research Resources (NCRR), and a MDIBL New Investigator Award funded by ME-INBRE (P20RR-016463) and the NIEHS Center for Membrane Toxicity Studies (P30ES-00382820).

0661 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Peter Reinthal

University of Arizona, Tucson, AZ, United States

Integrating Ecological and Contaminant Studies Using Radiogenic and Stable Isotopes: Case Studies of Lead Contamination in Aravaipa Creek, Arizona and Paleocological Conditions in Lake Malawi, Africa

John Lundberg was instrumental in stimulating new areas of ichthyology research by promoting the integration of various disciplines, especially systematics with ecological, developmental, functional and evolutionary studies as evident from the diverse array of studies presented in this symposium. Here we integrate fossil and isotopic analyses for forensic contaminant and palaeoecological studies. In fishes from Aravaipa Creek, high-precision isotopic analyses of lead (^{208}Pb , ^{207}Pb , and ^{206}Pb) are incorporated with ecological data to determine levels, sources and mechanisms of lead contamination in desert fishes and invertebrates and (2) stable isotopes of carbon ($\delta^{13}\text{C}$ ‰) and nitrogen ($\delta^{15}\text{N}$ ‰) to determine trophic interactions and mechanisms of bioaccumulation and paleoecological conditions. In some species, extremely high levels of lead contamination are determined and the source and transport mechanism of heavy metal accumulation are different than previously reported. In Cyprinididae and Cichlidae fossils taken from Lake Malawi sediment cores, stable isotopes of carbon ($\delta^{13}\text{C}$ ‰) are used to determine fluctuations in pelagic and benthic conditions in the previous 100,000 years.

0085 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Roberto Reis¹, Christian Cramer¹, Edson Pereira¹, Pablo Lehmann²

¹PUCRS, Porto Alegre/RS, Brazil, ²Unisinos, São Leopoldo/RS, Brazil

A Total Evidence Phylogeny of the Neoplecostomine and Hypoptopomatine Armored Catfishes

The Neotropical loricariid catfishes have received a great deal of interest by systematists in the last two decades. In this study we combined a 303 character morphological data matrix of the Neoplecostominae with a 169 character morphological data matrix of the Hypoptopomatinae and a 2634 basepairs matrix (fragments of COI, RAG1, and RAG2) of both subfamilies. We included all described species of neoplecostomines, most species of hypoptopomatines, several loricariids from five other subfamilies, totaling 207 species and 53 loricariid genera, in addition to 10 loricarioid outgroup species, to obtain the largest catfish phylogeny produced so far, and the first total evidence hypothesis of the loricariids. Maximum parsimony analyses using "new technology" search strategies were used to seek a solution for the partial contradictory results of previous solely

morphological or molecular analyses. We found 150 maximally parsimonious trees (11,135 steps, CI=0.28) and used strict consensus to summarize our hypotheses and Bremer support as a branch support measure. Our results show the Delturinae as the sister-group of all other loricariids except of *Lithogenes*, Loricariinae and Hypostominae as successive sister-taxa of the Neoplecostominae plus Hypoptopomatinae, which were recovered as monophyletic sister taxa to each other. All previously described genera of the Neoplecostominae were recovered as monophyletic and an interesting biogeographic pattern was revealed for *Pareiorhaphis*. Concordant with previous molecular analyses but also quite surprising, the genus *Pseudotocinclus* was recovered among the Neoplecostominae. As expected, *Parotocinclus* was found to be highly polyphyletic and will have to be split in several monophyletic genera.

0091 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Marcie K. Reiter, Carl D. Anthony, Cari-Ann M. Hickerson

John Carroll University, University Heights, Ohio, United States

Differential Territorial Behavior Between the Color Morphs of *Plethodon cinereus*

The red-backed salamander, *Plethodon cinereus*, is a polymorphic species that has served as a model organism in behavioral and ecological studies. Recent work suggests that the two most abundant color morphs, the unstriped and striped, are diverging on certain niche dimensions. Although many studies indicate that red-backed salamanders are territorial, nothing is known about possible differences that may exist in territorial behavior between the two common color morphs. Here we used striped and unstriped *P. cinereus* to examine potential variation in territorial behavior in laboratory encounters. Residents of each morph were paired with the same color morph, a different color morph, and a control. We detected no difference in behavior between unstriped and striped salamanders. The behavior of residents and intruders was as expected in the context of territoriality theory. Residents spent significantly more time in aggressive behaviors and intruders spent more time in submissive behaviors. We also examined potential for differential homing behavior between the two morphs. We marked unstriped (n=50) and striped (n=49) salamanders and displaced them 5m from the naturally occurring cover object they were found under. Of the 99 salamanders originally displaced, eight (seven unstriped and one striped) were recaptured. Unstriped salamanders homed to covers object more frequently than striped salamanders. We also found that newly captured salamanders were notably smaller than the originally displaced individuals. Although there is some evidence that the two morphs differ in their diet, mate choice, and habitat preference, our data do not indicate differences in their territorial behavior.

0223 Herp Conservation I, 556 AB, Thursday 8 July 2010

Rick Relyea

University of Pittsburgh, Pittsburgh, PA, United States

New Effects of Roundup® on Amphibians: Predation, Stratification, and Induction of Tadpole Morphology

To understand the impacts of anthropogenic chemicals on natural communities, we often must base our predictions on short-term, single-species tests that are conducted as part of the regulation process. While a valuable first-step, these tests tell us little about the impacts of contaminants under more natural conditions including the presence of natural stressors. Among the many natural stressors, predator stress is a common one whose interactions with pesticides have only been examined under laboratory conditions. Using two mesocosm experiments, I examined how predation stress interacted with the effects of Roundup®, the most widely applied herbicide in the world. The first experiment (conducted with three spring-breeding species of anurans) crossed four concentrations of Roundup with the presence of no predators, caged adult newts, or caged dragonfly larvae. The herbicide had interactive effects on tadpole survival and growth. The cues from caged dragonflies induced adaptive morphological changes in the tadpoles. Surprisingly, the herbicide induced the same morphological changes in the tadpoles. The second experiment (conducted with three species of summer-breeding anurans) crossed four concentrations of Roundup with the presence of no predators, caged dragonfly larvae, or lethal dragonfly larvae. The herbicide and predator treatments again had interactive effects on tadpole survival and growth. Moreover, the morphology of the tadpoles was again induced similarly by caged dragonflies and the herbicide. Collectively, these results suggest that the effects of Roundup on larval amphibians can differ tremendously depending on community context. Moreover, for reasons that are unclear, the herbicide is able to induce anti-predator responses.

0719 AES Stress Symposium II, 551 AB, Sunday 11 July 2010

Gillian M. C. Renshaw

Hypoxia and Ischemia Research Unit, Griffith University, Queensland, Australia, Australia

Assessing Oxidative Stress in Sharks and Rays

Hypoxia and reoxygenation usually triggers an increase in the formation of reactive oxygen species (ROS) by mitochondria, which is greatest during the reoxygenation phase. While the mismatch between ROS production and antioxidant defence results in oxidative stress, the down stream effects of increased ROS production range from lipid

peroxidation to the initiation of cell death. The giant shovel nose ray (*Glaucostegus typus*) and the epaulette shark (*Hemiscyllium ocellatum*) can live in habitats characterised by intermittently variable oxygen levels yet their tolerance to hypoxia is markedly different, *Hemiscyllium ocellatum* can tolerate anoxia while *Glaucostegus typus* can not. The level of lipid peroxidation and the ratio of oxidised versus reduced glutathione was measured in both species after a single standardised exposure to 5% of normal saturation that represented a maximal challenge.

0442 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Eric Reyier¹, Debra Abercrombie², Erick Ault³, George Burgess⁴, Demian Chapman², Jynessa Dutka-Gianelli³, Bryan Franks⁵, Samuel Gruber⁵, Johanna Imhoff⁴, Zack Jud⁶, Steven Kessel⁵, Craig Layman⁶, Ron Taylor³, Jim Whittington³, Joy Young³

¹Kennedy Space Center Ecological Program / IHA Environmental Services, Kennedy Space Center, Florida, United States, ²Stony Brook University, Stony Brook, New York, United States, ³Florida Fish & Wildlife Conservation Commission, Tequesta, Florida, United States, ⁴Florida Program for Shark Research / University of Florida, Gainesville, Florida, United States, ⁵Bimini Biological Field Station, Bimini, Bahamas, ⁶Florida International University, North Miami, Florida, United States

An Introduction to the Florida Atlantic Coast Telemetry (F.A.C.T.) Array

Understanding how and why animals move through their environment is central to resolving their role within a given ecosystem and a necessary step for crafting sound management strategies for exploited and imperiled species. Continued advances in low cost, scalable autonomous acoustic telemetry systems have greatly enhanced the ability to study the movement patterns and habitat selection of aquatic animals over large geographic areas and multi-year time scales. One example of this is the Florida Atlantic Coast Telemetry (F.A.C.T.) Array, a collaborative partnership of the Florida Fish & Wildlife Conservation Commission, Bimini Biological Field Station and University of Miami, Florida Program for Shark Research, Kennedy Space Center Ecological Program, and Florida International University. Now spanning a 300 km stretch of the east Florida coast, the F.A.C.T. Array consists of 170 VEMCO VR2 and VR2W autonomous receivers deployed across a continuum of coastal habitats from freshwater rivers and open estuarine waters of the Indian River Lagoon system to adjacent offshore reefs and wrecks. The array has proven to be highly capable of evaluating site fidelity, habitat preferences, seasonal migration patterns, and reproductive strategies of over a dozen of Florida's most valuable freshwater and estuarine sportfish and large coastal sharks, insights which will help guide future management efforts. Of equal importance, the FACT Array has improved communication among marine research organizations along the Florida east coast, spurring new collaborative life history studies of fishes which otherwise would have been logistically and financially prohibitive.

0435 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

Eric Reyier¹, Bryan Franks², Demian Chapman³, Steven Kessel², Samuel Gruber²

¹*Kennedy Space Center Ecological Program / IHA Environmental Services, Kennedy Space Center, Florida, United States*, ²*Bimini Biological Field Station, Bimini, Bahamas*, ³*Stony Brook University, Stony Brook, New York, United States*

Site Fidelity and Seasonal Movement Patterns of Juvenile Lemon Sharks in an Open Ocean Nursery at Cape Canaveral, Florida

For many coastal sharks, including the well studied lemon shark (*Negaprion brevirostris*), the geographic extent and temporal patterns of use in their winter nursery grounds remain poorly defined in most regions. Since 2003, we've documented large recurring winter aggregations of juvenile lemon sharks utilizing shallow surf zone habitats at Cape Canaveral, east-central Florida. To assess duration of residency within this open ocean nursery, as well as the timing of, and cues to, any coastal migrations, lemon sharks were implanted with acoustic transmitters in December 2008 (n = 9) and 2009 (n = 23). Fidelity to aggregation sites was monitored with up to 10 autonomous acoustic receivers while regional migrations were assessed via the Florida Atlantic Coast Telemetry (F.A.C.T.) Array, a network of 170 receivers spanning 300 km of the Florida east coast. Sharks released in December 2008 were regularly detected locally for up to 107 days. Five individuals were subsequently recorded on F.A.C.T. receivers 80 km north, confirming a northward spring migration as rapid as 18.1 km day⁻¹. Behavior differed somewhat for 2009 releases with many sharks migrating south as far as West Palm Beach (190 km), apparently in response to a prolonged period of below average water temperature. Unexpectedly, 18 adult lemon sharks originally tagged from aggregations near Jupiter, Florida (175 km south) were also detected at Cape Canaveral in spring 2009 providing a putative connection between these two groups. Continued tracking over the coming year coupled with ongoing genetic analyses will further clarify the strength of this relationship.

0081 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556 AB, Friday 9 July 2010

R. Graham Reynolds¹, Glenn P. Gerber²

¹University of Tennessee, Knoxville, TN, United States, ²Zoological Society of San Diego, San Diego, CA, United States

Ecology, Genetics, and Conservation of the Turks Island Boa (*Epicrates c. chrysogaster*)

The genus *Epicrates* is composed of nine species of boid snakes in the West Indies. Little is known about the Turks Island Boa (*E. chrysogaster chrysogaster*) a subspecies of the Southern Bahamas Boa endemic to the Turks and Caicos Islands, for which no published ecological, genetic, or conservation studies exist. Here we report on the first multi-year ecological study of the Turks Island Boa, focusing on an important population located on the small island of Big Ambergris Cay. One hundred and seventy eight captures were made over three trips to the Turks and Caicos in 2007, 2008 and 2009. We report on basic natural history information including size, coloration, body temperature, abundance, diet, foraging, and diurnal refuge selection; as well as clarify the known distribution and conservation concerns of this species. We also investigated genetic variation across the Turks and Caicos Banks using a 617 bp fragment of the mitochondrial marker Cytochrome B gene. Bayesian inference and maximum likelihood resulted in single consensus trees with identical topologies. Shallow branch lengths indicate recent divergence in this species, contrary to studies of other Turks and Caicos herpetofauna. A long history of human habitation, greatly exacerbated by exponentially increasing development in the last several decades, may be threatening the remaining populations of these boas, and this study fills a significant gap in knowledge of the biology of this species.

0082 Poster Session I, Exhibit Hall D, Friday 9 July 2010

R. Graham Reynolds¹, Nell A. Koneczny²

¹University of Tennessee, Knoxville, TN, United States, ²Maryville High School, Maryville, TN, United States

Molecular Divergence in Two Species of Dwarf Geckoes from the Turks and Caicos Islands

The dwarf geckoes (*Sphaerodactylus*) of the West Indies have undergone a tremendous radiation comparable to that of the well-known *Anolis* lizards. We investigated the divergence between two species of dwarf geckoes, *S. underwoodi* and *S. caicosensis*, endemic to the Turks and Caicos banks (respectively) of the southern Bahamian

Archipelago using an 863 bp fragment of the mitochondrial marker ND2 gene. These banks have been isolated from each other since their emergence above the Bahamas Platform in the Pleistocene, though islands on each bank have been alternately connected and isolated with fluctuating sea levels. Pairwise distance analysis revealed 10.9% corrected sequence divergence between the two species, corresponding to an estimated divergence time of between 5.5 - 8.4 Ma. Bayesian inference and maximum likelihood resulted in single consensus trees with identical topologies. Contrary to expectation, *S. underwoodi* is a clade nested within *S. caicosensis*, and *S. caicosensis* shows as much divergence as might be expected between different species. AMOVA results agreed with the partitioning between banks, and revealed some divergence on each bank. Our results indicate a great deal of mitochondrial divergence among dwarf geckoes in the Turks and Caicos, and that the possibility exists that current nomenclature does not fully describe the relationships of these geckoes. We also find support for previous research, showing that divergence times between geographically proximate dwarf geckoes in both the Greater and Lesser Antilles greatly predate the formation of the islands that currently encompass their range.

0664 Herp Morphology, 556 AB, Sunday 11 July 2010

Justin Rheubert, David Sever

Southeastern Louisiana University, Hammond, Louisiana, United States

Reproductive Morphology of *Hemidactylus turcicus*

The reproductive system of the Mediterranean Gecko, *Hemidactylus turcicus*, from southeastern Louisiana was investigated to determine the ultrastructural characters of the testis, efferent ducts, and kidneys. The active reproductive system is from December through September. Mature spermatozoa are released into the lumen of the seminiferous tubules and travel through a single rete testis that is composed of a simple squamous epithelium with labyrinthine intercellular canaliculi. Data suggest that the rete testis is involved in the absorption of luminal fluid and break down of molecules. The rete testis diverges into three to four ductuli efferentes that consist of ciliated and non-ciliated cells. Widened intercellular canaliculi are found within the ductuli efferentes suggesting absorptive activities. However, the non-ciliated cells do contain secretory granules suggesting an absorptive and secretory function for the ductuli efferentes. All tubes making up the ductuli efferentes empty into the epididymis. The epididymis consists of a tall columnar epithelium consisting of principal cells and basal cells. Basal cells are rarely observed except in the spermatogenically inactive months. Dense amount of secretory granules are found within the epithelial cells, and the epididymis is the location where the sperm mass stains positively for proteins and carbohydrates. From Bowman's capsule the kidney has proximal and distal convoluted tubules and the collecting duct. The posterior portions of the collecting duct are the only region that participate in the renal sexual segment. The sexual segment consists of a columnar epithelium with numerous Golgi complexes and dense secretory granules.

0254 Fish Life History, 551 AB, Friday 9 July 2010

Filipe Ribeiro¹, Edward Hale², Todd Clardy¹, Alison Deary¹, Eric J. Hilton¹, Timothy E. Targett², Jonh E. Olney¹

¹Virginia Institute of Marine Sciences, Gloucester Pt, VA, United States, ²University of Delaware, School of Marine Science and Policy, Lewes, DE, United States

Patterns of Early Life Stage Fish Ingress into Chesapeake and Delaware Bay

Many fishes, such as Atlantic Menhaden, Atlantic Croaker, Summer Flounder, and American Eel, are estuary-dependent, relying on species-specific transport mechanisms to reach nursery grounds in estuaries in the Mid-Atlantic Bight. These four species enter Chesapeake and Delaware Bay as larvae and early juveniles from fall to spring, through species-specific differences in spawning features (timing, location) and transport characteristics (swimming ability, body shape). We assessed differences in the timing and duration of ingress, patterns of density variation, and size distribution of these four species in both bays over three consecutive recruitment periods (Fall 2007 - Spring 2010). Early life history stage fishes were collected during weekly, night-time flood tides at shore-based stations in Chesapeake Bay (York River, VA) and Delaware Bay (Roosevelt Inlet, DE). All four species appeared earlier in the season and were observed later at Roosevelt Inlet compared to the York River, although considerable inter-annual variation was observed at both locations. Recruitment patterns of croaker, both fall- and winter-spawned cohorts of menhaden, and flounder showed differences in the strength of ingress and mean size between the sites over the three recruitment periods. Recruitment patterns for eel were more similar between the two bays, except for two large peaks (>50 individuals/1000m³) in recruitment at the York River during the 2007-2008 recruitment period. These patterns suggest species-specific and estuary-specific dynamics during the three recruitment seasons examined. We will discuss the ingress of these species and potential differences in their transport mechanisms through time based on these results.

0242 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Filipe Ribeiro¹, Tiago Navarro-Marques², Maria Filomena Magalhaes²

¹Virginia Institute of Marine Sciences, Gloucester Pt, VA, United States, ²Universidade de Lisboa, Faculdade de Ciências, Centro de Biologia Ambiental, Lisboa, Portugal

Life-history Variability of a Non-native Cichlid in the Guadiana Drainage: Predicting Invasion Success in Mediterranean Streams

Understanding the extent to which life-history traits are associated with fish invasions is a pressing ecological issue. The South American chameleon cichlid *Australoheros facetus* is becoming a successful non-native fish in Mediterranean streams in the Iberian Peninsula. In this study, we quantified seven life-history traits for three populations of the chameleon cichlid in the lower Guadiana Drainage exhibiting different degrees of success. Specifically, chameleon cichlid is rare in the Guadiana mainstream but increasingly abundant in the tributaries Vascão and Ardila rivers. Reproductive traits, such as size at maturity and duration of reproductive season, were similar among populations, but there was considerable variation in fish longevity, age, and growth. Fish aged 4+ occurred in the Guadiana mainstream, but longevity was only 3+ in the tributaries. Growth rates considerably differ between three populations, with Guadiana fish attaining maturity size faster than the fish present in the tributaries. Taken together, these results highlighted that adaptation to local conditions may indeed play a role in invasion success. However, the chameleon cichlid showed higher plasticity in growth than reproduction traits, contrary to what has been found in pumpkinseed sunfish (*Lepomis gibbosus*) a very successful invader in the Guadiana drainage. The extent to which this may contribute to explain the success of invasive vs. noninvasive introduced species in Mediterranean streams is discussed.

0609 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Aaron N. Rice, Peter J. Dugan, Janelle L. Morano, Christopher W. Clark

Cornell University, Ithaca, NY, United States

Acoustic Ecology of Black Drum (Sciaenidae: *Pogonias cromis*): Understanding Population-level Vocal Behavior and Responses to Anthropogenic Noise Using Automated Sound Detection

Sciaenids (including drum, croakers, and weakfish) are among the best-studied groups of sonic fishes. As such, they offer the opportunity to serve as a model system for fish bioacoustics, furthering the discipline for how scientists understand the role of sounds in fish behavior and ecology. Black drum produce a highly stereotyped frequency-modulated harmonic call during courtship behaviors, which is easily detectable in

spectrographic analysis. We analyzed over 20,000 hours of archival recordings (recorded in winter 2006-2007) from 12 continuously recording hydrophone units deployed off coastal Georgia for the occurrence of black drum vocalizations. Black drum produced calls in varying abundance ranging from less than one per hour to enormous choruses with thousands of calls per hour. To quantify these large numbers of calls, we developed a multi-stage detection algorithm consisting of detection, feature extraction and classification by artificial neural network, which automatically discriminated between black drum calls (true positives) and noise signals (false positives). In Georgia waters, black drum choruses last upwards of 8-10 hours per day, and are one of the dominant features of the marine acoustic landscape. In the presence of increased noise from ship traffic, black drum appeared to decrease their calling rates, and then increase calling once the ship noise decreased. Combining black drum vocalizations with state-of-the art signal processing techniques (as currently used in whale passive acoustic monitoring) now allows for a more detailed understanding of fish bioacoustics across large temporal and spatial scales.

**0674 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010; ASIH
STOYE AWARD ECOLOGY & ETHOLOGY**

Jonathan Richardson

Yale University, New Haven, CT, United States

**Fine-scale Adaptive Divergence of Wood Frog Populations (*Rana sylvatica*) in
Response to Habitat-mediated Selection**

There is increasing evidence that adaptive divergence among wildlife populations can occur over fine spatial and temporal scales. While much of the research into adaptive potential of populations has come from a few model systems, there are also data indicating that amphibians are capable of fine-scale evolution. In this study, I estimated the phenotypic divergence among populations of the wood frog (*Rana sylvatica*) that inhabit seasonal ponds. I performed a field-based reciprocal transplant experiment between pairs of neighboring open and closed-canopy ponds – pond types that present different selection pressures for amphibians. I evaluated the growth and development of larval wood frogs in both their natal and introduced habitats. Additionally, I used genetic assays to estimate divergence among the focal populations. I found strong evidence of phenotypic divergence between ponds of dissimilar canopy cover. Wood frog larvae originating from closed-canopy ponds were 27% heavier, 10% longer and developed faster than those originating from open-canopy ponds. These experimental results indicate that wood frog populations can diverge phenotypically over very small geographic scales. However, the genetic data show little genetic differentiation between populations within each pair. This could indicate that selection is intense and populations are able to diverge phenotypically in spite of high gene flow. Alternatively, these findings may suggest that adaptive divergence can occur quite rapidly as canopy

coverage changes over time, and that the genetic markers used in this study do not diverge at the same rate as the phenotypic traits under direct selection.

0400 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Max Ringler, Eva Ursprung

University of Vienna, Department of Evolutionary Biology, Vienna, Austria

A Low-cost Acoustic Location System to Analyse Individual Calling Activity in a Population of *Allobates femoralis* (Aromobatidae)

Territoriality of one or both sexes plays a vital role in the reproductive behaviour of Neotropical poison frogs and their relatives (Dendrobatoidea). In the pan-Amazonian species *Allobates femoralis* (Aromobatidae) males announce their all-purpose territories with distinct calls which also serve to attract females. The ability to monitor and analyse the individual calling activity and the acoustic interactions of several males is essential for the investigation of correlates of female mate choice and male reproductive success in this species. We used a flexible, low-cost system, employing off-the-shelf hardware and open source software to record the calling activity in a community of vocalizing males and to infer their calling positions through a TDOA (time difference of arrival) analysis of their calls. The hardware part of the system consists of an outdoor-laptop (Panasonic Toughbook), a bus-powered 6-channel audio-USB interface (Emagic A62m) and omni-directional microphones (Sennheiser ME62). For simultaneous 6-channel recordings we used the audio recording and editing software Audacity 1.3.11 (<http://audacity.sourceforge.net>). The dynamic mathematics software Geogebra 3.2 (<http://www.geogebra.org>) was used for geometrical multilateration of the positions of callers by intersecting hyperbolas resulting from TDOA calculations.

0493 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Gilson Rivas¹, Robert Jadin², Tito Barros¹, Eric Smith³

¹*Museo de Biología, Facultad Experimental de Ciencias, La Universidad del Zulia, Apartado Postal 526, Maracaibo 4011, Estado Zulia, Venezuela,* ²*Department of Ecology and Evolutionary Biology, University of Colorado at Boulder, Boulder, CO 80309, United States,* ³*Amphibian and Reptile Diversity Research Center and Department of Biology, University of Texas at Arlington, Arlington, TX 76019, United States*

Notes on the Geographic Distribution, Taxonomy and Natural History of *Dipsas pratti* Boulenger 1897 (Squamata: Dipsadidae)

In recent years, research on the taxonomy and systematics of South American snail-eating snakes of the genus *Dipsas* has increased considerably. However, many secretive species from northern South America remain poorly studied and knowledge of their behavior and natural history is still lacking. One of these snakes, *Dipsas pratti*, has a troubled taxonomic history complicated by the lack of natural history information about the species. After the description of *D. pratti* in 1897 four species of *Dipsas* were described and later determined to be ontogenetic variants of the species and therefore all synonymized. Although *D. pratti* has been labeled as the type species for a group, it is known in the literature from not more than ten specimens. At present, this species is only known from the Cordillera Central and Cordillera Oriental of Colombia. Here, we redescribe this species based on six specimens from Venezuela, the holotype, a cotype, and two additional Colombian specimens. The Venezuelan specimens were collected in the Sierra de Perijá, Zulia state, ca. 1600 m elev. These specimens represent the first records for Venezuela and the northern most localities for the species, extending the known range approximately ca. 300 km northeast from the nearest locality in the Cordillera Oriental of Colombia. Our data increase considerably the knowledge of this secretive snake and call attention to the discovery of many species, which inhabit regions poorly studied because of conflicts in unstable political borders of Colombia and Venezuela.

0509 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Gilson Rivas¹, Pedro M. S. Nunes², James Dixon³, Walter Schargel⁴, Tito Barros¹, Edward Camargo⁵, César Barrio-Amorós⁶

¹Museo de Biología, Facultad Experimental de Ciencias, La Universidad del Zulia, Maracaibo, Estado Zulia, Venezuela, ²Departamento de Zoología, Instituto de Biociências, Universidade de São Paulo, São Paulo, SP, Brazil, ³Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Texas 77843, United States, ⁴Department of Biology, The University of Texas at Arlington, Arlington, Texas 76019, United States, ⁵Museo de la Estación Biológica de Rancho Grande, Ministerio del Poder Popular para el Ambiente, El Limón, Estado Aragua, Venezuela, ⁶Fundación Andígena, Mérida, Venezuela, Venezuela

Distribution, Taxonomy, Hemipenial Morphology and Natural History of Two Poorly Known Species of *Anadia* (Gymnophthalmidae): *A. pariaensis* Rivas, La Marca and Oliveros 1999, and *A. steyeri* Nieden 1914

The microteiid genus *Anadia* currently contains 17 species with a collective distribution ranging from Costa Rica south to Pacific Ecuador and from Western Colombia to Eastern Venezuela. However and in spite of that many of the species are relatively well known, some of them are particularly rare, especially two Venezuelan species. One of these is *Anadia pariaensis*, described based in a sub adult male and until recently, the single specimen known, which was collected in the Peninsula de Paria, northeastern Venezuela. Another poorly known species is *A. steyeri*, known at mid altitudes in the Venezuelan Cordillera de la Costa and Sistema Lara-Falcón, with only four specimens reported in the literature since almost a century old. Herein we present new taxonomic data of both species, including the hemipenial morphology and remarks on natural history, based in a new specimen of *A. pariaensis* as a well as five new specimens of *A. steyeri*. The discovery and analyzes of those specimens increases substantially the taxonomy and systematic knowledge of both species. Despite both species presents some similar morphological characteristics, the examination of the hemipenes revealed very different organs. The hemipenis of *A. steyeri*, present some characteristics that resembles the organs of two species from Santa Marta Mountain of “*bitaeniata*-group” (*A. pulchella* and *A. altaserrania*). On the other hand, the hemipenes of *A. pariaensis* is unique within the genus, presenting exclusive and incomparable characteristics that will not allow us to allocate it in any of the groups proposed.

0011 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

J. Dale Roberts

University of Western Australia, Nedlands, Western Australia, Australia

Sperm Competition and Testis Mass Evolution: Intraspecific Tests in the Australian Frog *Crinia georgiana*

Mating behaviours consistent with the occurrence of polyandry, multiple males with a single female, have been reported in at least eight frog families: e.g. rhacophorids from Africa and Asia, Australian myobatrachids and phyllomedusine frogs from Central America. Genetic data on the outcomes of polyandrous matings are rare but limited data from surveys of egg masses and direct analysis of particular matings both suggest multiple-male amplexus leads to multiple paternity. Consequently polyandrous mating systems are subject to sperm competition. Comparative studies of testis mass across species of myobatrachid frogs have shown that sperm competition favours the evolution of larger testes and longer sperm assuming male proximity is a proxy for risk of sperm competition. We report an intraspecific test of these outcomes using the quacking frog, *Crinia georgiana*. We assigned parentage using 4 microsatellite markers and the program Gerud. We sampled egg masses in 10 populations and scored rates of polyandry for 4 - 13 egg clutches per site excluding clutches with > 1 mother. Our data show two critical results: i) rates of polyandry and male density are positively correlated ii) rates of polyandry and testis mass are also positively correlated. Between population variation in testis form is consistent with predictions of sperm competition theory and with previous cross-species analyses of sperm and testis evolution in myobatrachid frogs.

0660 Fish Systematics I, Ballroom D, Monday 12 July 2010

Luiz Rocha

University of Texas at Austin, Port Aransas, TX, United States

Genic Speciation and the Accuracy of the Molecular Clock

The genic view of speciation (GVS) states that speciation is driven by processes at the gene (not the individual) level, that genomes are not cohesive, but porous, and that gene flow during speciation is possible. According to the GVS, under a speciation with gene flow scenario, the genes that promote reproductive isolation and those that are influenced by disruptive selection should start diverging first, whereas neutral genes should flow freely between emerging species, generating a characteristic heterogeneity of genetic divergences among different regions of the genome. When speciation is driven entirely by isolation, the genomes of the incipient species should behave as a cohesive unit, and all genes should start diverging at approximately the same time. Thus, the GVS predicts that speciation with gene flow leaves a distinct and unique

genomic signature that can be differentiated from that of allopatric speciation. This observation has profound effects on the way we calculate divergence times using the molecular clock. Since most molecular clocks are calibrated by geological events that caused allopatric speciation (e.g.: the closure of the Isthmus of Panama), their application should be limited to speciation events that follow strict allopatric patterns. Here I identify three cases in which there is a large discrepancy between mtDNA and nuclear DNA divergences in species pairs separated by the Isthmus of Panama versus pairs where speciation with gene flow is likely to have occurred, what indicates that generalizations made applying molecular clocks calibrated using allopatric speciation events should be revisited.

0519 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Luiz Rocha, Moises Bernal, William Ludd

University of Texas at Austin, Port Aransas, TX, United States

Molecules and Morphology Indicate Speciation by Hybridization in a Marine Fish

Mechanisms that lead to speciation remain among the most debated topics in evolutionary biology, and sympatric speciation is especially difficult to demonstrate in nature. Because of their peculiar biogeography and their ability to produce sounds, fishes of the genus *Haemulon* serve as a great subject for tests of speciation hypotheses. Collectively known as grunts, the genus is comprised of 19 nominal species. Aiming to elucidate the phylogenetic relationships among the species of *Haemulon*, a combined total of ~2,000 base pairs from two mitochondrial genes (cytochrome b and cytochrome oxidase I), and two nuclear loci (TMO-4C4 and RAG2) were obtained from all nominal species. The closure of the Isthmus of Panama seems to have played a role in the diversification of *Haemulon*, however, many sister species pairs have completely overlapping geographical distributions, indicating that vicariance is not the only process driving speciation in this genus. Our data also indicates that the species *H. carbonarium* seems to have originated through a hybridization event between *H. macrostomum* and *H. flavolineatum*. These three species form a strongly supported group in the phylogeny, however, mtDNA groups *H. carbonarium* with *H. macrostomum*, whereas nuclear DNA groups *H. carbonarium* with *H. flavolineatum*. A detailed morphological analysis shows that many morphological characters in *H. carbonarium* are intermediate between *H. macrostomum* and *H. flavolineatum*, indicating a probable hybrid origin for *H. carbonarium*. If supported by additional ongoing high throughput genomic analyses, this will be the first case of sympatric speciation by hybridization in a vertebrate animal.

0225 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Marcelo Rocha

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

Recent Advances in Pimelodidae Systematics

For a long time, the catfish family Pimelodidae had been composed of a group of catfishes without any known synapomorphy. This family also used to include integrants of the currently monophyletic Heptapteridae and Pseudopimelodidae; however the recognition of the Pimelodidae, as currently defined, was gradual. Nowadays the Pimelodidae comprises 30 valid genera containing around 100 described species. Some monophyletic groups within the family have been recognized in recent years. The group with the greatest number of species, and probably with the most problematic taxonomy is the Pimelodus group, comprising 11 genera and more than 30 species in the genus *Pimelodus*. The phylogenetic status of *Pimelodus* is dubious, and until today, no synapomorphy is known for its species. Species of *Pimelodus* are very widespread throughout the Neotropical region, and also present a great diversity of shape and color variation, making their taxonomic study challenging. Moreover, some taxa within the Pimelodus group are still poorly known, and only recently some of them have been studied in more detail, like *Bagropsis*, *Duopalatinus*, *Bergiaria* and some *Pimelodus* species. This group still includes the most recent species and genera discovered and described, and many small undescribed species, mainly from the deep water of the Amazon River. Recent collaborative work between South and North American researchers have increased the knowledge about these catfishes, and brought new insights into their relationships.

0258 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Gordon H. Rodda, Catherine S. Jarnevich, Robert N. Reed

USGS Fort Collins Science Center, Fort Collins CO, United States

The Seduction of MaxEnt: Challenges in Identifying Sites Climatically Matched to the Native Ranges of Animal Invaders

Maximum entropy (MaxEnt) species distribution models are increasingly used to characterize a species' native range climate, so as to identify sites elsewhere in the world that may be climatically similar and therefore at risk of invasion by the species. A recent MaxEnt model of Indian Pythons (*Python molurus*) by Pyron et al. (2008) used this approach to reject the findings of our (Rodda et al. 2009) rule-based model identifying US sites at risk of invasion by the python. We re-analyzed the Pyron et al dataset in MaxEnt and concluded that their approach was inappropriate for extrapolating fundamental climate suitability to another part of the world. MaxEnt invoked minimal

protections against data dredging, multi-collinearity of explanatory axes, and overfitting. MaxEnt endeavored to identify a single ideal climate, whereas our rule-based method allowed different climatic considerations to determine range boundaries in different parts of the native range. MaxEnt was extremely sensitive to choice of pseudo-absences for the python, with radically different portions of the US identified as suitable depending on the area from which pseudo-absences were drawn. MaxEnt was also extremely sensitive to choice of presence points: inclusion of just four erroneous localities in the Pyron et al dataset was responsible for their conclusion that a very small area of Florida is at risk of python invasion. The observed MaxEnt model instability and lack of statistical protections against overfitting, multi-collinearity, and data dredging may combine with a failure to distinguish fundamental from realized climate envelopes to produce models of limited utility.

0181 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; NIA BEST STUDENT POSTER AWARD

Renato M. Romero¹, Lilian Casatti¹, José Sabino²

¹Unesp, São José do Rio Preto, Brazil, ²Universidade Anhanguera-Uniderp, Campo Grande, Brazil

Stream Fish Fauna Structure in Three Basins of the Brazilian "Cerrado"

The fish assemblage structure in 19 streams of the Paraguay (PG), Paraná (PN) and São Francisco (SF) basins was evaluated with the objective to detect seasonal (dry x wet periods), conservation (more x less degraded) and environmental influences (hydrological, physicochemical, % of mesohabitat, ecotonal, and internal descriptors). Low similarity in species composition between pair of basins was registered (CBSPG-PN=0.14, CBSPN-SF=0.23, CBSSF-PG=0.11). Abundance was higher in PG (n=4674) than in PN (n=2486) and SF (n=2005) (ANOVA, p=0.02), with highest abundances in the dry season (p=0.01). Other quantitative measures like species richness, abundance and diversity index didn't vary in relation to conservation status nor between periods. Overall structure analysis (MDS with Cluster and ANOSIM) identified four groups of streams (p=0.001, R=0.819). Three groups represented by river basins with differences in conservation status (PG: p=0.001, R=0.305; PN: p=0.001, R=0.559; SF: p=0.001, R=0.451), but not in seasonality (p > 0.05). A fourth group (called "buritizal") is represented by streams with a specific physiognomy and fish fauna. No indicator species of conservative status was detected for PG or SF, but *Astyanax altiparanae* in PN was significantly related to degraded group (p=0.035). Canonical Correspondence Analysis revealed that streams and their fish fauna exhibited distinct features; PG streams had highest conductivity, flow and surface area; PN had highest turbidity, deep and % of runs; SF had highest % of pools, ecotonal and internal diversity. These results show that changes in environmental features presumably affect differently fish assemblage structures and, consequently, generalizations about these influences must be avoided.

0458 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Willem Roosenburg, Nick Smeenk

Ohio University, Athens, OH, United States

Comparison of Head-start and Wild Release Hatchlings from the Poplar Island Environmental Restoration Project

The Poplar Island Environmental Restoration Project is a > 400 hectare restoration project in Chesapeake Bay rebuilding Poplar Island, which had eroded and subsided to less than 4 hectares. Diamondback terrapins (*Malaclemys terrapin*) nest on sandy slopes of the perimeter dike and hatching success is high because raccoons and foxes have not colonized the island. Since 2004, approximately 200 hatchlings per year were distributed to elementary schools in Maryland where they over-winter and are head-started. Additionally, each year we catch and mark 1200 - 1500 natural hatchlings and release them at the time of emergence. Head-started animals reach sizes similar to those of 2 - 5 year old individuals from Chesapeake Bay. All animals are notch-coded and tagged with an internal binary coded wire tag. All head-started animals are also PIT tagged prior to their release in the following spring. In 2009, we initiated mark-recapture methods to recapture marked hatchlings. Recapture rates have been low but equal of both head-started and natural released animals. Among the head-started animals, we did not detect any advantage for large sized animals at the time of release. The findings of this study are preliminary and we anticipate including data from our 2010 field season.

0393 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Hannah Rosenblum, John Long, Marianne Porter

Vassar College, Poughkeepsie, NY, United States

Locomotor Kinematics of an Axially Undulating Batoid (*Narcine brasiliensis*)

Electric rays differ from other batoids because they do not appear to generate thrust using the body disc (modified pectoral fins), and instead use an axially undulating tail. In order to characterize this distinctive swimming mode and test the putative non-locomotor function of the disc, we examined 10 juvenile rays of the species *Narcine brasiliensis*. Using speed as a measure of performance, we tracked kinematic variables of the tail and body disc during axial undulation of the tail (straight swimming), and during gliding swimming (downward coasting). We predicted that the tail would be important for modulation of speed in straight swimming and that the disc would be important as the primary speed and distance modulator during gliding. However, stepwise linear regression showed that although tail features, especially tail beat frequency, were significant predictors of speed during undulation, disc pitch was also

an important contributing factor. Gliding speed and distance were modulated using the tail to maneuver during downward coasting. This result is similar to gliding in other fish and land animals. We found that gliding speed and distance were also controlled by disc pitch. Based on our results, we revised our original prediction and we propose that electric rays use their discs and pelvic fins to control body attitude and glide characteristics. This work was supported by NSF DBI-0442269 and IOS-0922605.

0228 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556 AB, Friday 9 July 2010

Sara Ruane¹, Robert Bryson, Jr.², Frank Burbrink¹

¹City University of New York, College of Staten Island and The Graduate Center, New York City, New York, United States, ²University of Nevada, Las Vegas, Las Vegas, Nevada, United States

Gene Tree/Species Tree Discordance within *Lampropeltis*

Phylogeographic analyses often reveal cryptic species within widespread taxa. Most of these studies rely on mitochondrial gene (mtDNA), resulting in a gene tree estimate rather than a species tree for the taxa of interest. Here, we estimate gene trees and species trees to examine the most widespread serpent in the New World, the milk snake (*Lampropeltis triangulum*), using both a mitochondrial gene and multiple, independent, single-copy nuclear loci (scnDNA). Using Maximum Likelihood and Bayesian inference we construct gene trees using mtDNA and compare them to a species tree estimated using scnDNA. We consider not only milk snakes in our analyses, but include all members of the genus *Lampropeltis* to determine phylogenetic placement. Both gene trees and species trees indicate that milk snakes are not monophyletic with respect to other species within *Lampropeltis* and, with the exception of *L. elapsoides*, none of the traditionally recognized milk snake subspecies form reciprocally monophyletic clades. Three distinct milk snake lineages occur in the United States, with at least five more occurring in Central and South America. We discuss causes of discordance between gene trees and species trees; these incongruous results further emphasize the importance of utilizing multiple, independent loci when inferring phylogenetic relationships.

0421 Roads Symposium I, Ballroom B, Saturday 10 July 2010

William C. Ruediger

Wildlife Consulting Resources, Missoula, MT, United States

Using Expert-Based/GIS Wildlife Habitat Connectivity Processes to Assess Wildlife and Aquatic Organism Concerns on Proposed Highway Projects

Twenty years ago, it was a rarity for State DOTs (Department of Transportation) to consider wildlife mortality, habitat loss or habitat connectivity as part of planning processes. Today, many DOTs address wildlife and aquatic organism habitat connectivity routinely and several states have implemented wildlife crossings and other mitigation measures. There remains a void between DOTs and resource agencies as what the ecological issues are, how to address these issues and what specific mitigation is required. State DOTs are allocated large portions of budgets with the expectation that highways will be improved and projects implemented on time. Resource agencies are often confused as to how and when to provide input into highway projects, or what mitigation measures are appropriate. Consequently, some DOTs and resource agencies may not effectively communicate or coordinate on these issues. The result can be delays in legitimate highway projects, costly wildlife mitigation measures or lost wildlife, aquatic organism or native plant mitigation opportunities. Expert-based/GIS wildlife habitat connectivity assessment is an evaluation tool that can be applied to specific highway segments, entire highway lengths or even entire state highway systems. The process uses existing GIS-based resource information and the knowledge of natural resource and transportation agencies, conservation groups and citizens interested in conserving wildlife resources. The process has been used successfully to assess highways in several states and has reduced highway project implementation delays, reduced planning and development costs, and has resulted in implementation of effective wildlife crossings and other wildlife, aquatic organism and native plant mitigation measures.

0445 Herp Conservation I, 556 AB, Thursday 8 July 2010

Francheska Ruiz-Canino

University of Puerto Rico, Rio Piedras, Puerto Rico

A New Way to Mark Small Amphibians

Mark recapture studies are important to understand populations and how they change in time. Finding a suitable mark for the species of interest is a very important part of the study. Small animals present a challenge as most techniques are either designed for large animals or are way too expensive to make a mark recapture study cost efficient. For amphibians the challenge is even greater as no technique that involves the surface of

the skin can be applied as frogs breathe and absorb water from the environment through their skin. One way to overcome this obstacle is my new technique developed with a native frog of Puerto Rico *Eleutherodactylus antillensis*. This new technique consists of inserting fluorescent tattoo dye in the hind limbs of the frogs on both the ventral and dorsal side with a small insulin needle. The tattoo dye is approved for human use and was originally developed for marking fish of commercial fisheries. From a single color you obtain a total of 10 combinations and 12 combinations when applying two colors with no more than two injections per individual. During a twenty-two month study marking the small frog (~28mm) the technique does not seem to affect survival of individuals as individuals have been found with the marks up to 12 months after its application and juveniles have been found as adults months later. This new technique will allow the application of mark-recapture studies to small animals which allows for better and more complete populations studies.

0292 Amphibian Ecology, 551 AB, Monday 12 July 2010

Daniel Saenz¹, Kristen Baum², Cory Adams¹

¹*Southern Research Station, Forest Service, Nacodoches, Texas, United States,*

²*Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, United States*

Antipredator Mechanisms in Larval Anuran Communities

Predation is known to be a major factor in structuring aquatic amphibian communities. Anuran larvae possess a variety of antipredator mechanisms that allow them to cope with predation pressure in a myriad of environments. Primary antipredator mechanisms are used by anuran larvae to avoid detection from predators. Sometimes, encounters with predators are inevitable, especially in predator rich environments, and anuran larvae must employ secondary antipredator mechanisms to avoid predation once they have been detected. We examined 12 species of anuran larvae and determined the types of defenses and the relative quality of each defense for each species. Also, we examined 50 different wetlands to determine predator regime and larval anuran community composition. Then, we attempted to determine if traits such as activity level, swimming burst speed, palatability, cover use, and escape path complexity could be used to predict a species' membership within specific communities. While preliminary analyses suggest that, both, primary and secondary antipredator traits, exhibited by many anuran species, are associated with particular predator regimes; community membership for some species was not predictable based on the traits we measured.

0288 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Daniel Saenz¹, Brendan Kavanaugh¹, Matthew Kwiatkowski²

¹*Southern Research Station, Forest Service, Nacogdoches, Texas, United States,*

²*Department of Biology, Stephen F. Austin State University, Nacogdoches, Texas, United States*

Occurrence of *Batrachochytrium dendrobatidis* on Amphibians from Eastern Texas

The amphibian disease chytridiomycosis, caused by the pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*), is well known as a major threat to amphibians resulting in mass die-offs and population declines throughout the world. *Batrachochytrium dendrobatidis* has been detected on amphibians from sites across North America including the Southeastern United States but there have been no reports of *Bd* from amphibian populations in East Texas. We sampled amphibians for the presence of *Bd* in four geographically disjunct sites in eastern Texas (approximately 31° N latitude) to determine *Bd* infection rates in areas not previously surveyed. Also, we attempted to determine which species might be at greatest risk to *Bd* in this region. Overall, we sampled a total of 266 adult amphibians of 18 different species, from 8 different families. Of these 18 species, 6 had at least one individual that tested positive for *Bd*. Thirteen of the 266 individuals tested positive for an overall detection rate of 4.8%. Though the fungus is present in the southeastern United States, including East Texas, to our knowledge no amphibian declines have been attributed to chytridiomycosis in this region.

0639 AES Conservation & Management, 552 AB, Friday 9 July 2010

S. R. Sagarese, M. G. Frisk

School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, New York, United States

An Investigation on the Effect of Photoperiod and Temperature on Vertebral Band Deposition in Little Skate, *Leucoraja erinacea*

An investigation was undertaken to determine whether photoperiod or temperature have an effect on the timing of vertebral band pair deposition in captive young-of-the-year (YOY) little skate, *Leucoraja erinacea*. The experimental design consisted of a randomized complete block split plot design with two factors: temperature and light. Temperature was nested within light and therefore four variables were tested: (1) constant light, (2) constant temperature, (3) seasonal light, and (4) seasonal temperature. For 18 months, little skate experienced accelerated seasonal conditions of temperature

and light to mimic 3 years of growth. This study provides primary and supporting evidence that seasonal photoperiod and temperature, respectively, have no effect on timing of vertebral band pair deposition in captive little skate. Vertebral analysis of seven surviving skates showed that all produced 1 to 1.5 band pairs regardless of treatment over 18 months. Centrum edge analysis of 56 specimens provided evidence that the timing of winter and summer band deposition was not affected by treatments. The winter band (translucent) appeared in February 2007 and January 2008 while the summer band (opaque) showed up in July for both 2007 and 2008 and mimicked patterns observed in the wild. While temperature and photoperiod appear to have no effect on timing of band pair deposition in YOY little skate, other mechanisms which may influence band deposition should be investigated including the effect of food ration and the presence of a circa-annual rhythm and/or hormone secretion.

0753 Fish Evolution, 555 AB, Saturday 10 July 2010

Norma Salcedo², Richard Strauss¹, David Rodriguez³, Robert Baker¹

¹Texas Tech University, Lubbock, Texas, United States, ²College of Charleston, Charleston, South Carolina, United States, ³Cornell University, Ithaca, New York, United States

Test of Vicariant Speciation on the Andean Catfish Genus *Chaetostoma* (Siluriformes: Loricariidae) in Southeastern Peru, Based on Morphological and Genetic Evidence

Most *Chaetostoma* species have restricted geographic distributions, and many of them are known only from their type locality. *Chaetostoma lineopunctatum* has been collected from central and southeastern Peru, specifically from Ucayali and Madeira River tributaries, which are separated by a chain of young mountains (the Fitzcarrald Isthmus). Our aim was to detect the presence of at least two cryptic species identified as *C. lineopunctatum* by quantifying morphological and molecular divergence based on caliper measurements and partial cytochrome b sequences (801 bp), respectively. Morphological divergence was statistically significant in the MANOVAs by locality ($P < 0.025$) and by basin ($P < 0.025$), but the groups could not be discriminated by basin with 100% confidence. Furthermore, neighbor-joining trees of specimens grouped by locality (based on Mahalanobis distances) did not show group patterns according to basin. The divergence values between haplotypes from the Ucayali River and the Madeira River ranged from 1.1% to 1.5%, which was similar to the 1.2% divergence among haplotypes found within the Ucayali River. We concluded that there is not enough evidence to consider these three populations as different species, based on the absence of morphological traits that can discriminate geographic populations and the low levels of genetic divergence.

0567 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

André Luís Sanches, Mônica Ceneviva-Bastos, Lilian Casatti

UNESP - São Paulo State University, São José do Rio Preto, São Paulo, Brazil

Do Food Web Parameters Vary According to Substrate Type? Evidences from Brazilian Streams

One of the central issues in ecology is to understand the nature of species interactions and determine its influences over community patterns and dynamics. In this context, food webs can provide useful portraits of ecosystem functioning. Despite that, little is known about the influence of physical habitat on food web parameters. Aiming to investigate whether food web parameters vary according to substrate type, three streams were sampled, one of which predominantly sandy, another rocky, and another silty; all inserted in the same forest fragment. Sampling included algae, macrophytes, plankton, macroinvertebrates, and fish, as well as habitat physical attributes. The diet of all heterotrophic taxa was determined. The number of links, link density, intermediate species, preys, predators, maximum chain length, and trophic levels were higher in the rocky stream. The sandy stream presented intermediate values of food web parameters and the silty one displayed the lowest, except for the number of top species (since all trophic species were very close to the base and many had no predators). In the silty stream, homogeneous substrate sustained a poorer community compared to the others, but some trophic species like *Cricotopus*, *Thienemanniella*, *Americabaetis* and *Simulium* were dominant, being the most eaten items, indicating that feeding preferences, especially for fish species, was mostly determined by resource density. Overall, the results indicated that stream bottom composition and its distinct heterogeneity degrees can affect community composition, complexity and stability, for it is a relevant factor to species occurrence, distribution, and trophic interactions.

0378 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Barbara Sanchez, Mark Steele

California State University, Northridge, Northridge, CA, United States

A Comparison of Growth and Condition of *Paralabrax nebulifer* (barred sand bass) from Polluted and Unpolluted Sites in Southern California

Environmental stressors can have detrimental effects on fish populations by limiting the abilities of individuals to acquire resources for growth, reproduction and survival. Pollutants such as PAH's, PCB's and heavy metals can cause physiological stress in fishes, especially in areas of high pollutant concentrations, such as is commonly found in harbors. This study evaluated the impacts of pollutants on growth and condition of a common coastal marine fish in Southern California. *Paralabrax nebulifer* (barred sand

bass) is one of the most frequently caught fishes in the recreational fishery in Southern California. This demersal species occupies a variety of habitats, including kelp beds, sand flats, inland harbors, and bays. This study was conducted at four sites: two polluted sites within harbors (Los Angeles/ Long Beach and San Diego Harbor) and two relatively unpolluted sites located outside of harbors (Ventura Flats and Barn Kelp). Fish were collected during the non-spawning season and length, body weight, liver weight, gonad weight, and the presence of fin deformations were recorded. We compared growth (size at age from otoliths), condition factors (K), hepatosomatic index (HSI), and gonadosomatic index (GSI).

0259 Fish Systematics I, Ballroom D, Monday 12 July 2010

Michael Sandel¹, Peter Unmack², Phillip Harris¹

¹*University of Alabama, Tuscaloosa, AL, United States*, ²*Brigham Young University, Provo, UT, United States*

Phylogenetic Affinities and Interrelationships of Centrarchidae and Elasmomatidae: A Synthesis of Molecules, Morphology and Biogeography

North American sunfishes (Centrarchidae) and pygmy sunfishes (Elasmomatidae) are the only freshwater percomorph families endemic to the Western Hemisphere. Their phylogenetic affinities have implications upon our understanding of the colonization history and vicariance processes responsible for continental patterns of freshwater biodiversity. A potential sister group relationship between the two families has been argued for decades, due primarily to their sympatric distribution and similar morphology. Recent molecular phylogenies have suggested ties between one or both families to temperate freshwater percomorphs from East Asia (Sinipercidae) and/or the Southern Hemisphere (Percichthyidae). Morphologists previously suggested such transcontinental relationships, but synapomorphies are apparently insufficient to elicit taxonomic recognition. This study is the first to address the problem using complete taxonomic sampling for all four families. Using the cytochrome b gene, we examine the effects of taxonomic sampling bias on the MP and ML topology, a factor likely to account for discordant interfamilial relationships among published mtDNA trees. A secondary objective of this study is to explore the limit of phylogenetic resolution for five mitochondrial genes, and provide a consensus phylogeny upon which hypotheses of vicariance and morphological synapomorphy are tested. We reconstruct ancestral sequences in order to improve the probability of homology among rapidly evolving mtDNA characters, and test intergeneric relationships with preliminary nuclear data. Sinipercidae is recovered as the sister group to Centrarchidae. A monophyletic Centrarchidae+Elasmomatidae is rejected, as is Percichthyidae (sensu Nelson 2006). The sister group relationship to Elasmomatidae is not supported by mtDNA analysis, but a novel hypothesis is presented.

0478 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

S. Laurie Sanderson

College of William & Mary, Williamsburg, VA, United States

Fish Versus Industrial Crossflow Filtration

Suspension-feeding fish, such as tilapia, goldfish, and shad, have been identified as the only vertebrates that have evolved crossflow filters. When fluid is pumped parallel to a crossflow filter, the filtrate exits through the filter pores while the retained particles are concentrated as they travel downstream. We use a miniature fiberoptic endoscope to quantify particle movement inside the oral cavities of live suspension-feeding fish. These data, combined with computational fluid dynamics simulations in fish oral cavities, permit a comparison between biological and industrial crossflow filtration. Multi-billion dollar industrial crossflow systems for biomedical and pharmaceutical processing, beverage preparation, and wastewater treatment are limited by pore blockage and the eventual deposition of particles that foul the filter. Relative to industrial crossflow processes, the filter pores are larger in fish, the channel length is shorter, and particles do not accumulate on fish filtration surfaces. Fish routinely retain particles that are small enough to be lost with the filtrate, and these particles rarely contact the filter surface as they are transported directly to the esophagus for swallowing. The surfaces of the branchial arches alone function as a crossflow filter when the gill rakers have been removed experimentally. Microthermistor flow probes to quantify pre-pump and post-pump flow reversals during feeding indicate that oscillatory flow may reduce particle deposition on the branchial arches. Ongoing experimental and computational studies are focusing on features of fish crossflow filtration that enable fish to maintain high pore Reynolds numbers and high permeation flux with no fouling of the filter.

0733 Turtle Ecology & Conservation, 555 AB, Friday 9 July 2010

Franziska Sandmeier, C. Richard Tracy, Bridgette Hagerty, Hamid Mohammadpour, Sally DuPré, Kenneth Hunter

University of NV, Reno, Reno, NV, United States

Natural and Acquired Antibodies to *Mycoplasma agassizii* in the Mojave Desert Tortoise: Implications for Managing a Wildlife Disease

This is the first range-wide analysis of the prevalence of upper respiratory tract disease (URTD) and seroprevalence of a known, etiological agent, *Mycoplasma agassizii*, in the Mojave desert tortoise (*Gopherus agassizii*). We analyze this host-pathogen system from the viewpoint that this is a potentially complex disease, with varying dynamics over

both space and time. We focus on population-level analyses ($n = 24$), and test for associations among prevalence of URTD, seroprevalence to *M. agassizii*, mean and standard deviations of levels of natural antibody to *M. agassizii*, genetics of tortoise populations, mean annual winter precipitation, and mean number of days below freezing. We detected significant associations between mean number of days below freezing and both prevalence of URTD and seroprevalence to *M. agassizii*. Furthermore, we detected a significant association between mean levels of natural antibody and seroprevalence to *M. agassizii*. Genetics of tortoise populations was associated with mean levels of natural antibody. We propose hypotheses, concerning possible ecological and evolutionary dynamics of the desert tortoise – *M. agassizii* system, based on these associations. We present recommendations for future research to address tests of these hypotheses.

0532 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Marites Sanguila¹, Cameron Siler², Arvin Diesmos³, Olga Nuñez⁴, Rafe Brown²

¹*Fr. Saturnino Urios University, Butuan City, Mindanao, Philippines*, ²*University of Kansas Biodiversity Institute, Lawrence, Kansas, United States*, ³*National Museum of the Philippines, Manila, Luzon, Philippines*, ⁴*Mindanao State University, Iligan City, Mindanao, Philippines*

Molecular Phylogeography, Species Boundaries, and Conservation Status of Southern Philippine River Toads

Taxonomists have long considered Philippine toads of the genus *Ansonia* an unremarkable pair of species from the southern portion of the archipelago. The most recent taxonomic assessments have considered Mindanao populations to be two minimally differentiated species: *A. muelleri* from eastern Mindanao Island, and *A. mcgregori* from the western portions of the island. The most recent IUCN assessment classified both Philippine *Ansonia* as “Vulnerable” because of specific threats to their preferred habitat, but the presumed widespread distribution of the two species prevented their elevation to higher threat categories. We used molecular phylogeographic analyses of two mitochondrial gene regions to investigate species boundaries of these Mindanao river toads. Our data strongly reject the hypothesis of two species (with an east-west split between them) and instead diagnose a minimum of between four and eight highly divergent evolutionary lineages that we presume will be recognized as species. The majority of the putative species breaks are associated with low elevation valleys of Mindanao, suggesting that the complex topography of the island has contributed to the evolutionary process of diversification. Our data emphasize the need to reevaluate the conservation status of many Southeast Asian amphibians in order to move away from “expert opinion” conservation assessments. Instead we urge conservation biologists to incorporate new phylogeographic studies, population genetic approaches, and distributional data from recent field surveys into

conservation status assessments of Southeast Asia's rich and highly endemic amphibian fauna.

0751 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Ralph Saporito¹, Monica Isola², Vivian Maccachero², Keith Condon³, Maureen Donnelly²

¹*Old Dominion University, Norfolk, VA, United States*, ²*Florida International University, Miami, FL, United States*, ³*Indiana University School of Medicine, Indianapolis, IN, United States*

Ontogenetic Scaling of Poison Glands in a Dendrobatid Poison Frog

The nature of chemical defenses in poison frogs has been explored in a variety of species, and most studies focus on the type of chemical defense and its source. The defensive compounds of frogs are stored in dermal granular glands that have been described for several species that are chemically protected from predators and/or microorganisms. Gland ultrastructure is known for nine species of dendrobatoid frogs, but the relationship between body size and chemical defense has not been explored. It might be expected that the capacity for defensive protection increases as a function of body size, especially given the fact that juvenile poison frogs are known to have smaller quantities of alkaloids than adults. We examined poison glands histologically in a sample of the poison frog *Oophaga pumilio* to determine if the physical basis of the defensive system changes as a function of body size. We measured average gland size, estimated the number of glands, and calculated the density and percentage of skin area occupied by glands in a patch of dorsal skin for 25 individuals. The size, number, and percentage of skin area occupied by poison glands increased allometrically as a function of body size, whereas poison gland density decreased with body size. Adults have a larger capacity to store alkaloids and more of their dorsal skin is associated with poison glands as compared to juveniles, which may translate into greater predator avoidance of adults. Furthermore, juveniles and subadults may benefit from automimicry because they resemble adults in appearance.

0069 Roads Symposium II, Ballroom B, Saturday 10 July 2010

Raymond M. Sauvajot¹, Amy Pettler², Seth P. D. Riley³

¹*National Park Service, Oakland, CA, United States*, ²*California Department of Transportation, Sacramento, CA, United States*, ³*National Park Service, Thousand Oaks, CA, United States*

Protecting Wildlife Habitat Linkages Through Collaborative Science, Transportation Planning, and Roadway Design Near Los Angeles, California

For over a decade, the National Park Service (NPS), California Department of Transportation (Caltrans), and other organizations have worked together collecting, analyzing, and sharing data about regional wildlife movement corridors in parks and open space near Los Angeles, California. Scientific studies include radio telemetry of coyotes, bobcats, and mountain lions, genetic assessments of carnivores, birds, and reptiles, monitoring undercrossings and culverts to evaluate wildlife utilization, assessing wildlife mortality along roads, and GIS analyses of potential wildlife movement corridors. Results from these studies demonstrate that regional wildlife viability will depend on protecting habitat linkages and wildlife movement corridors, and enhancing connectivity along roads that cross movement corridors. Caltrans, NPS, and other partners are now integrating scientific information with on-the-ground actions. Collaborative efforts include identifying priority sites for enhancements, installing wildlife-proof fencing along roads, enhancing existing culverts and undercrossings for wildlife movement, and conducting monitoring both before and after improvements to evaluate effectiveness. We demonstrate that by sharing expertise and experiences, and by linking science and planning, regional habitat connectivity can be enhanced in combination with transportation projects. We are now working to apply this model of partnership and collaboration to other areas facing similar wildlife conservation and transportation challenges.

0277 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD

Rachel Scharer¹, William F. Patterson III¹, John K. Carlson²

¹*University of West Florida, Pensacola, FL, United States*, ²*NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL, United States*

Preliminary Age Estimates of the Endangered Smalltooth Sawfish of South Florida

The US population of smalltooth sawfish, *Pristis pectinata*, is currently listed as endangered under the Endangered Species Act. Basic life history data critical for

conservation are lacking for this species. To address the lack of life history information, we have begun a project to examine the usage of vertebrae and rostral teeth for aging smalltooth sawfish. Vertebrae and rostral teeth were collected from naturally deceased fish (n=8) in southern Florida. Transverse sections were made through vertebral centra and were read with transmitted light under a stereo-microscope. No staining was required due to the clearly defined opaque and translucent zones in vertebral sections. Each section was read independently by two readers without any prior knowledge of fish size. If counts differed between readers, age was assigned by consensus. Size of aged fish ranged from 600mm to 4327mm total length, and age estimates based on vertebral sections was zero to ten years. Age validation currently is being explored through examination of calcium and trace metal concentrations across vertebral sections with laser ablation-inductively coupled plasma-mass spectrometry. Lastly, longitudinal sections of rostral teeth are being examined to explore whether analysis of rostral teeth may provide an accurate non-lethal aging method.

0547 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Robert Schelly, Zachary Baldwin, John Sparks

American Museum of Natural History - Ichthyology, New York, NY, United States

Madagascar's Nearshore Marine Fishes: Depauperate Fauna or Inadequate Sampling?

Madagascar's nearshore marine fish fauna has traditionally been considered to be low in diversity and more or less similar to that of the east African coast. Results of recent survey work along the Masoala Peninsula in northeastern Madagascar indicate that this notion is incorrect and attributable to both a lack of adequate sampling and ineffective sampling techniques. A variety of shallow nearshore habitats were sampled along the Masoala Peninsula over a month-long period in 2003, including exposed fore reef, reef crest, back reef, lagoon, and rocky bay sites. Using only snorkeling gear and rotenone, over twice as many species as previously reported to occur in this region were collected, including numerous taxa new to science. In addition, many additional pelagic taxa were observed, but not collected. Faunal inventory studies of marine fishes in Madagascar have frequently relied only on visual surveys. Our results indicate that this approach is ineffective and greatly underestimates true ichthyofaunal diversity for a number of reasons, which are discussed below.

0412 AES Genetics, 552 AB, Sunday 11 July 2010

Jennifer V. Schmidt¹, Chien-Chi Chen², Saad I. Sheikh¹, Mark G. Meekan³, Bradley M. Norman⁴, Shoou-Jeng Joung²

¹University of Illinois at Chicago, Chicago, IL, United States, ²National Taiwan Ocean University, Keelung, Taiwan, ³Australian Institute of Marine Sciences, Crawley, WA, Australia, ⁴Ecocean Inc., Cottlesloe, WA, Australia

Paternity Analysis in a Litter of Whale Shark Embryos

The reproductive biology of the whale shark (*Rhincodon typus*) is poorly understood on all levels. A 10.6 meter female whale shark caught off the coast of Taiwan in 1995 carried more than 300 embryos in her uteri, ranging in developmental stage from embryos still in egg cases, to hatched, near-term animals. This litter established that whale sharks develop by aplacental yolk-sac viviparity, and the range of developmental stages within the litter indicated ongoing fertilization over an extended period of time. This suggested that embryos of varying ages might have been sired by different males. Recently published microsatellite markers for *R. typus* have now allowed paternity investigation in a subset of 29 embryos from this female. The embryos available for analysis represent ~10% of the initial litter, and span nearly the full range of size and developmental stage. Genetic analysis determined that all embryos are likely to be full siblings sired by a single male. These data suggest that female whale sharks may be capable of long-term sperm storage after a single mating event, which may be a physiological adaptation to the limited mating opportunities available in a species that segregates by sex and age, and likely exists at low density in the open ocean. No tissue was available from the female for genetic analysis, but a 1222 nucleotide region of the maternally-inherited mitochondrial control region was sequenced from the embryos, identifying a novel haplotype most similar to two haplotypes previously isolated from the western Indian Ocean.

0798 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Ray Schmidt, Henry Bart Jr.

Tulane University, New Orleans, LA, United States

Phylogeography and Taxonomy of the Barbs (Cyprinidae: 'Barbus') from Guinea, West Africa

Species of the genus 'Barbus' occupy a variety of habitats throughout tropical Africa, Europe, the Middle East and Asia. Recent work revealed that 'Barbus' was polyphyletic throughout its range but other workers have been identifying monophyletic groups within the genus. This study involves specimens of 'Barbus' collected throughout

Guinea, West Africa on multiple expeditions in 2002 and 2003. The collecting effort was focused on the Fouta Djallon Highlands, Zone Forestière and coastal streams. The Fouta Djallon serves as the headwaters of many of the largest rivers in West Africa; the Zone Forestière and coastal watersheds harbor some of the last remnants of tropical rain forest within Guinea. Although some taxonomic work has recently been completed in this area, there are still many unresolved questions surrounding the ichthyofauna of Guinea and surrounding countries. Results of a phylogenetic analysis involving cytochrome b gene and Growth Hormone Intron 3 sequences from roughly 100 'Barbus' specimens collected from throughout the area has revealed a number of taxonomic issues in need of resolution, as well as, the presence of previously unknown species. We compare our 'Barbus' results with those of other recently studied taxa from the region to search for common biogeographic patterns.

0760 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Susana Schonhuth¹, Michael J. Blum², David A. Neely³, Lourdes Lozano-Vilano⁴, Hector Espinosa⁵, Anabel Perdices⁶, Richard L. Mayden¹

¹Saint Louis University, Saint Louis, Missouri, United States, ²Tulane University, New Orleans, Louisiana, United States, ³Tennessee Aquarium Research Institute, Cohutta, Georgia, United States, ⁴Universidad Autonoma de Nuevo Leon, Nuevo Leon, Mexico, ⁵Universidad Nacional Autonoma de Mexico, Mexico DF, Mexico, ⁶Museo Nacional de Ciencias Naturales, Madrid, Spain

Biogeographic Perspective on the Evolution of *Campostoma ornatum* (Actinopterygii: Cyprinidae) in Western Mexico

The Mexican Stoneroller, *Campostoma ornatum*, is the most poorly known member of the genus *Campostoma*. This polytypic taxon shows remarkable morphological variation throughout its unique distribution, which is restricted to a wide geographic region in southern North America dominated by the Sierra Madre Occidental. The aim of this study is to examine genetic variation across the range of the Mexican Stoneroller, and use these data to assess phylogenetic relationships among currently independent populations and determine potential historical processes and geological mechanisms for dispersal and vicariance across the complex range of the species. Methods: 183 specimens from 80 different localities representing the range of this species were collected for the genetic analyses. Phylogenetic analyses were performed independently for one mitochondrial (cytochrome b) gene and one nuclear (intron S7) gene. Phylogenetic trees were estimated for each data set using Maximum Likelihood (ML) and Bayesian Inference (BI). Results: Phylogenetic analyses consistently resolved a monophyletic *Campostoma ornatum* and recovered two well-supported clades within the species that exhibit marked differentiation. Currently, this species is found in 10 independent drainages in Northern Mexico, which are not recovered as independent lineages. Main conclusions: Results from different phylogenetic analyses found high levels of genetic divergence between two main lineages that consistently suggest ancient

isolation of southern drainages. Analyses indicated a range expansion through Pacific drainages from the ancestral Rio Grande System, and also suggested recent admixture by secondary contact through headwater connections in several regions of the SMO.

0193 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Aaron Schrey¹, Kyle Ashton², J. Steve Godley³, Earl McCoy¹, Henry Mushinsky¹

¹University of South Florida, Tampa, FL, United States, ²Archbold Biological Station, Lake Placid, FL, United States, ³Entrix, Riverview, FL, United States

Genetic Analysis Identifies Two Major Barriers to Gene Flow within the Florida Sand Skink's Distributions

The threatened Florida Sand Skink (*Plestiodon reynoldsi*) occurs on three central highland ridges of scrub habitat in Florida. This habitat has been severely altered and now primarily exists as small preserved patches. We explored the pattern of range-wide genetic differentiation with both DNA sequences and microsatellite loci to determine the relationship among extant scrub patches. Two previous studies identified population structure among Florida Sand Skinks and found this structure follows the geological history of central Florida. We expand these findings by focusing our analysis on determining what factors created the observed structure. Thus, we targeted our sample collection to characterize the margins of Florida Sand Skink genetic groups. Our results identify two major barriers to gene flow in the Florida Sand Skink's range. One divides Florida Sand Skink on the Mt. Dora Ridge from those on the Lake Wales Ridge and appears to be generated by a barrier to gene flow. The other divides Florida Sand Skinks from the Lake Wales Ridge into central and southern segments. Our genetic results, and the geography in this region, indicate that there is a restricted avenue for dispersal south on the Lake Wales Ridge.

0694 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

B. S. Schroeder¹, R. D. Mooi², M. F. Docker¹

¹Department of Biological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada, ²The Manitoba Museum, Winnipeg, Manitoba, Canada

An Isolated and Differentiated Population of *Gasterosteus aculeatus* (Gasterosteidae: Gasterosteiformes) from Nueltin Lake in Northwestern Manitoba

Gasterosteus aculeatus, the three-spined stickleback, is a small anadromous fish species that is well known for rapid morphological and molecular differentiation of populations

over post-glacial timeframes. In northern Manitoba, Canada, *G. aculeatus* is considered to be uncommon in the coastal drainages into Hudson Bay, and is usually found within 75km of the coast. We describe an apparently distinct population of this species from Nueltin Lake, Manitoba, near the border with Nunavut that is over 250km from the coast. This population is not likely to be anadromous. Although not morphologically remarkable, analyses of 12 microsatellite loci provide high F_{st} values for the Nueltin Lake population compared to populations downstream in the Thlewiaza River as well as those in other Hudson Bay coastal drainages ($F_{st}=0.18$ to 0.48). We suggest that the Nueltin Lake population is a post-glacial relict, isolated as a result of isostatic rebound. This distinct population of *G. aculeatus* in northwestern Manitoba should be considered for special conservation status as have unique populations of this species elsewhere in Canada. Other aquatic organisms in Nueltin Lake should be investigated for evidence of similar post-glacial isolation and differentiation.

0806 Herp Systematics, 551 AB, Monday 12 July 2010

James A. Schulte II¹, Derek E. Wildman², James R. Stewart³, Zhuo-Cheng Hou³, Amy L. Weckle³, Michael B. Thompson⁴

¹Clarkson University, Potsdam, NY, United States, ²Wayne State University, Detroit, MI, United States, ³East Tennessee State University, Johnson City, TN, United States, ⁴The University of Sydney, Sydney, NSW, Australia

Comparative Analysis of Placental Transcriptomes in an Australian Viviparous Skink, *Pseudemoia pagenstecheri*

Complex, integrated traits such as viviparity (live birth) evolve through the interaction of developmental-genetic networks in the context of historical selective conditions. Viviparity occurs in two modern amniote lineages, mammals and squamate reptiles (lizards and snakes) and remarkably has evolved independently more than 100 times in squamates. In mammals, the genetic mechanisms underlying pregnancy are relatively well-known but little is known in squamates. Advances in next-generation sequencing technologies have greatly facilitated the generation of extensive comparative gene expression datasets. We sequenced the transcriptome from two embryonic stages in the viviparous scincid lizard, *Pseudemoia pagenstecheri*. The goals of this study were several fold but for brevity we will discuss gene comparisons with those expressed in mice and human placentas; and identify unique *Pseudemoia* transcripts compared to other genomically well-characterized vertebrates. Significant differences and similarities in gene regulation occurred between the two developmental stages and specific functional pathways involved in this shift will be discussed. There also were a large number of gene transcripts expressed in mouse and human placentas expressed in the skink transcriptomes, as well as several species-specific transcripts expressed in *Pseudemoia*. These data greatly increase our knowledge of genes expressed in one viviparous squamate lineage and highlight the necessity more extensive comparative sampling from other viviparous and oviparous species at a variety of developmental stages.

0116 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Joshua Schwartz, Brandon Lentine, Raymond Hunce, Jennifer Noviski

Pace University, Pleasantville, NY, United States

Tests for Call Restoration in the Gray Treefrog, *Hyla versicolor*

Phonemic restoration, a form of temporal induction, occurs when the human brain compensates for masked or missing portions of speech by filling in obscured or non-existent sounds. We tested for temporal induction and related abilities in females of the gray treefrog, *Hyla versicolor*. Pulse number (call duration) is used by females for assessment of males. Accordingly, an ability to "restore" or interpolate between masked or otherwise sonically degraded portions of calls could help females during mate choice in noisy choruses. In phonotaxis experiments, we employed unmodified calls and those that had centrally placed gaps, regions overlapped by portions of other calls or filtered noise, or replaced with filtered noise. When offered call alternatives with equivalent numbers of clear pulses, we found that females discriminated against calls with gaps two or more times greater than the natural 25 ms interpulse interval. When gaps were replaced with zones of call overlap or noise (so, again the call durations of the alternatives were unequal), females discriminated either in favor (overlap) of the modified stimuli or failed to discriminate (noise). However, when the unmodified and modified stimuli were the same duration, females discriminated against the latter. Pulses formed from noise bursts were attractive, but less so than normal pulses. Our results therefore do not indicate that females of the gray treefrog employ a form of temporal induction that is fully restorative. However, the data indicate that acoustically anomalous sections of calls can retain attractive potential provided acoustic energy and pulses are present.

0683 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Christopher Searcy¹, Levi Gray², H. Bradley Shaffer¹

¹*University of California - Davis, Davis, CA, United States*, ²*University of New Mexico, Albuquerque, NM, United States*

Mass-dependent Survival and Dispersal in the California Tiger Salamander (*Ambystoma californiense*)

Due to the fossorial nature of ambystomatid salamanders, few studies have captured these species away from their breeding ponds. This has made it difficult to learn about demography and metapopulation dynamics among non-breeding stages of this group. Using a drift-fence array that stretches up to one kilometer from the edge of their breeding pond, we investigated survival between non-breeding stages of the California tiger salamander and dispersal of this species into the terrestrial environment. Tracking

individual salamanders was made possible through the use of a pattern recognition program and subdermal alphanumeric tags. Implanting 2,335 metamorphs and photographing 3,114 adults and juveniles yielded 850 recapture events. These data revealed that larger individuals are more likely to survive between years during both the adult and juvenile stages, and are more likely to reach maturity from the juvenile stage. In addition, larger metamorphs disperse farther from the breeding pond. The importance of these trends is seen in the fact that average metamorph mass in the 18 cohorts examined in this study varied almost threefold between 5.3 g and 15.86 g. Thus, the average individual in the largest cohort has a 16-fold higher probability of surviving to maturity and will disperse 667 m further from the breeding pond than the average individual in the smallest cohort. This will introduce huge temporal variation into the population dynamics of this species, with certain cohorts having a much higher probability of contributing individuals to future generations and contributing dispersers to neighboring breeding ponds.

0077 Fish Genetics & Biogeography, 556 AB, Friday 9 July 2010

Greg Seegert, Joe Vondruska

EA Engineering, Science & Technology, Deerfield, IL, United States

The Distribution of Fishes Near Eight Power Plants on the Ohio River During the Winter

For three successive winters, we monitored the distribution of fishes near eight power plants on the Ohio River to determine to what extent various species were attracted to the thermal discharges from these plants and how the abundance and distribution changed compared to our standard spring, summer, and fall monitoring. Fish were collected by electrofishing and seining (two years only). Our results showed that catches were generally lower during the winter. Catches were typically highest immediately downstream of each plant's discharge where water temperatures were warmest. Downstream catches were highest at those plants where the temperature rise above ambient was greatest. Although catches of most species declined in the winter, winter catches of some species (e.g., sauger and smallmouth buffalo) were often higher during the winter compared to the other seasons.

0670 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Richard Seigel¹, M. Rebecca Bolt², Stephanie Weiss²

¹*Towson University, Towson, MD, United States*, ²*Innovative Health Applications, Kennedy Space Center, FL, United States*

Preparing for the Inevitable: Anticipated Sea Level Rise and the Impacts on Reptiles and Amphibians at the Kennedy Space Center, Florida

One of the key concerns associated with global climate change is the subsequent rise in sea levels. Sea levels are increasing world-wide, but have risen almost 15 cm more than the global average along the U.S. mid-Atlantic and Gulf coasts. Impacts from rising sea levels are manifested in many ways, including beach erosion, flooding of low-lying areas, and increased salinity of freshwater and groundwater sources. The Kennedy Space Center (KSC), located on the east-central Florida coast, is an area which is considered to be highly vulnerable to future sea level changes. These changes not only have the potential to impact several billion dollars in national assets of the U.S. space program, but could also directly and indirectly affect some of the 69 species of amphibians and reptiles that occur on KSC, several of which are Threatened or Endangered. In this paper we review some of the likely impacts of sea level rise, with emphasis on possible management solutions that need to be developed and tested before the impacts become severe. Examples of possible management strategies include (a) increased use of beach hatcheries to mitigate loss of natural nests in sea turtles (loggerheads, green sea turtles, and leatherbacks) and (b) testing whether terrestrial species that inhabit the beach strand (e.g., gopher tortoises and indigo snakes) can make use of corridors leading to more protected habitats inland of the beach. Our overall message is that early testing and evaluation of management options are essential.

0353 Herp Conservation I, 556 AB, Thursday 8 July 2010

Erin Seney¹, Andre Landry, Jr.¹, Benjamin Higgins², Shanna Kethan³

¹*Sea Turtle and Fisheries Ecology Research Laboratory, Texas A&M University at Galveston, Galveston, Texas, United States*, ²*NOAA Fisheries Sea Turtle Facility, Southeast Fisheries Science Center, Galveston, Texas, United States*, ³*Lee High School, Baytown, Texas, United States*

Incidental Hook-and-Line Capture of Sea Turtles Along the Upper Texas Coast During 2004-2008

Five species of federally-protected sea turtles occur seasonally in the northwestern Gulf of Mexico, putting them at risk for interactions with commercial and recreational fisheries. We examined the incidental capture of sea turtles on recreational hook-and-

line gear along the upper Texas coast in 2004-2008. Fishing piers were contacted annually, and informational posters were placed at piers and other venues to promote reporting of hook-and-line-caught turtles. Reported turtles were transported to and held at NOAA Galveston. Radiography, examination, and appropriate procedures were conducted at the Houston Zoo's veterinary clinic. Forty Kemp's ridleys (*Lepidochelys kempii*), four loggerheads (*Caretta caretta*), and one green turtle (*Chelonia mydas*), were retrieved after hook-and-line capture in Galveston and Jefferson Counties. Eight ridleys were caught by surf fishermen, one ridley was caught from a nearshore boat, and the remaining turtles were retrieved from three privately-owned piers. Twenty ridleys were hooked in the mouth or jaw, whereas 18 ridleys and 3 loggerheads were throat-hooked or swallowed the hook. Two ridleys and one loggerhead were flipper-hooked, and the green turtle was hooked in the back of the neck. One ridley died after hook-removal surgery, and the remaining turtles were released following necessary treatment. Although captures by surf fishermen were probably under-reported, incidental hook-and-line captures represented 28% of documented non-nesting encounters of ridleys in Galveston and Jefferson Counties. Public outreach efforts should be expanded to target not only pier-based fishing, but all recreational anglers, in order to facilitate hook removal and determine the full extent of these potentially lethal interactions.

0470 Herp Development, 556 AB, Sunday 11 July 2010

Stanley K. Sessions¹, Brandon Ballengée²

¹*Department of Biology, Hartwick College, Oneonta, New York, United States,* ²*School of Computing, Communications, and Electronics, University of Plymouth, Plymouth, United Kingdom*

Limb Deformities in Amphibians: Developmental Mechanisms

Hind-limb deformities (extra limbs or missing limbs) in natural populations of amphibians have been an important environmental issue for more than a decade. The role of parasites (trematodes) as proximal causes of extra limbs and associated deformities is by now well established. On the other hand, recent evidence suggests that deformities featuring missing limbs (the most commonly reported deformities) are caused by "selective predation". Here we show that, in both cases, the observed deformities can be explained by the known characteristics and mechanisms of amphibian limb development and regeneration in response to mechanical perturbation.

Brian Shamblin¹, Karen Bjorndal², Alan Bolten², Campbell Nairn¹

¹Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia, United States, ²Archie Carr Center for Sea Turtle Research, University of Florida, Gainesville, Florida, United States

Phylogeography and Population Structure of the Southern Greater Caribbean Green Turtle Rookeries Revisited with Expanded Mitochondrial Sequencing

Analyses of sequence polymorphism within a portion of the mitochondrial control region have supported the presence of several demographically independent green turtle (*Chelonia mydas*) rookeries in the Greater Caribbean region. However, extensive sharing of haplotypes among nesting populations has limited inferences about colonization pathways and demographic connectivity among some rookeries. Moreover, broad overlap of haplotypes among rookeries has limited the resolution of mixed stock analyses of foraging aggregations. We screened the mitochondrial genome of several nesting green turtles carrying control region haplotype CM-A5 and representing the rookeries of Aves Island, Suriname, and Tortuguero to determine whether additional informative variation occurred outside of the established control region fragment. Despite extensive sequence conservation, we identified four single nucleotide polymorphisms (SNPs). Screening of these SNPs in 115 CM-A5 individuals resulted in four mitogenomic haplotypes that were strongly partitioned among rookeries. Pairwise F_{ST} comparisons and exact tests of population differentiation support the demographic independence of Aves and Suriname, highlighting the need to manage the smaller Aves rookery as a distinct management unit. The presence of the ancestral haplotype at all three rookeries and absence of derived variants in the Suriname rookery suggests that Suriname is likely the source of the CM-A5 lineage that has colonized northward and westward through the Greater Caribbean region. Sequence determination at the SNPs identified in the present study should improve resolution of mixed stock analyses. Mitochondrial screening in search of rookery-informative variation for the remaining common Greater Caribbean haplotypes, CM-A1 and CM-A3, is underway.

0087 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Donna Shaver¹, Charles Caillouet, Jr.², Andre Landry, Jr.³

¹National Park Service, Padre Island National Seashore, Corpus Christi, Texas, United States, ²Retired, Montgomery, Texas, United States, ³Texas A&M University at Galveston, Department of Marine Biology, Galveston, Texas, United States

Experimental Head Starting of Kemp's Ridley (*Lepidochelys kempii*) Sea Turtle: A Large Scale Case Study

Kemp's ridley (*Lepidochelys kempii*) is the smallest and most endangered of the sea turtles. Its nesting epicenter is near Rancho Nuevo, Tamaulipas, Mexico bordering the western Gulf of Mexico, but it is also native to Padre Island National Seashore (PAIS) near Corpus Christi, Texas, the Gulf of Mexico, the eastern U.S. coast, and European Atlantic waters. As part of a Mexico-U.S. recovery program, experimental head starting of Kemp's ridleys was initiated in 1978 to establish a secondary nesting colony at PAIS in case other recovery efforts failed. The experiment encompassed numerous phases including collecting and incubating eggs, imprinting hatchlings, transporting eggs and hatchlings, captive rearing to sizes thought capable of avoiding most predators at sea, tagging, releasing, analyzing tag-returns, and documenting nestings. Related research was also conducted. Approximately 24,000 head started and tagged Kemp's ridleys of the 1978-2000 year classes were released into the Gulf of Mexico or adjoining bays, mostly in the western Gulf, but some were released off the west coast of Florida and in Campeche Bay. They joined the natural population and were vulnerable to the same natural and anthropogenic threats affecting wild Kemp's ridleys. Some nested, and these were the first head started sea turtles documented nesting in the wild. This paper covers collecting and incubating eggs, imprinting hatchlings, transporting eggs and hatchlings, estimating age at maturity in the wild, and documenting nestings, foraging, and post-nesting movements. A companion paper by Caillouet et al. (2011) covers captive rearing, tagging, releasing, analyzing tag-returns, captive-breeding, and related research.

0541 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Katherine Shaw¹, Susan Foster²

¹*University of Connecticut, Storrs, CT, United States*, ²*Clark University, Worcester, MA, United States*

Geographic Variation in the Presence of the Sneaker Repertoire and Sneak Fertilization Propensity in the Threespine Stickleback (*Gasterosteus aculeatus* L.)

It is increasingly evident that the prevalence of alternative reproductive tactics may vary among populations of a given species, likely due to the interplay between environmental heterogeneity and tactic success. The presence of alternative reproductive tactics may lead to altered effectiveness of female choice, changes in the operational sex ratio (ratio of sexually active males to females), and may facilitate maintenance of genetic variation thereby influencing population genetics. Potential for interpopulation differences in the frequency of alternative reproductive tactics should be considered when quantifying and interpreting selection pressures and fitness measures. Here we report geographic variation in the presence of the sneaker repertoire and propensity to sneak fertilizations in wild populations of threespine stickleback. It is likely that sneaking fertilizations is a plesiomorphic character within the stickleback clade, as similar behaviors have been observed in other Gasterosteids and this behavior has been observed in the field, lab or inferred from genetic analyses in populations spanning the holarctic distribution of the threespine stickleback. However, our observational field studies suggest the sneaker repertoire is absent in a number of freshwater populations in coastal British Columbia although the behavior has been observed at low frequencies in several anadromous populations in adjacent areas. Anadromous and freshwater populations in south-central Alaska also exhibit variation in the frequency of sneak attempts during all observed courtships, ranging from 0 to 45%. Potential implications of observed interpopulation variation in alternative reproductive tactics within the stickleback adaptive radiation and the context-dependent nature of the sneaker repertoire will be discussed.

0163 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010; AES GRUBER AWARD

David Shiffman¹, Gorka Sancho¹, Bryan Frazier², John Kucklick³, Dan Abel⁴, Tracey Sutton⁵, Kristene Parsons⁵

¹College of Charleston Graduate Program in Marine Biology, Charleston, SC, United States, ²South Carolina Department of Natural Resources, Charleston, SC, United States, ³Hollings Marine Laboratory, Charleston, SC, United States, ⁴Coastal Carolina University, Conway, SC, United States, ⁵Virginia Institute of Marine Science, Gloucester Point, VA, United States

Stable Isotope Analysis of the Sandbar Shark, *Carcharinus plumbeus*: A Minimally Invasive Method for Comparison of Diet and Trophic Relationships between Genders, Locations, and Age Classes

The 2006 National Marine Fisheries Service SEDAR for large coastal sharks recommended the gathering of additional diet and trophic relationship data for the sandbar shark, *Carcharinus plumbeus*. No diet studies of any kind have been performed on South Carolina subpopulations of *C. plumbeus*, and stable isotope analysis has never been performed on this species. Muscle samples were taken from *C. plumbeus* caught by the South Carolina Department of Natural Resources and the Virginia Institute of Marine Science shark surveys. The analysis of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ from this muscle tissue is ongoing and will be compared with prey species and between other *C. plumbeus* samples to determine the diet and trophic level of South Carolina and Virginia subpopulations. Intra-subpopulation comparisons will be made to detect potential differences in diet and trophic level between sharks of different age classes and genders.

0036 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Bindesh Shrestha, Robert Javonillo, John Burns, Akos Vertes

George Washington University, Washington, DC, United States

Unique Protein Identified in a Characid Gill Gland

Gill glands develop from anterior gill filaments of the first gill arches during sexual maturation of males in a number of genera of characid fishes. During development, secondary lamellae shorten, while epithelial tissue grows over the space between adjacent gill filaments, resulting in the formation of chambers that retain ventral openings into the main gill cavity. All gill glands are characterized by enlarged columnar cells between adjacent secondary lamellae. Light microscopy occasionally reveals stainable material within the lumens of the gill gland chambers. Transmission electron microscopy shows the presence of abundant membrane-bound secretory

vesicles within the cytoplasm of the columnar cells. Because gill glands appear to be secretory and restricted to sexually mature males, it is hypothesized that they release a chemical signal that somehow affects mating. Laser ablation electrospray ionization mass spectrometry (LAESI-MS) has been successfully utilized for the direct analysis of living tissues and single cells from plants and animals. We used this technique to analyze male gill glands and unmodified gill tissue in both sexes of the bloodfin tetra, *Aphyocharax anisitsi* (Characiformes: Characidae). A protein of 11,386 Daltons was identified in the male gill glands that was absent from adjacent unmodified gill tissue in males or unmodified female gill tissue in the same location as the gill gland in males. Further analysis will attempt to determine the amino acid sequence of this protein so that additional studies can be performed to establish its function.

0059 Herp Development, 556 AB, Sunday 11 July 2010

Dustin Siegel, Robert Aldridge

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

Sexual Kidneys in Salamanders

Few vertebrates are currently recognized as having kidneys with secondary sexual function. In gasterosteids (sticklebacks), the highly secretory region of the ventral kidney ducts produces a protein called “spiggin” that is the major constituent of the foam nests of stickleback fishes. Because of its androgen dependence, the production of spiggin in the stickleback kidney has become an important quantifiable biomarker for reprotoxic chemicals in aquatic environments. In squamates, and possibly all lepidosaurians, the highly secretory sexual segment of the kidney (SSK) is formed in either the distal nephron tubules or collecting ducts, and has multiple hypothesized functions. Historical studies on squamates also describe an SSK in salamanders from citation of work by Aron (1924). However, unlike the numerous articles on the squamate SSK and the spiggin-producing kidney of sticklebacks, practically no literature exists on a SSK in salamanders. In this presentation we review the historical literature, the possible implications, and the phylogenetic distribution of kidneys with secondary sexual function in salamanders.

**0387 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT
PHYSIOLOGY, 555 AB, Friday 9 July 2010**

Cameron Siler, Rafe Brown

University of Kansas, Lawrence, Kansas, United States

**Historical Processes Behind Patterns of Limb Reduction and Loss in an Island
Radiation of Fossorial Lizards**

The transition from quadrupedal to limbless body plans has occurred repeatedly in numerous independent lineages of squamates. However, only four genera of lizards possess both fully limbed and limbless species. The known species-level diversity of skinks of the genus *Brachymeles* is concentrated in the Philippines, with species exhibiting a full range of limb development, including fully-limbed, intermediate, and limbless forms. To investigate the process of limb reduction and loss, we conducted a comprehensive phylogeographic analysis of *Brachymeles* using a multi-locus dataset and particularly dense geographic sampling. We measured several morphological characters and used these to analyze patterns of body form evolution across the clade. Given an historical phylogenetic framework, we tested the polarity of evolutionary change in body form, estimated the number of times limbs have been lost in *Brachymeles*, and surveyed morphological changes associated with limb reduction. Our results indicate that limb-reduction and loss has occurred independently multiple times in *Brachymeles*. Additionally, it is clear that the species diversity within the genus is vastly underestimated. The genus *Brachymeles* is an excellent model system to address a variety of hypotheses related to body form evolution, miniaturization, limb reduction and loss, and correlated character evolution.

0100 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Andrea Simmons, Mary Bates, Jeffrey Knowles, James Simmons

Brown University, Providence, RI, United States

Spatial Location Affects Vocal Interactions in Chorusing Bullfrogs

Our understanding of vocal interactions in large, dense frog choruses is limited by the accuracy of single-microphone techniques commonly used to record chorus activity. We developed a novel, multiple-microphone array to identify and classify vocal interactions in five natural bullfrog (*Rana catesbeiana*) choruses. Our results show that vocalizing males were not randomly spaced within these choruses, but tended to cluster together into closely-spaced groups of two to five individuals. There were non-random, differing patterns of vocal interactions within these clusters of closely-spaced males and between different, spatially separated clusters. Bullfrogs located within a cluster tended to overlap or alternate call notes with two or more other males in that same cluster.

These near-simultaneous calling bouts produced advertisement calls with more pronounced amplitude modulation than occurred in non-overlapping notes or calls. Bullfrogs located in different clusters more often alternated entire calls or overlapped only small segments of their calls. These males also tended to respond sequentially to calls of males in farther neighbors compared to those in nearer clusters. Results of computational analyses showed that the observed patterns of vocal interactions were significantly different than expected on the basis of random activity. These data suggest that chorusing males may both cooperate and compete with their neighbors, and that spatial separation is a significant factor modulating chorus activity.

0643 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Navasha Singh, Robert Espinoza

California State University, Northridge, Northridge, CA, United States

Green Guts are Great(er): Dietary Correlates of Lizard Digestive Tract Gross Morphology

Plant tissues are less nutritious and energy rich and harder to digest than animal tissues. Consequently, herbivorous vertebrates have evolved specializations in their morphology, physiology, and behavior that compensate for the challenges imposed by eating plants. For example, herbivorous lizards are widely considered to have specialized guts to facilitate the digestion of plant matter. But the gut morphology has been characterized in a relatively small number of lizard species (primarily herbivores) precluding broad generalizations linking form to function. We examined the external gross morphology of the guts of >25 herbivorous, >20 omnivorous, and >50 carnivorous/insectivorous species of lizards ($n > 200$). Our sample spans the breadth of lizard diversity and represents 12 independent origins of herbivory. The area of each gut segment (stomach, small intestine, and large intestine) was traced and estimated using ImageJ software. We tested the ways in which the gross gut morphology of herbivores has diverged from the ancestral carnivore condition and whether the guts of omnivores are intermediate using conventional statistics (ANCOVA) and phylogenetically based analyses. Our hypotheses that herbivores would have larger guts and that omnivores would be intermediate were generally supported. Stomach area: herbivores > omnivores = carnivores; small intestine area: herbivores > omnivores > carnivores; and large intestine area: herbivores > omnivores = carnivores. Our study supports the general hypothesis that as the proportion of dietary plant matter increases over evolutionary time, the size and capacity of lizard guts also increase to facilitate the digestion of plant tissues.

0093 Fish Community Ecology, 555 AB, Monday 12 July 2010

Shankul Singh-ngam, Narongrit Deesud, Jenjit Khudamrongsawat
Mahidol University, Bangkok, Thailand

The First Official Record of an Invasive Sucker Mouth Armored Catfish (*Pterygoplichthys pardalis*: Loricariidae) in Klong Na-Kluea, Pattaya City, Thailand, and its Habitat and Reproductive Characteristics

Pterygoplichthys pardalis has become a problem in Thailand for many years but no studies have been conducted. The invasion of this species was human-introduced based on an interview with local people. The habitat and reproductive characteristics of this invasive catfish in Klong Na-Kluea, the ditch of Pattaya City, were studied. The distribution of catfish appeared to be related to physical characteristics of habitat and water chemistry, especially salinity. Although *P. pardalis* can live only in freshwater, some individuals might be able to tolerate and survive in brackish water, especially the juveniles that were found 200 m from the ocean. However, *P. pardalis* could not live in the ditch with very high salinity because high mortality was found when seawater invaded the freshwater areas. Collections of specimens indicated the reproduction of this species had already begun in June 2009 when the first sampling was conducted and continued to January 2010 when the last sampling was done. Mean standard length was 21 cm (max 40 cm; min 4.5 cm). Positive correlation between log standard length and log body wet weight was observed. Average clutch size was 2,993 oocytes per female. Sex ratio was 1:1. Nesting sites were also found. Comparisons with other invasive catfishes in other countries showed some similarities, especially high fecundity outside their native habitat.

0463 Herp Conservation III, Ballroom B, Sunday 11 July 2010

David Skelly

Yale University, New Haven, CT, United States

Hermaphrodites in the Suburbs: The Landscape Ecology of Amphibian Intersex

The occurrence of intersex characteristics in amphibians has been linked to pesticide exposure in the laboratory and, within natural populations, proximity to agricultural activity. But, overall, the natural history of amphibian intersex is poorly studied and its occurrence in many landscape types and regions is unknown. We offer the first analysis of the frequency of amphibian intersex across a range of land covers representing the major landscape types within a region. We used remotely sensed information to characterize land cover surrounding more than 6000 potential sampling locations within the Connecticut River Valley. From among these, we selected 23 sites to collect postmetamorphic green frogs (*Rana clamitans*) from 4 land cover types: undeveloped,

agricultural, suburban, and urban. Collected males were preserved and then prepared gonadal tissue samples were screened for the presence of testicular oocytes. A total of 233 animals was examined. Thirteen % of all male green frogs had gonads containing testicular oocytes. Sexual abnormalities were not randomly distributed among sites or landscape types. No abnormal individuals were found in undeveloped sites. While 7% of individuals from agricultural sites had testicular oocytes, corresponding frequencies for suburban and urban sites were 21 and 18% respectively. In the first examination of amphibian intersex in suburban and urban contexts, we find that these developed landscapes may be hotspots for abnormal sexual development. While underlying mechanisms nominated for agricultural landscapes may also apply to suburban and urban landscapes, our findings suggest that other mechanisms also merit consideration.

**0214 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT
PHYSIOLOGY, 555 AB, Friday 9 July 2010**

Phillip L. Skipwith, Aaron M. Bauer, Todd R. Jackman

Villanova University, Villanova, PA, United States

Molecular Phylogenetics of New Caledonian Diplodactylid Geckos

Diplodactylid geckos represent the most species-rich tetrapod lineage endemic to the South Pacific island of New Caledonia. They are a morphologically diverse group comprising approximately 70 species, many still undescribed, in five highly divergent genera. The monophyly of this clade within the Diplodactylidae is well supported by molecular data and the smaller genera *Dierogekko*, *Eurydactylodes*, and *Oedodera* are all strongly supported as monophyletic by all loci examined to date. The species-rich *Bavayia* is also monophyletic, but relationships among species in the most distinctive genus, *Rhacodactylus* (New Caledonian giant geckos), remain unclear. We used the mitochondrial gene ND2 and several nuclear genes varying in their evolutionary rates (RAG1, PDC, KIF24, and KIAA1549) to investigate the phylogeny of *Rhacodactylus*. None of the molecular markers supports the monophyly of the genus, but specific patterns of implied affinity differ significantly. ND2 data strongly suggests a sister relationship between *R. chahoua* and *Eurydactylodes* but none of the nuclear genes do. A sister relationship between *R. ciliatus* and *R. sarasinorum* was recovered by ND2 and KIAA1549, but not by other genes. In contrast to the strongly supported maximum likelihood phylogeny of ND2, all of the nuclear loci provide relatively poor support for the relationships of *Rhacodactylus* spp. they imply. The large degree of morphological divergence seen in this group appears to have occurred over a relatively short time period. Due to their comparatively slow evolution speed, even the fastest of the nuclear genes have been unable to resolve these relationships.

0518 AES Stress Symposium I, 551 AB, Sunday 11 July 2010

Gregory Skomal¹, John Mandelman²

¹MA Marine Fisheries, Vineyard Haven, MA, United States, ²New England Aquarium, Boston, MA, United States

Investigations into Physiological Stress in Elasmobranchs: A Historical Perspective

Elasmobranchs, like most fishes, are being subjected to an increasingly vast array of chronic and acute anthropogenic stressors. Although the physiological stress response in teleosts has been studied for decades, this research has lagged far behind in elasmobranchs. Of the limited number of studies conducted to date, most have centered on sharks subjected to capture and handling stress. This work has shown that sharks, like teleosts, exhibit primary and secondary responses to stress that are manifested in their blood biochemistry. The former is characterized by immediate and profound increases in circulating catecholamines and corticosteroids, which are thought to mobilize energy reserves and maintain oxygen supply and osmotic balance. Mediated by these primary responses, the secondary effects of stress in elasmobranchs include hyperglycemia, metabolic (e.g. lacticacidosis) and respiratory (hypercapnia) acidoses, and profound disturbance to ionic, osmotic, and fluid volume homeostasis. The nature and magnitude of these secondary responses are species-specific and may be tightly linked to metabolic scope and thermal physiology along with the type and duration of the stressor in question. Initial studies have also shown that the threshold to cope with, and recover from, various stressors, appears to vary interspecifically. Given the diversity of elasmobranchs, additional studies that characterize the nature, magnitude, and consequences of physiological stress over a broad spectrum of stressors are essential for the development of conservation measures. Due to K-selected life history characteristics in this group, additional studies on the sublethal impacts of various stressors on reproduction, immune function, and growth are particularly in need.

0315 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Peter C. Smiley Jr., Barry J. Allred

USDA-ARS Soil Drainage Research Unit, Columbus, Ohio, United States

Design and Management Criteria for Fish, Amphibian, and Reptile Communities within Created Agricultural Wetlands

Design and management criteria for created agricultural wetlands in the midwestern United States typically focus on maximizing the ability to process agricultural runoff. Ecological benefits for fish, amphibian, and reptiles are often secondary considerations. One example of this water quality focus is exhibited by the wetland-reservoir

subirrigation system (WRSIS) in northwestern Ohio. WRSIS is a agricultural water recycling system having one created wetland designed to process agricultural chemicals (filtration wetlands) and one created wetland designed to store subirrigation water (reservoir wetlands). Our objective was to compare fish, amphibian, and reptile communities between WRSIS wetland types to gain insights on how the created wetlands could be designed and managed to benefit fishes, amphibians, and reptiles. Fishes, amphibians, and reptiles were sampled by seining, hoop netting, and gee minnow trapping in three filtration wetlands and three reservoir wetlands in June of 2006, 2007, and 2008. A blocked two factor ANOVA coupled with the Tukey test was used to determine if differences in community structure occurred between wetland types and years. No difference in species richness, abundance, or percent reptiles occurred between wetland types. Percent amphibians was greater in filtration than reservoir wetlands. Percent fishes was greater in reservoir than filtration wetlands. Jaccard's similarity index scores ranged from 0 to 0.5 and indicated species composition was different between wetland types. Our results suggest the design and management of WRSIS wetlands needs to be altered so filtration wetlands are actively managed as amphibian habitat and reservoir wetlands are managed as fish habitat.

0314 Fish Conservation, Ballroom B, Friday 9 July 2010

Peter C. Smiley Jr., Kevin W. King, Norman R. Fausey

USDA-ARS Soil Drainage Research Unit, Columbus, Ohio, United States

Influence of Herbaceous Riparian Buffers on Fish and Amphibian Communities within Channelized Headwater Streams in Central Ohio

Herbaceous riparian buffers are a widely used conservation practice in the United States for reducing nutrient, pesticide, and sediment loadings in agricultural streams. The importance of forested riparian zones for headwater streams has been documented, but the ecological impacts of herbaceous riparian buffers have not been evaluated. Our hypothesis was that establishment of herbaceous riparian buffers adjacent to channelized headwater streams will alter the riparian habitat and geomorphology, which will then cause changes in water chemistry, instream habitat, fish communities, and amphibian communities. Beginning in 2006 we sampled riparian habitat, geomorphology, instream habitat, water chemistry, fishes, and amphibians from three channelized streams without herbaceous riparian buffers, three channelized streams with herbaceous riparian buffers, and two unchannelized streams with forested riparian zones in central Ohio. Herbaceous riparian buffers were installed between 2003 and 2005 through the Conservation Reserve Enhancement Program. Preliminary analysis of the first two years of data observed that channelized streams with herbaceous riparian buffers had greater riparian widths than channelized streams without buffers. No differences in geomorphology, instream habitat, water chemistry, fish community, and amphibian community variables occurred between buffer types. These preliminary results suggest that widening riparian buffers of channelized headwater streams

without altering riparian vegetative structure, geomorphology, or instream habitat is not likely to influence fish or amphibian communities.

0051 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Daniel Smith

University of Central Florida, Orlando, FL, United States

The Effects of Roads and Habitat Fragmentation on an Assemblage of Herpetofauna: A Case Study in Central Florida

Ross Prairie is a 6,500 ha conservation area east of Ocala, FL. It has a rich assemblage of herpetofauna including the Eastern Indigo Snake, Gopher Tortoise, and Florida Gopher Frog. It is bisected by a major state highway and surrounded on three sides by county roads. Three housing developments exist along the boundaries. We performed road-kill, track, mark-recapture and telemetry studies to determine impacts of this development. Field work was conducted from 2002 to 2005. Road-kills included 573 individuals from 27 identifiable species. A total of 474 snake tracks were recorded. In most instances these correspond to the same locations identified as road-kill hotspots. A total of 1,777 herptiles were captured in right-of-way drift fence traps. Individuals of several species of snakes, frogs, and lizards were recorded crossing the road between sandhill and wet prairie habitats. Fifty gopher tortoises were captured and marked, 25 were equipped with radio-transmitters. Only three attempted crossings of the state highway were recorded. Tortoises used habitat as close as 10-20 m from the pavement. We captured 24 eastern indigo snakes over the entire study area, observed 2 others and encountered 5 road-kills. Home range of eastern indigo snakes averaged 10.3 ha. The individuals tracked used the road as a home range boundary. GIS was used in conjunction with telemetry, track, mark-recapture and roadkill data to predict habitat use and movement behavior associated with roads and adjacent development. To improve habitat connectivity and eliminate road mortality we proposed a system of culverts, bridges and fencing.

0270 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Gerald Smith¹, Nathan Carpenter¹

¹University of Michigan, Ann Arbor, Michigan, United States, ²Paleopublications, Eagle, Idaho, United States

Late Cenozoic *Ameiurus* from Pacific Drainage North America

Ameiurus catfish species diversified in at least nine isolated Miocene and Pliocene basins in NV, OR, WA, ID, and UT. Evidence of diversification consists primarily of shapes and ornamentation of pectoral spines and skull parts. *Ameiurus peregrinus* (Lundberg) evolved in the vicinity of the Oregon-Idaho Graben in SE Oregon, as the sister to *A. vespertinus* in the western Snake River Plain of SW ID. The earliest records are around 12 million years ago in the Juntura formation, OR, and the Truckee formation, NV. About 9 Ma, drainage flowing west from a ridge in SW OR was captured by a tributary flowing northeast from the same ridge into the Snake River Plain, ID, bringing *A. peregrinus* into contact with *A. vespertinus*. They coexisted and sometimes hybridized. Possibly as a consequence of the increased drainage area, the Chalk Hills Lake filled the western Snake River Plain and encroached into OR as it deposited the Chalk Hills Formation, now with two kinds of bullheads. Eventually, only *Ameiurus vespertinus* occupied the basin of Lake Idaho, the rift lake that deposited the Glens Ferry formation and flowed to the Sacramento and Klamath rivers, until cooler climates and glaciation ended the reign of western catfishes at the end of the Pliocene and the Snake River was captured by the Columbia River.

0807 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Katie L. Smith^{1,2}, M. Kearney¹, K. Parris³, J. Melville²

¹Department of Zoology, University of Melbourne, Parkville, VIC, Australia ²Dept. of Sciences, Museum Victoria, ³School of Botany, University of Melbourne, Parkville, VIC, Australia

Evolutionary insights into a hybrid zone between the south-eastern Australian tree frogs, *Litoria ewingii* and *L. paraewingii*

Hybrid zones - locations where genetically distinct populations interact and produce hybrid offspring - provide a unique opportunity to gain insight into the basis of reproductive isolation and speciation. The Hylid frogs, *Litoria ewingii* and *L. paraewingii* are parapatrically distributed throughout south-eastern Australia, with contact areas characterised by narrow zones of hybridisation. Detailed research in the 1960-70s demonstrated that divergence in male advertisement calls and one-way genetic incompatibility occurred along contact areas, and despite their morphological similarity, they were distinct species. The Glenburn transect, located along a narrow region of

hybridisation, was a particular focus of this research. In order to assess changes in the hybridisation between *Litoria ewingii* and *L. paraewingii*, we recently collected genetic samples and acoustic data from comparable populations along the Glenburn transect. We used a combination of acoustic data and mitochondrial DNA to (1) clarify the modern structure of the hybrid zone, (2) assess how this corresponds to the historic structure, and (3) examine the relationship between mitochondrial DNA and acoustic structure of pure types and hybrids. This research represents the first steps at utilising both genetic and acoustic data to explore the *Litoria ewingii*/*L. paraewingii* hybrid zone. Additionally, as the Glenburn transect is located in an area that has been highly disturbed by agricultural development, a temporal perspective such as this is of critical importance to understanding the evolution of hybrid zones through changing ecological conditions.

0272 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Katrina Smith, Sean Blomquist

Tennessee Technological University, Cookeville, TN, United States

Distribution of the Black Mountain Dusky Salamander on the Cumberland Plateau in Tennessee

Desmognathus walteri, Black Mountain Dusky Salamander, is a headwater stream salamander found in the Cumberland Plateau and Mountains ecoregion of Tennessee, Kentucky, Virginia, and West Virginia. Little is known about the ecology of this species and, with only 30 known occurrences in Tennessee, their distribution hasn't been well defined in Tennessee. Our research delineated their distribution in Tennessee. Based on a preliminary habitat model we randomly selected 54 first-order streams >300 meters to conduct visual encounter surveys. Currently, 17 new sites have been recorded for this species representing 16 new streams and 9 new watersheds (12-digit hydrologic units). The area representing *D. walteri* range in Tennessee increased from 442,070 ha to 721,324 ha. A new county record was documented in Rhea County representing a 7.8 mile southern range extension. A 14.4 mile western range extension was documented within Cumberland County and a 12.5 mile southeastern range extension within Anderson County. Surveys will continue in 2010, and we will develop habitat models at the watershed and microhabitat scales based on occupancy modeling. The results of this research will be applied to two conservation planning efforts on the Cumberland Plateau, the Northern Cumberlands Forest Resources Habitat Conservation Plan (HCP) and the Water Resources HCP.

0022 Herp Systematics & Biogeography, 551 AB, Saturday 10 July 2010

Krister Smith

Senckenberg Museum, Frankfurt, Germany

The Evolution of Mid-latitude Squamate Faunas During the Paleogene: The Biogeography of a World in Climatic Transition

The climate of the middle latitudes during the Eocene was similar to that of the tropical latitudes today. A plethora of new fossil finds now illuminates the evolution of lower vertebrate faunas and the response of this component of the terrestrial biota to major climate transitions during the Paleogene. Particularly important have been localities rich in isolated material. New probabilistic techniques and detailed osteological analyses allow for the secondary association of abundant dermal cranial remains and a far more comprehensive understanding of morphology. Thus, fossil taxa may be placed robustly in an explicit phylogenetic framework. Global warming near the Paleocene-Eocene boundary resulted in the first occurrence in mid-latitude North America of diverse lineages, including iguanids, anguids, and the xantusiid *Lepidophyma*. Many of these lineages continued to diversify at mid-latitude during the Eocene. Iguanidae (=Pleurodonta) is now especially well documented. Late Eocene iguanids include relatives of the polychrotine *Polychrus* and the iguanine *Dipsosaurus* and a crown corytophanine related to *Corytophanes* and *Laemanctus*. Most of these lineages seem to have disappeared from mid-latitude North America during the global cooling of the earliest Oligocene. Thus, middle latitude Eocene squamates are not merely related in a general sense to living tropical lineages. Rather, specific presently tropical clades were radiating at middle latitudes. This fact, in combination with the biogeographic shifts apparent in the fossil record, are consistent with the notion that the present latitudinal diversity gradient reflects in part the concentration of lineages into tropical latitudes in the later Cenozoic.

0693 Fish Systematics I, Ballroom D, Monday 12 July 2010

Leo Smith¹, Edward Wiley²

¹*The Field Museum, Chicago, IL, United States*, ²*The University of Kansas, Lawrence, KS, United States*

Inter- and Intrarelationships of the Perciformes

In their recently published teleostean classification, Wiley and Johnson highlighted the familiar problem that several recognized fish assemblages such as the classical Perciformes are unsupported by synapomorphic diagnoses. They noted that the traditional classification of this assemblage “looks impressively detailed, but the emperor really has no clothes. It is time for a change.” The difficulty in making the necessary wholesale change is that a comprehensive and evidence-based alternative must be provided. In this particular example, resolving the placement of the nearly 100 families in their revised Perciformes (Moronoidei or Percoidei of previous authors) among the remainder of percomorphs is the daunting first step toward resolving the so-called percomorph problem. In this study, we will present the results of a molecular study aimed at placing all perciform families with their percomorph allies. We will focus the talk on morphological and molecular investigations into some of the novel molecular groupings.

0718 AES Ecology, 551 AB, Thursday 8 July 2010

Wade D. Smith¹, J. Fernando Márquez-Farías², Jessica A. Miller³, Selina S. Heppell¹

¹*Oregon State University, Dept. of Fisheries & Wildlife, Corvallis, Oregon, United States*, ²*Facultad de Ciencias del Mar, Universidad Autonoma de Sinaloa, Mazatlán, Sinaloa, Mexico*, ³*Oregon State University, Coastal Oregon Marine Experimental Station, Hatfield Marine Science Center, Newport, Oregon, United States*

Spatial and Temporal Variation in Vertebral Chemical Composition: Evaluating the Potential to Distinguish Natal Origin from Natural Elemental Markers in Elasmobranchs

Differences in the chemical composition of calcified structures are used to reconstruct environmental history and reveal natal origins, dispersal patterns, spatial dynamics, and metapopulation structure of many marine organisms. Because the use of discrete nursery areas is common among elasmobranchs, distinctive chemical markers may be incorporated into the vertebrae of individuals as they occupy these areas during the first months or years of their lives. We evaluate the assumptions of elemental analysis for the cartilaginous vertebrae of elasmobranchs and compare the variation observed in this

study with that reported for the calcified structures of teleosts and mollusks. Vertebrae were collected from young-of-the-year scalloped hammerhead sharks (*Sphyrna lewini*) from five locations along the Pacific coast of Mexico and Costa Rica in 2007 and 2008 to assess patterns of spatial and temporal variability in elemental composition. Elemental composition was measured using Laser Ablation Inductively Coupled Plasma Mass Spectrometry and the resulting elemental concentrations were expressed relative to their ratio with calcium. Elemental composition (Ba, Cd, Co, Cr, La, Li, Pb, Mg, Mn, Ni, Rb, Sr, Ti, V, Zn, Zr) did not vary between vertebrate within age-0 individuals. However, elemental composition differed significantly between the region of vertebrae that was deposited post-partum in comparison to that which developed while in-utero. Multivariate analysis of variance was applied to examine temporal (intra- and inter-annual) differences in vertebral chemistry within and among sample locations. The ability to successfully classify individual specimens to their site of natal origin was assessed through quadratic discriminant function analysis.

0725 SSAR SEIBERT CONSERVATION AWARD, 555 AB, Friday 9 July 2010

Nicole Smolensky, Lee Fitzgerald

Texas A&M University, College Station TX, United States

Population Variation in Dune-dwelling Lizards in Response to Patch Size, Patch Quality, and Oil and Gas Development

Populations do not always show immediate response to habitat loss, nor are population fluctuations correlated to habitat loss alone. Local factors such as patch size and quality, in concert with stochastic population variation across space and time can mask effects of habitat loss on populations at broader spatial scales. We studied the relationships between quality and quantity of habitat patches and land conversion to caliche roads and well pads associated with oil and gas development. We asked how these factors affected abundance of dune-dwelling lizards, with emphasis on a habitat specialist, *Sceloporus arenicolus*. Open sandy depressions in dune complexes are an important landscape feature to these lizards, thus the size and total summed area of these patches in a study site were our measures of habitat quality and quantity. There were significant differences in habitat quality among sites, and habitat quality and quantity were significantly correlated. The abundances of all lizards, including *S. arenicolus*, varied significantly among sites. This variation could be explained by habitat quantity. The relationships between oil and gas development, habitat quantity and quality, and lizard abundances likely occur on different spatial scales constraining our ability to detect direct effects of oil and gas development alone. Our work represents the first study to investigate effects of oil and gas development on a dune-dwelling lizard assemblage. Future research that includes long-term studies at broader spatial and temporal scales and Before-After-Control-Intervention experiments will greatly improve our ability to detect effects of oil and gas development on habitat and biodiversity.

0337 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Sarah Snyder¹, C. Richard Tracy¹, Kenneth Nussear², Lesley DeFalco²

¹University of Nevada, Reno, Reno, NV, United States, ²US Geological Survey, Henderson, NV, United States

Quantifying the Thermal Quality of Burned and Unburned Habitat for the Desert Tortoise (*Gopherus agassizii*)

Recently, fires in the Mojave Desert have burned extensive portions of habitat used by the threatened desert tortoise (*Gopherus agassizii*). Burned landscapes may challenge the thermoregulatory opportunities of tortoises, because they rely on vegetative cover as a buffer from extremes in desert thermal environments. By reducing the availability, or altering the physical properties, of above-ground vegetative cover, fires may indirectly require behavioral and/or physiological changes by tortoises living in burned-unburned habitat interfaces. To assess differences in thermal quality with respect to preferred tortoise body temperature, we placed operative temperature models in various microhabitats available to tortoises in burned and unburned areas. We determined quantity of cover per shrub species using line transects in both habitat types. These two measurements were used to quantify the thermal environment available to a tortoise using a space-time index reported in meters squared x hours (m² x h). Although number of hours available for activity in burned and unburned areas may be similar at certain times of day, a reduction in cover in burned habitats results in fewer meters available, and thus a lower index. Results suggest that thermal opportunities may differ between burned and unburned habitat, influencing tortoise behavior, habitat use, and potential for population persistence.

0618 Fish Systematics I, Ballroom D, Monday 12 July 2010

Julie Sommer¹, Evelyn Habit², Victor Cussac³, Roberto Cifuentes², Cecilia Conte-Grand³, Guillermo Orti⁴

¹University of Nebraska, Lincoln, NE, United States, ²Universidad de Concepcion, Concepcion, Chile, ³Universidad del Comahue, Bariloche, Argentina, ⁴George Washington University, Washington, DC, United States

Phylogeny, Species Boundaries, and Marine to Freshwater Transitions in South American Silversides

A molecular phylogeny of the tribe Sorgentinini reveals significant discordance with previous hypotheses based on morphology. A total of 446 individuals representing 16 out of 23 nominal species were sampled from throughout their range in South America. Mitochondrial cytochrome b DNA sequences were obtained for all specimens and a

subsample was analyzed for the S7 nuclear marker. The molecular evidence provided strong support for the monophyly of both included genera and many of the nominal species, but failed to produce diagnostic characters to differentiate two nominal species within *Basilichthys* (*B. microlepidotus* and *B. australis*) and several species within *Odontesthes*. The latter include the Chilean freshwater species *O. mauleanum* and *O. microlepidotus*, the widespread marine taxa *O. regia* and *O. gracilis* from the Chilean Pacific coast and J. Fernandez Islands, respectively, and several freshwater and marine species from Argentina. Most notably, a clade comprising *O. bonariensis* and *O. argentinensis* and several species recently described from Southern Brazil is strongly supported by the molecular data, but shows poor resolution to differentiate the contained taxa. Although some species are strictly marine or freshwater, two clades identified by the molecular data show strong evidence of repeated historical transitions between marine and freshwater habitats. Phylogenetic reconstruction implies an ancestral marine habitat for this group, with at least five instances of freshwater invasion and some reversals to marine habitat.

0482 Fish Systematics & Morphology, Ballroom D, Friday 9 July 2010

John Sparks¹, Zachary Baldwin¹, Christopher Braun²

¹American Museum of Natural History, NY, United States, ²Hunter College/CUNY, NY, United States

Anatomical Specializations and Enhanced Auditory Ability in Malagasy-South Asian Cichlids

The Malagasy-South Asian (MSA) cichlids exhibit numerous anatomical specializations that appear to be associated with enhanced auditory ability. Taxa within this assemblage range from unspecialized (*Katria*), to moderately specialized (*Ptychochromis*, *Ptychochromoides*, and *Paratilapia*), highly specialized (*Etroplus*), and extremely specialized (*Paretroplus*). All MSA cichlids, with the exception of *Katria* and *Oxylapia*, possess enlarged exoccipital foramina and large, paired anterior extensions of the gas bladder. In *Paratilapia*, *Ptychochromis*, and *Ptychochromoides*, paired anterior diverticula of the gas bladder abut the enlarged exoccipital openings, whereas in *Etroplinae* (*Paretroplus* + *Etroplus*), the paired gas bladder diverticula penetrate the exoccipital foramina and abut the inner ear, creating a direct otophysic connection. In *Paretroplus*, the exoccipital foramina are greatly enlarged and internally comprise multiple chambers. Likewise, the paired anterior gas bladder extensions in *Paretroplus* are by far the most structurally complex, with multiple bullae separated by constrictions, extremely narrow connections to the main chamber, a tough, rigid tunica externa, and complex intracranial expansions. Gas bladder and associated anatomical specializations are examined in a phylogenetic context and with reference to audiograms generated for a number of species using ABR (AEP) methodology.

0301 Fish Behavior/Acoustics, 555 AB, Sunday 11 July 2010

Patty Speares, Carol Johnston

Auburn University, Auburn, AL, United States

The Effects of Conspecific Playbacks on Behavior and Hormone Modulation in *Etheostoma crossopterum*

Steroid hormones have been implicated in modulating many behaviors essential to survival, including those related to reproductive behavior. Social cues, such as acoustic signals, can regulate these hormones, and therefore ultimately affect these critical behaviors. Interactions between vocalizations, hormones, and behavior have been well studied in birds, amphibians and some species of fishes. There are still many questions that remain, however, regarding the effect of playback vocalizations on hormone levels in fishes. It is known that playbacks of male vocalizations can affect hormone levels in male fishes, when examined in concert with other behaviors. What effect playback vocalizations have on males independent of these behaviors and how these vocalizations affect female hormone levels has not been investigated, however. This presentation will discuss the behavioral and hormonal responses to acoustic vocalizations in the fringed darter, *Etheostoma crossopterum*. Darters are small benthic fish that adopt a reproductive strategy in which a male establishes a nest cavity and recruits multiple females to lay eggs within his shelter. These nest guarding males have been shown to be vocal and acoustic communication is thought to be critical in allowing these males to recruit females (courtship vocalizations) and also ward off other males (aggressive vocalizations). Recordings made from males in aggressive, courtship and spawning interactions will be used as playbacks for both male and female fish. Behaviors and hormonal responses of the fish in response to these playbacks will be discussed, as well as the methodology for obtaining the hormone data using water collection methods.

0773 Acoustics Symposium III, Ballroom D, Sunday 11 July 2010

Mark W. Sprague, Joseph J. Luczkovich

East Carolina University, Greenville, NC, United States

Propagation of Fish Sounds in Very Shallow Water

An understanding of sound propagation is necessary in order to interpret recordings of sounds produced by any animal. This is especially true for interpreting fish sound recordings because poor underwater light transmission limits a researcher's ability to determine the location of the sound source. The propagation distance of a fish sound depends on the source level, the background level, and the propagation losses. In very shallow environments (water depths 10 m or less), such as estuaries and shallow rivers and lakes, sound reflections off of the bottom and the surface of the water are important

factors in sound propagation and can limit the frequencies that will travel significant distances. Researchers must understand how far sounds propagate in order to establish limitations on the position of a sound source in a recording. Sound propagation properties are important to the fish producing sounds as well and may have significant influences on fish behavior. For example, it is advantageous for fish producing spawning advertisement calls to broadcast their sounds to potential mates but disadvantageous to broadcast the same sounds to potential predators. We will discuss the implications of sound propagation on the location of and distribution of individuals within aggregations of calling fishes. Sound propagation distance could be an important factor in selection of the location of spawning aggregations and the distance between individuals competing acoustically for potential mates.

0473 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Emily Standen

McGill University, Montreal, PQ, Canada

Why was Karel Liem Excited about Pelvic Fins?

The last 'serious' question Karel asked me was at my thesis defense. It was a leading comment more than a question and in my haze of adrenalin I only vaguely remember it having to do with adaptation, natural selection, Darwin's Tripod and how pelvic fins, in their diversity of form and function, could be the absolute example explaining the roles of agency, efficacy and scope in evolutionary theory. Wow! I thought as he spoke, I'm almost done my defense. In the time after my defense I have had time to reflect back on Karel's comment. Pelvic fins in fishes are morphologically and functionally diverse. Of all fish fins, pelvic fins have been lost the most number of times and could be argued to be the most diverse in form and hypothesized function suggesting an interesting degree of genotypic and phenotypic flexibility. Guided by my own work on the locomotory function of trout pelvic fins as well as Karel's enthusiasm for the topic I will attempt to use pelvic fin morphological and functional diversity to address the concepts of agency, efficacy and scope in evolutionary theory.

0602 Poster Session I, Exhibit Hall D, Friday 9 July 2010; ASIH STORER HERPETOLOGY AWARD

Edward Stanley

Richard Gilder Graduate School, New York, New York, United States

A Phylogenetic Analysis of the *Cordylus warreni* Species Complex

The *Cordylus warreni* species complex comprises seven nominal taxa: *Cordylus warreni warreni*, *Cordylus warreni barbertonensis*, *Cordylus depressus*, *Cordylus mossambicus*, *Cordylus regius*, *Cordylus breyeri* and *Cordylus vandami*. These large, spinose girdled lizards are found in rocky outcrops throughout the mountainous regions of Northeast South Africa, Swaziland, Zimbabwe and Mozambique. Extensive variation in color pattern and scale characters is seen across this group and the status of many of the taxa is controversial. I used a molecular approach to explore the evolutionary relationships of the complex, employing dense taxon sampling and analyzing mitochondrial and nuclear DNA to produce a well-resolved phylogeny. Eight lineages were recovered with good support that corresponded closely to both phenotype and geographical distribution. All eight lineages recovered by the analysis showed significant differentiation. A deep divide was recovered between the South African and Swaziland populations of the lowveld subspecies, *Cordylus warreni barbertonensis*, with the latter clade more closely related to the subspecies from the Lebombo mountains, *Cordylus warreni warreni*. Several characters differentiate the swazi and South African forms. The distinctively smooth scaled lizards from Entabeni forest reserve were once considered to be a valid species, *Cordylus laevigatus*, but our study recovers them within *Cordylus depressus*.

0180 Fish Systematics I, Ballroom D, Monday 12 July 2010

Jay Stauffer¹, Timothy King¹

¹*Penn State University, University Park, PA, United States*, ²*U. S. Geological Survey, Kearneysville, WV, United States*

Differentiation in Southern Appalachian Brook Trout, *Salvelinus fontinalis*

Geographic constraints within Great Smoky Mountains National Park (GRSM) isolate populations of Brook Trout, *Salvelinus fontinalis*. Functionally, these geographic populations are veritable "sky islands" as there is little or no opportunity for gene flow. Demographically, these processes reduce effective population size and accelerate extinction. Tissue samples from Greenbrier, Indian Camp, and Cosby creeks were genotyped and F_{ST} values between populations ranged from 0.429 - 0.60. The minimum polygon clusters formed when plotting the sheared second principal components of the morphometric data against the first principal components of the meristic data for populations from each creek were significantly different ($p < 0.05$). Thus, genetic and

morphometric analyses allowed discrimination among the source populations. GRSM fishery managers reestablished *S. fontinalis* in LeConte Creek of the Pigeon-French Broad river system in 1999 using fish from the above streams. Seven years post translocation, we collected, genotyped, and compared fish from LeConte Creek, using parentage assignment testing. We determined at least 77% of the fish sampled resulted from parents originating from the same source stream (i.e., three discernable populations of *S. fontinalis* co-exist in LeConte Creek). Thus, among the introduced populations there is positive (selective) assortative mating and/or some form of post-reproductive isolating mechanism; thus these populations may in fact be species *sensu* the biological species concept.

0249 Fish Systematics II, Ballroom D, Monday 12 July 2010

Jay Stauffer¹, Adrianus Konings², Rachel Cleaver Yoder¹

¹*Penn State University, University Park, PA, United States*, ²*Cichlid Press, El Paso, Texas, United States*

Two New Cichlids in the Genus *Stigmatochromis* from Lake Malawi, Africa

Two new cichlids from Lake Malawi, Africa are described. Morphometric and meristic data were collected for the two new species and all other species in the genus. Principle component analysis was used to create minimum polygon clusters to determine differences among groups. *Stigmatochromis* n. sp. "guttatus" was distinguishable from all other species in the genus. *Stigmatochromis* n. sp. "tolae" is visually very similar to *Stigmatochromis woodi*, however, breeding habitat preference differs between the two. *Stigmatochromis* n. sp. "tolae" was distinguished from all other species in the genus.

0031 Herp Physiology, 556 AB, Monday 12 July 2010

John Steffen, Arthur Appel

Auburn University, Auburn, AL, United States

The Energetic Costs of Social Displays in Male Brown Anoles

Male anoline social displays are dynamic and typically consist of several different components (e.g., head nods, dewlap extension, and two and four legged push-ups), which appear to be physically costly. Studying the energetics of these different display components may allow us to define the limits of sexual selection by designating which display components are significantly energetically expensive, and which may then act as a form of fitness cost. To investigate the energetic expense of these display components, we quantified oxygen consumption (VO₂) of displaying male brown anoles. We placed focal adult males in transparent respirometry chambers that were 5 cm away from a

size-matched male and a female (both in separate, transparent plastic boxes). We performed Flow-through respirometry on the focal male to determine male oxygen consumption while engaged in social displays. We used an event recorder program to count the number and duration of all display components, and we obtained oxygen consumption values for each display component that occurred. Multiple regression of display VO₂ against real-time sums of the display component O₂ consumption rates revealed that push up and head nod frequency were the only components to explain a significant variation in display VO₂. These results imply that components of display behavior such as dewlap extensions and head nods are relatively energetically inexpensive, whereas 2 and 4-legged push-ups are more costly. These findings may have implications for understanding which components of the anoline display are under significant sexual selection.

**0019 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT
PHYSIOLOGY, 555 AB, Friday 9 July 2010**

Michael Steffen, Ronald Bonett

University of Tulsa, Tulsa, OK, United States

Phylogeography of an Endemic Ouachita Mountain Salamander (*Eurycea multiplicata*)

The Ouachita Mountains of Oklahoma and Arkansas are home to many endemic species, including several plants, crayfish, fishes, and salamanders. Recent studies have shown high levels of genetic diversity within endemic Ouachita salamanders, indicating a long history of population fragmentation and divergence. One such species, the Many Ribbed Salamander (*Eurycea multiplicata*) contains four highly divergent mitochondrial lineages across the Ouachitas. Using phylogenetic analyses based on mitochondrial and nuclear DNA we present patterns of lineage divergence and diversification with *E. multiplicata* and compare them to other Ouachita taxa to provide insight as to what historical factors have shaped the biodiversity of this region.

0669 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Anne Stengle¹, Thomas Tynning²

¹University of Massachusetts, Amherst, MA, United States, ²Berkshire Community College, Pittsfield, MA, United States

Body Temperature Range of Black Ratsnakes (*Pantherophis alleghaniensis*) Occupying Forest and Roadside Habitats

Use of forest openings may be critical to body temperature regulation of black ratsnakes, especially at the northern edge of their geographic range, and innovations in technology have provided new opportunities to examine their thermal ecology. Beginning in June of 2008, we monitored the habitat use and body temperature of eight black ratsnakes at the edge of their range in Massachusetts using implanted radio transmitters and internal temperature data loggers. Our study site included forested habitat surrounded by state highways, residential areas, and a college campus, and contained at least four hibernacula. Three of these snakes during the month of August used edge habitat along roadsides, while the other five utilized forest habitat. During the month of August, roadside snakes had both higher mean daily body temperatures ($23.4 \pm 0.5^\circ\text{C}$) and a narrower range of daily body temperatures ($5.42 \pm 0.3^\circ\text{C}$) than those using forest habitats (21.9 ± 0.5 and $7.0 \pm 0.4^\circ\text{C}$ respectively). Our results suggest that there is a thermoregulatory benefit for snakes using forest openings associated with roadways, though there may be other benefits. No road mortality of snakes was observed during our study, but this is a potential risk associated with use of road edges. These variations in thermal ecology have conservation implications for populations at the edge of their geographic range.

0466 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Ashley Stoehr¹, Cheryl Wilga¹, Rebecca Allen²

¹University of Rhode Island, Kingston, RI, United States, ²Ross University, Roseau, Dominica

Prey Processing in Elasmobranchs

Prey processing is an integral part of the feeding process, however, there are relatively few studies that focus on post-capture behavior in fishes. Arch morphology is related to prey capture mode in elasmobranchs, but the relationship is little understood for prey processing. The effects of jaw, hyoid and branchial arch morphology on prey processing were studied in white-spotted bamboo sharks (*Chiloscyllium plagiosum*), spiny dogfish (*Squalus acanthias*), and little skates (*Leucoraja erinacea*), which possess short lateral, medium lateral, and anterior hyomandibular orientations, respectively. The kinematics

of the jaws, hyoid, and 2nd branchial arches (posteriorly or laterally oriented), and associated pressures were quantified during suction and bite processing. In all species gape, hyoid, and pharyngeal expansion generated subambient pressures, while gape, hyoid, and pharyngeal compression created superambient pressures. The hyoid and pharyngeal arches move in synchrony during suction and bite processing in skates and dogfish, but not in bamboo sharks. The directional movement of the arches during processing appears to depend on the morphological orientation and skeletal coupling to other structures. Bite events are longer in duration than suction events. Skates had the longest durations for all events. The bamboo sharks created the greatest suction pressures, while pressures were more similar for bite events. The bamboo sharks, which are specialist predators, are more stereotyped in their mechanisms compared to the dogfish and skates, which are generalist predators. These differences during prey processing reflects different degrees of cranial kinesis and morphological constraint among the species.

0708 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD

Kristine Stump¹, Diego Cardenosa², Gaby de Tezanos², Samuel Gruber³

¹University of Miami - Rosenstiel School of Marine and Atmospheric Science, Miami, FL, United States, ²Universidad de Los Andes, Bogota, Colombia, ³Bimini Biological Field Station, Bimini, Bahamas

Assessing Juvenile Lemon Shark Mortality over Time Using a Long-term Mark-Recapture Dataset

In Bimini, Bahamas, a juvenile lemon shark (*Negaprion brevirostris*) nursery in a Marine Protected Area (MPA) recently created by the Government of the Bahamas faces the threat of extensive habitat loss due to a large-scale coastal development project adjacent to the MPA. Within the threatened North Sound nursery, juvenile *N. brevirostris* remain site-attached for a period of several years before expanding their home ranges to include a secondary nursery over a wider area. Due to the wealth of existing knowledge about this system in a relatively undisturbed state, effects of an anthropogenic impact on *N. brevirostris* can be quantified. A long-term tagging program dataset that exists for the juvenile *N. brevirostris* population allows for a comparative analysis of mortality estimates between the years before and after the onset of various degrees of nursery habitat degradation. Early mark-depletion experiments in the undisturbed nursery found a range of annual first-year survivorship between 38% and 65% which was negatively correlated with initial abundance and consistent with density-dependent survival. Following a major dredging campaign in 2001 associated with the development of Bimini Bay Resort and Marina, analyses of first-year survival in the North Sound detected a decrease of 23.5%. Here, mortality estimates since 2001 are calculated and compared to previous years to elucidate any changes correlated with

major development activities within the North Sound nursery, including extensive mangrove removal in 2005.

0137 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Jennifer Stynoski¹, Virginia Noble², Meredith Strider³

¹University of Miami, Coral Gables, FL, United States, ²Organization for Tropical Studies, Heredia Province, Costa Rica, ³University of Maryland, College Park, MD, United States

To Eat but Not to Be Eaten: Honest Begging Signals and Visual Detection of Predators and Mothers by Tadpoles of the Strawberry Poison Frog (*Oophaga pumilio*)

Theory suggests that offspring solicitation behavior (or “begging”) is a costly signal that indicates need to parents who subsequently provision the appropriate amount of food. Empirical work in birds, mammals, and invertebrates supports this theory, but studies have been complicated by factors such as sibling competition and indirect measurements of provisioning and fitness. Phytotelm-dwelling tadpoles of the Strawberry Poison Frog (*Oophaga pumilio*) display begging behavior by stiffening their tail and vibrating against the visiting mother to stimulate nutritive egg laying. We studied aspects of this behavior using free-living animals in Costa Rica. We videotaped tadpoles in the lab with various stimuli and determined the proportion of time tadpoles rested, swam, or vibrated. Tadpoles did not use chemosensory cues to detect the presence of adult *O. pumilio*, but were more active when given visual cues and vibrated only when given tactile cues. Begging was much more intense at conspecific adults than at other species of bromeliad-dwelling frogs. Tadpoles swam less in the presence of a predatory spider, suggesting that begging activity is costly. Fast-growing tadpoles in the middle stages of development begged more intensely than those in early or late development. Lastly, tadpoles starved for various lengths of time begged intensely, but those fed the same day did not beg. Together, this work suggests that these individually-reared and diurnal tadpoles use visual signals both to honestly signal their need to mothers and to avoid predation. Ongoing work is also exploring the effects of begging on maternal resource allocation and tadpole growth.

0782 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

James Sulikowski¹, Ben Galuardi², Walter Buble², William Driggers⁴, Eric Hoffmayer³, Angela Cicia¹, Paul Tsang²

¹University of New England, Biddeford, ME, United States, ²University of New Hampshire, Durham, NH, United States, ³Gulf Coast Research Laboratory, Ocean Springs, MS, United States, ⁴National Marine Fisheries Service, Pascagoula, MS, United States

Dismissing Dogma? What Do We Really Know About the Spiny Dogfish, *Squalus acanthias*, Population in the U.S. Portion of the Western North Atlantic Ocean

The status of the spiny dogfish, *Squalus acanthias*, stock in the U.S. portion of the northwest Atlantic has become a contentious issue. Distributed from Maine to Florida, this species was once considered to be the most abundant shark throughout its U.S. range. As a result of reported declines below biomass threshold levels, in early 2000 the Mid-Atlantic, New England Fishery Management Councils, and Atlantic States Marine Fisheries Commission implemented a management plan which imposed annual quotas and possession limits for vessels fishing in both federal and state waters. Due to such characteristics as slow growth, extended gestation period, small litter size, and a spawning stock biomass (SSB) below threshold levels as recent as 2005, the spiny dogfish population was not anticipated to rebound for more than a decade. However, recent Northeast Fishery Science Center (NEFSC) survey data suggest a four-fold increase in SSB has occurred between 2005-2009. Based on the aforementioned life history characteristics, this substantial increase in biomass is considered biologically unrealistic. We present preliminary data to support hypotheses that are divergent to common paradigms: 1) we hypothesize that the biological unrealistic increases in SSB may be due, in part, to a substantially more active vertical movement pattern that prevents this species from being effectively captured by NEFSC otter trawl surveys; and 2) we hypothesize that the gestation period of spiny dogfish may be less than the proposed 22 months and that there may also be regionally different reproductive cycles across this species U.S range.

0716 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

John P. Sullivan

Cornell University Museum of Vertebrates, Ithaca, NY, United States

John Lundberg, Ichthyological Ambassador, Molecular Phylogeneticist, and an Expanded Molecular Phylogenetic Hypothesis for the “Big Africa” Catfish Clade

Through his students and collaborators, the influence of John Lundberg’s approach to scientific discovery, phylogenetics, and his role in fostering systematic ichthyology in developing countries, extends far and wide. I describe how John Lundberg’s characteristic insights enhance our recent and ongoing molecular phylogenetic studies of siluriforms and how his example informs the work I am currently undertaking in a Fulbright Scholarship to the Democratic Republic of the Congo. As a fruit of recent African fieldwork, I present an updated and expanded molecular phylogeny for more than 50 siluroid taxa identified in our earlier work as the “Big Africa” clade that includes the families Amphiliidae, Malapteruridae, Mochokidae, Claroteidae, Lacantuniidae, Auchenoglanididae and Schilbidae.

0178 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Adam Summers

FHL, University of Washington, Friday Harbor, WA, United States

Karel Liem and the Importance of Intuition and Controversy in the Advancement of Biology

Karel Liem possessed many fine qualities that made him both an outstanding mentor and a respected scientist, but perhaps no talent was so important or difficult to quantify as his intuition about function. This ability to home in on significant questions was paired with an instinct for developing an argument in such a way that it inspired others to probe more deeply.

0508 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Tracey Sutton¹, April Cook¹, John Galbraith², Michael Vecchione³

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

Deep-Sea Fishes of the Mid-Atlantic Ridge: Results of the 2009 Henry Bigelow Expedition

As part of an ongoing study of the northern Mid-Atlantic Ridge biodiversity and ecology (CoML field project MAR-ECO), a detailed survey of the pelagic and demersal fishes in the region of the Charlie-Gibbs Fracture Zone (~ 600 n.m. south of Greenland) was conducted. A total of 17181 pelagic fishes (92 spp., 35 families) were sampled from 0-3000+ m, with the Myctophidae the most species-rich. The bristlemouth *Cyclothone microdon* was by far the dominant species in numbers (82% of total), while the sawtooth eel *Serrivomer beani* dominated biomass (27%). A total of 441 deep-demersal fishes (28 spp., 13 families) were sampled from 1872-3527 m, with the Macrouridae and Alepocephalidae comprising half of species numbers. The abyssal halosaur *Halosauropsis macrochir* was most abundant, while the abyssal grenadier *Coryphaenoides armatus* contributed the most biomass. Remarkable among the pelagic fish data were routine shallow catches of bathypelagic fishes (see A.B. Cook et al., this volume), and among the demersal fishes were the large size of the individuals, above or near the maximum known for many species. The high species number relative to sample number portends the enhanced deep-sea biodiversity about abrupt topographic features, while the lack of asymptote of species number versus sampling effort underscores our incomplete inventory of this biodiversity.

0579 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

Christopher Sweetman, Tracey Sutton

Virginia Institute of Marine Science, Gloucester Point, Virginia, United States

Distribution and Trophic Ecology of *Bathylagus euryops* (Teleostei: Microstomatidae) along the Northern Mid-Atlantic Ridge

The assemblage structure and ecology of meso- and bathypelagic fishes are poorly known in general, particularly over mid-ocean ridges. In June 2004, the month-long MAR-ECO (Census of Marine Life) research expedition aboard the R/V G.O. Sars sampled the deep-pelagic fauna over the northern Mid-Atlantic Ridge with the objective of quantitatively assessing the nekton associated with the ridge from Iceland to the

Azores. A total of 115 discrete-depth trawl samples were taken from the surface to depths of 3000+ meters using two different double-warp midwater trawls, one of commercial fishing size (a large 'Akra' trawl) and one of oceanographic research size ('Macroplankton' or 'Krill' trawl). Catch data revealed the deep-sea smelt *Bathylagus euryops* to be the biomass dominant species, accounting for over 28% of total biomass, as well as being the 3rd most abundant species along the MAR. Further distributional analyses elucidated a trend in decreasing biomass from north to south with a biomass maximum around 1500-2000 meters. Understanding the food-web structure and organic cycling of deep-pelagic ecosystems is critical for increasing our knowledge of the distributional patterns of deep-sea fishes. Preliminary results indicate that gelatinous zooplankton represents a significant component of the diet of *B. euryops*. Molecular probes are currently being developed to identify these prey items in this, and other fishes that consume gelatinous zooplankton.

0098 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Lindsey Noele Swierk, Tracy Langkilde

Penn State University, University Park, PA, United States

Finding a Perfect Match: Female Choice on Male Traits in Eastern Fence Lizards, *Sceloporus undulatus*

What makes a desirable mate? Understanding how animals select their mates can offer insight into which traits confer fitness benefits. However, reliably determining if female selection on male traits exists can be challenging. Especially in reptiles, female choice can be confounded by female selection of quality territory, or by the result of male contests. We designed an experiment using eastern fence lizards (*Sceloporus undulatus*) to uncover if females select their partners based on specific traits. We conducted 68 female choice trials in which one female lizard was presented with two males possessing identical territories. We quantified the time females spent associating with both males. Although females preferred to associate with the larger male in their arena, if females were presented with males of identical size they nevertheless exhibited a clear preference for one male over the other. This suggests that additional male traits, such as genetic makeup, may be important in female choice. Future research is planned to examine factors that influence mate choice and mechanisms by which individuals may compensate for pairing with a suboptimal mate, using both fence lizards and wood frogs, *Rana sylvatica*, as model systems.

0631 Herp Conservation III, Ballroom B, Sunday 11 July 2010

Brooke L. Talley¹, Karen R. Lips²

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

Patterns Prevalence and Intensity of Infection of *Batrachochytrium dendrobatidis* across Illinois

We surveyed Illinois anurans from 22 locations, composed of 99 wetlands, over 2 breeding seasons in 2008 and 2009. We quantified the prevalence and intensity of infection by *Batrachochytrium dendrobatidis* (*Bd*) in populations representing a wide range of species, latitudes, and habitats. We swabbed over 5,000 individuals of 11 species, including 7 widespread species to compare infection among latitudes and habitats independent of species identity. In 2008 *Bd* was present in the central (54% prevalence) and northern (27% prevalence) wetlands, but absent from the southern site. Anurans at all 12 wetlands sampled in 2008 were *Bd* positive; prevalence ranged from 46-64% in 3 central Illinois wetlands, and 8-60% in 5 northern Illinois wetlands. All 7 widespread species were infected; prevalence ranged from 30 - 60% among species. *Bd* infection intensity varied between sites; in northern Illinois the average infection was 940 zoospore equivalents (N = 96; range: 1-20,852), and in central Illinois it was 3,095 (N = 51; range: 2-57,020). Species varied in intensity of infection, *Acris crepitans* had the highest levels at both sites (45,872 and 20,852 zoospores), while *Hyla chrysoscelis* also had high levels (57,020) at the northern site. The highest infections were concentrated at one wetland at each site. Results are consistent with reports of population declines of *Acris crepitans* in northern Illinois. Our estimates of prevalence and intensity are higher than most reported for the US amphibians and emphasize the need for large scale, systematic surveys to understand enzootic disease dynamics.

0646 Fish Systematics I, Ballroom D, Monday 12 July 2010

Kevin Tang¹, Henry Bart², Andrew Simons³, Robert Wood¹, Wei-Jen Chen⁴, Micheal Dosey², Mary Agnew¹, M. Vincent Hirt³, Lei Yang¹, Richard Mayden¹

¹*Saint Louis University, St. Louis, MO, United States*, ²*Tulane University, New Orleans, LA, United States*, ³*University of Minnesota, Minneapolis-St. Paul, Minnesota, United States*, ⁴*National Taiwan University, Taipei, Taiwan*

Phylogenetic Relationships of the Cyprinid Subfamily Gobioninae (Teleostei: Cypriniformes)

The subfamily Gobioninae is a diverse group of cyprinid fishes, distributed across Eurasia. Previous studies have supported the monophyly of the subfamily based on

both morphological and molecular characters, but relationships within the Gobioninae are far from resolved. For this study, sequence data from more than 140 taxa, representing over 80 gobionine taxa in 30 different genera, were sequenced. Representative species were drawn from available cyprinid and cypriniform diversity, with outgroup taxa ranging from other cyprinid subfamilies to more distantly related ostariophysan groups. Our analyses were based on sequences from two mitochondrial loci (COI, cyt b) and two nuclear loci (RAG1, rhodopsin), which were then evaluated using parsimony, maximum likelihood, and Bayesian methods. Our results find strong support for the monophyly of Gobioninae as well as lineages within the subfamily. These relationships within the Gobioninae as well as its relationships to other cyprinid subfamilies will be discussed.

0591 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Chantel Taylor, Nicholas Gidmark, Elizabeth Brainerd

Brown University, Providence, RI, United States

Anatomy and Function of the Pharyngeal Jaw in a Durophagous Cyprinid Fish

Cyprinids have lost all bony elements of the fifth gill arch except ceratobranchials. Teeth ankylos to the hypertrophied ceratobranchials, forming laterally paired, lower pharyngeal jaws. Upper pharyngeal jaws are absent; the upper biting surface consists of a pedestal of bone, projecting ventrally from the basioccipital bone and covered with a horny pad. Though rigorous histology has not been published on this pad, it is less stiff than either bone or tooth enamel. The function of this pad is unclear - most vertebrates process food with tooth-on-tooth contact. We used an in-vivo skeletal imaging technique -X-ray Reconstruction of Moving Morphology, or XROMM - to determine 3D bone positions during biting in a molluscivorous cyprinid, *Mylopharyngodon piceus*, the black carp. XROMM allows calculation of 3D moment arms of the two large jaw closing muscles that pull the jaw against the basioccipital pad. The orientations of these muscles are nearly 90 degrees different, and muscular forces exceed 230 Newtons per side. The large angle between retractors may aid in creating more stability at large gapes. By combining bone positions, material properties data and 3D force modeling, we develop a framework for studies of muscle physiology, functional anatomy, and durophagy in this species. Specifically, we demonstrate the importance of the ligament connecting right and left lower pharyngeal jaws in counteracting 3D torques from the adductor muscles. We have also found that the retractor os pharyngeus superioris - a smaller jaw retractor - is subdivided, a common evolutionary trend in high-force producing fishes.

0742 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

David Taylor

Commonwealth of Massachusetts Division of Fisheries and Wildlife, Westboro, MA, United States

The Use of Simple Protocol to Standardize the Efforts of Cooperators Headstarting the Northern Red-bellied Cooter

Since 1985, headstarting has been used as a tool in the conservation of the federally Endangered Massachusetts population of Northern Red-bellied Cooter (*Pseudemys rubriventris*). A simple headstarting protocol was followed by about 20 cooperating organizations and individuals each year. Some of these groups (e.g. zoos and aquariums) had full-time animal care staff while other turtles were raised by schools or individuals. The protocol provided easy to follow guidelines for appropriate diet, water temperature, water quality and lighting/basking. Hatchlings were kept for 9 months (September - May). Growth was most affected by water temperature (optimal was 86°F/30°C), and proper diet. Cooperators were required to submit data on average weights and carapace lengths once a month. These data provided an opportunity to detect facilities that were not following the protocol and individual turtles that were not doing well. Slow growth was the most frequently encountered problem which was related to lower than recommended water temperatures and/or improper diet. Failures to follow the protocols led to cases of abnormalities in shell shape and soft shells with poor bone growth. Survival to release was 94% and did not significantly differ between large institutions and schools/individuals.

0371 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

David Taylor, Joseph Szczebak

Roger Williams University, Bristol, RI, United States

Ontogenetic Patterns in Bluefish *Pomatomus saltatrix* Feeding Ecology and the Effect on Mercury Biomagnification

The bluefish *Pomatomus saltatrix* is an apex predator common to temperate and semi-tropical waters worldwide. Owing to their high trophic level status, bluefish may have elevated concentrations of biomagnifying contaminants, including mercury (Hg). In this study, we examined the biomagnification and trophic transfer of Hg in bluefish across multiple life history stages (early juveniles to adults; age-0 to age-7). Bluefish were collected from the Narragansett Bay (RI, USA), and white muscle tissue was analyzed for total Hg. Results were evaluated relative to bluefish age, body size, and Hg content of preferred prey. Dietary and nitrogen stable isotope ($\delta^{15}\text{N}$) analysis was also used to

elucidate the effect of trophic processes on bluefish Hg concentrations. The Hg content of bluefish muscle tissue was positively correlated with age and length, although age-0 juveniles accumulated Hg faster than older conspecifics (age-1+). Accelerated Hg biomagnification in age-0 bluefish is likely due to these individuals occupying a comparable trophic level to age-1+ bluefish (3.5 and 3.6, respectively), as well as age-0 bluefish having greater standardized consumption rates of Hg-enriched prey. The positive correlation observed between mean biota Hg content and $\delta^{15}\text{N}$ signatures further indicates that Hg is trophically transferred through the estuarine food web, and higher trophic level organisms (i.e., bluefish with enriched $\delta^{15}\text{N}$) have increased Hg concentrations. Concluding, results from this study suggest that: (1) early life history is critical to the cumulative Hg burden in bluefish, and (2) dietary preference and trophic structure are important factors affecting Hg biomagnification in bluefish.

0108 Herp Physiology, 556 AB, Monday 12 July 2010

Emily Taylor, Benjamin Capper, Jessica Felix, Anthony Lumbad, Nicholas Pollock, Kelsey Tallon

California Polytechnic State University, San Luis Obispo, CA, United States

Effects of Testosterone on the Bactericidal Properties of Lizard Blood

Testosterone is immunosuppressive in many animal species, resulting in sex and seasonal differences in immune function. In lizards, testosterone lowers lymphocyte count, inhibits T cell-mediated immunity, and results in increased parasite loads. We tested the hypothesis that testosterone inhibits complement-mediated killing of bacteria in Western fence lizards (*Sceloporus occidentalis*). Lizards were collected in summer when testosterone is low, surgically implanted with either testosterone-filled or blank (control) implants, and maintained in the laboratory. We collected plasma from the lizards and incubated it overnight with *E. coli*. Compared to the negative control, plasma from both testosterone-treated and control males exhibited strong bactericidal properties. However, plasma from testosterone-treated males killed more bacteria than that of control males. This led us to reject our hypothesis because testosterone actually improves complement-mediated killing of bacteria. We are repeating the experiment this spring using free-ranging males instead of captive males. Regulation of the bactericidal properties of blood by sex hormones and other factors may be important in the community ecology of infectious bacteria. In California, *S. occidentalis* are major hosts for ticks that are vectors for the spirochete *Borellia burgdorferi*, which causes Lyme disease in humans. *Sceloporus occidentalis* are incompetent hosts for *Borellia*, meaning that their bactericidal proteins kill the spirochete in nymphal ticks, thereby preventing the ticks from passing on the bacterium to mammals as adults. Further studies will examine effects of sex hormones and immune function on the borreliacidal properties of host blood in the context of the community ecology of Lyme disease.

0570 AES GRUBER AWARD, 551 AB, Friday 9 July 2010

Mae Taylor, Harold Laubach, David Kerstetter

Nova Southeastern University, Dania Beach, FL, United States

Spiral Valve Parasites of Selected Tropical Pelagic Elasmobranchs from the Western North Atlantic Ocean

Concerns regarding population status of many elasmobranchs have prompted investigations into less obvious sources of declines, such as morbidity due to parasites. Endoparasite (internal) loads in the elasmobranch spiral valve may be a source of such unaccounted mortality and morbidity by both inhibiting nutrient uptake and stimulating inflammatory responses within the gastrointestinal tract in the host. Spiral valves of the night shark (*Carcharhinus signatus*, n=16), silky shark (*Carcharias falciformis*, n=18) and pelagic stingray (*Pteroplatytrygon violacea*, n=99) were obtained opportunistically from pelagic longline operations. Each species had varying rates of parasitization: pelagic stingray 29%, silky shark 77%, and night shark 92%. Total spiral valve parasite loads were compared against the total length, weight and sex of the host; however, no relationship was observed between these factors. A total of 133 elasmobranch hosts were examined, yielding over 800 individual parasites. The majority of parasites were cestodes (92% pelagic stingray, 93% silky, 99% night), although trematodes (5% pelagic stingray, 2% silky, 1% night), nematodes (1% silky), and acanthocephalans (3% pelagic stingray and 4% silky) were also represented throughout the samples. There are over ten families of cestodes represented throughout the samples, two families of trematodes, one family of nematode and two families of acanthocephalans. Site specification was not examined for this research. Parasites were not shown to be host specific. These results establish baseline values for expected spiral valve parasite load and species compositions for pelagic shark and stingray hosts.

0413 Fish Ecology, Morphology & Physiology, 556 AB, Saturday 10 July 2010

Mollie Taylor¹, J. Kevin Craig¹, Jennifer Wanat¹

¹Florida State University, Tallahassee, FL, United States, ²Apalachicola National Estuarine Research Reserve, Apalachicola, FL, United States

The Foraging Ecology of Juvenile Spot, *Leiostomus xanthurus*, in Apalachicola Bay, Florida

Estuaries provide important nursery habitats that support the production of ecologically and economically important fishes. Apalachicola Bay experiences considerable variation in hydrography due largely to variation in river flow that may impose constraints on the functioning of juvenile nursery habitats. Using juvenile spot, a common estuarine-

dependent species, as a model species I am testing the hypothesis that variability in diet of juvenile spot within primary nursery habitats is related to seasonal variation in river flow and associated environmental conditions. The diets of 86 juvenile spot (9 - 112 mm standard length) from 12 locations throughout Apalachicola Bay sampled monthly from February to April 2009 were included in this analysis. Individual stomach and intestine contents were identified to the lowest taxonomic level possible, counted, and a volumetric measurement was estimated for each prey category. The relative importance and percent frequency of occurrence of individual prey items was then calculated. Prey items of juvenile spot included harpacticoid and calanoid copepods, ostracods, small bivalves, nematodes, gammarid amphipods, and polychaetes. The frequency of occurrence and index of relative importance were compared between sites in Apalachicola Bay and among monthly sample collections. Continued diet and future stable isotope analyses over two years will contribute to a better understanding of the effects of variable freshwater input on the foraging ecology of juvenile spot during their residency in estuarine nursery habitats.

0074 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Amber Teare, David Rostal

Georgia Southern University, Statesboro, GA, United States

Reproductive Biology of the Alligator Snapping Turtle (*Macrochelys temminckii*)

Reproduction in ectotherms is heavily influenced by abiotic factors. Chelonian reproduction is particularly affected by temperature and photoperiod. The physiological changes associated with reproduction are understood for many sea turtle, tortoise and freshwater species (Ernst and Lovich 2009). Temperate turtles experience similar environmental conditions, resulting in similar seasonality in timing of mating, gamete production and hormone cycles. However, knowledge of reproductive cycles chiefly pertains to species that bask. The alligator snapping turtle (*Macrochelys temminckii*) is unique among temperate freshwater turtles in that it is nocturnally active and does not bask, and thus may be less influenced by changes in photoperiod (Jensen and Birkhead 2003). By studying *M. temminckii*, we can separate the effects of water temperature and photoperiod on chelonian reproduction. We hypothesized that water temperature is the more prominent cue for reproduction in turtles and predict that alligator snapping turtles will exhibit a hormone cycle similar to other temperate species. In this study, a Georgia population of *M. temminckii* was investigated to delineate their reproductive hormone cycles and gonadal development. Testosterone and estradiol were analyzed by ELISA. Females were examined by ultrasound to determine follicular development and egg production. Preliminary results indicate that mating occurs in spring and nesting occurs in late spring/early summer. Hormone analyses show that males exhibit a postnuptial peak in testosterone during the fall, while females exhibit a biphasic cycle, with testosterone peaking in spring and fall. These

findings show that *M. temminckii* display hormonal cycles and reproductive seasonality similar to other temperate turtles.

0129 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Javier Tellechea¹, Walter Norbis¹, Daniela Olsson¹, Michael Fine¹

¹University of Puerto Rico, San Juan, Puerto Rico, ²Universidad de la Republica, Montevideo, Uruguay, ³Virginia Commonwealth University, Richmond, VA, United States

Calls of the Black Drum (*Pogonias cromis*: Sciaenidae): Geographical Differences in Sound Production Between Northern and Southern Hemisphere Populations

The black drum *Pogonias cromis* appears to have a bipolar distribution being present in temperature latitudes in the Northern and Southern hemispheres. It is an estuarine-dependent demersal coastal species distributed along the Western Atlantic Ocean from Massachusetts, United States, to Rio de la Plata estuary Montevideo, Uruguay. However, its occurrence is not known from equatorial waters. Likely reproductive isolation between the two populations suggests the hypothesis of differentiation of their vocal repertoires. We quantified call development and sexual differences, not previously examined in this species. Unlike most sciaenids, both sexes possess robust sonic muscles, and both produce a disturbance call when handled. However, only males produce an advertisement call used in courtship. The disturbance call consists of a variable train of short-duration pulses (average 23 ms). The duration, interpulse interval and dominant frequency of pulses are similar in males and females and change developmentally: pulse duration and interpulse interval increase and dominant frequency decreases with fish size. Advertisement calls, recorded in the field and in captivity, are long-duration (average 184 ms) and tonal. Based on variation in fundamental frequency, which decreases with fish size, field choruses are composed of different-sized individuals. The duration of advertisement calls, about a third of those from Florida populations, suggests genetic differentiation between northern and southern populations.

0111 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; NIA BEST STUDENT POSTER AWARD

Fabricio Teresa, Lilian Casatti

Universidade Estadual Paulista - UNESP, Sao Jose do Rio Preto, Brazil

Mesohabitat Fish Preferences and its Consistency across Spatial Scales in Neotropical Lowland Streams

Factors structuring communities vary across different spatial scales, but the responses to some variables can be strong enough to persist over spatial scales. Here we investigated whether hydrological features are meaningful factors structuring fish communities by evaluating their relationship with the proportion of functional groups in different spatial scales. Hydrological measurements (width, depth and flow) and fish were sampled in 62 five meters segments in three streams located in Southeastern Brazil. Hydrological measurements were combined in a cluster analysis to define the mesohabitats. Fish abundance and frequency in the mesohabitats were used to define guilds (riffle and pool species) by using the Indicator Species Analysis. Six and nine species showed preference to riffle and pool, respectively. In order to evaluate the consistency of mesohabitat scale patterns in reach scale we used data from 32 sites at the scale of stream reaches and analyzed how fish guild proportions were related to reach hydraulics (%POOL = proportion of pools vs. riffles). No correlation was found between proportion of pool species and %POOL (Spearman Correlation, $p > 0.22$), whereas a negative correlation between proportion of riffle species and %POOL was observed ($R = -0.42$, $p = 0.02$). These results indicate that mesohabitat preferences were partially consistent with the analysis made at the reach scale. Hydrological features in riffles are probably the most important concerns to riffle-dwelling individuals in streams. Presumably, siltation and habitat simplification, which are common impacts in Brazilian freshwater ecosystems, can reduce riffles distribution and contribute to decline of riffle-dwelling species.

0358 NIA I, 556 AB, Saturday 10 July 2010; NIA BEST STUDENT PAPER AWARD

Andrea Tonolli Thomaz¹, Luiz Roberto Malabarba¹, Sandro Luis Bonatto²

¹*Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil,* ²*Pontificia Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil*

Elucidating the Relationships and Diversity of *Hollandichthys* Eigenmann 1909 (Teleostei: Characidae) at Populational and Supraspecific Levels - a Phylogenetic and Phylogeographic Approach

Hollandichthys is a genus of inseminating characid fishes whose relationships and diversity are still undiscovered. Its relationships are uncertain, having been considered as incertae sedis in Characidae. Recent hypothesis set this genus alternatively related to two different genera, *Pseudochalceus* and *Rachoviscus*. *Hollandichthys* has been long considered a monotypic genus living in creeks associated with the Atlantic Forest (one of the most endemic regions in the world), but it hides a great diversity behind a single valid species name - *H. multifasciatus*. To access the phylogenetic relationships of *Hollandichthys* we have analyzed mtDNA and nuclear genes representing 41 Characidae species. To access the evolutionary history of the genus, we have sequenced 201 specimens from 20 populations from all distributional range. We found *Rachoviscus* as sister-group of *Hollandichthys*. Furthermore, the results support the evidence that insemination evolved at least three times inside this family. In the phylogeographic approach, we found a clear separation in two different groups (North and South) in the area of Paranaguá estuary in the Brazilian Coast, dating from 1.9 Mya, and the several populations consistently arranged into five groups that better fits to the diversity of our molecular and geographic dataset. In a general manner, the evolutionary history inferred for this genus is strictly correlated with the climatic changes that caused impact in the Atlantic Forest. A bottleneck would have happened during the last maximum glacial, followed by a population growth that coincides with the expansion of the forest - from small isolated areas to a large continuum.

0779 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; ASIH STORER ICHTHYOLOGY AWARD

Andrew Thompson¹, Luiz Rocha²

¹The George Washington University, Washington D.C., United States, ²The University of Texas Marine Science Institute, Port Aransas, TX, United States

The Systematics and Biogeography of the Atlantic Labrid Species *Bodianus insularis*

Over the past decade, molecular techniques have been established as standard methodology in taxonomy and biogeography studies. Such techniques are often associated with the discovery of previously unrecognized species, sometimes referred to as cryptic species. Here we sequenced two mitochondrial DNA genes from isolated populations of species of the genus *Bodianus* on both sides of the Atlantic and the isolated central Atlantic islands in order to confirm their taxonomic status and estimate phylogenetic relationships between species and populations. The geographic distributions of *Bodianus insularis* and *B. pulchellus* are especially intriguing: the former occurs in the three very isolated islands of Ascension, St. Helena and St. Paul's Rocks, and the later occurs on both sides of the Atlantic but nowhere in between. Instead of identifying cryptic species, our results indicate that the populations of *B. pulchellus* on both sides of the Atlantic are part of a single species, and that, surprisingly, *B. insularis* from St. Paul's rocks belongs to *B. pulchellus*. *B. insularis* populations from Ascension and St. Helena on the other hand, formed a well defined clade. Thus, the St. Paul's Rocks populations that have been historically identified as *B. insularis* are actually an odd color morph of *B. pulchellus*. While surprising, this result is not completely unexpected, as strange color morphs of other species were previously recorded in the very isolated St. Paul's Rocks.

0005 SSAR S EIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Brad Timm¹, Kevin McGarigal², Robert Cook³

¹University of Massachusetts, Amherst, MA, United States, ²University of Massachusetts, Amherst, MA, United States, ³U.S. National Park Service, Cape Cod National Seashore, Wellfleet, MA, United States

Movement Ecology of Eastern Spadefoots (*Scaphiopus h. holbrookii*) in the Province Lands Dunes of Cape Cod National Seashore

The Eastern spadefoot (*Scaphiopus h. holbrookii*) is a regionally threatened species that is locally common at Cape Cod National Seashore (CACO), representing what is likely the largest population in the northeastern United States. Populations of Eastern spadefoots

are few and far between throughout the Northeast, largely the result of the patchy distribution of habitat suitable to this species, most notably sandy/loosely-compacted substrates required for burrowing. This presentation will discuss results obtained from two years of radio-telemetry work conducted on adult Eastern spadefoots at CACO including a discussion of upland habitat preferences, movement patterns, and burrowing ecology. In addition, this presentation will examine the use of fine-scale remote-sensing maps in assessing habitat preferences and in identifying potential locations of Eastern spadefoots in early-successional, pitch-pine/scrub-oak communities.

**0641 Fish Evolution, 555 AB, Saturday 10 July 2010; ASIH STOYE AWARD
GENERAL ICHTHYOLOGY**

Michelle Tipton

Wesleyan University, Middletown, CT, United States

**Phylogeography of the Blacknose Dace, *Rhinichthys atratulus* and
Complications Caused by *Rhinichthys obtusus***

The main goal of this project is to determine the source population or populations of Blacknose Dace, *Rhinichthys atratulus*, which were responsible for the recolonization of Connecticut after the last glacial retreat. This investigation was complicated by the discovery of inconsistent classifications of this species and its sister taxon *Rhinichthys obtusus*. Despite the recent designation of Western Blacknose Dace, *R. obtusus*, as a species distinct from Eastern Blacknose Dace, *R. atratulus*, questions about their taxonomic distinctiveness and distributions remain. Applying physical descriptions to *R. atratulus* and *R. obtusus* in the field presents problems due to their morphological similarity. This has been a complicating factor for conducting phylogeographic analyses of *R. atratulus*. Through genetic sequencing, I am able to distinguish *R. atratulus* from *R. obtusus* which have been misidentified based on morphology in the field or due to incorrect distribution information. Preliminary analyses using two mitochondrial genes, ND2 and control region, find *R. atratulus* and *R. obtusus* to have approximately a ten percent and two percent difference in nucleotide bases, respectively. I hypothesize that these genetic differences are consistent across their ranges. We determined this through more genetic sequencing. Resolving this complication of inconsistent species classification will allow a more accurate determination of how *R. atratulus* recolonized previously glaciated areas. Furthermore, these results have implications for solidifying classification discrepancies, clarifying characteristics for field identification, updating species distributions, and ultimately determining the patterns of post-glacial recolonization.

0529 Karel Liem Symposium, Ballroom D, Friday 9 July 2010

Tim Tinkt¹, Erik Verheyen², Dominique Adriaens¹

¹*Ghent University, Ghent, Belgium*, ²*Royal Belgian Institute of Natural Sciences, Brussels, Belgium*

Liem's Paradox Extrapolated: Is There Also a Trade-off Between Mouth Brooding and Feeding in Cichlids?

When Liem published his research on 'modulatory multiplicity' in the late seventies, it seemed to contradict previously formulated hypotheses on the functional performance of highly specialized phenotypes. The fact that some morphologically specialized cichlids retain a wide array of prey capture techniques even became known as Liem's paradox. After initially being written off as laboratory artifacts, his findings were later supported by field observations and an extension of optimal foraging theory explained in what evolutionary context such 'Jack of all trades' specialists could evolve. From a functional morphological perspective the combination of different feeding modes without much compromise was unexpected, but experimental data have shown that in some cases the expected trade-offs can be avoided. We investigated if a similar trade-off is avoided at another level, i.e. whether oral apparatus functionality for feeding is affected by its function for mouth brooding. We determined the theoretical bite force, kinematical transmission coefficient of the anterior-jaw four-bar linkage and several other feeding related aspects for two different trophic types of cichlids from Lake Victoria (*Haplochromis piceatus*, a 'suction feeder' and *H. fischeri*, a 'biter'). By comparing the theoretical performance of males and females of these maternally mouthbrooding cichlids, we could get an idea of how the added constraint of holding as much eggs as possible could affect the functioning of the oral apparatus in food gathering. We also performed a geometric morphometric analysis, which allowed us to visualize any morphological differences between the sexes that might have functional implications.

0230 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Stephen D. Tonjes

Florida Department of Transportation, Deland, FL, United States

Ledges to Nowhere - Structure to Habitat Transitions

Three roadway projects nearing completion in FDOT District 5 (east central Florida) include modifications to existing bridges and culverts that add ledges for the passage of small wildlife. In all three projects, the ledges ended abruptly at the ends of the structures, with no transition and even significant obstacles between the ledges and the surrounding habitat. Each of the roadway projects was designed independently by a different engineering firm, so the lack of awareness was not limited to one individual

designer or firm. Resolving these issues often results in complicated and expensive coordination. Currently, the design engineers for each project have produced corrected drawings. Modifications are completed or underway, except at one structure, for which the roadway Contractor declined to bid on the changes. A second project to correct the problem will be needed. Small oversights during design and construction can virtually eliminate the usefulness of wildlife passages included in structures. The purpose of this poster is to call attention to problems that are being encountered in the design and construction of wildlife crossing structures that significantly undermine their usefulness to wildlife. Engineers and biologists should collaborate throughout the design process, and biologists should monitor these accommodations during and after construction.

0234 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Stephen D. Tonjes

Florida Department of Transportation, Deland, FL, United States

Wildlife Ecology for Dummies: Design Elements of Wildlife Crossing Structures – A Literature Review

This poster describes a unique resource available to transportation professionals - planners, project managers and engineers - who are not ordinarily familiar with wildlife ecology, but who must make decisions about the utility and the design of wildlife crossing structures. We surveyed existing literature and summarized in a table format specific recommendations for design elements of wildlife crossing structures. Each recommendation cites the source from which it was taken. The tables are divided into the following sections: crossing structures; fencing and other barriers; approaches and transition zones; animals; traffic; alternatives; and citations. Transportation planners and designers have found this document to be useful in answering specific questions about siting, dimensions, materials, and context of wildlife crossing structures. Transportation professionals generally are not conversant with wildlife ecology literature, and existing transportation ecology studies usually have been designed to answer biological questions instead of engineering questions. We know of no other reference available to transportation professionals that extracts the information they need from this daunting collection. Much more work is needed to make statistically valid generalizations involving all the elements of wildlife crossing structure design. A research project is underway specifically to strengthen and expand these guidelines that transportation professionals can actually use.

0495 Fish Systematics I, Ballroom D, Monday 12 July 2010

Luke Tornabene¹, Carole Baldwin², Lee Weigt², Frank Pezold¹

¹Texas A&M University - Corpus Christi, Corpus Christi, TX, United States, ²National Museum of Natural History: Smithsonian Institution, Washington D.C., United States

Exploring the Diversity of Western Atlantic *Bathygobius* (Teleostei: Gobiidae) with Cytochrome c Oxidase-I

Bathygobius is currently thought to be represented by three species in the western Atlantic: *B. curacao*, *B. mystacium*, and *B. soporator*. Specimens of *Bathygobius* were collected throughout the western Atlantic, and a 650-bp portion of the mitochondrial gene cytochrome oxidase-c subunit I was sequenced to aid in re-examining the species classification of the genus. A neighbor-joining tree was constructed from the sequence data, and voucher specimens from each genetically distinct lineage were subsequently examined for diagnostic morphological characters. The results suggest that there are at least six species of *Bathygobius* in the western Atlantic. Two genetic lineages are identified as *B. curacao* and *B. mystacium*. Three lineages possess characters that would previously have led to their identification as *B. soporator*. One of those is identified as *B. soporator*, although there is genetic structure within that lineage that may require further taxonomic action. A second "*B. soporator*" lineage is identified as *Gobius lacertus*, a synonym of *B. soporator*, and *G. lacertus* is resurrected here as *Bathygobius lacertus* for that lineage. The third "*B. soporator*" lineage and the one remaining genetic lineage cannot be assigned to any nominal *Bathygobius* species and are recognized as new species. Subtle differences in pigmentation, along with some fin-ray and scale characters, distinguish the western Atlantic *Bathygobius* species. Combining molecular and morphological investigations in this study has brought clarity to the taxonomy of a morphologically conservative group of fishes and doubled the number of currently recognized species.

0498 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Luke Tornabene, Frank Pezold

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

Phylogenetic Analysis of Western Atlantic *Bathygobius* (Teleostei: Gobiidae): A Total Evidence Approach

The interspecific relationships of the six western Atlantic *Bathygobius* were analyzed using sequence data from the mitochondrial gene cytochrome b and the nuclear gene S7. Eastern Pacific and West African *Bathygobius* were also included in the analysis. Molecular phylogenies for both genes were generated using maximum parsimony, maximum likelihood, and Bayesian methods. Trees from this analysis were also

compared to a phylogeny generated from a cytochrome c oxidase-I data set from a previous study. Despite the highly conserved morphology of western Atlantic *Bathygobius*, and homoplasy in the dataset, some morphological and pigmentary characters mapped onto the phylogenies are diagnostic of clades.

0691 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Mike Tousignant, Dave Kerstetter

Nova Southeastern University, Davie, FL, United States

Reproductive Periodicity of the Pelagic Stingray, *Pteroplatytrygon violacea*, in the Western North Atlantic Ocean

The pelagic stingray is a moderately sized stingray in the Family Dasyatidae and is the only dasyatid that lives in epipelagic waters. Our current knowledge on the reproductive cycle of the pelagic stingray is limited. It is believed that the pelagic stingray reaches sexual maturity at two years in both sexes, with a gestation period of two to three months. Due to the short gestation period, it has been suggested that the pelagic stingray has either an annual or biannual reproductive periodicity. Specimens of mixed sexes and sizes were collected as bycatch in the pelagic longline fishery from the western North Atlantic, mainly in the South Atlantic Bight (SAB) and Florida East Coast (FEC) NOAA Fisheries pelagic statistical areas. In all, the reproductive tracts of 54 sexually mature males, one immature male, 65 sexually mature females, and two immature females were collected during the period of August 2008 to December 2009. Adult females are gravid in the months of August to February. Adult males had greater testicular weight from August to October. Females collected from March to July were not observed to be gravid while males collected during the same period had significantly ($t = 8.2638$, $P 0.0001$) less testicular weight. These data suggest a possible reproductive cycle starting around August and lasting until February for this population.

0014 Herp Morphology, 556 AB, Sunday 11 July 2010

Stanley Trauth¹, David Sever¹

¹Arkansas State University, State University, AR, United States, ²Southeastern Louisiana University, Hammond, LA, United States

Ultrastructural Observations of the Secretory Epithelium of the Distal Genital Tract in the Flathead snake, *Tantilla gracilis*

We examined the secretory epithelium of the distal genital duct system of reproductively-active male Flathead Snakes, *Tantilla gracilis*, using transmission electron microscopy (TEM). Snakes were collected from the Interior Highlands ecoregion of Arkansas between early April 2007 and mid-May 2008. Specimens were returned to the lab and sacrificed using sodium pentobarbital. The genital ducts were excised and prepared for TEM using routine histological and ultrastructural techniques. We focused our study on three distinct regions of a genital duct: the more proximal ductus deferens, an enlarged distal segment known as the ampulla ductus deferentis, and the most caudal portion, the ampulla urogenital papilla. The secretory epithelial cells in these areas varied from low cuboidal columnar in the ductus deferens to a pseudostratified columnar type within the ampulla ductus deferentis. Apical cell surfaces contained low-to-tall microvilli, and secretory activity ranged from merocrine to an apocrine discharge. Sperm aggregates associate closely with the epithelial surfaces in all ductal regions. It remains unclear as to the functional significance of secretory products released by the epithelia within this duct system.

0544 Herp Conservation III, Ballroom B, Sunday 11 July 2010

Emilie Travis¹, Betsie Rothermel¹, Debra Miller¹, Michaelle Purdee³, Jessica Gonynor³, Michael Yabsley³

¹Archbold Biological Station, Lake Placid, Florida, United States, ²Veterinary Diagnostic and Investigational Laboratory, University of Georgia, Tifton, Georgia, United States, ³Warnell School of Forestry and Natural Resources and Southeastern Wildlife Disease Study, University of Georgia, Athens, Georgia, United States

Population-level Impacts of Emerging Diseases on Red-spotted Newts (*Notophthalmus viridescens viridescens*) at a Blue Ridge Mountains Site in Georgia

We initiated an amphibian monitoring program in 2008 at the Wharton Conservation Center (WCC), a protected site in the Upper Tallulah River watershed of northeastern Georgia. In previous years, we found several pond-breeding species were infected with *Batrachochytrium dendrobatidis* (Bd) and/or *Ranavirus* and observed some disease-

associated mortality. Our objectives were to determine the prevalence of *Bd* and *Ranavirus* in Red-spotted Newts (*Notophthalmus v. viridescens*) and measure the population-level effects of these pathogens on the Red-spotted Newts at the WCC. We installed a drift fence around our main study pond to monitor movements and determine the disease status of different life stages of Red-spotted Newts. In June 2009, we initiated a capture-mark-recapture study of adult Red-spotted Newts, following Pollock's robust design model. We tested adult newts for *Bd* using skin swabs and PCR-based assays and also tail-clipped them upon first capture for *Ranavirus* testing. We estimated survival, capture probability, and population size of Red-spotted Newts by running a set of biologically meaningful models in Program MARK. Preliminary analyses suggested there was high survival of adults and we documented successful reproduction, despite high prevalence of *Bd* infection. *Bd* prevalence varied by season and we discovered that individuals were apparently able to clear themselves of *Bd* infection. Prevalence of *Ranavirus* was found to be low, but will continue to be monitored. We have little evidence of negative disease impacts on this Red-spotted Newt population, but we plan to continue intensive monitoring at this site as part of a multi-species monitoring effort throughout 2010.

0564 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Krystal Tronboll, Andrew Bohonak

San Diego State University, San Diego, CA, United States

Historical Biogeography of Slender Salamanders in Southern California

Salamanders often feature in studies of fundamental evolutionary processes. Here, we use geographic and genetic data from a group of small, terrestrial plethodontids to investigate adaptive and non-adaptive speciation in a spatially explicit context. In San Diego County, the taxon recognized as *Batrachoseps major* is comprised of two parapatrically distributed mtDNA clades, with haplotypes from both clades known to occur in or near sympatry at several localities. Despite approximately 9% mtDNA divergence, allozymes and morphology do not support the hypothesis that these clades are distinct evolutionary lineages. The data have been interpreted as evidence for a widespread ancestor fragmented by sharp tectonic and climatic shifts. Isolated groups are thought to have differentiated in allopatry, followed by male-mediated dispersal from refuges. In this study, we use both mitochondrial and nuclear sequence data to examine the degree to which ancient and contemporary rivers and floodplains may have shaped the evolution of this species. This work elucidates the evolutionary history and trajectory of *Batrachoseps* in southern California, and contributes data relevant to the general phenomenon of amphibian species declines.

0090 Poster Session II, Exhibit Hall D, Saturday 10 July 2010; ASIH STORER ICHTHYOLOGY AWARD

Chun-Hsin Tsai, Sheng-Hai Wu

National Chung-Hsing University, Taichung, Taiwan

A Comparison of Fish Assemblages Between Marsh Grass Bed and Cleared Habitats in a Protected Coastal Wetland in Taiwan

We studied the ichthyofauna in the Kaomei wetland, a protected intertidal coastal wetland covering the largest bulrush marsh grass bed in western Taiwan. Fishes were collected by consecutive day and night sampling using fyke nets on eight sampling surveys at four sites (2 marsh grass bed and 2 cleared habitats) between September 2006 and September 2007. Marsh grass sites includes natural *Bolboschoenus planiculmis* and a few mangrove stands; and cleared sites have sandy or mudflat substrates without vegetation. A total of 2984 individuals weighing 34 kg were caught during the study period, which belonged to 27 families and 43 species. Gobiidae was the most diverse family (6 species), followed by Leiognathidae (4 species). The fish community was dominated by the grass puffer fish (*Takifugu niphobles*, representing 36% of individuals) and the three-striped tiger fish (*Terapon jarbua*, representing 21% of individuals), the two species accounted for 57% of the total catch. Some species were specific to a particular habitat type: 15 species were found exclusively in marsh grass habitats and 14 species were limited to cleared sites. Analysis of similarities demonstrated that fish assemblage structures were different between the marsh grass bed and cleared sites ($p = 0.001$). The results indicated that coastal wetland ecosystem were important habitats for fishes, the grass bed and sandy (mudflats) function as nursery sites for specific fish species.

0430 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Hui-Shan Tsai, Ya-Hui Yang, Sheng-Hai Wu

Department of Life Science, National Chung-Hsing University, Taichung City, Taiwan

Signals from Tadpole Buccal Structures: Phylogenetically or Environmentally Constrained?

The tadpole buccal cavity structures are the fine features in the inner cavity of tadpole's head-body part. Recent researches show that there are some phylogenetically signals from these structures. This study surveyed the buccal structures of 8 species of Taiwan anuran tadpoles of two ecomorphological types: the lentic and lotic forms. We recorded buccal cavity characters from scanning micrographs and performed phylogenetic analyses. If tadpole characters contain mainly phylogenetic information, species in the same taxonomic category should be grouped together. On the other hand, if tadpole

characters reflect adaptation, species of the same ecomorphotype should be grouped together. A total of 59 buccal characters were observed, including previously undescribed ontogenetic changes. Two bufonid species are grouped together in all analyses, regardless of the ecomorphotypes of the outgroup taxa. Furthermore, evolutionary trees rooted by different ecomorphotype of outgroups do not result in the grouping of similar ecomorphotype in the same clade. It suggests some characters contain phylogenetic information. Ecomorphological pattern emerged from most trees suggests some oral structures are environmentally determined. Buccal characters examined in this study exhibit more environmental rather than phylogenetic signals, but are useful for lower level taxonomy.

0015 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Tracey Tuberville¹, Kurt Buhlmann¹, Terry Norton², Brett Moule³, Veronica Greco²

¹UGA's Savannah River Ecology Lab, Aiken, SC, United States, ²St. Catherines Island Wildlife Foundation, Midway, GA, United States, ³South Carolina Department of Natural Resources, Columbia, SC, United States

Headstarting as a Management Component for Gopher Tortoises (*Gopherus polyphemus*): Results and Observations from Three Study Sites

Numerous turtle population viability models have concluded that juvenile survivorship is the most influential parameter on population trends after adult survivorship, suggesting that increasing juvenile survivorship (either through habitat manipulation, predator control, or headstarting) might prove to be a useful management target. However, little is known about the survivorship and ecology of juveniles of most turtle species, including even well-studied species such as the gopher tortoise. The limited data available on the fate of head-started gopher tortoises further constrains attempts to evaluate headstarting as a management tool. We will summarize juvenile mark-recapture data from reintroduction projects for gopher tortoises at three study sites (Savannah River Site, SC, 2002-2006; St. Catherines Island, GA, 2006-2009; Aiken Gopher Tortoise Preserve, SC, 2008-2009), including a comparison of the survivorship and growth in head-started and naturally-recruited individuals. Based on these results and our field observations, we will evaluate the utility of headstarting under different management scenarios, describe the problems encountered, and provide recommendations for improving implementation.

0361 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Derek Tucker, Lance McBrayer

Georgia Southern University, Statesboro, GA, United States

Studying the Effects of Habitat Type on Locomotor Performance when Negotiating an Obstacle Using the Florida Scrub Lizard (*Sceloporus woodi*)

Jumping is a component of performance used by many vertebrates to navigate three-dimensional habitats. As a performance trait, jumping can be important in predator evasion, prey capture, and overcoming physical barriers encountered during walking or running. The Florida scrub lizard (*Sceloporus woodi*) is endemic to the Florida sand-pine scrub and longleaf pine habitats of central Florida. *S. woodi* is found in both habitat types because each contain open sandy areas with little ground cover and arboreal perches. The Florida scrub lizard is a mostly terrestrial lizard that exhibits some arboreal behavior in longleaf pine habitat. Lizards jump on and off the base of trees in longleaf pine and onto perches for displaying and thermoregulation in scrub. The purpose of this study is to test whether running and jumping ability differs between lizards from scrub and longleaf pine habitats when confronted with an obstacle that they must jump or climb. Lizards were captured in the summer of 2009 in the Ocala National Forest. Locomotor performance trials were conducted in the Animal Care Facility at Georgia Southern University. A customized chamber 90 cm x 61 cm x 20 cm (L x H x W) was constructed for the trials. Two CASIO high speed video cameras recording at 300 frames/second were used to quantify the maximum velocity and acceleration as the lizard approached the obstacle (logs of varying size), the behavior exhibited (run onto log, jump over, hide under, etc.), jump angle, and jump distance onto the log.

0571 Fish Systematics I, Ballroom D, Monday 12 July 2010

Peter Unmack, Dennis Shiozawa, Paul Evans

Brigham Young University, Provo, UT, United States

A Mitochondrial DNA Phylogeny of *Oncorhynchus clarkii*, Cutthroat Trout

Approximately 14 subspecies of *Oncorhynchus clarkii*, Cutthroat Trout are recognized from western North America. Most populations are seriously threatened or endangered mostly due to introgression, predation and competition from introduced trouts as well as general habitat degradation. Many of these impacts occurred so early that the original distributions of some subspecies are incompletely known. Much genetic work has been conducted on different subspecies mostly aimed at determining levels of introgression. Here we present data from multiple protein coding mitochondrial genes in a combined analysis to investigate broader phylogenetic patterns across the range of the species. Three main groupings were found, a basal cluster consisting of *O. c. clarkii*, Coastal

Cutthroat Trout, *O. c. henshawi*, Lahontan Cutthroat Trout and *O. c. lewisi*, Westslope Cutthroat Trout. The last two groups are sister lineages, with one consisting of *O. c. bouvieri*, Yellowstone Cutthroat Trout and *O. c. sp.*, Bear River Cutthroat Trout. The last lineage consists of *O. c. pleuriticus*, Colorado River Cutthroat Trout, *O. c. stomias*, Greenback Cutthroat Trout, *O. c. virginalis*, Rio Grande Cutthroat Trout and *O. c. utah*, Bonneville Cutthroat Trout. We found moderate to strong resolution between the three lineages, but mostly poor resolution within each lineage. Aspects of the biogeographic history of the group will be discussed and compared with previous hypotheses.

0398 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Eva Ursprung, Max Ringler

University of Vienna, Department of Evolutionary Biology, Vienna, Austria

Calling Activity, Territory Size and Reproductive Success in the Dendrobatoid Frog *Allobates femoralis* (Aromobatidae) – An Integrative Approach

Acoustic signalling is found in almost all anuran amphibians and serves to attract mates as well as to announce area occupancy in territorial species. In the dendrobatoid frog *Allobates femoralis* (Aromobatidae) males use distinct advertisement calls to announce their multi-purpose territories and to attract females. The phonotactic behaviour of *A. femoralis* males to conspecific advertisement calls allows for measurement of territory sizes with playback experiments. At the border of the territory the resident male stops approaching the loudspeaker, starts antiphonal calling or turns back to his previous calling position. Hence, two types of territories can be defined: calling territories and playback territories. Males form calling communities with inter-territory distances of 15 metres where each individual has several calling neighbours at the same time. To maximize the efficiency of the calling effort, callers adjust their performance to the calling behaviour of neighbours by call alternation as well as avoidance of bout overlap. In 2009 we performed playback experiments to determine territory sizes while in 2010 we simultaneously recorded a calling community of *A. femoralis* males to quantify calling activity. In both years we sampled genetic material of adults and tadpoles from clutches and artificial pools, for parentage analysis. We will present the methodology and first results of this ongoing study. In a future study we will combine these acoustic, spatial and genetic analyses in an integrative approach to investigate the relevance of calling activity and territory size on mating and reproductive success.

0313 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Federico Valdez¹, Eli Greenbaum¹, Tony Gamble², Aaron Bauer³

¹The University of Texas at El Paso, El Paso, TX, United States, ²University of Minnesota, Minneapolis, MN, United States, ³Villanova University, Villanova, PA, United States

Phylogeography of Peruvian Geckos in the *Phyllodactylus microphyllus* Group

Leaf-toed geckos in the genus *Phyllodactylus* are endemic to Central and South America, and the West Indies. The paired distal “leaf-toed” scansors of these rupicolous geckos are an adaptation for living among rocks, often in semi-arid habitats. The evolutionary relationships among species of South American *Phyllodactylus* are unknown and herein, we focus on populations of the *P. microphyllus* species group from the western side of the Peruvian Andes. We sequenced 315 base pairs (bp) of the mitochondrial cytochrome b gene and 1,017 bp of the recombination-activating gene-1 (RAG1), and analyzed these data with maximum likelihood (GARLI) and Bayesian analysis (Mr. Bayes 3.0). Results indicated that populations of *P. microphyllus* are not monophyletic—populations from Huacho, Peru (near Lima) represent an undescribed taxon that is sister to *P. lepidopygus*. Other populations of *P. microphyllus* from northwestern Peru are monophyletic, but form at least three divergent clades: Bayovar (near Piura), Isla Santa (near Ancash), and several beach localities near Chiclayo (close to the type locality in Lambayeque Dept.). Our results suggest taxonomic changes are necessary for the *P. microphyllus* group, including the description of at least one new species.

0306 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

James Van Dyke, Steven Beaupre

University of Arkansas, Fayetteville, AR, United States

Enriched Stable Isotope Tracers Indicate Income Allocation in Putative Capital Breeding Snakes

Mechanisms by which resources are allocated to competing functions are key components of individual life histories, and may explain variation in life-history traits. Reproductive allocation strategies are traditionally separated into dichotomous extremes based on body condition changes during the reproductive cycle. Capital breeders lose body mass and are hypothesized to allocate stored resources to reproduction. Income breeders do not lose body mass, and are hypothesized to allocate immediate food resources to reproduction. However, physiological mechanisms underlying differences between capital and income strategies have not been identified. We examined the ability

of five viviparous snake species, including putative capital and income breeders, to allocate income resources to eggs during vitellogenesis. We fed ^{15}N -labeled L-Leucine to experimental groups of 4-7 females of each species during vitellogenesis, while control groups of 4-7 females were not fed enriched diets. ^{15}N -ppm of yolks, obtained by yolkectomy, was then measured using mass spectrometry. Scale samples taken prior to supplementation were used to estimate background "capital" ^{15}N -concentrations, and scale samples taken at ovulation were used to estimate the amount of ^{15}N -leucine assimilated from enriched diets. Yolks of enriched females were significantly more enriched in ^{15}N than yolks of non-enriched females in all species, indicating significant allocation of income to yolk during vitellogenesis, regardless of putative allocation strategy. Our results suggest that apparent capital-income allocation strategies are not based on physiological differences, but are consequences of timing of foraging success relative to vitellogenesis. These data cast doubt on the capital-income dichotomy as representative of a life-history adaptation.

0310 Herp Development, 556 AB, Sunday 11 July 2010

James Van Dyke, Steven Beaupre

University of Arkansas, Fayetteville, AR, United States

Estimating Reproductive Effort in Viviparous Snakes: Metabolic Costs of Vitellogenesis

Reproductive effort is a central concept to life history theory and reproductive energetics. Components of reproductive effort include energy contents of allocations to offspring and metabolic costs of reproductive processes. Regardless of reproductive mode, most reptiles are lecithotrophic, and reproductive allocation primarily occurs during vitellogenesis. However, most investigations of reproductive effort focus on metabolic costs of pregnancy or gravidity. We estimated metabolic costs of vitellogenesis and pregnancy in five species of viviparous snakes (*Agkistrodon contortrix*, *Nerodia sipedon*, *Thamnophis sirtalis*, *Boa constrictor*, *Eryx colubrinus*) by measuring oxygen consumption rates at critical periods before, during, and after vitellogenesis, at ovulation, during pregnancy, and after parturition. Within-species comparisons showed that total oxygen consumption during vitellogenesis was not significantly different from that during pregnancy for all species except *N. sipedon*, in which oxygen consumption was greater during pregnancy. Similarly to other studies of metabolic costs of pregnancy, sums of post-partum litter and maternal oxygen consumption rates were either not significantly different from (*N. sipedon*, *T. sirtalis*, *E. colubrinus*), or significantly greater than (*A. contortrix*, *B. constrictor*), our estimates of pre-partum maternal oxygen consumption rate in all species. This suggests that much of elevated oxygen consumption during pregnancy results from neonatal growth and maintenance rather than maternal effort. As a result, maternal oxygen consumption during vitellogenesis may exceed that of pregnancy after accounting for offspring demands. Metabolic costs of

vitellogenesis constitute a significant portion of reproductive effort that may vary on organismal, temporal and geographic scales, and warrant further investigation.

0327 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Marat Vasilenko¹, Rick Blob², Margaret Ptacek², Eric Schultz¹

¹University of Connecticut, Storrs, CT, United States, ²Clemson University, Clemson, SC, United States

Components of Mating Behavior and Temporal Predictors of Mating Success in Mollies (*Poecilia: Mollienesia*)

Livebearing fishes in the subfamily Poeciliinae are subjects of a large literature on how primary and secondary sexual characters have diversified in response to natural and sexual selection. Despite this long-standing interest there has been little quantitative analysis of mating behavior. We collected high-speed (500 frames per second) videographic sequences of mating attempts without courtship in five species of *Poecilia*, comprising repeated observations of six to ten captive males of varying size in each species, with both receptive and unreceptive females. Each sequence was scored with respect to copulatory success, evaluated as whether the tip of the gonopodium contacted the urogenital area of the female. We observed three distinct phases in the mating sequence: 1) circumduction of the gonopodium, 2) approach to the female, and 3) proximity to the gonopore. The three phases comprise roughly 25%, 25% and 50% of total event time, respectively. We scored the duration of each phase and tested for differences among males, among species, between receptive and unreceptive females, and between successful and unsuccessful copulations. Success was typically associated with a briefer circumduction phase (i.e. more rapid motion of the gonopodium), a more rapid approach, and a more prolonged period of proximity. These results suggest that there is a selective benefit for rapid precopulatory movements and for prolongation of time in close contact with the female.

0127 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010; AES GRUBER AWARD

Jeremy Vaudo, Michael Heithaus

Florida International University, North Miami, FL, United States

The Effects of Sampling Unit and Sample Size on Stable Isotopic Community Metrics in a Batoid Community

Stable isotopic analysis is becoming an increasingly popular technique in elasmobranch ecology, but sample sizes of these large predators are often low. Using data from a nearshore batoid community, we examined the effects of using individuals as the sampling unit and sample size on a variety of community isotope metrics. The ranges of d15N and d13C for the batoid community increased substantially when calculated using individuals as opposed to species means (2.7x and 1.9x, respectively). In addition, total niche area for the community was 6.2x larger when calculated using individuals. Sample size had little effect on the estimates of mean d15N and d13C values. Estimates of d15N and d13C range and total niche area, however, initially increased dramatically with sample size before approaching an asymptote. These results suggest small sample sizes and examining communities using mean d15N and d13C values for species may greatly underestimate the niche space occupied and trophic complexity of elasmobranch communities. We recommend the use of individuals as the sampling unit and rarefaction curves to determine if individual species have been adequately sampled for the stable isotopic analysis of elasmobranch communities.

0115 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Juliette Veloso¹, Randriamahita ¹, Floriot Randriamangason¹, Ernest Bekarany¹, Gerardo Garcia², Gerald Kuchling³, Richard Lewis¹, Lance Woolaver¹

¹Durrell Wildlife Conservation Trust, Antananarivo, Madagascar, ²Durrell Wildlife Conservation Trust, Jersey, United Kingdom, ³University of western Australia, Nedlands, Australia

Reinforcing Through Head-starting a Population of *Erymnochelys madagascariensis* at Ankarafatsika National Park Madagascar

Head-starting of the critically endangered endemic Malagasy turtle *Erymnochelys madagascariensis* started in 1999 in Ampijoroa, Madagascar, to promote recovery of turtle populations in Ankarafatsika National Park which had been depleted by human exploitation. Through collaboration with local people hatchlings from protected wild nests from a small but relatively healthy population are taken into captivity and head-started for several years prior to release into another wetland with a depleted

population in the same drainage system. During 1999 and 2000 all (139) hatchlings from 14 wild nests were collected for head-starting. Since 2001 only two hatchlings per nest (about 11%) are taken into captivity and the majorities are released directly into the adjacent wetlands, with 14 to 32 nests found annually and 10 to 44 hatchlings brought into captivity. During the 10 years of head-starting, the death rate in captivity has been less than 4% and the growth rate is higher in captivity than in wild populations. In March 2004 and November 2009, 158 and 180 head-started individuals were released into Ankomakoma Lake. This reinforced population is monitored twice a year. For the first release, the survival probability of released juveniles and re-capture probability is 0.96 and 0.56 respectively. The population at the release site is growing. Due to a high natural predation rate of wild hatchlings and small juveniles, head-starting is a useful method to speed up the recovery of depleted *Erymnochelys madagascariensis* populations once the cause of decline has been addressed and removed.

0525 General Ichthyology, Ballroom B, Friday 9 July 2010

Jonathan Velotta¹, Arne Christensen², Stephen McCormick², David Post³, Eric Schultz¹

¹University of Connecticut, Storrs, Connecticut, United States, ²Conte Anadromous Fish Laboratory, Turners Falls, Massachusetts, United States, ³Yale University, New Haven, Connecticut, United States

Microevolutionary Changes to Osmoregulatory Physiology in Alewife (*Alosa pseudoharengus*)

Transitions between salt and fresh water, which are deeply rooted in vertebrate evolution, require multiple concerted changes to osmoregulatory systems. Considerable work has been conducted on proximate changes in these systems, based on the responses of euryhaline fishes to varying salinity and on ontogenetic changes in anadromous fishes. The ultimate context for these changes is poorly understood. For instance, it is not known whether performance in fresh water trades off against performance in salt water. We are investigating this question in the alewife (*Alosa pseudoharengus*), an ancestrally anadromous fish in which multiple, independently derived FW only (landlocked) populations have evolved. Specifically, we are testing whether landlocked alewives exhibit reduced osmoregulatory function in salt water and/or enhanced osmoregulatory function in freshwater as compared to anadromous alewives. YOY alewives from landlocked and anadromous populations have been experimentally challenged with a range of salinity levels. Whole-organism osmoregulatory performance was assessed by measuring survival and plasma osmolality after the salinity challenge. Osmoregulatory processes were measured as the abundance of critical ion cotransporters, as well as the abundance and activity level of sodium-potassium ATPase. Osmoregulatory performance and sodium-potassium ATPase activity are reduced among landlocked alewives challenged in SW, indicating

that adaptation to an FW-only lifecycle results in a loss of SW function. No changes in FW function have yet been detected.

0210 Fish Community Ecology, 555 AB, Monday 12 July 2010

Francis Veraldi

US Army Corps of Engineers, Chicago, IL, United States

A Brief Synopsis of the Chicago Area Waterway System and the Potential Dispersal of Asian Carps and Other Non-Indigenous Fishes: A Technical Perspective

The dispersal of Asian carp species, silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*H. nobilis*) through the Illinois River and into the man-made Chicago Area Waterway System (CAWS) has caused great public alarm in that these invasive and adaptable species may succeed in over taking the Great Lakes as they have in the Mississippi River basin. Historically, a natural biogeographic nexus intermittently occurred during high water where species between the Mississippi River and the Great Lakes would naturally intermingle. The permanent man-made connection, in conjunction with non-native species introduction (both accidentally and purposefully); however, poses a great challenge to water resource managers and agencies. There is an enormous amount of information, analysis, debate and philosophy for one to digest in making a personal decision of what is fact, fiction or speculation. This brief synopsis is more or a less a back brief to the Ichthyology community of practice on what some of the basic facts are in terms of history, ecology, invasive species and ongoing projects.

0396 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Jessica Veysey, Kimberly Babbitt

University of New Hampshire, Durham, NH, United States

Forested Buffer Width Impacts the Size-Class Structure of Pool-Breeding Amphibians

Forested buffers are a common suggested management approach for pool-breeding amphibians in eastern North America, yet the effects of buffer width on amphibian-population size structure have not been experimentally tested. We used clear cutting to experimentally manipulate forested buffer widths at 11 vernal pools in central Maine. Each pool was randomly assigned to one of three possible treatments: >1000-m buffer (i.e., an uncut, reference treatment), 100-m buffer, or 30-m buffer. From 2004 to 2009, we captured and measured all adult spotted salamanders (*Ambystoma maculatum*) and wood

frogs (*Lithobates sylvaticus*) using these pools. We constructed size-class categories for length, mass, and body condition, for each sex of each species. We used contingency tables and log-linear regression to assess whether the distribution of individuals across size classes was dependent on treatment and year. In general, for both species, animals from the 30-m treatment were more likely to be shorter, weigh less, and have worse body condition, than animals from the reference or 100-m treatments. We observed, however, notable variations to this pattern for the different sexes across years. Our findings suggest that 30-m buffers may not effectively mitigate the impacts of forest disturbance on spotted salamander and wood frog size-class distribution. The observed impacts on size class structure may have important implications for breeding-population size. Additional research is needed to determine the mechanism driving the interaction between forest disturbance, buffer width, and size class structure.

0211 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Cesar Villanueva¹, Eli Greenbaum¹, Chifundera Kusamba², Mwenebatu Aristote³

¹University of Texas at El Paso, El Paso, TX, United States, ²Centre de Recherche en Sciences Naturelles, Lwiro, South Kivu, Congo, the Democratic Republic of the, ³Institut Supérieur d'Ecologie pour la Conservation de la Nature, Katana, South Kivu, Congo, the Democratic Republic of the

A Molecular Phylogeny of the African Lizard Genus *Adolfus* (Squamata: Lacertidae), with Evidence of a Cryptic Species from the Itombwe Plateau of the Albertine Rift

Currently, four species of the lacertid lizard genus *Adolfus* are known from Central and East Africa, including *A. africanus* (mid to low elevation forests from Cameroon to Kenya), *A. alleni* (montane moorlands of Kenya and Uganda), and *A. jacksoni* and *A. vauereselli* (both known from mid to high elevation forests in countries surrounding the Albertine Rift). We sequenced 2316 bp of two mitochondrial (16S and cyt b) and two nuclear (RAG1 and cmos) genes from 43 samples of *Adolfus* (representing every species except *A. alleni*) and six lacertid outgroups (*Acanthodactylus*, *Algyroides*, *Iberolacerta*, *Lacerta*, *Podarcis* and *Timon*). 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 *Adolfus*, and suggest *A. africanus* and *A. jacksoni* are sister taxa. Populations of *Adolfus vauereselli* included two well-supported, divergent clades from forests of the Albertine Rift (representative of the type locality) and high-elevation grasslands of the Itombwe Plateau of eastern Democratic Republic of the Congo. Morphological analysis of the Itombwe specimens identified several distinct features that suggest the population is a new cryptic species. The recognition of this new, endemic species underscores the conservation importance of the Itombwe Plateau, a unique ecosystem that is severely threatened by unchecked deforestation and poaching.

0460 Turtle Ecology & Conservation, 555 AB, Friday 9 July 2010

Richard C. Vogt¹, Gilmar Klein², Camila Rudge-Ferarra¹

¹Instituto Nacional de Pesquisas da Amazonia, Manaus, Amazonas, Brazil, ²Instituto Chico Mendes de Biodiversidad, Porto Trombetas, Para, Brazil

Posthatching Migration of Hatchling *Podocnemis expansa* with Adults in the Rio Trombetas, Para, Brazil

Movements of hatchling freshwater turtles once they enter the water have not been studied in detail. As a compliment to our study of *Podocnemis expansa* in the Trombetas River in the Amazon Basin of Brazil we attached 3 g VHF transmitters to 10 hatchlings and 50 g transmitters to 3 adult females and released them on the nesting beach, Praia Jacare, at 0830h 14 December along with 2000 other hatchlings. Our goal was to determine the feasibility of following hatchlings to determine their migration patterns and document the possibility that they might be migrating with adult females to the flooded forests. Four hatchlings were never recorded after release. Six were recorded 2 to 11 times at different way points, the final record of a hatchling was 4 days later at GPS point 217 in 4.5 m of water. One hatchling was recorded at 11 different way points, twice after 3 days, and once after 4 days. Of the 217 way points where turtles with transmitters were noted five of the points had adults and hatchlings, one point, after 3 days had 3 hatchlings still migrating together. One area, waypoints 186-190, had females and hatchling surfacing together, after 3 days moving down river. These data indicate that hatchlings and females are migrating together in groups, warranting the expenditure for sonar transmitters, so that the movements of adults and hatchlings can be monitored as they migrate downstream to the flooded forests in the lakes, up to 120 km from the nesting beach.

0252 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Jaymie Voorhees, Lorin Neuman-Lee, Stephen Mullin, Karen Gaines

Eastern Illinois University, Charleston, IL, United States

Lipid Concentrations in Neonate Watersnakes (Colubridae: *Nerodia*) as a Function of In Utero Exposure to Atrazine

As a component of a commonly-applied herbicide, atrazine is known to disrupt endocrine function in a number of vertebrate species. Recent studies have established links between the intensity of endocrine disruption and the amount of lipid accumulation in various tissues. Viviparous watersnakes provide a model system in which we investigated the relationship between lipid levels in the livers of neonate snakes that had been exposed to atrazine in utero via their mothers' diets. We fed fish

laced with one of four atrazine concentrations to adult female watersnakes (*Nerodia sipedon*) throughout their gestation. Upon birth, we removed all liver tissue from the euthanized neonates and determined the mass of each sample. We assayed the amount of fat deposition in these tissue samples by exposing them to a chloroform-methanol extraction method. We discuss our results with respect to both the potential for indirect negative impacts of atrazine on non-target organisms, and the importance of examining one of several possible endpoints that indicate the intensity of atrazine exposure.

0475 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Joseph Waddell, William Crampton

University of Central Florida, Orlando, Florida, United States

Environmental Conductivity and Sexual Dimorphism in a Genus of South American Electric Fishes (*Brachyhypopomus*)

The Amazon basin is a mosaic of habitat types, which can vary dramatically in conductivity. Morphology of the caudal filament, which is comprised mainly of electric cells (electrocytes), has been shown to correlate with conductivity levels in a manner that maximizes power output. Species in low conductivity habitats typically exhibit a serial-configuration of electric cells - i.e. long, thin caudal filaments, while species in high conductivity habitats exhibit a parallel-configuration - i.e. wide, thick tails. This pattern is often exaggerated during the breeding season, where males of certain species exhibit caudal filaments wider or longer than females, thus producing more powerful signals. While this pattern has been shown previously in a small number of species (n=5), we expand the correlation to the rest of the genus *Brachyhypopomus* (n=28), focusing on species found in the Amazon basin. This allows for a more robust statistical assessment that we accomplish using a suite of tests: ANCOVA, t-tests, MANOVA, and discriminant function analysis. For species that exhibit sexual dimorphism, we found statistically significant differences in tail size between males and females, exaggerated in shape as predicted by environmental conductivity. We also empirically correlated electrocyte arrangement with habitat conductivity for *Brachyhypopomus*, and placed these characters onto a phylogeny. This project is the first to empirically test for a correlation between habitat conductivity and tail morphology using the comparative method (in order to remove the effect of phylogenetic inertia), thereby strengthening the case for the evolution of these characters as a response to environmental conductivity.

0121 Herp Conservation II, Ballroom B, Sunday 11 July 2010

Hardin Waddle¹, Robert Dorazio², Susan Walls²

¹U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, United States, ²U.S. Geological Survey, Southeast Ecological Science Center, Gainesville, FL, United States

Presence of Invasive Cuban Treefrog Reduces Probability of Occurrence of Native Treefrog Species in Southern Florida

The Cuban treefrog, *Osteopilus septentrionalis*, an introduced species in southern Florida, USA, represents a potential threat to native treefrog species, but the ecological consequences of this invasive species are not fully known. We developed a new model for estimating patterns of co-occurrence of interacting species in which the occurrence of one species is assumed to depend on the occurrence of another, but the occurrence of the second species is not assumed to depend on the presence of the first species. We assessed whether the occurrence probabilities of native treefrog species differ in the presence and absence of Cuban treefrogs while accounting for differences in occurrence associated with differences in habitat. We found that sites occupied by Cuban treefrogs were 9.0 times less likely to contain green treefrogs and 15.7 times less likely to contain squirrel treefrogs compared to sites without Cuban treefrogs. We found no evidence of an effect of Cuban treefrog presence on the detection of the native species, indicating that their behavior is not altered by the presence of the Cuban treefrog. We also found a significant effect of longitude on the occurrence of Cuban treefrogs which supports our hypothesis that these frogs are invading from the assumed source to the west of our study area. Our model is not able to determine the mechanism by which the native treefrog species are excluded from sites, but other studies indicate that Cuban treefrogs are predators of these species, and they likely also compete for common resources.

0030 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Peter Wainwright

University of California, Davis, CA, United States

John Lundberg's Influence: Tree Thinking, Fossils and Functional Innovations in Parrotfishes

My first exposure to phylogenetic thinking and the importance of fossils to understanding the evolution of functional morphology came from John while I was an undergraduate at Duke in the late 1970s. It is remarkable to me how sustaining these themes have been and how far we've come since those days. I celebrate John's influence with a discussion of our current work on the impact of feeding innovations on

diversification of parrotfishes. We tested for changes in the rate of evolution of functional morphological traits of the jaws following the origin of two separate innovations. Using a time-calibrated molecular phylogeny and functional morphological traits from 120 species of labrid fishes we found no evidence of changes in jaw evolution following the origin of the parrotfish pharyngeal jaw that permits their unique feeding biology. However, parrotfish with an intramandibular joint show up to 8x faster evolution of oral jaw traits, a pattern that supports the role of this innovation in spurring diversification of parrotfish feeding systems. Our insights depend on estimates of phylogenetic relationships among species and the time-course of diversification, with the later being achieved through the use of fossils in time-calibrating the phylogeny. John was ahead of his time in 1979 but his message is perhaps even more relevant today: phylogenies are crucial to the organization of evolutionary hypotheses and fossils anchor our estimates of when events occurred. With the addition of key modern methods to these fundamentals new insights are rolling in on what shaped diversification of fishes.

0553 AES Morphology, 552 AB, Sunday 11 July 2010

Jessie Waitt¹, Michelle Degnin¹, John F. Morrissey¹, Donna M. McLaughlin²

¹Sweet Briar College, Sweet Briar, VA, United States, ²Central Virginia Community College, Lynchburg, VA, United States

Morphological Variation of the Placoid Scales and Teeth of Chain Catsharks, *Scyliorhinus retifer*: The Influence of Body Location, Age, and Sex

The morphology of placoid scales and teeth of elasmobranchs has long been viewed as being of taxonomic and phylogenetic importance. Unfortunately, an appreciation for morphological variation of these structures due to differences in sex, age, or anatomical position has not been achieved. In an effort to document this variation in chain catsharks (*Scyliorhinus retifer*), samples of placoid scales were taken from 19 body locations of both sexes at all ages (neonate through adult) and examined with a scanning electron microscope. Similarly, teeth from both jaws of both sexes at all ages (neonate through adult) were examined via light and scanning electron microscopy. Substantial and significant morphological differences due to age, sex, and anatomical position were found in both the placoid scales and teeth of this shark. The easily demonstrable variation in these hard parts is contextualized in terms of swimming behavior, dietary shifts during ontogeny, and systematics.

0182 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Christina J. Walker, James J. Gelsleichter

University of North Florida, Jacksonville, FL, United States

The Use of Metallothionein as a Biomarker for Toxic Metal Exposure in Sharks: Associations Between MT Expression and Mercury Concentration in Muscle in *Sphyrna tiburo*

The development of a biomarker to detect metal toxicity in high-risk shark populations is a necessary step in beginning to evaluate the impacts of heavy metal exposure in these animals and their relatives, based on their tendency to accumulate high levels of metals due to their life history characteristics. Metallothionein (MT), an intracellular protein involved in metal regulation and toxicity, is one possible biomarker, having been previously shown to increase in production in the presence of elevated metal concentrations in some organisms. The objective of this study was to evaluate the use of MT as a biomarker for heavy metal exposure in sharks by examining associations between MT expression and methylmercury concentrations in muscle from bonnethead *Sphyrna tiburo*, which have been shown to accumulate potentially toxic levels of this metal. Muscle samples from *S. tiburo* from three Florida Gulf coast locations were used for immunoblotting, using a polyclonal MT antibody against cod, to determine the presence of MT. Mercury (Hg) concentrations were measured in the same samples using EPA Method 7473. The associations between metal concentrations and MT levels will be discussed.

0239 Acoustics Symposium I, Ballroom D, Saturday 10 July 2010

Carrie Wall, Peter Simard, David Mann

University of South Florida, College of Marine Science, St. Petersburg, FL, United States

Fish Passive Acoustics in the Gulf of Mexico: Knowing the Unknown

While it is widely known that numerous fish species produce sound, discerning when and from what species is more challenging. Through the use of autonomous passive acoustic technology, we aim to document the spatial and temporal patterns of fish sound production in the eastern Gulf of Mexico, where many commercially and recreationally important species reside. Two methods have been employed off west-central Florida: moored passive acoustic arrays deployed in 2008 and 2009 covering 800 km² to over 16,600 km² from the coast to 100 m deep, and autonomous gliders with integrated hydrophones deployed cross-shelf for up to two weeks. Low frequency (50 Hz - 6000 Hz) sounds recorded by these methods provide a better understanding of the diurnal and spatial distribution of known fish calls (e.g., red grouper *Epinephelus morio* and gulf toadfish *Opsanus beta*). However, this is seemingly overwhelmed by the vast number of

sounds produced by unknown species. This includes a strong diurnal 6000 Hz signal, frequent nocturnal calls, overlapping multispecies calls among other highly unusual sounds. With our recordings we are able to characterize the location and timing of these stereotyped sounds, and are able to use that information to guide our attempts to identify the sound producers.

0726 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

Cathy Walsh, Stephanie Leggett, Carl Luer, Michael Henry

Mote Marine Laboratory, Sarasota, FL, United States

Effects of Nurse Shark, *Ginglymostoma cirratum*, Peripheral Blood Leukocytes Following in vitro Exposure to Red Tide Toxin

Blooms of the toxic dinoflagellate, *Karenia brevis*, occur almost annually off the west coast of Florida. Commonly called "red tides", these blooms produce neurotoxins, collectively termed brevetoxins (PbTx), that severely impact many species of marine mammals, sea turtles and fish. Effects on immune cells from nurse sharks, *Ginglymostoma cirratum*, were investigated following in vitro exposure of peripheral blood leukocytes (PBL) from healthy captive nurse sharks to brevetoxin. Differential expression of genes affected by brevetoxin exposure was determined through suppression subtractive hybridization (SSH) experiments. Using unexposed PBL from nurse sharks as control, SSH experiments indicated that genes involved in transporter function, translation initiation, and cell signaling were up-regulated following 18 h exposure to 560 nM PbTx-2, while genes involved in mitosis and inflammation were down-regulated. Real-time PCR conducted on a gene (transmembrane 9 superfamily member 3) coding for a protein with transporter functions exhibited significant gene up-regulation in response to 140 nM PbTx-2. Coincidentally, presence of a functional transport system in nurse shark PBL was indicated by efflux of the fluorescent dye, calcein-AM, by PBL treated with 100 nM PbTx-2 for 25 min. Finally, evidence for metabolism of xenobiotic compounds through conjugated pathways in shark immune cells was demonstrated by LC/MS detection of a glutathione conjugate, GSH-PbTx, following 3 h exposure to 50 μ M PbTx-2. This study represents the first report of the effects of brevetoxins on immune cells in an elasmobranch species and suggests that exposure to red tide toxins may have significant implications for immune function in sharks.

0335 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

Hans Walters¹, Ramón Bonfil⁴, John Morrissey², Dennis Thoney³

¹Wildlife Conservation Society/New York Aquarium, Brooklyn, New York, United States, ²Sweet Briar College, Sweet Briar, Virginia, United States, ³Vancouver Aquarium, Vancouver, British Columbia, Canada, ⁴Shark Tracker/NABU, Brooklyn, NY, United States

Movements of Sand Tiger Sharks (*Carcharias taurus*) in the Northwest Atlantic Ocean

From 2003-2006, we attached pop-up satellite tags to 16 sand tiger sharks, *Carcharias taurus*, to study movements and habitat preferences in the northwest Atlantic Ocean. Ten tags deployed off South Carolina returned data from nine males and one female. Tracks ranged from 29 - 184 days. Three tags jettisoned in state waters off New Jersey, Delaware, and Florida, respectively. Six tags jettisoned in U.S. Federal waters, and one transmitted east of the Exclusive Economic Zone. Depth data indicate several tags experienced significant drift; readings of < 0 meters were common, delaying transmissions after premature releases. Light levels enabled estimates of horizontal movements. Tag-manufacturer software provided crude location estimates, and the Kftrack program reduced location errors to produce Most Probable Tracks (MPTs) for four sharks. Males moved north after tagging, but remained off North Carolina until July before continuing northward. Three sharks moved offshore, and one remained close to shore; we estimated swimming speeds of 0.27 - 2.24 km/hr. MPTs for two males indicated their presence off New Jersey and Delaware in late September and early October, respectively. A tagged female provided the only pop-up location south of the deployment area, from on or close to shore in northern Florida in late October. Sharks spent May and June at depths of ≤ 30 meters. Most moved into deeper waters of ≤ 152 meters as summer progressed, but one shark remained at shallow depths. Ambient temperatures may influence movements, as most sharks swam deeper in response to temperatures $> 25^\circ$ C.

0431 AES Conservation & Management, 552 AB, Friday 9 July 2010

Christine Ward-Paige¹, Camilo Mora¹, Heike K. Lotze¹, Christy Pattengill-Semmens², Loren McClenachan³, Ery Arias-Castro³, Ransom A. Myers³

¹Dalhousie University, Halifax, NS, Canada, ²Reef Environmental Education Foundation, Key Largo, FL, United States, ³University of California, San Diego, CA, United States

Patterns of Shark Occurrence on Reefs in the Greater-Caribbean: A Footprint of Human Exploitation

Recent studies have documented dramatic declines in large coastal and pelagic shark populations which have been attributed to commercial fishing. However, the status of sharks in other systems such as coral reefs remains unexplored despite a long history of exploitation. We explored the contemporary distribution and sighting frequency patterns of sharks on reefs in the greater-Caribbean and assessed the possible role of human exploitation on such patterns. Historical records, range maps, and habitat suitability models indicate that sharks should be widely distributed and common throughout the greater-Caribbean. However, analysis of 76,340 underwater surveys show that sharks are largely absent on contemporary reefs; a pattern that was more pronounced with the exclusion of nurse sharks. Comparison with human population showed that, with the exception of nurse sharks, sharks occur most often in areas with low human population or where marine conservation exists. Population viability analysis suggest that the absence of sharks in the presence of humans can be explained by exploitation alone, since we found that sharks are vulnerable to even light levels of fishing pressure. Our results show that under current levels of fishing mortality even the most productive sharks are at risk. Our findings indicate that preventing the loss of sharks on reefs in the greater-Caribbean requires urgent management measures to protect sites where sharks still exist. The fact that sharks still occur in a few densely populated areas where strong fishing regulations are in place indicates the possibility of success and encourages the implementation of conservation measures.

0557 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Karen M. Warkentin¹, Camden M. Rouben¹, Marc A. Seid²

¹*Boston University, Boston, MA, United States*, ²*Smithsonian Tropical Research Institute, Balboa, Panama*

Highspeed Video Analysis of the Hatching Process in Red-eyed Treefrogs, *Agalychnis callidryas*

The described mechanism of amphibian hatching involves release of proteolytic enzymes from hatching glands on the dorsal surface of the head, which digest components of the vitelline membrane. Two phyllomedusine hylids, *Phyllomedusa trinitatis* and *Agalychnis callidryas* appear to lack hatching glands on the head surface; other phyllomedusines have not, to our knowledge been examined for hatching glands. To analyze the hatching process of *A. callidryas*, we recorded highspeed video of >80 embryos hatching. Individual eggs were removed from their clutch and placed on a stage before the camera. If necessary, they were prodded to stimulate hatching. Review of recordings revealed that characteristic vigorous movements known to occur during hatching are not the means of membrane rupture. Rather, hatching appears to be a two-stage process. In many recordings, embryos performed subtle full-body shaking and/or a few isolated mouth movements prior to membrane rupture. In some eggs, perivitelline fluid began leaking from a hole formed in front of the mouth apparently without physical contact. Other embryos pushed their snout against the membrane and it gradually protruded without vigorous movement. Typically the initial leak or snout protrusion was followed, sometimes many seconds later, by large undulations of the body and tail that propelled the embryo from the capsule. Such movements did not cause hatching if the snout had moved away from the initial hole. We hypothesize that *A. callidryas*, like some fishes, have hatching glands within the mouth and release enzymes via a behavioral mechanism as the first stage of hatching.

0550 Amphibian Ecology, 551 AB, Monday 12 July 2010

Karen M. Warkentin¹, Justin C. Touchon¹, Michael W. McCoy¹, Myra C. Hughey¹, James R. Vonesh²

¹*Boston University, Boston, MA, United States*, ²*Virginia Commonwealth University, Richmond, VA, United States*

Consequences of Hatching Timing in Red-eyed Treefrogs: Timescale, Currency and Context-dependence of Trade-offs

Across taxa, many embryos respond to changing risks and opportunities with apparently adaptive shifts in hatching timing. While immediate benefits of such shifts

are often clear, we know less about trade-offs that favor plasticity, and particularly little about long-term consequences of hatching timing and how they vary across environments. The arboreal embryos of red-eyed treefrogs, *Agalychnis callidryas*, hatch up to 30% prematurely to escape from egg-stage risks, entering ponds at different times, ages (4–7 days), sizes, and developmental stages. We assessed consequences of hatching timing in a series of experiments across different timescales and venues, varying the aquatic environmental context. Within minutes after hatching, the diel timing and synchrony of arrival in the water affect vulnerability to fish. In the day after hatching, premature hatchlings are more vulnerable to multiple predators than are full-term hatchlings. However, after a two-day exposure to aquatic predator cues early-hatched tadpoles become less vulnerable than naïve full-term hatchlings. In one factorial mesocosm experiment we found no effect of hatching age on one-month survival, with or without odonate or belostomatid predators but, with predators, early hatchlings grew faster. In another mesocosm experiment, hatching early reduced survival to metamorphosis, regardless of predator presence or resource levels, but did not affect larval period or metamorph size. Overall, the consequences of hatching early are partly context-dependent and weaken with time since hatching. We have detected both compensatory benefits and unanticipated costs, but the magnitudes of costs are small relative to the ~80% mortality reduction achieved by egg-predator-induced early hatching.

0226 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010

Mark Waters

Ohio University Eastern Campus, St. Clairsville, Ohio, United States

Lingual Luring by Viperine Snakes (*Natrix maura*)

Descriptions of lingual luring in snakes are rare and limited to a few species of New World natricines. Here, I describe lingual luring by the viperine snake (*Natrix maura*), an Old World natricine found around the western Mediterranean. Lingual luring was observed under natural conditions in a population of snakes on Mallorca, Spain. Unlike previous studies, all luring sequences were observed in adult snakes. In all instances luring was performed from an ambush position and directed towards fish swimming near the surface of the water. Lingual luring differed from chemosensory tongue flicking in both duration of tongue extension and the pattern of tongue movement. Snakes struck at fish immediately following luring and in three cases were observed capturing prey. Lingual luring in *Natrix maura* is similar to that described for *Nerodia clarkii* compressicauda and *Thamnophis atractus*. This invites questions about the origin of lingual luring in natricines. Did lingual luring arise separately in New and Old World natricines or does it represent a behavior ancestral to all natricines?

0500 Karel Liem Symposium II, Ballroom D, Friday 9 July 2010

Jacqueline F. Webb

University of Rhode Island, Kingston, RI, United States

The Joy of Fishes - Sensory Biology Meets Evolutionary Morphology

When Karel gave me the opportunity to sit in on Bio 130 as a graduate student, I didn't know how it would set the stage for my career. The lateral line system had been the realm of taxonomists/systematists on one hand, and physiologists/behavioral biologists on the other. My work evolved in an effort to bring the two together by applying those principles of comparative and evolutionary biology revealed to me by Karel's work to the analysis of the evolution of the lateral line system. I wisely followed his example and chose to look at cichlids (and other "labroids" - damselfishes, wrasses, surfperches). Early on, I showed that the diversity of trunk canal patterns in Lake Tanganyika cichlids rivals that of teleosts, and suggested that heterochrony can explain patterns of diversification in the trunk canal. The unusual trunk canal of the damselfishes *Amphiprion* and *Azurina*, which I discovered while working in the MCZ raised fundamental (and yet unanswered) questions about the developmental basis for lateral line scale meristics. After analyzing the development of the "narrow" cranial lateral line canals in two cichlids (*Oreochromis*, *Archocentrus*), my lab has turned to *Aulonocara*, a genus of Lake Malawi cichlids, and likely the only teleost with "widened" canals amenable to developmental and behavioral lab investigations. We are currently combining the morphological and functional approaches inspired by Karel by testing the hypothesis that widened canals evolved as a result of heterochrony and analyzing the role of widened canals in lateral line-mediated feeding behavior.

0755 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Nicholas Webber, Michelle Boone, Christopher Distel

Miami University, Oxford, OH, United States

Effects of Carbaryl Exposure in Aquatic and Terrestrial Life Stages of American Toads

The effects of many pesticides have been shown to alter time and size at metamorphosis, which can have impacts on terrestrial growth and survival; however, few studies have examined the effects of aquatic exposure on juveniles or the impacts of terrestrial exposure on juveniles. We examined the effects on feeding ability and survival of larval and juvenile American Toads (*Bufo americanus*) after short-term exposure to the insecticide carbaryl both in the larval and juvenile stages of life. This outdoor and laboratory experiment showed juvenile exposure had little to no effect on feeding and

survival while larval exposure led to major differences in mass at metamorphosis. Our study suggests that larval exposure may be more important than terrestrial exposure.

0339 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Katrina Weber, Eli Greenbaum

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

Molecular Data Elucidate a Species Complex within Populations of *Ptychadena mascareniensis* (Anura: Ptychadenidae) in Democratic Republic of the Congo

Previous phylogenetic analyses have revealed high levels of genetic differentiation within the widespread anuran species, *Ptychadena mascareniensis*. Herein, we increase sampling of Central African populations of *P. mascareniensis* by over six times to examine their relationships to previously identified clades in East Africa, and to search for additional cryptic species. We sequenced 575 bp of one mitochondrial (16S) gene and 935 bp of one nuclear (RAG1) gene from 40 DRC specimens tentatively identified as *P. mascareniensis* and two outgroups (*Hildebrandtia* and *Phrynobatrachus*). Our 16S sequences were combined with a previously available dataset (143 total sequences) and analyzed with maximum-likelihood and Bayesian inference criteria using the programs GARLI and MrBayes. The results corroborate previous findings, indicating the presence of five genetically distinct clades distinguished by an uncorrected pairwise divergence greater than 5%, which has previously been used to distinguish evolutionary lineages within this group. Three of the five clades were represented by specimens collected in the DRC, with the exception of a clade encompassing Madagascar, the Seychelles, and the Mascarenes (the type locality for *P. mascareniensis*) and a clade restricted to West Africa. Two clades occur in East Africa and include DRC specimens that show evidence of spatial segregation, with one taxon collected mainly in savannah habitat, whereas the other was found in forested areas. The clade containing forest species provides evidence of biogeographic connections between eastern DRC and the western forests of Kenya and Uganda. Our study confirms and expands previous assertions that taxonomic diversity within *P. mascareniensis* is underestimated.

0465 Poster Session III, Exhibit Hall D, Sunday 11 July 2010

Matthew Weeg¹, Jacqueline Grant², George Samra²

¹*The Pennsylvania State University, Altoona, PA, United States*, ²*The Pennsylvania State University, University Park, PA, United States*

Effects of Elevated Salinity on the Morphology and Behavior of Green Frog Tadpoles

Road deicing salts contaminate runoff and increase salinity of roadside ponds, which directly and indirectly affects tadpole mortality. High salinity causes tadpole mortality, but less is known about how sub-lethal salt concentrations affect tadpole behavior. Tadpoles exhibit a characteristic escape response that is mediated by a sensory system (the lateral line) that detects water movement. Normal lateral line function is dependent upon ion concentrations in the surrounding water. We predicted that exposure to salt would interfere with escape behaviors through disruption of lateral line function. To test this, we exposed tadpoles to freshwater or sub-lethal salt concentrations (200mg/L or 800 mg/L NaCl) and measured escape behaviors elicited by water jets. We then compared swimming distance across the three experimental groups. Tadpoles in all three treatment groups exhibited escape responses, although there were differences in the behavioral metrics we measured. Tadpoles exposed to both low (200mg/L) and high (800 mg/L) salt concentrations swam significantly shorter distances than controls. Tadpoles in the high salt group were significantly larger than those in the low salt and control groups. These results suggest that exposure to sub-lethal salt concentrations reduces anti-predator escape behaviors, making tadpoles more susceptible to predation attempts. It is likely that salt exposure disrupts the lateral line system, thus decreasing the tadpole's ability to detect and respond to water currents produced by a predator. This represents an indirect effect of salt on tadpole mortality, and suggest that road salts may pose a serious ecological threat to amphibian populations, even at sub-lethal concentrations.

0662 SSAR SEIBERT SYSTEMATICS & EVOLUTION/SSAR SEIBERT PHYSIOLOGY, 555 AB, Friday 9 July 2010

Denita M. Weeks, Robert E. Espinoza

California State University, Northridge, Northridge, California, United States

Geckos on Ice: Unexpected Thermal Tolerances and Temperature-dependent Performance of the World's Southernmost Gecko

Although most geckos are nocturnal and live in tropical climates, *Homonota darwinii*—the world's southernmost gecko—occurs as far south as 52 °S. The southern range of *H.*

darwinii is often cold during the activity season, so climate likely imposes a thermal challenge for this species. We tested the general hypothesis that several aspects of the thermal biology of this widespread species match its thermal environment over its broad latitudinal range. We predicted that the species would exhibit the greatest thermal mismatch to local thermal conditions in the coolest environments that species occupies. We measured the thermal tolerances (critical thermal minimum, CT_{min} and panting threshold, PT) and temperature-dependent sprint performance (10, 15, 25, 35, and 40 °C) of four populations of *H. darwinii* spanning the latitudinal range of this species. CT_{min} differed across populations, but not latitudinally as anticipated. Remarkably, some populations had subzero CT_{min} s indicating supercooling—the first time this phenomenon has been reported for any gecko. PTs did not differ among populations. Our sprint data indicate similar shifts in temperature-dependent performance over the range of *H. darwinii*. The lower tolerances for cold suggest that some populations experience substantially cooler temperatures during the activity season, which will be tested with microclimate data collected from each site. Our long-term goal is to incorporate these and temperature-dependent metabolic data into a biophysical model that will estimate the future distribution of this lizard following predicted changes in regional temperature.

0655 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

Nicholas Wegner¹, N. Chin Lai², Kristina Bull¹, Jeffrey Graham¹

¹*Scripps Institution of Oceanography, La Jolla, CA, United States*, ²*University of California, San Diego, La Jolla, CA, United States*

Ram Ventilation in the Shortfin Mako, *Isurus oxyrinchus*: Examining Oxygen Utilization and the Branchial Pressure Gradient Using a Large Water Tunnel

This paper investigates aspects of ram ventilation in a lamnid shark, the shortfin mako, *Isurus oxyrinchus*, and examines the extent to which intrinsic structural differences in the gill design of elasmobranchs and teleosts may affect the lamnid-tuna convergence for high-performance swimming. The study of makos swimming in a water tunnel demonstrates that, despite differences in gill design, mouth gape, and basal swimming speeds, O_2 utilization at the gills and the pressure head driving branchial flow for makos are similar to values reported for tunas. Also comparable to tunas are estimates of both the velocity and the residence time of water in the interlamellar channels of the mako. However, mako and tuna gills differ in the sites of primary branchial resistance. In the mako, much of the total branchial resistance resides with the septal channels, structures inherent to the elasmobranch gill and not present in tunas. The added resistance at this location is compensated by a correspondingly lower resistance at the gill lamellae, which is accomplished through wider interlamellar channels. Although greater interlamellar spacing minimizes branchial resistance, it also limits lamellar number and results in a lower total gill surface area for the mako relative to tunas. The elasmobranch gill design

thus appears to constrain gill area and may potentially limit mako aerobic performance in comparison to tunas.

0617 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Tiffany A. Weidner, Amy C. Hiron, David W. Kerstetter

Nova Southeastern University Oceanographic Center, Dania Beach, FL, United States

Combined Gut-Content and Stable Isotope Trophic Analysis of the Pelagic Stingray (*Pteroplatytrygon violacea*) from the Western North Atlantic Ocean

The understanding of an organism's trophic level is vital to understanding the impact that a specific organism has on the ecosystem, and trophic relationships are vital for correctly modeling ecosystems and ecosystem effects of fisheries removals. The pelagic stingray is found in sub-tropical and tropical waters worldwide and is thought to inhabit the epipelagic zone of the ocean based on fishery catch records. The species is a common bycatch in the Atlantic pelagic longline fishery, yet its ecological role is poorly understood. Very few studies have been done on the diets of the pelagic stingray, most with low sample sizes. For this work, 124 specimens (63 males and 61 females) were collected during commercial pelagic longline fishing operations in the U.S. South Atlantic Bight between August 2008 and December 2009. Stomachs were fixed in formalin, then dissected and the contents quantified to the lowest taxonomic level. Preliminary dissections have shown the major dietary items are crustaceans (40%) and mollusks (30%), in contrast to previous studies from the Pacific, which found mollusks (50%) to be the dominant prey item, followed by Actinopterygian fishes (19%) and crustaceans (17%). Due to the span of collection time, diet distributions between seasons, between sexes, and length were addressed. Comparisons have shown little differences between diets of males and females or diets between seasons. In addition, stable isotope analysis of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ was performed on white muscle and liver tissues to correlate trophic feeding level data from the gut-content analysis.

0257 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Luke Welton¹, Cameron Siler¹, Arvin Diesmos², Rafe Brown¹

¹University of Kansas, Lawrence, Kansas, United States, ²National Museum of the Philippines, Manila, Philippines

Species Boundaries in Philippine Bent-toed Geckos (Gekkonidae: *Cyrtodactylus*)

The Philippine archipelago is considered a biodiversity hotspot, characterized by high levels of vertebrate diversity and endemism. Analyses of morphology and mitochondrial gene sequences demonstrate that species diversity in the genus *Cyrtodactylus* has previously been underestimated, and is in need of taxonomic review. Morphological and genetic divergence within "widespread" species allows us to enumerate several distinct evolutionary lineages that are undoubtedly valid species. These new taxa are single-island endemics, or are occasionally confined to particular geological components of larger islands. We interpret this newly defined species diversity in light of the unique geological history of the archipelago and we suspect that numerous additional species await discovery. Taxonomists should continue being attentive to "widespread" species, specifically those in the northern portions of the archipelago, which can be expected to harbor multiple distinct evolutionary lineages. Only by comprehensively evaluating the widespread species complexes, will the true extent of diversity within Philippine *Cyrtodactylus* be fully realized.

0696 Lundberg Symposium, Ballroom D, Sunday 11 July 2010

Mark Westneat

Field Museum of Natural History, Chicago, IL, United States

Creative Ichthyological Research and the Holy Trichotomy: Phylogenetics and Functional Morphology Inspired by John Lundberg

Late last millennium, an eclectic group of rogue biologists formed the influential clandestine organization DUCCIS, the Duke University Center for Creative Ichthyological Studies. Led by JGL, this shadowy entity infiltrated freshwater and marine habitats throughout the world, surveying, measuring, and consuming fishes of every size, shape, and culture. This program of piscine intrigue was directed toward investigating the heritage of various US and international fish groups, as well as publishing propaganda regarding the alleged associations within the innocent ichthyocommunity of structure, function, and ecology. It was a highly creative time during which JGL fomented the integration of radical ideas such as morphometrics, biomechanics, homology, and various mechanisms of outgroup rooting, which took

hold among his ichthyocolytes and shaped the systematic agenda of droves of operatives now functioning at all levels of academia. This report uncovers the white, slimy underbelly of this controversial period in ichthyology, and highlights some of the recent activities of a Chicago arm of this sinister network involved in such questionable activities as molecular phylogenetics of coral reef fishes, analyses of morphometrics and jaw function in fishes, and the bizarre concatenation of hundreds of published evolutionary trees of fishes into a single large, pretentious phylogenetic megatree of all fishes. Evidence suggests that the visualization of such large megatrees and online integration of data on fishes may be a secret plot by these ichthyophiles to provide a rapid means of exploring the evolution of structure, function and ecology to a wide community of scientists and the general public.

0706 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Mark Westneat, John Lundberg

Field Museum of Natural History, Chicago, IL, United States

A MegaTree for all Fishes: A Higher-Level Framework for Vertebrate Evolution II

Aggregation of biodiversity information is happening at a massive scale, often faster than we can organize and visualize the data for informative patterns. A large phylogenetic framework is a useful way to organize and visualize information, with new tools such as the EOL and MorphBank being developed to empower the searching of large trees for evolutionary trends, diversification rates, character correlations, data richness, and the literature. Large phylogenies are powerful heuristic tools for data exploration and are informative for both research and education long before every node is supported by detailed character data (and in fact can be used to highlight areas in need of new data). Here we present a second edition of our MegaTree of all families of fishes, with most groups resolved according to classical or recent hypotheses of relationships. The phylogeny contains over 800 fish families, both fossil and living, with taxonomy derived from Eschmeyer and Nelson. The phylogeny is dynamic, flexible, and subject to simultaneous manipulation by multiple users. It is freely available as a Mesquite file for editing and use by the community. Group effort is needed in the resolution of family name lists, the application of published phylogenies to the hierarchical structure of the tree, and the splicing in of more fully resolved phylogenies at the species level. Tree splicing or grafting, to produce MegaTrees, is available in a workflow using tools such as PhyloGrafter, that will enable the ichthyological community to make a MegaTree of all fish species using the current backbone.

0523 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Bradley Wetherbee¹, Joseph Marini¹, Kevin Fung¹, Mahmood Shivji², Richard Nemeth³, Jeremiah Blondeau³, Elizabeth Kadison³

¹University of Rhode Island, Kingston, Rhode Island, United States, ²Nova Southeastern University, Fort Lauderdale, Florida, United States, ³University of the Virgin Islands, St. Croix & St. Thomas, Virgin Islands, U.S.

Interactions Among Three Species of Sharks and Grouper Spawning Aggregations in the US Virgin Islands

Grouper spawning aggregations along deep reefs of the US Virgin Islands represent a large potential prey source for large predators including sharks. To examine the relationship between grouper spawning aggregations and sharks, we tagged three species of sharks with acoustic transmitters and monitored their movements over several years using an array of receivers deployed at spawning sites and at locations spanning a stretch of deep reef approximately 100 km in length between the US Virgin Islands and Puerto Rico. Each species of shark demonstrated different behavioral patterns, with temporal and spatial patterns of movement of one species closely associated with spawning events, but little connection between spawning aggregations and behavior of the other two species of sharks. Lemon sharks (*Negaprion brevirostris*) were present at the spawning sites at a much higher frequency during the spawning season, but largely absent during non-spawning months. Caribbean reef sharks (*Carcharhinus perezi*) moved little throughout the year and were detected on receivers in proximity to spawning sites almost continuously. Tiger sharks (*Galeocerdo cuvier*) were detected on receivers throughout the year along the entire extent of the array of receivers and showed no obvious movement patterns associated with spawning activities and little consistency among individuals. Our findings illustrate variable interactions that may occur between different species of sharks and grouper spawning aggregations and that prey availability may influence the spatial and temporal patterns of activity of co-occurring species of sharks in different ways.

0434 AES Behavior & Ecology, 552 AB, Friday 9 July 2010

Bradley Wetherbee¹, Mahmood Shivji², Guy Harvey³, Neil Burney⁴, Choy Aming⁴

¹University of Rhode Island, Kingston, RI, United States, ²Nova Southeastern University and Guy Harvey Research Institute, Ft. Lauderdale, FL, United States, ³Guy Harvey Research Institute, Ft. Lauderdale, FL, United States, ⁴Bermuda Shark Project, Bermuda, Bermuda

Movements and Habitat Use of Tiger Sharks (*Galeocerdo cuvier*) Revealed by Tracking with Satellite Transmitters, the Bermuda-Bahamas Connection

Movements and habitat use of tiger sharks (*Galeocerdo cuvier*) vary among locations and describing behaviors that apply to major demographics the tiger shark populations is challenging. Tiger sharks are common inhabitants of deep reefs off Bermuda during summer months, but are thought to leave in fall and exhibit a seasonal movement cycle. We tagged tiger sharks in Bermuda in late summer with fin-mounted "spot" satellite transmitters (n=9) and archival popup satellite transmitters (n=7) to investigate movement patterns and habitat use of these sharks. Sharks generally remained near Bermuda until fall, when they made directed southeastern movements of 1-2 weeks duration and 1300-1700 km until reaching the Bahamas or Lesser Antilles. The sharks spent the winter months moving within relatively small areas, at times very close to shore. Several individuals exhibited more pelagic behavior remaining farther from shore in deep water. Sharks spent the majority of their time in the uppermost portion of the water column in water greater than 26°C. Monitoring of these sharks continues with the goal of documenting their movements as summer approaches with a possible return to Bermuda. Tiger sharks tagged in Bermuda demonstrate relatively consistent behavior occupying a northern summer habitat and migration to a southern wintering area over 1000 km distant. The results of our study support the contention that tiger sharks are highly mobile apex predators that connect widespread insular and pelagic habitats within the Western North Atlantic.

0075 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Patricia A. White

Defenders of Wildlife, Washington, DC, United States

Keynote: Road Planning 101

Transportation planning guides decisions that influence the location, direction and shape of the development that happens tomorrow and hence the location, types and quality of habitat that we are able to protect. The bad news is, the transportation

planning process is complicated, obtuse and a bit overwhelming. At any given time, several simultaneous processes, plans and products are in play. The good news is, recent advances in transportation planning have created roles for natural resource professionals and the variety of data and information necessary for conservation. The transportation planning process provides an opportunity to voice concerns early enough to actually avoid many impacts. By the time a bad road plan gets to the project stage, all we can do is minimize and mitigate the harm. Proactive transportation planning to maintain and increase habitat connectivity, public education and communication among professional sectors of society are the most economical and effective means to find ways to minimize, mitigate, and even prevent road impacts. This session will provide an overview of the transportation planning process with specific instruction on where and how natural resource professionals can most effectively incorporate conservation into long-range transportation plans. Using modern data and mapping technologies, we can virtually hardwire natural resource conservation into the transportation planning process.

0169 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Steven Whitfield¹, Jacob Kerby², Lydia Gentry³, Maureen Donnelly¹

¹Florida International University, Miami, Florida, United States, ²University of South Dakota, Vermillion, South Dakota, United States, ³University of Idaho, Moscow, Idaho, United States

Temporal Variation in Prevalence and Intensity of Chytridiomycosis in Three Species of Frogs at La Selva, Costa Rica

The emerging infectious disease chytridiomycosis, caused by the chytridiomycete fungus *Batrachochytrium dendrobatidis* (*Bd*), is implicated in widespread amphibian population declines. In the neotropics, most declines have occurred in elevations over 400m asl, in theory because *Bd* is intolerant to higher temperatures in lowland tropical forests. However, the lowland (<140m) La Selva Biological Station, in Costa Rica, has experienced gradual yet significant population declines over the past three decades. Here, we report results of a 12-month disease surveillance program at La Selva for three common species of frogs that vary in their dependence on aquatic habitats. We combine skin swabbing with a qPCR assay to analyze prevalence and *Bd* load across a year. Prevalence overall is low (~6% of frogs at the site infected). There was dramatic temporal variation in the prevalence of *Bd* (ranging from <1% in several months to a peak of ~18% in January), yet no temporal variation in *Bd* load. Prevalence was strongly negatively correlated with air temperature. There was no difference among species in prevalence despite variation in life histories, suggesting that *Bd* infection is not limited to those species with aquatic life stages. Our data indicate that *Bd* can attain relatively high prevalence even in lowland forests, and that lowland forests should not necessarily be considered unsusceptible to *Bd*-associated declines. However, because high temperatures do appear to limit prevalence of *Bd*, our study does provide support for

the hypothesis that regulation of *Bd* by temperature limits widespread extinctions to cooler montane regions.

0698 AES Behavior & Ecology, 551 AB, Saturday 10 July 2010

Nicholas Whitney¹, Harold Pratt², Theo Pratt², Jeffrey Carrier¹

¹Mote Marine Laboratory, Sarasota, FL, United States, ²Mote Center for Tropical Research, Summerland Key, FL, United States, ³Albion College, Albion, MI, United States

It's 3 A.M., Do You Know What Your Shark is Doing? Fine-scale Ethograms from Accelerometers

Although acoustic and satellite telemetry techniques have greatly enhanced our ability to track shark position and depth, the actual behavior of the animal cannot be determined from broad movement data. We applied three-dimensional acceleration data-loggers to six adult nurse sharks (*Ginglymostoma cirratum*) in the Florida Keys to provide the first fine-scale ethograms for sharks in the wild. Data-loggers were deployed for periods of 23 to 104 h (59 + 35 h, mean + SD). Four of the six animals were simultaneously tagged with coded acoustic transmitters to acquire the sharks' location from an array of acoustic receivers, and two sharks carried depth/temperature loggers to provide additional context to acceleration and location data. Behaviors such as swimming, resting, diving, fast-starts, rolling associated with mating, and other behaviors were identifiable and quantified on a per-second basis. Of the two animals with depth loggers, one showed repetitive diving behavior between the surface and 20-32 m for 33 h after tagging. Accelerometer data showed changes in body posture associated with diving and ascending, and indicated that the shark would occasionally rest on the bottom for several minutes between dives. The animal returned to shallow (< 3 m) water for the final 16 h of the track and mated repeatedly during this time. Thirty-seven of 53 (70%) mating events took place during the day, with only 2 (3.7%) events between the hours of 22:00 and 05:00. No events occurred in water deeper than 4 m, and nearly all were in 2 m or less.

0740 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Thane Wibbels

University of Alabama at Birmingham, Birmingham, Alabama, United States

Temperature-Dependent Sex Determination: Implications for Turtle Conservation Programs Using Egg Hatcheries and Head-starting

A variety of reptiles possess temperature-dependent sex determination (TSD). This form of sex determination has significant implications for the ecology, evolution, and conservation of these species. Conservation programs that include head-starting and/or egg hatcheries must address a variety of questions regarding TSD when attempting to develop optimal conservation strategies. As examples: 1) What is the effect on sex ratio when you move eggs from in situ nests to an egg hatchery, and what sex ratio should you produce in the egg hatchery? 2) Should you try to duplicate the natural sex ratio or should you manipulate the sex ratio? 3) If you decide to produce a specific sex ratio, what temperatures should you use? That is, should you incubate all eggs at a temperature that would potentially produce the desired sex ratio or should you incubate a proportion of the eggs at a male-producing temperature and the remainder at a female-producing temperature? 4) How is temperature affecting sex, and are certain temperatures better for producing a given sex? The purpose of this presentation is to provide insight on these basic questions by drawing from data and conclusions from a wide variety of studies. Our current state of the knowledge is not conclusive, however, it provides insight and specific examples which can facilitate the development of effective management strategies in head-start programs for turtles with TSD. Such strategies can take advantage of TSD in order to enhance the conservation of turtles.

0576 Herp Systematics, 551 AB, Monday 12 July 2010

John Wiens¹, Caitlin Kuczynski¹, Ted Townsend², Tod Reeder², Dan Mulcahy³, Jack Sites³

¹Stony Brook University, Stony Brook, New York, United States, ²San Diego State University, San Diego, California, United States, ³Brigham Young University, Provo, Utah, United States

Combining Phylogenomics and Fossils in Higher-level Squamate Phylogeny: Molecular Data Change the Placement of Fossil Taxa

Molecular data offer great potential to resolve the phylogeny of living taxa, but can molecular data improve our understanding of the relationships among fossil taxa? Simulations suggest that this is possible, but few empirical examples have demonstrated the ability of molecular data to change the placement of fossil taxa. We offer such an

example here. We analyze the placement of snakes among squamate reptiles, combining published morphological data (363 characters) and new DNA sequence data (15,794 characters, 22 nuclear loci) for 45 living and 19 fossil taxa. We find several intriguing results. First, some fossil taxa undergo major changes in their phylogenetic position when molecular data are added. This suggests that it may be problematic to assume that fossil taxa can be placed in a molecular phylogeny based on their placement in analyses of morphology alone (as often done in analyses of divergence-time estimation). Second, most fossil taxa are placed with strong support in the expected clades by the combined-data Bayesian analyses, despite >98% missing data cells each and recent suggestions that extensive missing data are problematic for Bayesian phylogenetics. Third, morphological data can change the placement of living taxa in combined analyses, even when there is an overwhelming majority of molecular characters. Finally, we find strong but apparently misleading signal in the morphological data, seemingly associated with a burrowing lifestyle in snakes, amphisbaenians, and dibamids. Overall, our results suggest promise for an integrated and comprehensive Tree of Life by combining molecular and morphological data for living and fossil taxa.

0120 AES Stress Symposium II, 551 AB, Sunday 11 July 2010

Rachel Wilborn¹, Wayne A. Bennett¹

¹*Cooperative Institute for Marine and Atmospheric Studies, Rosenstiel School for Marine and Atmospheric Science, University of Miami, Miami, FL, United States,* ²*University of West Florida, Pensacola, FL, United States*

Effects of Exhaustive Exercise on Juvenile and Adult Stingrays, *Dasyatis sabina*

Physiological responses to exhaustive exercise provide insight into swim performance limits in fish, and potentially highlight ontogenetic differences between adults and juveniles of the same species. Metabolic responses to swim exhaustion (i.e., oxygen consumption, ventilation rates, and blood lactate) were quantified in juvenile and adult Atlantic stingrays (*Dasyatis sabina*). Adult stingrays were significantly larger and heavier than juveniles (Independent T-test, $P < 0.01$) providing a definitive comparison. A direct correlation between body size and metabolism was found for many parameters measured. Adult stingray oxygen consumption rates were 3-fold greater than juvenile rates pre-exhaustion (0.0339 and 0.0127 mg g^{-0.67} hr⁻¹ respectively) and 4-fold greater post-exhaustion (0.0391 and 0.0094 mg g^{-0.67} hr⁻¹ respectively). However, pre- and post exhaustion ventilation rates were not significantly different between life stages. Adult hematological lactic acid values post-exhaustion were 150% greater than juveniles (0.9899 mmol/L and 0.6418 mmol/L). Metabolic adjustments to exhaustive swimming (i.e., escape responses) may impact overall survival strategies as related to predator avoidance tactics, habitat selection, and utilization.

0032 AES Conservation & Management, 552 AB, Friday 9 July 2010

Tonya Wiley¹, Shelley Norton², John Carlson³, Amanda Frick²

¹*Texas Parks and Wildlife Department, Coastal Fisheries Division, Dickinson, Texas, United States,* ²*NOAA Fisheries Service, Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida, United States,* ³*NOAA Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, Florida, United States*

Designating Critical Habitat for the Endangered Smalltooth Sawfish *Pristis pectinata* in the United States: Challenges and Results

On April 1, 2003, the U.S. distinct population segment (DPS) of smalltooth sawfish (*Pristis pectinata*) was listed as endangered by NOAA Fisheries Service. At the time of listing, very little information was known about the habitat usage patterns for this species; therefore, critical habitat could not be determined. Following the listing studies necessary for the identification of specific habitats and environmental features important for the conservation of the species were conducted. Facilitating recruitment into the adult population by protecting the species' juvenile nursery areas was identified as the key conservation objective for the species that would be supported by the designation of critical habitat. The location of potential nursery areas was determined through applying a model developed for identifying elasmobranch nursery areas to smalltooth sawfish encounter data. The habitat features essential to the conservation of the species (also known as the essential features) were identified as red mangroves and shallow euryhaline habitats characterized by water depths less than ~ 1.0 m. These essential features are necessary to facilitate recruitment of juveniles into the adult population by providing for potential predator avoidance and habitat for prey. Two specific areas located along the southwestern coast of Florida between Charlotte Harbor and Florida Bay which contain nurseries and the essential features were designated as Critical Habitat. The Charlotte Harbor Estuary Unit comprises approximately 221,459 acres (346 mi²) of coastal habitat; and the Ten Thousand Islands/Everglades Unit (TTI/E) comprises approximately 619,013 acres (967 mi²) of coastal habitat.

0512 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, 556 AB, Friday 9 July 2010

Lisabeth Willey¹, Paul Sievert¹

¹University of Massachusetts Amherst, Amherst, MA, United States, ²USGS, Massachusetts Cooperative Fish & Wildlife Research Unit, Department of Natural Resources Conservation, University of Massachusetts, Amherst, MA, United States

Multi-scale Habitat Analysis of Eastern Box Turtles (*Terrapene c. carolina*) in Central Massachusetts

Resource selection can be viewed as occurring in a hierarchical fashion, at the order of the region, population, home range, and resource. Our objective was to determine which factors influence the distribution of Eastern box turtles (*Terrapene c. carolina*) at various levels of resource selection in the Connecticut River Valley in Massachusetts, where they are a Species of Special Concern. By comparing remotely sensed geologic, topographic, and land-use characteristics at known over-wintering locations with those at random points, using logistic regression and classification and regression trees (CART), we characterized box turtle habitat at the regional, population, home-range, and daily habitat selection levels. Results from our models can be used to inform management and regulatory decisions and to aid in the selection of sites for future survey and conservation efforts. Importance of habitat variables changed from the broadest (regional) to finest (daily movement) level, with topographical features (elevation and slope) being most important at the regional level, sand and percent cover at the lifetime level, percent forest and aspect at the annual home-range level, and no remotely measured variables were important at the daily movement level. Box turtles were generally associated with highly forested areas near open habitat and southwest aspect, low slope and elevation at the regional and lifetime movement levels, but they were associated with higher elevations and more northern aspects than generally available at the home range level. Logistic regression and classification trees produced similar results, but had different strengths in predicting and describing box turtle habitat.

0384 Karel Liem Symposium, Ballroom D, Thursday 8 July 2010

Cheryl Wilga

University of Rhode Island, Kingston, RI, United States

Twenty Years of Shark Research Championed by Karel

Karel Liem has had a great impact on my research career from my undergraduate research to my recent appointment at the MCZ. Spiny dogfish research at FHL was the first of a series of studies focused on understanding the evolution of the morphology

and mechanics of feeding mechanisms in elasmobranchs. The studies showed that sharks are not stereotypical predators but have a variety of feeding mechanisms associated with an astounding diversity of morphologies for group containing so few species. Fluid dynamics studies have revealed the effects of some of the various mechanisms for feeding on the surrounding environment. Batoids and sharks take advantage of the environment to manipulate fluid flow in remarkable ways to capture prey and locomote. Sharks take advantage of current flow to gain lift at the head to counter the downward pitch at the head induced by the heterocercal tail. Consequently, one of the most unexpected results is that the pectoral fins are used to alter body pitch, roll and yaw rather than lift production during steady forward swimming. Chondrichthyans have more jaw suspension types than any other vertebrate group and are accompanied by the evolution of various combinations of passive and active support by ligaments and muscles in various groups. This has led to a fundamental difference in the suction feeding mechanism between actinopterygians and elasmobranchs as well as divergence of feeding mechanisms within elasmobranchs. Current research shows variation in the coordination of capture and processing mechanisms with ventilation in elasmobranchs.

0383 AES Feeding Symposium I, 552 AB, Saturday 10 July 2010

Cheryl Wilga¹, Ashley Stoehr¹, Danielle Duquette²

¹*University of Rhode Island, Kingston, RI, United States*, ²*University of New Hampshire, Durham, NH, United States*

Biomechanics and Ecology of Feeding in Elasmobranchs

The feeding behavior of sharks and skates is compared to investigate suction and bite mechanisms. Suction flow is generated by rapid expansion of the oropharyngeal cavities to pull prey into the mouth. In contrast, bite feeders simply grasp the prey between the jaws. Three species are compared: bamboo sharks are specialized suction feeders; little skates are specialized for grasping; and spiny dogfish are generalist suction and bite feeders. The movement of oropharyngeal structures and pressure in the buccal, hyoid and pharyngeal regions were quantified using sonomicrometry and transducers. Regressions and ANOVA's were used to test the relationship between kinematics and pressure. Bamboo sharks, which have the smallest change in gape area and a large change in hyoid area, generate the greatest oropharyngeal pressures at fast rates of change in hyoid area. Little skates have the largest change in gape area and smallest change in hyoid expansion and consequently generate the weakest pressure with the slowest rate of change in hyoid expansion. Dogfish have an intermediate change in gape area and a large change in hyoid area, but generates intermediate pressure at fast rates of hyoid expansion. Bamboo sharks are benthic ambush predators that take prey from complex reef environments where strong suction is an advantage. Skates are also benthic ambush predators that grab prey after trapping it against the substrate with the fins;

therefore rapid jaw movements and suction are not crucial. Dogfish use ram to overtake benthic and pelagic prey and a combination of suction and biting for capture.

0245 AES Physiology & Reproduction, 552 AB, Thursday 8 July 2010

L. Jay Williams, James Sulikowski

University of New England, Biddeford, ME, United States

The Use of Steroid Hormone Concentrations to Determine Individual Variability in the Reproductive Cyclicity of the Little Skate, *Leucoraja erinacea*, from the Western Gulf of Maine

Many elasmobranch species including the little skate, *Leucoraja erinacea*, have suffered declines in population biomass. Recent studies (2007 & 2009) indicate little skate populations are recovering, but the current biomass remains substantially lower than historic levels. In order to effectively manage an elasmobranch species it is crucial to understand the reproductive biology. A promising non-lethal technique to assess reproductive parameters is the use of circulating steroid hormones. However, high variability amongst individuals has limited the ability to clearly interpret correlations between steroid hormones and reproductive cyclicity in some species suggesting the need to refine this technique. Thus, the goal of my study is to use circulating steroid hormones to define the reproductive cyclicity and degree of individual variability in the continuously breeding little skate from the western Gulf of Maine. From September 2008 to 2009 weekly blood samples were collected from a laboratory population of mature little skates and analyzed for circulating levels of E α , T, and P α , by radioimmunoassay. Preliminary E α results indicate a high degree of variability between individuals by month (up to 1,500pg/ml) and within individuals over an annual cycle (up to 2,000pg/ml). Ideally, the results from this study can be used as a model to refine this technique and subsequent analysis in order to better elucidate the reproductive trends in the little skate and other ovoviparous elasmobranch species.

0758 Fish Conservation, Ballroom B, Friday 9 July 2010

Philip Willink¹, Eustace Alexander²

¹*The Field Museum, Chicago, IL, United States*, ²*Conservation International - Guyana, Georgetown, Guyana*

Using Fish Assemblages in Different Habitats to Develop a Management Plan for the Upper Essequibo Conservation Concession, Guyana

The Upper Essequibo Conservation Concession is a reserve in central-eastern Guyana managed by Conservation International. The region is uninhabited by people and poorly studied. The first scientific fish survey was in 2007 in conjunction with the filming of the BBC nature documentary *Lost Land of the Jaguar*. Aquatic habitats were primarily flowing water, ranging from the main channel of the Essequibo River to small forest creeks. Ponds and seasonally flooded forests were uncommon. Large predatory fishes were abundant in the Essequibo River. Fishes tolerant of low oxygen levels were common in ponds / flooded forests. There was zero similarity between the fish assemblages of the Essequibo River and inland ponds / flooded forests. The rest of the habitats and fish assemblages formed a continuum between these extremes. Although not under immediate threat, future threats to the Upper Essequibo Conservation Concession include logging, mining, and over-fishing. Because of the heterogeneous distribution of fish assemblages, and because each threat will differentially impact different habitats, a variety of management options need to be implemented in order to conserve the fish biodiversity of the Upper Essequibo Conservation Concession.

0770 Herp Conservation II, Ballroom B, Sunday 11 July 2010

John Willson¹, Michael Dorcas², Ray Snow³

¹*Savannah River Ecology Lab, Aiken, SC, United States*, ²*Davidson College, Davidson, NC, United States*, ³*Everglades National Park, Homestead, FL, United States*

Identifying Plausible Scenarios for the Establishment of Invasive Burmese Pythons in Southern Florida

The Burmese python (*Python molurus bivittatus*), a native to Southeast Asia, has been abundant in the pet trade for decades and is now firmly established in southern Florida, including Everglades National Park (ENP). This species is a long-lived, behavioral, habitat, and dietary generalist that likely threatens numerous species of native wildlife. Python populations in ENP have increased exponentially since the 1990's and the range of pythons appears to be expanding both into the Florida Keys and northward into peninsular Florida. Understanding how pythons became established will be helpful in preventing additional introductions of Burmese pythons in other parts of the United

States or establishment of similar species in Florida. In this study we evaluate the plausibility of various scenarios for the introduction and establishment of Burmese pythons in southern Florida. Specifically, we use two modeling approaches to evaluate the time of introduction and characteristics of the founder population that could have lead to the introduction and establishment of this species. First, we develop a model that uses the relationship between python capture rates over time and population size to estimate the time period for population establishment. Second, we develop a demographic age-structured population model to estimate rates of python population growth under various establishment scenarios. We discuss the plausibility of various introduction scenarios in light of our modeling results and spatial, temporal, and demographic patterns of python captures in the region.

0026 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Bryan Windmiller¹, John Berkholtz²

¹*Hyla Ecological Services, Concord, MA, United States*, ²*Zoo New England, Stoneham, MA, United States*

Nest Protection and Headstarting as Tools to Aid in the Recovery of a Declining Blanding's Turtle Population

One of the largest populations of Blanding's turtles (*Emydoidea blandingii*) in New England occurs in a suburban landscape at Great Meadows NWR in Massachusetts. This population has declined by more than 50% since 1973. Our results suggest that the greatest current threat to the population is a low recruitment rate of adults; 15 of 20 adult females captured recently were marked as adults more than 20 years ago. As management interventions, we protect Blanding's turtle nests from predation and human destruction, and headstart some of the hatchlings for a period of eight months. Thus far, we have radio-tracked a sample of 24 headstarted juveniles after release into Great Meadows. To date, survivorship from egg deposition to hatching in protected nests has been 73%, survivorship through the headstarting process has been 91%, and post-release survivorship of headstarted juveniles has been approximately 85% from release to the onset of the first winter in the wild and also 85% from the first to the second winter in Great Meadows. The above survivorship levels are considerably higher than published data or estimates for Blanding's turtle eggs and juveniles with no intervention. Additionally, headstarting has allowed us to gather data on habitat use and movement patterns of young turtles that would be otherwise difficult to obtain. We hope that nest protection, headstarting, and other monitoring, management, and outreach efforts that we have conducted with the Great Meadows Blanding's turtles will eventually result in increased recruitment and the recovery of this critical population.

0217 Poster Session I, Exhibit Hall D, Friday 9 July 2010; AES CARRIER AWARD

Megan Winton¹, Enric Cortés²

¹*Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, United States*, ²*National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL, United States*

SHARKGUT: A Diet Database Quantifying Shark Predation

Sharks are known to play an influential role in the food webs of marine communities. While information from single diet studies is most often limited to small geographic ranges and time periods, investigation of spatial and temporal patterns in shark resource utilization requires long term, large-scale information. We present SHARKGUT, a shark diet database, intended to be a centralized, comprehensive archive of the entire body of shark diet literature. Designed to facilitate the retrieval and analysis of diet composition data for both predators and their prey items, the database currently contains information for 177 shark species from 27 families and over 1,700 species of prey items extracted from 418 publications spanning the years 1907 to 2007. In addition to prey types and quantitative diet indices, the database includes study region, season, and taxonomic classification of prey items, as well as sex, size, and maturity status of study specimens if available. Combining all available data into a standardized database will provide a valuable tool to scientists and resource managers investigating trophic interactions and other ecosystem processes.

0215 AES GRUBER AWARD, 551 AB, Friday 9 July 2010

Megan Winton¹, David Ebert¹, Lisa Natanson², Gregor Cailliet¹

¹*Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, United States*, ²*National Marine Fisheries Service, Northeast Fisheries Science Center, Narragansett, RI, United States*

Age, Growth, and Maturity of the Roughtail Skate, *Bathyraja trachura* (Gilbert, 1892), from the Eastern Bering Sea

Fishery landings of skates in Alaskan waters surpass those of all other U.S. states combined. Many skates possess life history characteristics that may make them vulnerable to exploitation; therefore, the accurate assessment of growth rates, longevity, and reproductive productivity is indispensable in developing management plans. The objectives of this study were to provide age estimates and describe growth characteristics of *Bathyraja trachura* from the eastern Bering Sea, specifically examining longevity, size and age at maturity, variation in these traits between sexes, and potential

differences in growth between two marine ecosystems. Age estimates were determined using counts of vertebral bands in both unstained thin sections and those prepared using a histological method. Observed age estimates from thin sections ranged from 0 to 30 years, with a maximum age estimate of 29 and 30 years for males and females, respectively. Of the four models applied, the two-parameter von Bertalanffy growth function provided the best description of growth and generated estimates of $k = 0.078$ and $L_{\infty} = 985.7$ mm TL. No significant differences were detected between the growth of males and females. Median length and age at 50% maturity were estimated at 748.2 mm and 16 years for males and 791.9 mm and 18.6 years for females. The results of this study may indicate a latitudinal pattern in size and growth, with individuals from the eastern Bering Sea growing more slowly and reaching higher maximum ages than previously reported for specimens collected off the western coast of the United States.

0561 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Samantha Wisniewski, Scott Henke

Caesar Kleberg Wildlife Research Institute, Texas A&M University - Kingsville, Kingsville, TX, United States

A Model for Brown Treesnake Risk Assessment

Brown tree snakes (*Boiga irregularis*) are a mildly venomous, rear-fanged constrictor that is native to Australasia. The brown tree snake (BTS) is now an exotic invasive causing significant economic, biological, and human health problems on Guam. Brown tree snakes have been found in the continental U.S. and risk of brown tree snake introduction will continue to increase greatly over the next 10 years due to extensive military expansion and development on Guam. We collected data for shipments leaving Guam over 3 consecutive years (2006-2008) to determine at-risk locations in the continental U.S. for BTS introduction. Known BTS locations were used with shipping and climate data in a maximum entropy approach (using program Maxent) to predict the spread of BTS over time. Locations receiving the highest number and weight of shipments from Guam which also have BTS-suitable climates are concentrated in the southern U.S., and San Diego, CA holds a particularly high risk due to the amount of shipments coming from Guam. High-risk areas are important targets for the North America Brown Tree Snake Control Team (NABTSCT) for increased public education, training and awareness of BTS as an invasive species. This study can be used as an example for analysis of potential range expansion of other invasives with climate change and human contributions to exotic species introduction.

0744 Poster Session II, Exhibit Hall D, Saturday 10 July 2010

Samantha Wisniewski¹, Scott Henke¹, Dave Britton²

¹Caesar Kleberg Wildlife Research Institute, Texas A&M University - Kingsville, Kingsville, TX, United States, ²U.S. Fish and Wildlife Service, Albuquerque, NM, United States

The North America Brown Treesnake Control Team

The North America Brown Treesnake Control Team (NABTSCT) is an advisory organization working towards preventing the introduction of the invasive brown treesnake (*Boiga irregularis*) into the continental United States. The NABTSCT was formed in 2002 as a part of the Aquatic Nuisance Species Task Force in order to facilitate communication and coordination of efforts among agencies concerning brown treesnakes. Individual snakes have been inadvertently transported as hitchhikers to Texas, Hawaii, Alaska, and Oklahoma via aircraft and cargo. The control team emphasizes public education and awareness in high-risk areas of the continental United States to prevent brown treesnake introduction. NABTSCT believes that prevention is the best method of control, and with that in mind, the NABTSCT supports a public website, risk assessment modeling, a snake identification search engine, education materials, and rapid response to brown treesnake sightings. These tools can be used as models to design preventative control methods for other injurious wildlife species.

0453 Headstarting Turtle Symposium I, Ballroom B, Monday 12 July 2010

Maria Wojakowski, Russell Burke

Hofstra University, Hempstead, NY, United States

Using Stage-based Matrix Models to Examine and Prioritize Conservation Effort on Nesting Beaches

In 1987, Crouse et al. introduced a stage-based matrix model to examine population dynamics and conservation opportunities for loggerhead sea turtles (*Caretta caretta*) in the southeastern United States. Crowder et al. (1994) modified Crouse et al.'s seven-stage model, instead using a five-stage model to determine the impact of turtle excluder devices (TEDs) on loggerhead bycatch in southeastern US trawl fisheries. Both studies identified the importance of the large-juvenile stage in sea turtle conservation. Even small decreases in the number of large juveniles cause notable reductions in loggerhead populations. Since then, stage-based matrix models have been used to determine conservation strategies for threatened and endangered turtles, e.g. the Spotted Turtle (*Clemmys guttata*) (Enneson & Litzgus 2008), the Diamondback Terrapin (*Malaclemys terrapin*) (Mitro 2003), the Desert Tortoise (*Gopherus agassizii*) (Wisdom et al. 2000).

Heppell (1998) examined matrix models for a number of different turtle species to establish trends for management efforts across taxa. We build on this work, reviewing and compiling the results of matrix models to understand turtle life history and conservation potential. Matrix models have shown that headstarting and conservation strategies focused on the hatchling stage are not as valuable as once believed (Heppell et al. 1996), yet there is also evidence for the importance of hatchling conservation efforts. We examine both claims and compare the results of matrix models designed to reflect these different conservation strategies in the attempt to give a rigorous, life history-based direction to hatchling and nesting beach conservation efforts.

0628 Fish Systematics I, Ballroom D, Monday 12 July 2010

Robert Wood, Justin Baker, Kerstin Edberg

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

Molecular Systematics and Population Subdivision within *Crystallaria asprella* Recently Rediscovered Populations from Missouri

The genus *Crystallaria* contains two species of darters that are collectively distributed broadly but disjunctly across eastern North America. The recent rediscovery of multiple populations of *Crystallaria asprella* in several river systems in Missouri has warranted a range wide reappraisal of genetic diversity and subdivision within these species as these populations were unavailable at the time of the last published study. Evaluation of mitochondrial and nuclear data sets for these species suggest novel patterns of genetic divergence within *C. asprella*. These data will be compared to patterns of genetic subdivision within co-distributed species of darters in an effort to gain a more complete perspective on extrinsic factors promoting population subdivision.

0146 Roads Symposium I, Ballroom B, Saturday 10 July 2010

Roger Conant Wood

The Wetlands Institute and the Richard Stockton College of New Jersey, Pomona, NJ, United States

Terrapins and Tires: A Large-Scale Community-Based Conservation Initiative in Southern New Jersey, USA

The Wetlands Institute has been compiling northern diamondback terrapin (*Malaclemys terrapin terrapin*) road kill data for two decades along the Atlantic coast of southern New Jersey. Large numbers of individuals and organizations have been involved in this activity. Our data collection is highly visible to the general public and so has generated

considerable newspaper, magazine and TV coverage. We have been experimenting with various kinds of roadside terrapin barrier fences over the past six years in an effort to reduce the number of road kills during the annual nesting season. Numerous individuals, local town governments, the Cape May County Highway Department, the New Jersey Department of Transportation, and the Forsythe National Wildlife Refuge have all participated in the construction and testing of different types of barrier fences. As part of our terrapin conservation efforts, we have incubated and hatched undamaged eggs taken out of road-killed female terrapins, head-started (with the help of Stockton College, the Philadelphia Zoo, two local high schools, and a number of elementary school teachers) the resultant hatchlings for nearly a year, and then involved large numbers of school children and members of the general public in their release. In summary, we have been gathering basic data of biological interest, while at the same time increasing public awareness about the problems that humans cause, and also involving large numbers of scientists, volunteers, schools from kindergarten to college, and non-profit and governmental organizations of various kinds in different aspects of our ongoing terrapin conservation efforts.

0037 Headstarting Turtle Symposium II, Ballroom B, Monday 12 July 2010

Roger Wood¹, Patrick Baker¹, Rosalind Herlands², John Rokita²

¹*The Wetlands Institute, Stone Harbor, NJ, United States*, ²*Richard Stockton College of New Jersey, Pomona, NJ, United States*

A Unique Long-Term Headstarting Program for the Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) in Southern New Jersey, USA

Along the coast of southern New Jersey, northern diamondback terrapins (*Malaclemys terrapin terrapin*) incur high mortality as a result of both vehicle strikes and incidental drowning in commercial crab traps. Adult females are disproportionately affected because only they are struck and killed by motor vehicles while searching for nest sites on roads that cross or are adjacent to their salt marsh habitat. Over the past twenty years, annual mortality of nesting diamondback terrapins along a 38-mile transect on the Cape May Peninsula of southernmost New Jersey has ranged from 366 to 657 (mean = 493). Since 1991, 9,359 roadkills have been recorded within our transect. Outwardly undamaged eggs have been recovered from carcasses and incubated at 30 deg. C, a temperature known to produce only females. In a typical year, 40 to 50% of these eggs produce hatchlings. The tiny terrapins are then headstarted for 10 months, by which time they attain a size equivalent to that of a 3 or 4 year old terrapin in nature, before being released into their salt marsh habitat. Pit tags, first used in 1997, now uniquely identify several thousand headstarters. In recent years, adult headstarters have returned to their release sites to nest. Estimated age at maturity of these headstarters is 8-10 years. This project is unique in that the source of all eggs for our headstarters is roadkilled females. Comparisons of hatchlings from roadkills with those from natural nests show no differences in size, weight, scute anomalies, or external markings.

**0528 General Ichthyology, Ballroom B, Friday 9 July 2010; ASIH STOYE AWARD
GENERAL ICHTHYOLOGY**

Jeremy Wright

University of Michigan, Ann Arbor, MI, United States

Comparative Toxicity of Ictalurid Catfish Venoms

Members of the North American catfish family Ictaluridae have been known to possess venom glands associated with their fin spines for over 100 years, but the chemical compositions of, and toxic effects elicited by the secretions of these glands have only rarely been subjected to rigorous study. I examined the comparative toxicity of ictalurid catfish venoms by performing injections of varying doses of venoms from over 20 ictalurid species (representing four genera) into an ecologically relevant, model predator species (*Micropterus salmoides*). Results of venom injection were coded using a newly developed toxicity index, which was used to quantitatively compare toxicity of ictalurid species' venoms. Toxic peptides responsible for the production of these effects were then preliminarily identified using SDS-PAGE analyses, which compared the protein content of venom extracts with control extracts prepared from catfish fin tissue. The toxic effects produced varied between different species' venoms, and included rapid loss of coloration, myoclonus, hemorrhage at the bases of fins, loss of equilibrium, and in some cases, mortality. SDS-PAGE analyses indicated that this variation was at least partially due to the presence of unique toxic peptides in some species and genera, though other putative toxins appear to be widespread among ictalurids. Body size and venom gland morphology were also indicated as factors influencing toxicity in North American catfishes, suggesting that large body size and concomitant release from strong predation pressure may have led to the loss of venom glands in some ictalurid lineages.

**0134 Poster Session I, Exhibit Hall D, Friday 9 July 2010; ASIH STORER
HERPETOLOGY AWARD**

Yunke Wu

Harvard University, Cambridge, MA, United States

**Color Pattern Evolution and Lineage Diversification in the Chinese Stout
Newts (Salamandridae: *Pachytriton*)**

Montane amphibians are ideal models to study lineage diversification at both spatial and temporal scales. Among other reasons, their limited dispersal ability allows independent phenotypic-trait evolution through interactions with the environment. We present a phylogenetic and phylogeographic study of the stout newts, a genus of salamanders restricted to montane streams in southeastern China. We use these data to trace the evolutionary history of external color patterns and to understand the formation

and distribution of genetic lineages under the influence of paleoclimatic variations. A mitochondrial genealogy was obtained for 24 populations that include all three described species. The unspotted color pattern that is shared by *P. labiatus* and northeastern populations of *P. brevipes* could be the result of parallel evolution. Similarly, homoplasy is likely between the nominal *P. brevipes* and *P. archospotus*, which both possess numerous black spots. Based on molecular dating estimates initial cladogeneses within *Pachytriton* occurred in the early Late Miocene, which coincides with a substantial intensification of the East Asian summer monsoon 7-10 Ma. Subsequent lineage diversifications occurred mostly after 3.6 Ma, along with further strengthening of the summer monsoon. Heavy summer precipitation cause overflows of montane streams and may promote dispersal into adjacent mountains followed by isolation and divergence. Contrasting phylogeographic patterns are found among species with hypotheses of directional expansion and/or local extinction. Single-dimensional ecological niche modeling suggests a possibly negative impact of Early Pliocene climate warming on these cold-adapted salamanders. Supported by NSF (EF-0334846, AmphibiaTree) to JH.

0012 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Leren Xu, Deyuan Ou, Dongmei Yang

Guizhou University, Guiyang, Guizhou, China

Identification of Mast Cell Tryptase in Some Lower Vertebrates from China

Mast cell tryptase, an inflammatory mediator, has been considered as a specific cellular marker of mast cells in human tissues and a murine monoclonal antibody (mAb AA1), raised against human mast cell tryptase has been successfully used in an indirect immunoperoxidase method to immunostain paraffin sections. In our previous works by using the method, not only human mast cells, but also mast cells in some other mammalian species such as pig, cow, sheep, cat, rat and dog also contained tryptase have been demonstrated. In very recent years, our laboratory and other workers in China have demonstrated that mast cells in some lower vertebrates also contain tryptase in their cytoplasm. We found that the mast cells in the intestine and tongue of bullfrogs *Rana catesbeiana* and Lin et al. (2009) demonstrated that the mast cells in the digestive tract of Nile tilapia (*Tilapia nilotica*) also contained tryptase. The tryptase-positive mast cells mainly lie in lamina propria of intestine and among the mucosal epithelial cells, a few were distributed in the base of intestinal villi and around submucosal glands. The excellent cross-reaction with the mAb AA1 in bullfrog and tilapia mast cells suggested that mast cells in some lower vertebrates including amphibian and teleostean also contain tryptase and like in mammalian the neutral proteases in mast cells in lower vertebrates may play an important role in the immuno-activity. The indirect immunoperoxidase method by using mAb AA1 also can be considered as a specific method to detect mast cells in some lower vertebrate tissues.

0389 SSAR SEIBERT ECOLOGY AWARD, 555 AB, Thursday 8 July 2010

Katharine Yagi, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

The Effect of Flooding on the Spatial Ecology of Spotted Turtles (*Clemmys guttata*) in a Southern Ontario Population

Many studies have focused on the effects of anthropogenic habitat alterations on animals, but little attention has been given to the effects of rapid natural changes in habitat. The purpose of this study was to examine the effects of flooding caused by beavers on the spatial ecology of the federally endangered Spotted Turtle (*Clemmys guttata*) in an isolated bog that was historically drained for peat extraction. We examined home range size, daily distances moved, and habitat use before and after flooding. We predicted that home range sizes and movements would be greater after flooding because the increased water level made more of the bog available to the turtles.

We predicted a change in habitat use as more aquatic habitats became available post-flooding. Using radio telemetry, 19 turtles were tracked throughout their active season to determine spatial patterns during the flooded conditions. We used historical data collected by the Ontario Ministry of Natural Resources to represent Spotted Turtle spatial patterns before flooding conditions. Daily movements were significantly larger during post flooding conditions compared to pre-flood conditions. Home ranges were larger during the flooded conditions although the comparison was not statistically significant. After flooding, there was a strong preference for flooded areas and drainage ditches rather than terrestrial sites throughout the active season. Understanding the response of Spotted Turtles to a rapid change in habitat will help biologists determine the best management plan to protect critical habitat and populations of this species at risk.

0351 AES Feeding Symposium II, 552 AB, Saturday 10 July 2010

Atsuko Yamaguchi, Shinya Tanaka, Keisuke Furumitsu, Gen Kume

Nagasaki University, Nagasaki, Japan

Feeding Habits of the Fanray *Platyrrhina sinensis* (Batoidea: Platyrrhinidae) in Ariake Bay, Japan

Feeding habits of the fanray *Platyrrhina sinensis* were clarified on stomach content analyses of 334 specimens collected in Ariake Bay, Japan from 2003 to 2007. A total of 324 individuals contained food items and 10 (3.0%) were empty. Mean percentage of stomach contents weight per body weight was 0.59. Thirty-seven taxonomic levels of prey items were identified. Based on the percentage of ranking index (%RI), the most

important preys were shrimps such as *Leptochela gracilis* followed by fish and mysids. These three main prey categories collectively had a %RI value of 93.7. There were no differences between sexes in the diet composition, but the ontogenetic dietary shift was observed. Shrimps were consistently the most important prey category throughout the size classes. Meanwhile, smaller individuals actively feed on mysids, and fish constituted the substantial portion of their diet for larger individuals. The Shannon-Wiener diversity index H' (2.65) indicated that this species is a generalist, and the tendency enhanced in larger individuals.

0286 AES Morphology, 552 AB, Sunday 11 July 2010

Kara Yopak¹, Shaara Ainsley², David Ebert², Lawrence Frank¹

¹University of California San Diego, Center for Scientific Computation in Imaging, La Jolla, CA, United States, ²Pacific Shark Research Center, Moss Landing Marine Laboratories, Moss Landing, CA, United States

Skating Over the Issue: Neural Adaptations to the Bathyal Environment in Deep-sea Skates

The deep sea is a vast and still largely unexplored habitat. As neural development in fishes has been shown to reflect morphological adaptations, particularly in extreme environments, quantitative analysis of deep-sea species is potentially highly informative. Members of the family Rajidae (skates) make up a highly diverse group, comprising approximately 40% of all batoids, with 30 genera across approximately 280 species. Despite their diversity, few studies have quantified interspecific brain size (encephalization) or the relative development of major brain areas (telencephalon, diencephalon, mesencephalon, cerebellum, medulla) and discrete sub-sections of these brain structures that receive direct sensory input (e.g. optic tectum and the dorsal and medial octavolateral nuclei) in rajids. The brains of five species of deep-sea skate, *Bathyraja aleutica*, *B. parmifera*, *Raja binoculata*, *R. rhina*, *Rhinoraja interrupta*, ranging in primary habitat depth from 50m to as deep as 1,600m, were assessed and compared to the brain organization of other batoids (n=24) as well as a broad dataset of sharks and holocephalans (n=84). Trends show both strong phylogenetic patterns as well as possible ecological adaptations. Though morphologically dissimilar, pilot data suggest similar patterns of brain organization between the deep-sea members of Rajidae and the deep-sea sharks and holocephalans, such as *Etmopterus baxteri*, *Centroselachus crepidater*, and *Harriotta raleighana*, which have a relatively small telencephalon, a small, smooth cerebellum, and a large medulla, particularly the areas that receive electroreceptive and lateral line input. We hypothesize that a combination of phylogenetic and ecological pressures is contributing to brain development in these species.

0601 SSAR SEIBERT CONSERVATION AWARD, 555 AB, Friday 9 July 2010

Derek Yorks, Paul Sievert

University of Massachusetts Amherst, Amherst, Massachusetts, United States

The Importance of Lighting Levels in Design of Under-Road Passages for Freshwater Turtles

Roadways are pervasive on much of the landscape and can be significant sources of mortality for turtles. This mortality is likely a major driver of the pattern of declining turtle populations in rapidly urbanizing environments. Increasingly, under-road passages are being employed to allow a range of wildlife species to move safely between habitat patches that are bisected by roadways. In an ongoing study, the amount of available light permitted to enter through the top of experimental tunnels has emerged as a critical indicator of tunnel effectiveness. Using painted turtles (*Chrysemys picta*), we conducted behavioral trials at an outdoor field laboratory to examine the influence of varying light levels, in combination with tunnel size, on turtle movements. A total of 625 turtles were tested using a complete factorial experimental design to evaluate tunnel lighting and size effects on receptiveness of turtles to use road passage structures. Responses of turtles were analyzed both as a binomial response (success/fail), and as a continuous variable (total time for the turtle to complete the trial). Light levels evaluated were 0%, 75%, and 100% of ambient light levels, and the amount of light passing through a simulated grate in the median of a highway. Successful completion of the trial increased, while median time to complete the trial decreased, as light transmitted through the tops of tunnels increased. Our results indicate the importance of designing road passage structures that provide adequate lighting for freshwater turtles.

0281 Herp Conservation III, Ballroom B, Sunday 11 July 2010

Melissa Youngquist¹, Michelle Boone¹, Caren Helbing², Jameson Jordon², Marek Kobylarz², Nik Veldhoen², Clara Wilson¹

¹*Miami University, Oxford, OH, United States*, ²*University of Victoria, Victoria, British Columbia, Canada*

Is Timing Everything? The Effects of Carbaryl on Green Frog (*Rana clamitans*) Development and the Thyroid Hormone Axis

Recent evidence indicates that pesticide exposure can affect time to and size at metamorphosis of amphibians. Because metamorphosis is under the complete control of thyroid hormones, it is possible that pesticides affect the thyroid axis. Our object was to determine how carbaryl, a widely used insecticide, influences thyroid hormone action and development of green frog tadpoles (*Rana clamitans*). Tadpoles were reared at two

different densities and exposed to the pesticide at different developmental stages (1 mg/L carbaryl at 2, 4, 8, and 16 weeks after hatching) in outdoor 1,500 L artificial ponds. Survival, mass, and stage at 19 weeks were used to determine treatment effects on development. Tadpoles were allowed to complete metamorphosis in the lab. A molecular assay was used to determine how treatment affected expression of thyroid hormone receptors in the brain. Exposure did not affect survival. Pond density and timing of exposure did influence mass and stage. Tadpoles in low density ponds exposed at 16 weeks were larger and more developed at 19 weeks than tadpoles in other treatments. This increase in mass and development was independent of food resources in the mesocosms. Molecular analysis is expected to show a change in thyroid hormone receptor mRNA levels due to exposure at 16 weeks, as we have found in related laboratory studies. These data suggest that carbaryl can have a direct effect on development of green frogs and thyroid hormone action at later developmental stages, suggesting that this insecticide can act as an endocrine disruptor.

0266 Acoustics Symposium II, Ballroom D, Saturday 10 July 2010

Lucia Ziegler¹, Matías Arim¹, Peter M. Narins¹

¹*Sección Zoología Vertebrados, Facultad de Ciencias. Universidad de la República., Montevideo, Uruguay,* ²*Departments of Physiological Science and Ecology & Evolutionary Biology, University of California Los Angeles, Los Angeles, CA, United States*

Flexibility in the Advertisement Call of *Hypsiboas pulchellus* (Anura: Hylidae) in Response to Microhabitat Characteristics

The structure of the environment surrounding signal emission produces different patterns of degradation and attenuation potentially affecting communication. The expected adjustment in call structure to ensure signal transmission in an environment was formalized in the Acoustic Adaptation Hypothesis. Within this framework, most studies considered anuran calls as fixed attributes determined by local adaptations. However, variability in vocalizations as a product of phenotypic expression has also been reported. Empirical evidence supporting the association between environment and call structure has been inconsistent, particularly in anurans. Here we present evidence for phenotypic flexibility in the advertisement call of *Hypsiboas pulchellus*, in response to induced changes in the acoustics of their microhabitat. Males were recorded in the field in natural conditions. Microhabitat was then modified placing a styrofoam enclosure around each calling male. After calling was resumed, we recorded the calls inside the enclosure. Results from Student tests for independent samples (intra-individual variation) and paired samples (inter-individual variation) rendered similar results. All temporal variables showed significant differences, with longer call elements when the individuals were broadcasting inside the enclosure. Spectral attributes were also subject to modulation, although the magnitude and direction of these adjustments were inconsistent among males. Playback experiments within the enclosure yielded results

which rule out treatment-induced variation, highlighting the potential rôle of call flexibility on detected call patterns. Our study questions the view of fixed adaptations as the sole determinant of the match between call and environment, positing phenotypic flexibility as a key factor for the understanding of this interplay.

0562 Poster Session I, Exhibit Hall D, Friday 9 July 2010

Rodrigo Zieri, Lilian Franco-Belussi, Classius de Oliveira

UNESP - São Paulo State University, São José do Rio Preto, Brazil

Effects of Testosterone Cypionate in the Hepatic and Testicular Pigmentation of the Anuran *Eupemphix nattereri*: Morphological and Stereological Studies

In amphibians, pigmented cells appear in tegument and in lung as typical melanocytes and in spleen and liver as melanomacrophage or also known as Kupffer cells. The present study aimed at characterizing morphological and stereological patterns of pigmented cells in the liver and testis of the anuran *Eupemphix nattereri*, under effect of steroid hormone. Ten adult males, collected in Sao Paulo State, Brazil, received a 5 mg/kg dose of testosterone cypionate solving in vegetal oil during 7 days, injected in the dorsal lymph sac. Group of five animals was euthanatized after 24h and other group, after 15 days and submitted to morphological studies with light and transmission electron microscopy. The control group received only vegetal oil at the same concentration. Were analyzed 25 histological fields for each animal using an image analyzing system software (Image ProPlus, Media-Cybernetics, Inc.). In the hepatic tissue were found kupffer cells, characterized by multivesicle bodies in the cytoplasm, including large amount of melanosomes. In the testis, melanocytes-like cells are present in the interstitium, with large and irregular aspect and a great amount of intensely pigmented cytoplasm. Was observed an increase of approximately 2x in the occupied area by the pigmented cells in the liver and 4x in the testis, comparing the treatment group and the control. Between the treatments, an increase of approximately 1,8x was observed in the liver of animals euthanatized after 15 days.

0247 Herp Morphology, 556 AB, Sunday 11 July 2010

Breda Zimkus, James Hanken

Museum of Comparative Zoology, Harvard University, Cambridge, MA, United States

Evolution of Miniaturized Body Size in Puddle Frogs (Anura: Phrynobatrachidae): Correlations with Osteology, External Morphology, and Reproductive Mode

Miniaturization, the evolution of tiny adult body size, has played an important role in vertebrate evolution, especially within amphibians. This study examines miniaturization in a phylogenetic context to determine if reduction in body size is correlated with evolution of novel morphologies or reproductive modes. Body size evolution is reconstructed within the species-rich sub-Saharan puddle frogs (*Phrynobatrachus*), with adults ranging in size from 12 mm to greater than 50 mm. Each of the three major clades of puddle frogs follows a trend of body size reduction; the ancestor of the puddle-frog lineage was significantly larger than the majority of extant species. Evolution of pedal webbing is highly concurrent with body size reduction, and extent of pedal webbing statistically correlates with body size. Fusion of carpal (wrist) elements—from six separate bones to four—closely follows the reduction in body size that occurred between the first major clade and the subsequent two major clades. Changes to phalangeal morphology, which include asymmetric loss or duplication of phalanges in both the forelimb and hind limb, are most commonly observed in small species. Ancestral reconstructions of reproductive mode suggest that *Phrynobatrachus* independently evolved alternative modes at least seven times, including terrestrial deposition of eggs and terrestrial, non-feeding larvae. Alternative reproductive modes occur within both miniaturized and non-miniaturized species. Miniaturization has played an important role in the evolutionary radiation of this Afrotropical lineage and has been a key factor in their successful diversification across sub-Saharan Africa. Supported by NSF (EF-0334846, AmphibiaTree) to JH.

Author Index

A

- | | |
|--|-------------------------------------|
| Aalbers, Scott.....47 | Aming, Choy.....515 |
| Abate, Maria.....1 | Amorim, Maria Clara P.13 |
| Abbott, Emily.....26 | Anderson, Christopher.....14 |
| Abed-Navandi, Daniel.....370 | Anderson, Corey.....14 |
| Abel, Dan.....441 | Anderson, Paul.....15, 16, 231, 234 |
| Abercrombie, Debra.....403 | Anderson, W. Gary.....17 |
| Abibou, Djihbrihou.....45 | Anderson, Wesley.....17, 18 |
| Aburto, Octavio.....147 | Andreadis, Paul.....19 |
| Aceró P., Arturo.....48 | Andrews, Allen H.....19 |
| Acord, Megan2 | Andrews, Kimberly M.....20, 21 |
| Adams, Aaron.....317 | Anthony, Carl D.....2, 401 |
| Adams, Andrew.....2, 3 | Aponte-Osborne, Yaira.....322 |
| Adams, Cory.....4, 420 | Appel, Arthur.....460 |
| Adams, Dean.....149 | Appeldoorn, Richard.....317 |
| Adams, Erin.....15 | Araújo, Maria Lúcia.....21 |
| Adriaens, Dominique.....4, 5, 216, 480 | Arbour, Jessica.....22 |
| Adrian, Andrew.....6 | Arch, Victoria.....23 |
| Afiadata, Achankeng.....313 | Areanas, Alejandro.....359 |
| Agnew, Mary.....469 | Ares, Nichole.....24 |
| Aguirre, Windsor.....42 | Arias-Castro, Ery.....504 |
| Aide, T. Mitchell.....216 | Arim, Matías.....536 |
| Ainsley, Shaara.....534 | Aristote, Mwenebatu.....496 |
| Ajemian, Matthew.....6 | Armbruster, Jonathan W.....24, 127 |
| Akama, Alberto.....154, 155 | Arnold, Rachel.....340 |
| Alberg, Timothy J.7 | Arsenault, Lilianne.....25, 215 |
| Albert, James.....8, 91 | Art, Michael.....330 |
| Albertson, R. Craig.....9 | Artchawakom, Taksin.....221 |
| Aldridge, Robert.....9, 10, 247, 442 | Asahida, Takashi.....250 |
| Alexander, Eustace.....524 | Aschliman, Neil.....26 |
| Alioto-Jurado, Dom.....11 | Ashley-Ross, Miriam.....181 |
| Allen, Larry G.11, 209 | Ashton, Kyle.....432 |
| Allen, Mike.....348 | Astley, Henry.....26, 27 |
| Allen, Rebecca.....462 | Atema, Jelle.....172 |
| Alloush, Menemsha.....254 | Ault, Erick.....403 |
| Allred, Barry J.447 | Auster, Peter.....28 |
| Almeida-Toledo, Lurdes.....172 | Austin, Christopher.....29, 205 |
| Alves Gomes, José155 | Autumn, Kellar.....200 |
| Ambrosino, Christine.....12 | Awruch, Cynthia.....29, 30 |
| | Azizi, Emanuel.....26 |

B

Babbitt, Kimberly.....	223, 274, 394, 495
Bade, Lyndell M	31
Bagley, Justin.....	301
Baicere-Silva, MSc Clarianna.....	31, 396
Baitchman, Eric.....	239
Baker, John.....	32
Baker, Justin.....	33, 529
Baker, Patrick.....	530
Baker, Robert.....	422
Baldisserotto, Bernardo.....	67
Baldwin, Carole.....	33, 482
Baldwin, Zachary.....	429, 456
Balhoff, James P.	142
Ballengée, Brandon.....	24, 437
Banford, Heidi.....	34
Bangley, Charles.....	35
Bank, Crista.....	36
Barber, Paul.....	204, 295
Baremore, Ivy	36, 201
Barger, Brenna.....	37
Barrera, Angélica.....	389
Barrett, Kyle.....	355
Barrio-Amorós, César	412
Barros, Tito.....	241, 411, 412
Bart Jr., Henry	430
Bart, Henry.....	469
Bart, Henry MI.....	45, 469
Basham, Kayla.....	241
Baskin, Jonathan N.	38, 154
Bates, Mary.....	443
Bauer, Aaron M.	38, 51, 88, 214, 260, 446, 490
Baum, Kristen	420
Baumgartner, Kyle.....	39
Beachum, Collin.....	40
Beard, Karen H.	371
Beaupre, Steven	134, 490, 491
Becker, Sarah N.	40
Bedore, Christine	41, 254
Bekarany, Ernest	493
Bell, Michael	42
Belleggia, Mauro.....	43
Benavides, Martin.....	44
Bender, Matthew	97
Benine, Ricardo.....	396
Bennett, Mike.....	279
Bennett, Wayne A.	128, 519
Bentley, Andrew.....	45
Benz, George	331
Bergstrom, Margot A.	46
Berkholtz, John.....	525
Bernal, Diego.....	47, 313
Bernal, Moises	414
Berzins, Ilze.....	16, 231, 234
Betancur-R., Ricardo.....	48
Bethea, Dana.....	49, 226, 250, 282
Bevier, Catherine.....	49
Biciloa, Pita.....	157
Bickel, Ryan.....	188
Bilhovde, Boyd.....	152
Birkett, Katherine.....	50
Bishop, Phillip.....	143, 334, 335, 367
Biswas, Sayantan.....	51
Bizzarro, Joseph J.....	52, 71, 123, 140, 324
Bjorndal, Karen.....	438
Blackburn, David.....	37
Blair, Andrea.....	57
Blanco-Parra, Maria del Pilar.....	53
Blanquiceth, Vanessa.....	251
Blasina, Gabriela.....	240
Blevins, Erin.....	53, 306
Blob, Rick.....	492
Block, Barbara	54
Blomquist, Sean.....	55, 451
Blondeau, Jeremiah.....	514
Bloom, Devin.....	387
Bloom, Stephanie.....	56
Blum, Michael J.	431
Boback, Scott.....	202
Bock, Brian.....	148
Boeckman, Christopher.....	57, 329
Bohlen, Joerg.....	106

Bohonak, Andrew.....	253, 485
Boistel, Renaud.....	4
Bolt, M. Rebecca.....	436
Bolten, Alan.....	438
Bonatto, Sandro Luis.....	477
Bonett, Ronald.....	57, 461
Bonfil, Ramón.....	503
Bonner, Timothy.....	119
Boone, Michelle.....	
.....	74, 130, 331, 394, 507, 535
Bortone, Stephen.....	58
Bottoni, Luciana.....	316
Boughton, Raoul.....	329
Bowen, Brian.....	59, 118
Boyd, Sunny.....	188
Boyle, Kelly.....	59
Braccini, Matias.....	44
Brady, Steven.....	60
Bragg, Rob.....	61
Brainerd, Elizabeth L.	61, 182, 470
Branch, Bill.....	62
Braun, Christopher.....	456
Bravo, Nereida.....	63
Breece, Matthew.....	63
Brehme, Cheryl.....	64, 65
Bremec, Claudia.....	43
Brennan, Patricia.....	65
Breton, Jonathan.....	133
Brewster-Geisz, Karyl.....	66
Brill, Richard W.	227
Brinn, Richard	67
Brito, Ananda.....	49
Britton, Dave.....	528
Britz, Ralf.....	106
Brochu, Kristen.....	68
Brodman, Robert.....	68, 192
Brooks, Edward.....	69
Brooks, Ronald J.....	258
Brown, Christopher W.....	70
Brown, Rafe.....	37, 169, 426, 443, 512
Brown, Simon C.	71
Brunner, Tanya.....	71

Brush, Jaclyn.....	233
Bryson, Jr., Robert.....	418
Bubley, Walter.....	72, 465
Bucciarelli, Gary.....	97
Buchanan, Scott W.....	73
Buhlmann, Kurt.....	74, 487
Bulen, Benjamin.....	74
Bull, Kristina.....	510
Burbrink, Frank.....	75, 95, 395, 418
Burgess, George.....	116, 238, 348, 403
Burghardt, Gordon.....	97, 233
Burke, Russell.....	76, 256, 398, 528
Burkholder, Derek.....	76
Burmeister, Sabrina.....	77, 310
Burney, Neil.....	515
Burns, John.....	369, 441
Buser, Thaddaeus.....	78
Bushnell, Peter.....	171
Butler, Brian	74
Butman, David.....	392
Buttlar, Magdalena.....	1

C

Cachera, Marie.....	140
Cadrin, Steven.....	36, 225
Cailliet, Gregor M.	71, 245, 526
Caillouet, Jr., Charles	439
Cain, Patrick.....	78
Calcagnotto, Daniela.....	172
Callahan, Briana.....	79
Camargo, Edward.....	412
Cameron, Timothy.....	156
Campana, Steven.....	159
Campbell, Chelsey.....	238
Cannatella, David.....	80, 194
Capper, Benjamin.....	472
Cardenosa, Diego.....	463
Cardwell, Michael.....	80
Carey, Andrea.....	81
Carfagno, Gerardo.....	81
Carithers, James.....	81

Carlile, Larry.....	21, 236	Chung, Jae.....	97
Carlson, John K.	116, 196, 226, 428, 520	Church, James.....	98
Carpenter, Kent E.....	103	Cicia, Angela.....	99, 465
Carpenter, Nathan.....	450	Cifuentes, Roberto.....	455
Carr, John.....	191	Cipolato, Giacomo.....	309
Carrier, Jeffrey.....	517	Clack, Jennifer.....	309
Carruth, Wade.....	82	Clardy, Todd.....	100, 407
Cartamil, Daniel.....	83, 253, 364	Clark, Christopher W.	408
Caruso, Nicholas.....	83	Clark, Eugenie.....	100
Carvalho, Fernando R.....	84, 85	Clark, J. Alan.....	307
Carvalho, MSc Fernando.....	31	Cleaver Yoder, Rachel.....	460
Carvalho, Tiago.....	86	Cliff, Jeremy	233, 323
Casatti, Lilian.....	90, 416, 423, 476	Close, Matthew.....	101
Casazza, Michael.....	204	Coates, Peter.....	204
Casper, Brandon.....	86	Coffey, John.....	118
Castillo, Cristina.....	33	Cole, Kathleen.....	102
Castillo-Geniz, Leonardo.....	83	Coleman, Andrew.....	103
Castro, Delilah.....	87	Coleman, Felicia.....	344
Catenazzi, Alessandro.....	288	Collette, Bruce B.....	103
Cavender, Ted.....	88	Collines, Sarah.....	9
Cazzolli, Taryn.....	88	Collins, James P.	235
Ceballos, Claudia.....	89	Colosi, Jordan G.	104
Ceneviva-Bastos, Mônica.....	90, 423	Condon, Keith.....	427
Chabarria, Ryan.....	90	Conte-Grand, Cecilia	455
Chakrabarty, Prosanta.....	91, 122	Contreras, Armando.....	105
Chakraborty, Mukta.....	77	Contreras, Jorge.....	105
Chang, Shun-Ping.....	92	Conway, Kevin.....	106
Chapman, Demian... ..	44, 93, 263, 403, 404	Cook, April.....	107, 467
Chapman, Lauren.....	93	Cook, Robert.....	107, 478
Chen, Chien-Chi.....	430	Cooke, Steven	69
Chen, Di-Rong.....	94, 291	Cooper, Peter.....	66
Chen, Wei-Jen	469	Cooper, W. James.....	9
Chen, Xin.....	95	Copus, Joshua	108
Chen, Yongjiu.....	95	Cordes Landry, Lisa.....	281
Cherkiss, Michael.....	186	Cortés, Enric.....	109, 332, 348, 357, 526
Chernoff, Barry.....	96, 392	Cosandey-Godin, Aurelie.....	110
Chin, Andrew.....	218	Côté, Isabelle.....	310
Chisholm, John.....	269	Cox Fernandes, Cristina.....	154, 155
Chiu, Pai-Ho.....	341	Craig, J. Kevin.....	473
Christensen, Arne.....	494	Craig, Matthew.....	59
Christiaens, Joachim.....	4	Cramer, Christian.....	400
Christoffel, Rebecca	97	Cramer, Patricia	110, 268

Crampton, William.....	68, 380, 498
Crawford, Andrew J.....	277
Croteau, Emily.....	111
Crother, Brian	112
Crow-Sanchez, Karen	63
Crumrine, Patrick.....	329
Cudney, Jennifer.....	113
Cundall, David.....	101
Cupp, Paul.....	113
Currylow, Andrea.....	114
Curtis, Caitlin.....	115
Curtis, Judson M.	115
Curtis, Tobey.....	116
Cussac, Victor	455

D

Dahdul, Wasila M.....	142, 306
Dale, Jonathan.....	117
Dallara, Alexandra.....	175
Daly-Engel, Toby.....	118
Dammeyer, Nathan.....	119
Dantas de Araujo, Lucelle.....	67
Danylchuk, Andrew.....	69
Das, Indraneil	119
Dautrich, Jennifer.....	120
David, Andrew.....	184
Davis, Christopher.....	121
Davis, Justin.....	121
Davis, Matthew.....	122
De Kegel, Barbara.....	4
De la Maza-Benignos, Mauricio.....	321
de Tezanos, Gaby.....	463
Dean, Mason N.	52, 123, 271
Deary, Alison.....	123, 407
Deehr, Rebecca A.	31
Deesud, Narongrit	445
DeFalco, Lesley	455
Degrin, Michelle.....	500
Dehn, A. Mickey.....	124
Deitloff, Jennifer.....	125
del Papa, Cecília.....	308

Delcourt, Johann.....	298
Delis, Pablo R.....	125
DeMartini, Edward E.....	19
Demski, Leo.....	126
Denton, John.....	127
Denver, Dee	396
Desfosse, Joe	66
deSouza, Lesley S.	127
Dever, Jennifer.....	383
Dewar, Heidi	392
Di Giacomo, Edgardo.....	156
Di Nucci, Dante.....	245
Di Santo, Valentina.....	128
Dickson, Juleen	129
Diep, Brian	38
Dierick, Manuel	4, 216
Diesmos, Arvin	37, 426, 512
DiFiore, Bart	47
Dillman, Casey	129
Dindo, John	103
Distel, Christopher	74, 130, 507
Dixon, James	412
Doan, Tiffany	131
Docker, M.F.	432
Dolce, Jocelyne	320
Donaldson, Terry J.	131
DoNascimento, Carlos	132
Donavan, Courtney	133
Donnelly, Maureen	212, 365, 427, 516
Doosey, Michael	133, 469
Dorazio, Robert	499
Dorcas, Michael	524
Douglas, Lara	134
Drayer, Andrea	135
Driggers III, William	224
Driggers, William	250, 465
Drown, Devin	295
Druskat, Erich	135
Drymon, Marcus	136
DuBeck, Guy	66
Dubois, Alain.....	277
Dudley, Sheldon	233, 323

Duffy, Clinton.....	44
Duffy, Kathleen.....	137, 138
Dugan, Peter J.....	408
Duncan, Kanesa	118
Duncan, Neil	138
DuPré, Sally	425
Duquette, Danielle	522
Durbin, Dennis.....	344
Durbin, Edward.....	317
Durkee, Steve.....	66
Durso, Andrew	139
Dutka-Gianelli, Jynessa	403

E

Earley, Ryan	247
Earsom, Steve	344
Ebert, David A...63, 71, 140, 245, 526, 534	
Eble, Jeff	59, 140
Eckstut, Mallory.....	112
Edberg, Kerstin.....	141, 529
Edmunds, Richard C.	142
Egan, Scott	143
Egeter, Bastian.....	143
Eichelberger, Jennifer	144
Eidam, Dona M.	145
Ellerby, David	178
Eluvathingal, Lilly.....	145
Emel, Sarah.....	57
Eng, Rowena	93
Engeman, Jeffrey.....	142
Engstrom, Tag.....	148
Erazmus, Kayleigh	146
Erb, Lori.....	147
Erickson, Daniel.....	63
Erisman, Brad E.....	11, 147
Escalona, Tibisay	148, 149
Escobedo-Olvera, Miguel.....	83
Espinosa, Hector.....	431
Espinoza, Eduardo.....	264
Espinoza, Mario	150
Espinoza, Robert E.	444, 509

Evans, Paul	488
Everly, Anne	56
Eytan, Ron I.	151

F

Falzone, Martín	245
Farnsworth, Scott	151
Farrell, Terence.....	152
Farrugia, Thomas	150
Fausey, Norman R.	448
Feldheim, Kevin	44, 93, 253
Felix, Jessica	472
Ferdous, Shobnom	153
Ferreira, Katiane	396
Ferry-Graham, Lara	123, 346
Ficetola, Gentile Francesco	316
Field, Lyndsay.....	313
Figueroa, Daniel	43, 156, 240
Fine, Michael L. ...	156, 227, 341, 378, 475
Fischer, Keith.....	318
Fisher, Katie	196
Fisher, Robert	64, 65, 157
Fisher, Robert N.	70
Fisher-Reid, M. Caitlin	158
Fisk, Aaron	159, 233, 323, 330, 369
Fitzgerald, Lee	454
Flawd, Devin	294
Floyd, Kevin	159
Fluker, Brook	160
Fogarty, Michael J.	292
Fonseca, Paulo J.	13
Fontenot, Clifford.....	161
Ford, Ryan	161, 322
Fornell, Angela M.	162
Foronda, Josh.....	162
Foster, Susan	32, 187, 440
Fox, Dewayne.....	63
Franco-Belussi, Lilian	537
Frank, Lawrence.....	534
Frank, Michael	163
Franklin, Michael	209

Franks, Bryan.....261, 262, 263, 403, 404
 Franks, James.....164, 224
 Frazier, Bryan.....441
 Freeborn, Layla.....164
 Freedman, Jonathan A.....299
 Freidenburg, Kealoha165
 French, Thomas166
 Freshwater, Wilson48
 Frick, Amanda520
 Frick, Lorenz.....171
 Frick, Lorenz H.166
 Frisk, M.G.167, 421
 Froeschke, Bridgette.....168
 Froeschke, John169
 Fryer, Brian323
 Fugate, David.....263
 Fuiten, Allison37, 169
 Fuller, Pamela.....392
 Fung, Kevin.....514
 Furumitsu, Keisuke533

G

Gabrielsen, Charlotte274
 Gahagan, Benjamin170
 Gaines, Karen.....360, 497
 Galbraith, John.....107, 467
 Gallagher, Austin.....171
 Galuardi, Ben.....164, 465
 Galván, Felipe.....389
 Galván-Magaña, Felipe.....53
 Gamble, Robert J.292
 Gamble, Tony.....490
 Garcez, Riviane.....172
 Garcia, Ernie.....300
 Garcia, Gerardo493
 Garcia, Juan.....105
 García-Ramirez, Ma. Elena.....231
 Gardiner, Jayne M.....172
 Gardner, David.....112
 Garey, Michel Varajão.....173
 Gaudreau, Mandy.....174

Gedamke, Todd.....261, 263
 Geheber, Aaron.....57, 175, 329
 Geist, Nicholas.....175
 Gelsleichter, James J.....
161, 176, 294, 322, 501
 Geluso, Keith.....220
 Gentry, Lydia.....516
 Georgalas, Vyton.....309
 Gerald, Gary.....177
 Gerber, Glenn P.....405
 Gerlach, Justin.....177
 Gerry, Shannon.....178
 Gerson, Marina.....179
 Gervasi, Carissa.....179
 Gharzi, Ahmad.....180
 Gherard, Katie.....181
 Gibb, Alice.....108, 181
 Gidmark, Nicholas J.182, 470
 Gignoux-Wolfsohn, Sarah183
 Girman, Derek.....79, 208
 Glass, Jessica R.....104
 Gledhill, Christopher.....184
 Gleiss, Adrian.....184
 Glorioso, Brad M.....185
 Godley, J. Steve.....432
 Goetz, Scott.....186
 Golub, Justin.....187
 Gomes, Levy.....67
 Gonynor, Jessica.....484
 Goodman, Rachel.....188, 302
 Gordon, Noah.....188
 Goutte, Sandra.....265
 Graham Wolf, David143
 Graham, Jeffrey.....83, 364, 510
 Graham, Matthew.....112
 Graham, Sean.....189, 247
 Grande, Terry.....142
 Granneman, Jennifer190
 Grant, Jacqueline.....509
 Gray, Levi.....434
 Greco, Veronica.....487
 Green, David M.....34, 190

Greenbaum, Eli..	38, 87, 191, 490, 496, 508
Greene, Harry.....	97
Greenwald, Katherine.....	192
Gregory, Patrick.....	192
Groom, Kasie.....	193
Grubbs, R. Dean.....	226, 271
Gruber, Samuel.....261, 262, 263, 361, 403, 404, 463
Guarnizo, Carlos E.....	194
Gubler, Jenny.....	194
Guidugli, Michelle.....	195
Guilfoyle, Kevin.....	196
Gulak, Simon.....	196, 250
Gunson, Kari.....	197
Guzy, Jacquelyn.....	198

H

Habit, Evelyn.....	455
Hable, Whitney.....	2, 3, 81
Haciski, S. Insley.....	198
Haddad, Célio Fernando Baptista.....	173
Hagerty, Bridgette.....	199, 425
Hagey, Travis.....	200
Hale, Edward.....	407
Hale, Kathryn.....	200
Hale, Loraine.....	49, 201
Hale, Lori.....	36
Hall, Alexander.....	202
Hall, Allison.....	202
Hall, Janis.....	203
Hall, Richard.....	66
Halstead, Brian.....	204
Halstead, Neal.....	329
Halvorsen, Michele.....	86
Hamilton, Alison.....	204, 205
Hammerschlag-Peyer, Caroline.....	206
Hampton, Paul.....	206, 345
Handy, Richard.....	361
Hanken, James.....	56, 260, 538
Hanning, Irene.....	220
Hansen, Anne.....	335

Harlow, Peter.....	157
Harmon, Luke.....	200
Harold, Antony.....	207
Harper, George.....	380
Harris, Lindsay.....	41, 254
Harris, Phillip.....	424
Harrison, Scott.....	82
Hart, Kevin J.	31
Hart, Kristen.....	186
Hartel, Karsten.....	207
Harvey, Emily.....	208
Harvey, Guy.....	515
Hastings, Philip A.....	147, 151
Hatch, Kent.....	196
Hauser, John.....	292
Havird, Justin.....	208
Hawk, Holly.....	209
Hawlena, Dror.....	210
Hayes, Amanda.....	202
Hayes, Malorie.....	210
Hazard, Lisa.....	211
Hearn, Alex.....	264
Heath, Daniel.....	219
Heath, Stacy.....	212
Heberer, Craig.....	47
Hegna, Robert.....	212
Heiken, Kory.....	213
Heinz, Heather.....	214
Heithaus, Michael.....	76, 319, 493
Helbing, Caren	535
Hellberg, Michael E.....	151
Hendon, Jill.....	214, 224
Hendon, Read.....	164
Henen, Brian.....	354
Henke, Scott.....	527, 528
Henry, Donovan.....	40
Henry, Emily.....	17
Henry, Michael.....	502
Heppell, Selina S.....	453
Herbert, Sarah.....	367
Herlands, Rosalind.....	530
Herman, Tom.....	25, 215

Hernandez, L. Patricia.....	182, 216
Hernandez, Omar.....	148
Herrel, Anthony.....	5
Herrera Montes, Maria Isabel.....	216
Herrick, Susan.....	217
Hersey, Sean.....	218
Heupel, Michelle.....	218, 269, 369
Hickerson, Cari-Ann M.....	2, 401
Higgins, Benjamin.....	436
Higgs, Dennis.....	219
Hill III, Jacques.....	221
Hill, Jacques.....	220
Hillard, Scott.....	354
Hillyard, Scott.....	211
Hilton, Eric J.....
.....	100, 123, 129, 142, 222, 314, 407
Hime, Paul.....	188
Hinderliter, Matthew.....	222
Hines, A.....	48
Hirons, Amy C.....	511
Hirt, M. Vincent.....	469
Ho, Hsuan-Ching.....	340
Ho, Winnie W.....	155
Hocking, Daniel.....	223
Hoffmayer, Eric.....	164, 214, 224, 465
Hogan, Fiona.....	225
Hogan, LeAnn.....	66
Holland, Kim.....	117, 118
Holland, Travis.....	164
Hollensead, Lisa.....	49, 226
Holt, Daniel.....	226
Honeycutt, Rodney L.....	97
Horodysky, Andrij Z.....	227
Hostetler, Jeff.....	236
Hoth Von Der Maden, Jürgen.....	321
Hou, Zhuo-Cheng.....	433
Howey, Christopher.....	228
Howey, Lucy.....	228
Hsieh, S. Tonia.....	229
Hua, Xia.....	230
Huang, Yi-hui.....	103
Huber, Daniel.....	16, 123, 231, 271

Huddleston, Patrick.....	380
Hueter, Robert E.....	172
Hughey, Myra C.....	505
Humphreys, Robert L.....	19
Hunce, Raymond.....	434
Hunter, Kenneth.....	425
Hurme, Kristiina.....	232
Hussey, Nigel.....	233, 323, 369
Hutchinson, Deborah.....	233
Hwang, Candy.....	97
Hyatt, Michael.....	234
Hyde, John.....	253
Hyman, Oliver.....	235
Hyslop, Natalie.....	236, 365

I

Ida, Hitoshi.....	250
Igleski, Matthew.....	237
Ilves, Katriina.....	237
Imhoff, Johanna.....	238, 403
Infante, Carlos.....	56
Innis, Charles.....	239
Inoue, Jun G.....	250
Isaac, Leigh Anne.....	239
Isola, Monica.....	427
Izzo, Luciano.....	240

J

Jackman, Todd R.	38, 51, 214, 241, 446
Jackson, Laura.....	241
Jackson, Scott.....	242
Jacobson, Sandra L.....	243, 268
Jadin, Robert.....	411
Jaeger, Jochen A.G.....	244
James, Kelsey.....	245
Jañez, Julieta.....	156, 245
Janzen, Fredric.....	396
Jarnevich, Catherine S.....	415
Javonillo, Robert.....	246, 441
Jellen, Benjamin.....	247

Jenkins, Christopher.....236, 248
 Jere, Wilson.....249
 Ji, Hwan Sung.....249
 Johnson, G. David.....250
 Johnson, Steve.....329
 Johnson, Valerie.....125
 Johnston, Carol.....226, 386, 457
 Jones, Lisa.....250
 Jones, Robin M.....254
 Jones, Sue.....29
 Jordan, Joshua.....29
 Jordan, Lance.....228
 Jordon, Jameson.....535
 Jorgensen, Dennis.....14
 Joung, Shoou-Jeng.....430
 Joyce, Warren.....159
 Juanes, Francis.....273, 317
 Jud, Zack.....403
 Junior, Larreal.....251
 Juterbock, Eric.....252

K

Kaatz, Ingrid.....252
 Kacev, David.....253
 Kacev, Dovi.....83
 Kadison, Elizabeth.....514
 Kaiser, Kristine.....254
 Kajiura, Stephen.....41, 254
 Kanno, Yoichiro.....255
 Kanonik, Alexandra.....256, 398
 Kats, Lee.....97
 Kaufman, Les.....1, 256
 Kavanaugh, Brendan.....421
 Ke, Lin-Hua.....94
 Kearney, M.450
 Keck, Benjamin.....257
 Keevil, Matthew G.....258
 Kellogg, Loren.....237
 Kemp, Aimee.....258
 Kemp, Iris.....207
 Kenaley, Christopher.....259

Kennedy, Alicia.....260
 Kerby, Jacob.....516
 Kerney, Ryan.....260
 Kerstetter, David W.....
261, 263, 473, 483, 511
 Kessel, Steven.....261, 262, 263, 403, 404
 Ketchum, James.....264
 Kethan, Shanna.....436
 Kéver, Loïc.....378
 Khan, Ahmed.....397
 Khudamrongsawat, Jenjit.....445
 Kim, Jin Koo.....279
 Kim, Sora.....264
 Kime, Nicole.....265
 King, Charles.....156
 King, Kevin W.....448
 King, Timothy.....459
 Kingsbury, Bruce.....163, 266, 267
 Kingsley, David.....42
 Kinney, Michael.....267
 Kintsch, Julia.....268
 Kisfaludy, Edward.....364
 Klein, Gilmar.....497
 Kley, Nathan.....323
 Klimley, Peter.....159, 264
 Kneebone, Jeff.....269
 Knip, Danielle.....218, 269
 Knouft, Jason.....40, 270, 376
 Knowles, Jeffrey.....443
 Kobylarz, Marek.....535
 Koch, Stephanie.....74
 Koenig, Christopher.....344
 Koester, David.....72
 Kohin, Suzanne.....47, 392
 Kohler, Nancy.....116, 137, 138, 324
 Kohli, Brooks.....271
 Kolbe, Jason.....188
 Kolmann, Matthew.....271
 Koneczny, Nell A.....405
 Konings, Adrianus.....249, 460
 Konstantinidis, Peter.....272
 Koo, Kim Jin.....249

Korfel, Chelsa.....	273
Koske, Amy.....	273
Kothari, Cartik.....	142
Kovach, Adrienne.....	274
Kovacs, Kit.....	159
Kovitvongsa, Kathryn.....	275
Kracker, Laura.....	28
Krahforst, Cecilia.....	275
Kruger, Kerry M.....	276, 277
Kroetz, Andrea.....	277
Kuchling, Gerald.....	493
Kucklick, John.....	441
Kuczynski, Caitlin.....	518
Kuhajda, Bernard.....	160
Kuhn, Kristen.....	278
Kume, Gen.....	533
Kusamba, Chifundera.....	496
Kwiatkowski, Matthew.....	421
Kwun, Hyuck Joon.....	279
Kynard, Boyd.....	378
Kyne, Peter.....	279

L

Ladich, Friedrich.....	280, 370
Lai, N. Chin.....	510
Lambert, Brad.....	353
Landry, Jr., Andre.....	436, 439
Landry, Nathan.....	2, 3
Langen, Tom.....	281
Langkilde, Tracy.....	468
Langston, Ross.....	297
Lannom, Karen.....	55
Lannoo, Michael.....	300
LaPorte, Alicia.....	282
Lapp, Hilmar.....	142
Larson, Joanna.....	282
Latour, Robert J.....	227
Laubach, Harold.....	473
Lauder, George.....	53, 283
Laverty, Jolene.....	284
Lawson, Lucinda.....	284

Lawton, Mike.....	25
Layman, Craig.....	76, 319, 403
Layman, Craig A.....	342
Lazcano, David.....	105
Leavitt, Daniel.....	285
Leavitt, Dean.....	312
Lebron, Alexander.....	286
Lee, Mao-Ying.....	287
Leggett, Stephanie.....	502
Lehmann, Pablo.....	400
Lehr, Edgar.....	288
Lehtinen, Richard.....	81
Lemenager, Lee.....	288
Lener, Christine.....	289
Lentine, Brandon.....	434
Leopold, Danielle.....	289
Lessa, Rosângela.....	21
Letcher, Benjamin.....	255
Leung, Jaime.....	279
Lewallen, Eric.....	290
Lewis, Richard.....	493
Lewis, Zachary.....	260
Lewison, Rebecca.....	253
Liao, James.....	290
Lieb, Carl.....	159
Lienesch, Philip.....	141
Lin, Te-En.....	94, 291
Lin, Yi-Fu.....	94, 291
Lindberg, William.....	15
Link, Jason S.....	292
Lips, Karen R.....	40, 83, 469
Liss, Stephanie.....	69
Literman, Robert.....	293
Little, Caitlyn.....	294
Litzgus, Jacqueline D.....	258, 284, 381, 382, 533
Livingston, Jessie.....	294
Lobel, Lisa.....	295
Lobel, Phillip.....	275, 295, 296, 311
Locascio, James.....	296
Long, John.....	389, 417
Longenecker, Ken.....	297

Longrie, Nicolas.....298
 Lontoh, Melonie.....1
 Lopez, Hector.....154
 Lopez, J. Andres.....145
 Lopez-Fernandez, Hernan.....298
 Lorenz, O. Thomas.....366
 Lorson, Benjamin D.299
 Losos, Jonathan.....188
 Lotze, Heike K.....504
 Lovejoy, Nathan.....68, 290
 Lovich, Robert.....300
 Lowe, Christopher.....150
 Lozano, Germán E.....301
 Lozano-Vilano, Lourdes.....431
 Lozano-Vilano, Ma de Lourdes..301, 321
 Luck, Emmet Allen.....188, 302
 Luckenbill, Kyle.....302
 Luczkovich, Joseph J.31, 275, 303, 457
 Ludt, William.....414
 Luer, Carl.....502
 Lugli, Marco.....304
 Lumbad, Anthony.....472
 Lumbantobing, Daniel.....304
 Lundberg, John G.132, 142, 305, 513
 Lutterschmidt, William.....161
 Lydersen, Christian.....159

M

Mabee, Paula.....142, 306
 Maccachero, Vivian427
 Macesic, Laura.....306
 Macey, John.....21, 236
 Macey, Suzanne.....307
 MacGowan, Brian.....114
 Magalhães, Beatriz.....49
 Magalhaes, Maria Filomena.....408
 Maia, Anabela.....120, 308
 Malabarba, Luiz.....31, 369, 396
 Malabarba, Luiz R.....84, 85, 308
 Malabarba, Luiz Roberto.....477
 Malabarba, Maria Claudia.....308

Malavasi, Stefano.....309
 Maljkovic, Aleksandra.....310
 Mandelman, John.....69, 99, 171, 447
 Mangiamele, Lisa.....310
 Mann, David.....
15, 296, 311, 343, 344, 378, 501
 Mann, Kenneth.....9, 343
 Marcon, Jaydione.....67
 Marcus, Jeffery.....141
 Marczak, Susanne.....254
 Marini, Joseph.....514
 Marion, Angela.....312
 Marion, Ken.....103
 Márquez-Farías, Fernando.....53
 Márquez-Farías, J. Fernando.....453
 Marsh, Richard.....26
 Marshall, Heather.....313
 Marsh-Matthews, Edie.....154
 Martin, Christopher.....216
 Martin, Jennifer.....314
 Martin, Lynn.....329
 Martineau, Katherine.....254
 Maruska, Karen.....314
 Marvin, Glenn.....315
 Mascarenas, Ismael.....147
 Masin, Simone.....316
 Masonjones, Heather D.....316
 Masschaele, M.....216
 Mateo, Ivan.....317
 Matheson, Richard.....318
 Matich, Philip.....319
 Maxime, Emmanuel.....319
 May, Peter.....152
 Mayden, Richard L.....431, 469
 Maynard, Amy.....120, 320
 Mazzotti, Frank.....186
 McBrayer, Lance.....488
 McBride, Richard S.292
 McCallister, Michael.....322
 McCandless, Camilla.....116
 McCann, Heather.....323
 McCann, Katelyn.....202

McCartney, Jacob.....	323	Michel, Matt	337
McClenachan, Loren.....	504	Michell, Kathy.....	338
McComb, D. Michelle.....	67	Midford, Peter E.....	142
McCormick, Stephen.....	494	Milani, Nadia.....	132
McCoy, Earl D.....	198, 212, 432	Miller Hesed, Kyle.....	221
McCoy, Krista.....	341	Miller, Debra.....	484
McCoy, Michael W.....	505	Miller, Jessica A.....	453
McElroy, W. David.....	138, 292, 324	Miller, Kathleen.....	96
McFall, Greg.....	28	Miller, T.J.....	167
McGarigal, Kevin.....	478	Mitrus, Slawomir.....	339
McGrath, Patrick.....	325	Miya, Masaki	250, 340
McHale, Allison.....	325	Mockford, Steve.....	25, 215
McKaye, Kenneth.....	326	Mohammadi, Shabnam.....	221, 341
McKenzie, Jonathan.....	327	Mohammadpour, Hamid.....	425
McKinney, Jennifer.....	224, 327	Mok, Hin-Kiu.....	341
McLaughlin, Donna M.....	500	Moloney, James.....	269
McLaughlin, Paul.....	328	Monjeló, Luiz Alberto.....	21
McLeod, David.....	221	Montana, Carmen.....	374
McMahan, Caleb.....	329	Montana, Carmen G.	342
McMahon, Taegan.....	329	Montgomery, Chad.....	352
McMeans, Bailey.....	330, 331	Montie, Eric.....	343
McMichael, Robert.....	318	Montie, Misty.....	344
McNeil, Jennifer.....	25, 215	Moody, Kevin.....	344
McPeek, Tamara.....	331	Mooi, R.D.....	432
McRae, Lori.....	71	Moon, Brad.....	206, 345
McRae, Mark	71	Moore, Douglas.....	7
McVay, John.....	29	Moore, Jon.....	28
Meekan, Mark G.....	430	Mora, Camilo.....	504
Meinwald, Jerrold.....	233	Morafka, David.....	211, 354
Mejia Falla, Paola A.....	332	Moran, Clinton.....	346
Mejía-Falla, Paola Andrea.....	357	Morano, Janelle L.....	408
Mello, Joseph.....	135	Moreira, Cristiano.....	346, 347
Mello, Waldiney.....	333	Morgan, Alexia.....	348
Melo, Sara.....	21	Mori, Akira.....	233
Melville, J.	450	Morrissey, John F.....	500, 503
Melzer, Sabine.....	334, 335	Moss, Amanda.....	348, 349
Mendelson, Tamra.....	367	Mott, Cy.....	350, 351
Menezes, Naercio.....	396	Motta, Philip J.	172, 351
Meredith, Tricia.....	335	Moule, Brett.....	487
Merson, Rebeka Rand.....	203, 218, 399	Muelleman, Peter.....	352
Meshaka Jr., Walter E.	125	Mulcahy, Dan.....	518
Meszaros, George.....	336	Muldoon, Kerry.....	353

Mullin, Stephen.....39, 139, 200, 360, 497
 Mulvaney, Dana.....306
 Munroe, Thomas A.....287
 Murray, Chris.....329
 Mushinsky, Henry R.198, 212, 432
 Musick, J.....167
 Musick, Jack.....379
 Musick, John A.....227
 Muths, Erin.....353
 Mycoff, Leah.....81
 Myers, Andrew.....307
 Myers, Ransom A.....504
 Mylniczenko, Natalie.....356

N

Nagy, Kenneth.....354
 Naikatini, Alivereti.....157
 Nairn, Campbell.....438
 Nance, Holly.....118
 Nanjappa, Priya.....20, 300, 355
 Naples, Lisa.....356
 Narins, Peter M.23, 254, 536
 Narvaez, Salvador.....105
 Nascone-Yoder, Nanette.....56
 Natanson, Lisa.....44, 93, 526
 Navarro-Marques, Tiago.....408
 Navas, Carlos.....49
 Navia, Andrés F.....332
 Navia, Andrés Felipe.....357
 Nazari-Serengeh, Farzaneh.....357, 358
 Near, Thomas J.104, 257, 278, 358
 Neely, David A.....431
 Negrete, Ana Cecilia.....359
 Nelson, Diane.....100
 Nelson, Jay A.....124
 Nelson, Jessica.....360
 Nemeth, Richard.....514
 Neuman-Lee, Lorin.....39, 360, 497
 Neun, Heather.....361
 Neuwald, Jennifer.....293
 Newman, Steven.....361

Newsome, Seth.....389
 Nichols, Ryan S.....19
 Nicholson, Kirsten.....194, 237, 362
 Niedzwiecki, John.....363
 Niemiller, Matthew.....358
 Niño-Torres, Carlos Alberto.....53
 Nishida, Mutsumi.....340
 Niukula, Jone.....157
 Noaker, Danielle.....16, 231
 Noble, Virginia.....464
 Nogueira, Adilia.....155
 Norbis, Walter.....475
 Norman, Bradley M.184, 430
 Norton, Shelley.....520
 Norton, Stephen.....363
 Norton, Terry.....487
 Nosal, Andrew.....364
 Noviski, Jennifer.....434
 Nowakowski, Justin365
 Nunes, Pedro M. S.....412
 Nuñez, Olga.....426
 Nussear, Kenneth.....455

O

O’Connell, Ann.....365
 O’Connell, Martin.....121, 327, 365, 366
 O’Donnell, Patrick.....234
 Ohmer, Michel.....367
 Olaya-Nieto, Charles W.....301, 368
 Oli, Madan.....236
 Olin, Jill.....331, 369
 Oliva, Mark A.....254
 Oliveira, Classius de.....537
 Oliveira, Cristina.....369
 Oliveira, Ken.....2, 3, 36, 81, 133, 225, 328
 Oliveira, Tacyana P.R.370
 Oliver, Steven.....371
 Olney, Jonh E.....407
 Olson, Christina.....371
 Olsson, Daniela.....475
 Ondich, Breanna.....71

O'Rourke, Cynthia.....	367
Orr, James.....	372
Orr, James W.....	340
Orti, Guillermo.....	48, 373, 455
Osse, Jan W.M.....	373
Otto, Clint.....	374
Ou, Chouly.....	374
Ou, Deyuan.....	532
Overath, R. Deborah.....	115
Overholtz, William J.	292
Owen, Patrick.....	375
Owens, Hannah.....	376
Owens, Thomas C.....	70

P

Pace, Cinnamon.....	181
Page, Lawrence.....	208, 270, 376
Paig-Tran, Erin (Misty).....	377
Palmer, Matthew.....	258
Palmero, Veronica.....	74
Pankhurst, Ned.....	30
Paredes, Gustavo.....	147
Parker, Erika.....	378
Parmentier, Eric.....	298, 341, 378
Parris, Kirsten.....	450
Parsons, Kristene.....	379, 441
Pasicolan, Leilani.....	380
Patel, Ketan.....	380
Patel, Maulik.....	19
Paterson, James.....	381, 382
Paton, Peter.....	107
Pattengill-Semmens, Christy.....	504
Patterson III, William F.....	428
Paulson, David.....	382
Peebles, Ernst.....	296
Peek, Ryan.....	383
Perdices, Anabel.....	431
Pereira, Edson.....	400
Perkins, Rupert.....	262, 263
Perrotti, Lou.....	174
Perry, Derek.....	384, 385

Perry, Gad.....	17, 18
Petersen, Chris.....	300
Peterson, Charles.....	386
Peterson, Stacy.....	29
Petry, Paulo.....	8
Pettler, Amy.....	428
Pezold, Frank.....	90, 95, 482
Philipp, David.....	69
Phillips, Catherine.....	119, 386
Phillips, John.....	362
Pierce, Josh.....	387
Pietsch, Theodore W.	340
Pilgrim, Melissa.....	152
Piller, Kyle.....	57, 281, 329, 387
Pinou, Theodora.....	289
Pitcher, Lennie.....	40
Pitman, Robert.....	290
Polgar, Gianluca.....	309
Pollock, Nicholas.....	388, 472
Polo, Carlos.....	389
Poncin, Pascal.....	298
Popp, Brian.....	117
Popper, Arthur.....	86
Porter, Marianne.....	389, 417
Portik, Daniel.....	241
Post, David.....	494
Poulakis, Gregg.....	115, 369, 390, 391
Poulos, Helen.....	292
Powers, Sean.....	6, 136, 277
Pramuk, Jennifer.....	191
Pratt, Harold.....	517
Pratt, Jr., Harold.....	116
Pratt, Theo.....	517
Preti, Antonella.....	392
Provenzano, Francisco.....	393
Ptacek, Margaret.....	492
Puglis, Holly.....	394
Purdee, Michaelle.....	484
Purrenhage, Jennifer.....	394
Putrea, Solida	374
Pyron, Alex.....	75
Pyron, Robert.....	395

Q

Qeteqete, Sipiriano.....	157
Quagio-Grassiotto, Irani.....	31, 369, 396
Quattrini, Andrea.....	237
Quimba, Elizabeth.....	396
Quinones, Patricia.....	23
Quintero, Enrique.....	251

R

Rago, P.....	167
Rahim, Abdul.....	397
Rahman, Shahriar.....	256, 398
Raigoza, Rodolfo.....	359
Raiwalui, Vika.....	157
Ramos, Andreia.....	13
Ramsay, Jason.....	398
Randriamahita.....	493
Randriamangason, Floriot.....	493
Rapp Py-Daniel, Lucia.....	154
Reed, Robert N.	186, 415
Reeder, Tod.....	312, 518
Reeves, Daniel.....	399
Regula Meyer, Lisa.....	337
Reina, Richard D.	166
Reinthal, Peter.....	400
Reis, Roberto.....	8, 400
Reiter, Marcie K.	401
Relyea, Rick.....	402
Renshaw, Gillian M.C.....	402
Revell, Liam.....	188
Reyier, Eric.....	403, 404
Reynolds, R. Graham.....	405
Rheubert, Justin.....	406
Ribeiro, Filipe.....	407, 408
Rice, Aaron N.....	252, 408
Richardson, Jonathan.....	409
Richter, Stephen.....	61, 135, 195
Ricke, Steve.....	220
Riley, Lincoln.....	380
Riley, Seth P. D.	428

Ringler, Max.....	410, 489
Rios, Nelson.....	45
Rivas, Gilson.....	251, 411, 412
Rivera, Paula.....	156
Roberts, J. Dale.....	413
Roberts, Thomas.....	26, 27
Robertson, Bruce.....	143
Rocha, Luiz.....	59, 413, 414, 478
Rocha, Marcelo.....	415
Rodda, Gordon H.	186, 415
Rödel, Mark-Oliver.....	191
Rodriguez, David.....	422
Rodriguez-Pineda, José Alfredo.....	321
Roe, John.....	163
Rohr, Jason.....	329
Rokita, John.....	530
Roloff, Gary.....	374
Romansic, John.....	329
Romero, Renato M.....	416
Romine, Jason.....	238
Roosenburg, Willem.....	228, 417
Rose, Emily.....	316
Rosenblum, Hannah.....	417
Rossa-Feres, Denise de Cerqueira.....	173
Rostal, David.....	82, 348, 349, 474
Rothermel, Betsie.....	484
Rouben, Camden M.	505
Royer, Mark.....	364
Rozar, Ronald.....	186
Ruane, Sara.....	418
Rudge-Ferarra, Camila.....	497
Rudolph, Craig.....	387
Ruediger, William C.....	419
Ruiz-Canino, Francheska.....	419
Rulifson, Roger.....	35, 113
Russell, Laura.....	45
Ryan, Michael.....	265

S

Sabaj Pérez, Mark.....	132, 384
Sabino, José.....	416

Sado, Tetsuya.....	250	Schulte II, James A.	433
Saenz, Daniel.....	387, 420, 421	Schultz, Eric.....	492, 494
Sagarese, S.R.....	421	Schulze-Haugen, Margo.....	66
Saidapur, Srinivas.....	145	Schuster, Sara.....	65
Sakaue, Jiro.....	250	Schwartz, Joshua.....	434
Salcedo, Norma.....	422	Scofield, Douglas G.	254
Salice, Christopher.....	18	Searcy, Christopher.....	434
Sampaio de Abreu Ribeiro, Janessa.....	67	Seegert, Greg.....	435
Samra, George.....	509	Segura-Guevara, Fredys F.	368
Sanches, André Luís.....	423	Seid, Marc A.....	505
Sanchez Uieda, Virginia.....	90	Seigel, Richard.....	78, 151, 436
Sanchez, Barbara.....	423	Seney, Erin.....	436
Sánchez, Felisa.....	43	Sepulveda, Chugey.....	47, 313
Sancho, Gorka.....	441	Sessions, Stanley K.	34, 437
Sandel, Michael.....	424	Sever, David.....	164, 406, 484
Sanderson, S. Laurie.....	425	Shaffer, H. Bradley.....	434
Sandmeier, Franziska.....	199, 425	Shamblin, Brian.....	438
Sanguila, Marites.....	426	Shanbhag, Bhagyashri.....	145
Santana-Morales, Omar.....	83	Shanker, Kartik.....	51
Sapigao, Francisco.....	97	Shao, Kwang-Tsao.....	287
Saporito, Ralph.....	212, 427	Shattuck, Zachary.....	119
Satoh, Takashi P.....	340	Shaver, Donna.....	439
Sauvajot, Raymond M.....	428	Shaw, Katherine.....	440
Savage, Jay.....	112	Shawa, Mary.....	326
Savaria, Michael.....	2, 3	Shedlock, Andrew M.	340
Savitzky, Alan.....	233, 341	Sheikh, Saad I.....	430
Savoy, Tom.....	63	Shiffman, David.....	441
Scharer, Rachel.....	428	Shimazaki, Mitsuomi.....	340
Schargel, Walter.....	412	Shiozawa, Dennis.....	488
Schelly, Robert.....	429	Shivji, Mahmood.....	93, 228, 514, 515
Scherer, Rick.....	353	Shrestha, Bindesh.....	441
Scheutz, Matthias.....	188	Siegel, Dustin.....	442
Schieble, Chris.....	365	Sievert, Paul.....	382, 521, 535
Schieble, Christopher.....	327	Siler, Cameron.....	426, 443, 512
Schlenker, Lela.....	99	Silva, George.....	66
Schmidt, Jennifer V.	430	Simard, Peter.....	501
Schmidt, Ray.....	430	Simmons, Andrea.....	443
Schonhuth, Susana.....	431	Simmons, Dwayne.....	23
Schrey, Aaron.....	212, 432	Simmons, James.....	443
Schriner, Elizabeth.....	363	Simões, José Miguel.....	13
Schroeder, B.S.	432	Simons, Andrew.....	469
Schroeder, Frank.....	233		

Simpfendorfer, Colin.....	Staab, Katie Lynn.....	182
.....29, 30, 218, 267, 269, 348, 369	Stafford, Christopher.....	391
Sims, David.....	Stallsmith, Bruce.....	6
.....69	Standen, Emily.....	458
Singh, Navasha.....	Stanley, Edward.....	459
.....444	Staudinger, Michelle.....	273
Singhas, Charles.....	Stauffer, Jay.....	249, 459, 460
.....275	Stauffer, Jr., Jay R.....	299
Singh-ngam, Shankul.....	Stead, Joanna.....	279
.....445	Steele, Mark.....	190, 423
Sites, Jack.....	Steffen, John.....	460
.....518	Steffen, Michael.....	350, 461
Skelly, David.....	Steinberg, Brad.....	381, 382
.....445	Stengle, Anne.....	462
Skipwith, Phillip L.....	Sterba-Boatwright, Blair.....	169
.....446	Stevens, Philip.....	390, 391
Skomal, Gregory.....	Stevenson, Dirk.....	236
.....69, 116, 269, 313, 384, 385, 447	Stevenson, Duane.....	222, 372
Sloman, Katherine.....	Stewart, Donald.....	252
.....69	Stewart, James R.....	433
Smeenck, Nick.....	Stiassny, Melanie.....	127
.....417	Stoehr, Ashley.....	462, 522
Smiley Jr., Peter C.....	Strauss, Richard.....	422
.....447, 448	Strider, Meredith.....	464
Smith, Brian E.	Strother, James.....	377
.....292	Stuart, Bryan.....	23
Smith, Chad.....	Stump, Kristine.....	463
.....266	Stunz, Gregory.....	169
Smith, Daniel.....	Stunz, Gregory W.....	115
.....449	Sturm, Joshua.....	389
Smith, Eric.....	Stynoski, Jennifer.....	464
.....411	Sulak, Ken.....	28
Smith, G. Troy.....	Sulikowski, James....	72, 99, 294, 465, 523
.....155	Sullivan, John P.	466
Smith, Gerald.....	Summers, Adam P.....	52, 377, 466
.....450	Suski, Cory.....	69
Smith, Katie L.	Sutherland, Ron.....	355
.....450	Sutton, Tracey.....	107, 379, 441, 467
Smith, Katrina.....	Swarmer, Tiffany.....	79
.....451	Sweetman, Christopher.....	467
Smith, Krister.....	Swierk, Lindsey Noele.....	468
.....452	Switzer, Theodore.....	318
Smith, Leo.....		
.....453		
Smith, Ryan.....		
.....375		
Smith, Wade D.		
.....453		
Smith, Winston P.....		
.....243		
Smolensky, Nicole.....		
.....454		
Snow, Ray.....		
.....186, 524		
Snyder, Sarah.....		
.....455		
Solow, Andrew.....		
.....311		
Somerton, David.....		
.....372		
Sommer, Julie.....		
.....455		
Sosa-Nishizaki, Oscar.....		
.....83		
Sosebee, Katherine.....		
.....167, 292		
Soykan, Candan.....		
.....392		
Sparks, John.....		
.....429, 456		
Spataro, Marc.....		
.....29		
Speare, Richard.....		
.....367		
Speares, Patty.....		
.....457		
Sprague, Mark.....		
.....275, 303		
Sprague, Mark W.		
.....457		

Szabo, Zoltan.....59
Szczebak, Joseph.....471

T

Talley, Brooke L.....40, 469
Tallon, Kelsey.....472
Tambella, Mauro.....156
Tanaka, Shinya.....533
Tang, Kevin.....469
Targett, Timothy E.....407
Tate, Erin.....16
Tawaka, Sarah.....157
Taylor, Chantel.....470
Taylor, David.....24, 179, 471
Taylor, Emily.....472
Taylor, Mae.....473
Taylor, Marcus.....364
Taylor, Mollie.....71, 473
Taylor, Ron.....403
Teare, Amber.....474
Tellechea, Javier475
Teresa, Fabricio.....476
Thiet, Rachel.....174
Thomason, Sarah.....111
Thomaz, Andrea Tonolli.....477
Thompson, Andrew.....478
Thompson, Michael B.....433
Thomson, Jordan.....76
Thoney, Dennis.....503
Timm, Brad.....107, 478
Timmers, Amy.....390, 391
Tipton, Michelle.....96, 479
Tkint, Tim.....480
Tobin, Andrew.....267, 269
Toledo-Piza, Monica.....172
Tonjes, Stephen D.480, 481
Toonen, Robert.....118
Tordecilla-Petro, Glenys.....369
Tornabene, Luke.....482
Torres-Carvajal, Omar.....131
Torricelli, Patrizia.....309

Touchon, Justin C.....505
Tousignant, Mike.....483
Townsend, Ted.....518
Townsend, Troy.....326
Tracy, C. Richard.....199, 288, 425, 455
Trani Griep, Margaret.....355
Trauth, Stanley.....484
Travis, Emilie.....484
Tricas, Timothy.....12, 314
Tringali, Mike.....115
Tronboll, Krystal.....485
Trueb, Linda.....169
Trujano-Alvarez, Ana Lilia.....57
Tsai, Chun-Hsin.....486
Tsai, Hui-Shan.....486
Tsai, Kai-Yun.....341
Tsang, Paul.....72, 465
Tuberville, Tracey D.21, 74, 487
Tucker, Derek.....488
Tuma, Michael.....354
Tupper, Todd.....107
Tynning, Thomas.....462

U

Unmack, Peter.....424, 488
Ursprung, Eva.....410, 489

V

Valdez, Federico.....490
Valenzuela, Nicole.....89, 148, 149, 293
Van den Boogaart, J.G.M.....373
Van Dyke, James.....490, 491
Van Hoorebeke, Luc.....4
Vandergon, Thomas.....97
Vandewalle, Pierre.....298
VanScoy, Greta.....65
Vari, Richard.....347
Vasilenko, Marat.....492
Vaudo, Jeremy.....493
Vecchione, Michael.....107, 467

Vega, Robert R.....	115
Vela-Valladares, Lilia.....	321
Veldhoen, Nik.....	535
Veloso, Juliette.....	493
Velotta, Jonathan.....	494
Veraldi, Francis.....	495
Verheyen, Erik.....	480
Vertes, Akos.....	441
Vetter, Russ.....	253
Veysey, Jessica.....	495
Vieglais, David.....	45
Villanueva, Cesar.....	496
Vision, Todd J.	142
Vogt, Richard C.....	148, 497
Vokoun, Jason.....	255
von Hippel, Frank.....	42
von Hippel, Frank A.....	145
Vondruska, Joe.....	435
Vonesh, James R.....	505
Voorhees, Jaymie.....	497

W

Waddell, Joseph.....	498
Waddle, J. Hardin.....	185, 499
Wagner, Brian.....	33
Wagner, Robert.....	387
Wainwright, Peter.....	216, 499
Waite, Jessie.....	500
Walker, Christina J.....	322, 501
Walker, Terence I.....	166
Wall, Carrie.....	501
Walls, Susan.....	499
Wallsgrove, Natalie.....	117
Walsh, Cathy.....	502
Walsh, J.P.....	275
Walsh, Jennifer.....	274
Walters, Hans.....	503
Walton, Michael.....	336
Wanat, Jennifer.....	473
Wang, Jasmine.....	178
Ward-Paige, Christine.....	504

Warkentin, Karen M.	286, 505
Waters, Mark.....	506
Watkins-Colwell, Gregory	65
Watling, James.....	365
Webb, Jacqueline F. ...	7, 46, 129, 198, 507
Webber, Nicholas	507
Weber, Katrina.....	87, 508
Weckle, Amy L.....	433
Weeg, Matthew.....	509
Weeks, Denita M.	509
Wegner, Nicholas.....	364, 510
Weidner, Tiffany A.....	511
Weigt, Lee.....	33, 482
Weiss, Stephanie.....	436
Welton, Luke	512
Wernle, James.....	9
Westerfield, Monte.....	142
Westervelt, James D.....	21
Westneat, Mark.....	512, 513
Wetherbee, Bradley.....	228, 514, 515
Whitcomb, Amelia.....	372
White, Jimmy.....	218
White, Mary.....	112, 241
White, Matthew.....	271
White, Nicole.....	103
White, Patricia A.....	515
Whiteman, Howard.....	111, 351
Whitfield, Steven.....	516
Whitney, Nicholas.....	517
Whittington, Jim.....	403
Wibbels, Thane.....	103, 349, 518
Wiens, John J.....	158, 230, 518
Wilborn, Rachel.....	519
Wilbur, Amy.....	48
Wildhaber, Mark.....	169
Wildman, Derek E.....	433
Wiley, Edward O.	45, 453
Wiley, Tonya.....	520
Wilga, Cheryl.....
.....	120, 308, 320, 398, 462, 521, 522
Willey, Lisabeth.....	521
Williams, L. Jay.....	523

Williams, Rod.....	114
Willink, Philip.....	524
Willson, John.....	524
Wilson, Clara.....	535
Wilson, Jacqueline.....	66
Wilson, Maria.....	343
Wilson, Rory.....	184
Windmiller, Bryan.....	525
Winemiller, Kirk O.	342, 374
Wintner, Sabine.....	44, 233, 323
Winton, Megan.....	109, 526
Wisniewski, Samantha.....	527, 528
Wojakowski, Maria.....	528
Wood, Robert.....	33, 141, 469, 529
Wood, Roger.....	530
Wood, Roger Conant.....	529
Woodley, Christopher.....	267
Woolaver, Lance.....	493
Worm, Boris.....	110
Wright, Jeremy.....	531
Wu, Sheng-Hai.....	92, 94, 291, 486
Wu, Yunke.....	531
Wund, Matthew.....	32
Wylie, Glenn.....	204

X

Xu, Leren.....	532
----------------	-----

Y

Yabe, Mamoru.....	340
Yabsley, Michael.....	484
Yagi, Katharine.....	533
Yamaguchi, Atsuko.....	533
Yang, Dongmei.....	532
Yang, Lei.....	469
Yang, Ya-Hui.....	486
Yasick, Alison.....	336
Yopak, Kara.....	534
Yorks, Derek.....	535
Young, Forrest.....	356

Young, Joy.....	403
Youngquist, Melissa.....	535

Z

Zachariah, Trevor.....	356
Zalazar, Raúl.....	245
Zapata, Fernando A.....	332
Zhang, Haili.....	42
Ziegler, Lucia.....	536
Zieri, Rodrigo.....	537
Zimkus, Breda.....	538
Zug, George.....	205
Zwemer, Charles.....	202