

0555 NIA II, 551 AB, Monday 12 July 2010

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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

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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 autodiometric 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 Dosey

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

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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

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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

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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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

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 Cartilagosos 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

Aarob 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

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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

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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

¹*University of Connecticut, Storrs, CT, United States*, ²*Southern 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

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

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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

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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

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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

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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

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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

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

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

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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

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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

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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

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

Justin Golub, Susan Foster

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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

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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

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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 dispersed 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.

0491 Herp Ecology & Systematics, Ballroom B, Thursday 8 July 2010

Daniel Harvey¹, Patrick Weatherhead²

¹*Willow Creek Wildlife Consulting, Ottawa, Ontario, Canada*, ²*University of Illinois, Urbana, Illinois, United States*

Habitat Selection as the Mechanism for Thermoregulation in a Northern Population of Massasauga Rattlesnakes (*Sistrurus catenatus*)

We investigated the association between temperature, habitat selection and thermoregulation in a population of massasauga rattlesnakes (*Sistrurus catenatus*) near their northern range limit on the Bruce Peninsula, Ontario, where cold temperatures are likely an important constraint. We defined the performance range as the range of body temperatures within which most functions are performed reasonably well (i.e. $\geq 50\%$ of optimal). Movement data indicated that the lower limit of the massasauga's performance range was 19.9 °C. Operative environmental temperatures on the Bruce Peninsula were almost always below the massasauga's preferred range (30.0 °C - 33.6 °C) and were frequently below the performance range in the spring and fall. Thermoregulation was achieved primarily by microhabitat selection. Massasaugas thermoregulated more effectively as their visibility increased and forest cover decreased. Gravid females basked more and used less forest cover than other snakes. Gravid females also increased basking in response to low environmental temperatures in the spring and summer (i.e. gestation), whereas nongravid females and males did not vary basking with regards to environmental temperature in any season. Male and nongravid female massasaugas did not fully take advantage of thermoregulatory opportunities in the spring and fall, and as a consequence were often too cool to perform essential functions such as prey capture. In contrast, gravid females made the behavioral adjustments necessary (e.g. basking) to maintain body temperatures suitable for gestation. Our results are consistent with the hypothesis that temperature limits reptile distribution primarily via effects on juvenile recruitment.

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 groupswith 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 pufish 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

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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

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³*University of Nebraska at Kearney - Department of Biology, Kearney, NE, United States,* ⁴*University 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

¹*Virginia Institute of Marine Science, Gloucester Point, VA, United States*, ²*NMFS, 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

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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.

0426 Herp Ecology & Behavior, 555 AB, Saturday 10 July 2010; ASIH STOYE AWARD ECOLOGY & ETHOLOGY

Kristiina Hurme

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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

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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

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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

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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 ($\Delta\text{pH}/\Delta\text{t}$) and lactate ($\Delta\text{lac}/\Delta\text{t}$) 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 $\Delta\text{lac}/\Delta\text{t}$ 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

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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

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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

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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

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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

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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

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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

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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

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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, Koror, 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

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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 Perijá, 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

¹none, Stamford CT, United States, ²Bioacoustics Research Program, Cornell Laboratory of Ornithology, Ithaca NY, United States, ³Dept. 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

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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

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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

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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

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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

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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

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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

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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

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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.
