

0158 Poster Session II, Saturday 9 July 2011

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Spatial and Temporal Distribution of Leaf Litter Anuran Communities and Potentially Influential Environmental Variables at Three Atlantic Forest Areas in Southeastern Brazil

We conducted a 12-month survey of leaf litter anuran assemblages at three areas in different stages of succession in the Parque Estadual do Rio Doce, the largest Atlantic Forest remnant in Minas Gerais state, southeastern Brazil. We measured species richness, abundance, and biomass, plus variables that could potentially affect anuran communities including aspects of invertebrate litter fauna, leaf litter biomass and structure, and microclimatic conditions. We first characterized and compared the three areas according to the variables studied, and then defined sample units that were not spatially correlated to test for spatial and temporal correlations between anuran species richness, abundance and biomass (as dependent variables) and the environmental variables (as independent variables) using multiple regression. The forest areas in later stages of succession had more anuran species and higher anuran abundance and biomass, as well as more invertebrate taxa, but lower invertebrate abundance. Leaf litter biomass was higher in the mature forest, but leaf litter depth on the soil was shallower. Humidity and temperature did not vary significantly among areas. Temporally, anurans were more abundant during the rainy season as were invertebrates, and leaf litter biomass was greater. Spatially, anuran abundance was influenced by dry leaf litter biomass and richness of invertebrate taxa. The best model to explain variation in anuran abundance included dry leaf litter biomass and rainfall, but still it did not explain a significant amount of variation. The available data on leaf litter anuran communities indicates no general pattern concerning spatial or temporal distribution.

0468 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Morgan Raley

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The Longnose Shiner, *Notropis longirostris* (Hay, 1881), as a Case Study of Mobile Vicariance Shaping Coastal Phylogeography

The Longnose Shiner, *Notropis longirostris*, is a benthic cyprinid common to the coastal states (Louisiana, Mississippi, Alabama, Georgia and Florida) bordering the Gulf of Mexico. This shiner and its straw-colored congeners, *N. ammophilus*, *N. rafinesquei*, and *N. sabiniae*, form a well-supported clade of notopine taxa restricted to coastal plain physiographic regions. These species typically occur over shallow shifting sand or fine

gravel substrates at the lower ends of sandbars in relatively slow current. *N. longirostris* exhibits a unique allopatric distribution bifurcated by the Mobile River basin; within the Mobile itself, *N. longirostris* is uncommon and isolated to the lower-most reaches of the basin, seemingly replaced by *N. ammophilus* in the uplands. Allozyme data presented by Wiley & Titus and Titus, Wiley & Allen suggested that populations of *N. longirostris* have been genetically isolated from one another due to Mobile vicariance. Raley & Wood presented mitochondrial sequence data to support these assertions. Additional mitochondrial and nuclear sequence data have been collected for the group and results will be presented that further test perceived regional phylogeographic patterns. These results highlight the existence of an undescribed form of "Longnose Shiner" from rivers east of the Mobile River basin that have differentiated largely in cypsis. Anecdotal fin-coloration evidence exists to substantiate this assertion. Efforts to further quantify and recognize this new cyprinid are recommended.

0469 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Jason Ramsay, Cheryl Wilga

University of Rhode Island, Kingston, RI, USA

Function of The Jaw Depressors during Feeding in Little Skates, *Leucoraja erinacea*

The coracomandibularis (CM) and coracoarcualis (CA) muscles of little skates are arranged in-series, extending from the pectoral girdle to the lower jaw. Shortening of the CM and CA should result in lower jaw depression. However, the CM and CA can potentially contract isometrically or eccentrically; functioning to transfer force and motion from the coracohyomandibularis (CHYM) muscles to the lower jaw or to support the buccal cavity, respectively. Hyomandibulae, upper and lower jaw kinematics, motor activity in the CM, CA and CHYMs, and fascicle shortening in the CM and CA were recorded simultaneously with buccal pressure during prey capture and processing. During prey capture the CM and CA are active along with the left and right CHYM. However, the CM actively shortens while the CA actively lengthens as the hyomandibulae and lower jaw are being depressed. During prey processing only the CM and CA are active. The CM shortens while the CA stays the same length. Hyomandibulae depression is reduced, but lower jaw depression is similar to that of prey capture. The patterns of CM and CA activity and strain in little skate suggests that during prey capture the muscles have taken on a supportive role, stabilizing the floor of the buccal cavity similar to a skeletal hyoid. In contrast, during processing the CM actuates jaw depression, while the CA stabilizes the CM origin. Such functional plasticity of the feeding muscles may have played a key role in the increased functional versatility of the feeding apparatus of batoids compared to sharks.

**0369 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011; NIA
BEST STUDENT PAPER AWARD**

C. Keith Ray, Jonathan Armbruster

Auburn University, Auburn, AL, USA

**Redescription and Morphometric Analysis of *Isorineloricaria* (Siluriformes:
Loricariidae)**

The troubled history of the members of the *Hypostomus emarginatus* species group has been the subject of much taxonomic avoidance in recent years. We review the complex history of the *H. emarginatus* species group, along with resurrecting and redescribing the genus *Isorineloricaria* Isbrücker 1980. We also redescribe and diagnose the species of *Isorineloricaria*. Species recognized as taxonomically valid are: *I. ammophila* from the Apure and Orinoco Rivers in Venezuela; *I. emarginata* from the lower Amazon River and its tributaries; *I. gomesi* from Jaguaribe River, Ceará state, Brazil; *I. horrida* from the upper Amazon River, including the mainstem, Rio Napo, Rio Marañon, Rio Ucayali, Rio Juruá, Rio Purus, and Rio Madera; *I. phrixosoma* from the Rio Ucayali, Peru; *I. spinosissima* from the Guayas River basin, Ecuador; *I. tenuicauda* from the Magdalena River basin in Colombia; *I. unicolor* from from upper Amazon tributaries of Bolivia, Brazil, Colombia, Ecuador, and Peru; *I. villarsi* from the Maracaibo basin in northwestern Venezuela and eastern Colombia; *Isorineloricaria n. sp. 'Apure'* is described from the Apure and Orinoco Rivers in Venezuela. Biogeographic patterns and their relationships with hypothesized geologic events across South America are also discussed. *Isorineloricaria* appear to be in two main groups, a largely trans-Andean group (with one species in the Orinoco drainage) and an entirely cis-Andean group. Furthermore, the rise of the Andes may have allowed the invasion of the piedmont areas by the smaller members of *Isorineloricaria*.

**0740 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011;
ASIH STOYE GENERAL HERPETOLOGY AWARD**

Jolene Rearick

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Evolution of Freeze Tolerance in Anurans

Tolerance of freezing is currently recognized in six anuran species belonging to two families and three genera (*Rana sylvatica*, *R. arvalis*, *Pseudacris crucifer*, *P. triseriata*, *Hyla versicolor* and *H. chrysoscelis*). Because these species are fairly distantly related (MRCA ~120mya), freeze tolerance is hypothesized to have evolved multiple times from common shared mechanisms of dehydration tolerance in amphibians. Using ancestral character state reconstructions on probability distributions of phylogenetic trees, I will test two hypotheses: 1) dehydration tolerance as the ancestral state of clades containing freeze tolerant anurans species and 2) freeze tolerance is the ancestral state of all anurans, the families Ranidae and Hylidae and clades containing freeze tolerant species.

To identify characteristics significantly associated with freeze tolerance I will perform correlation analyses between freeze tolerance and other physiological, life history, and evolutionary history characters. Identification of specific preadaptations or correlated traits will be applied towards creating a predictive framework to evaluate the potential for freeze tolerance in other vertebrate species. A lack of correlation or ancestral preadaptive traits would imply that hypotheses about the evolution of freeze tolerance need to be revisited and mechanisms controlling the expression of this trait may be more complex than previously thought. Understanding the timing, frequency and characteristics associated with the evolution of freeze tolerance has broad implications in both cryomedicine and complex trait evolution.

0623 Invasive Species, Symphony I & II, Sunday 10 July 2011

Robert N. Reed¹, Bjorn Lardner², Gordon H. Rodda¹, Julie A. Savidge², Amy A. Yackel Adams³

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Individual and Demographic Responses to Simulated Elevated Prey Densities in Brown Treesnakes (*Boiga irregularis*) on Guam

Introduced Brown Treesnakes (BTS) have ravaged the native biota of Guam, a U.S. territory in the western Pacific Ocean. While small lizards remain abundant on Guam, BTS have reduced or eliminated populations of large-bodied prey (rats, birds, etc), resulting in reduced body size, lower body condition, and lower annual survival of adult snakes as compared to when snakes reached peak population sizes several decades ago. The efficacy of control tools used on Guam to suppress and contain the local BTS population is reasonably well studied and understood. However, BTS introduced to new islands would encounter unreduced prey populations, and snake suppression on Guam may allow prey species to recover. The effects of such increased prey abundances for subsequent population growth and management of BTS are poorly understood. We experimentally examined this issue by artificially increasing prey availability for a marked population of BTS in a 5-ha area on Guam that is closed to emigration and immigration. At an individual level, increased food availability led to rapid increases in body size and condition. Rapid growth was observed in individuals that had previously displayed 'asymptotic' growth curves. Supplemental feeding also had major demographic effects in terms of proportion of reproductive females and subsequent recruitment of juveniles. We will discuss the implications of our findings for interdiction and population control of BTS.

0179 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Aaron Reedy¹, Daniel Warner¹

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Maternal Nest-site Choice in the Lizard *Anolis sagrei*: A unique Research-based Educational Model for Youth at an Urban High School

Student understanding of the scientific method is relatively poor, particularly in urban high school classrooms. The reasons for this poor understanding are complex, but are at least partially due to a lack of research experience in the preparation of science teachers and a lack of active inquiry-based science education in the classroom. To address these issues, we developed an experiment with live lizards (*Anolis sagrei*) to serve as scaffolding for a new model of multi-layered mentoring. Students conducted an experiment to test the hypothesis that “female lizards choose nest sites with conditions that are conducive to embryonic development.” Eighty lizards were housed in the classroom, and students were responsible for animal care and management of the experiment. Female lizards (n=60) were provided five nesting substrates that differed in moisture content (0%, 12.5%, 25%, 50% 75%), and all eggs (n=128) were incubated (27°C) in one of five randomly chosen moisture levels that mirrored the five nesting substrates. The student researchers found that female lizards preferred relatively moist oviposition conditions, and these conditions had positive effects on egg survival and hatchling body size. Student learning of the scientific method was assessed by lab reports (sophomore students) or by written scientific papers formatted for a professional journal (senior zoology students), while the teacher will prepare a professional paper for peer-reviewed publication. We believe that reptiles provide excellent tools for science education, as they provide an effective way to engage high school students in professional science and provide meaningful professional development to teachers.

0654 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

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Ranavirus-exposed Wood Frog Tadpoles (*Lithobates sylvaticus*) are Robust to Three Natural Environmental Challenges

Amphibian larvae in ponds and ephemeral pools cope with an array of challenges on the path to metamorphosis. Additionally, mass mortality events are increasingly being reported from ranaviruses. One hypothesis for this increase is that amphibians are becoming immunocompromised by natural and anthropogenic stressors. This study examined how high density, predator cue, and food limitation influence wood frog tadpole performance and response to ranavirus exposure in individual- and population-level experiments. Tadpole mass, development, and corticosterone levels were measured to determine the physiological effect of each treatment. Disease mortality,

prevalence, and time to death were recorded to evaluate disease severity. Although the food limitation negatively impacted tadpole physiology, tadpoles exposed to high densities and/or predators remained unaffected. Amazingly, every treatment group was able to cope with disease as well or better than controls. Prevalence was similarly high for all treatments and no differences were observed in time to death. Case mortality was comparable for all treatments (~50%) except for the population-level high density treatments (12%). Competing risk analysis of metamorphosis and survival showed that tadpoles in those high density treatments were three times more likely to metamorphose than the no-stress controls, which perhaps "rescued" them from ranavirus induced mortality. These results suggest that the environmental challenges studied may not increase the severity of disease, and indeed, in the case of high density, may even promote survival. Accordingly, disease management strategies should focus less on pond conditions, and more on preventing introductions of ranavirus to naïve ponds.

0092 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Jeanine Refsnider, Fredric Janzen

Iowa State University, Ames, IA, USA

Nest-site Choice in Response to Climate Change and Effects on Offspring Performance in a Turtle with Temperature-dependent Sex Determination

Reptiles with temperature-dependent sex determination may be particularly threatened by climate change, as increasing temperatures could lead to skewed sex ratios. A potential compensatory mechanism is nest-site choice, with females selecting nest sites to match incubation conditions to climatic conditions. I studied nest-site choice in painted turtles (*Chrysemys picta*) to determine the extent to which local adaptation in nesting behavior is genetically and environmentally based. Gravid females from five populations across the species' range were housed in an outdoor common garden environment. Nest-site choice was compared among populations to evaluate variation in nesting phenology, shade cover over the nest, nest depth, incubation regime, and offspring sex ratio. Populations differed in nesting phenology and nest depth, but not in shade cover over nests; thus, when exposed to novel climatic conditions, females from transplanted populations chose nest-sites with similar shade cover to those of local females, thereby producing similar offspring sex ratios. The performance of hatchlings produced in this experiment declined with decreasing mean temperature of the mother's site of origin, and nests with greater variation in daily temperature range produced hatchlings that performed faster and more readily than nests with less variable incubation temperatures. Therefore, selection of shadier nest-sites may be a mechanism by which female turtles could compensate for climatic warming, and the increase in temperature fluctuations predicted by climate change models may result in the production of faster hatchling turtles with enhanced righting ability. Importantly,

however, the fitness consequences of hatchling turtle performance are yet to be determined.

**0738 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD,
Minneapolis Ballroom E, Thursday 7 July 2011**

Lisa Regula Meyer

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The Impact of *Typha angustifolia* and *Phragmites australis* Invasions in Wetlands on Behavior of Larval and Adult *Rana clamitans*

Invasive plants may have chemical components to which native amphibians are naïve, and change the structure of the entire habitat by rapidly establishing a monoculture. Invasive plants threaten amphibians and other wetland organisms more so than fully terrestrial organisms for many reasons. This study compares the behavior of *Rana clamitans* tadpoles in a swim T-maze when presented with *Typha angustifolia* or *Phragmites australis*, *Juncus effusus*, or no plant. Individuals were lab-reared. The ability to recognize and avoid unknown, possibly dangerous chemicals is advantageous to larval amphibians, which are sensitive to numerous factors. The behavior of adults caught from similarly non-invaded ponds was also investigated using arenas with *T. angustifolia*, *P. australis* or native plant mix. Samples of plant communities were obtained from previously studied wetlands. Differences in behavior based upon different plant communities may prove important for amphibians, especially if there is significant difference between invaded and non-invaded plant communities. Despite the preservation of total wetland area via no-net-loss policies, if the preserved wetlands are dominated by invasive plants, the net effect for amphibians may be negligible.

0544 Poster Session III, Sunday 10 July 2011; ASIH STORER HERPETOLOGY AWARD

Brendan Reid

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Estimating Population Connectivity Using Kinship Methods in Blanding's Turtle (*Emydoidea blandingii*)

Several aspects of chelonian life history, including extreme longevity and changes in habitat use across different age classes, complicate the measurement of key ecological and demographic parameters in many turtle species. Recent work in seabirds and other species has shown that the use of genetic kinship analysis can be extremely helpful in studying similarly problematic species. Kinship methods, particularly when combined with mark-recapture studies, can help to reveal dispersal patterns, source-sink dynamics, and contemporary changes in connectivity that would otherwise be difficult

or impossible to observe. Here, I apply these methods to an ongoing mark-recapture study of Blanding's Turtle (*Emydoidea blandingii*) populations in Central Wisconsin. Preliminary results indicate that kinship methods can be useful in evaluating the relative degree of demographic closure among different populations and in determining lifetime dispersal ability and spatial dispersal patterns in this long-lived species and may be an extremely useful tool for studying turtle populations in general.

0140 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

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A New Genus and Five New Species of Cascudinhos of the Subfamily Hypoptopomatinae (Siluriformes: Loricariidae) from Northern South America

Hypoptopomatinae is a subfamily of small sized loricariid catfishes distributed over most of South America. An ongoing phylogenetic analysis of that subfamily by the authors revealed a well supported clade composed of several species usually assigned to *Parotocinclus*. This clade, however, is not closely related to the type-species and other *Parotocinclus* species, and is being transferred to a new genus. Contrary to the real *Parotocinclus* species, which are found on rivers draining the Brazilian Shield, species in this clade are distributed on the Amazon, Orinoco and the Guyanas. The new genus is composed of very small, usually long snouted, and darkly colored cascudinhos, and is diagnosed by the color pattern and osteological features not shared with any other hypoptopomine. The most important synapomorphy is a contact between a cheek canal plate and the cleithrum in the pectoral girdle, which is exclusive and unreversed in the new genus. The species *Parotocinclus longirostris*, *P. polyochrus*, *P. eppleyi*, *P. collinsae*, *P. britskii* and *P. amazonensis* are being transferred to the new genus. *Parotocinclus aripuanensis* is considered a junior synonym of *P. amazonensis*. In addition to the new genus, five new species are being diagnosed and described, totaling eleven species formally recognized in this new taxon. Considering the patchy knowledge of fish distribution in South America, it is likely that additional diversity remains to be discovered in the new genus.

0606 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Melissa Reneski, Andrew Kinziger

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Temporal Genetic Analysis Reveals Divergence of Hatchery Steelhead (*Oncorhynchus mykiss*) via Drift

The genetic goal of many captive propagation programs is to minimize genetic change resulting from drift and selection. The objective of this study was to assess the genetic stability of a hatchery steelhead (*Oncorhynchus mykiss*) from the Mad River, California over 35 years of captive breeding. The genetic population structure of founding (1975) and contemporary (2009-2010) hatchery and wild stocks were compared using 14 microsatellite loci. Comparative samples from four non-indigenous populations transplanted to the Mad River were also assessed. Our analysis indicated that historical hatchery and wild populations were genetically identical. From this common genetic base, founding and contemporary hatchery stocks diverged from one another whereas wild stocks appeared to be essentially homogenous through time. Individual admixture coefficients from Bayesian cluster analysis indicated that admixture from nonlocal populations was not responsible for the observed patterns of divergence. Instead drift in the absence of migration is implicated. The hatchery population was largely closed to migration ($m=0.0006$) from the wild and had a low effective population size ($N_e=246$). In contrast, wild populations regularly received immigrants from the hatchery population ($m=0.176$) and had a much a larger effective population size ($N_e=1,935$). Thus, opening the hatchery population to immigration from the wild would likely serve to restore the genetic integrity of the hatchery population.

0494 Poster Session III, Sunday 10 July 2011

Justin Rheubert, David Sever

Southeastern Louisiana University, Hammond, LA, USA

Reproductive Morphology of the Tuatara (*Sphenodon punctatus*)

Over the past decade studies on reproductive morphology in squamates has expanded tremendously. In squamates the reproductive system consists of the testis, efferent ducts, kidneys, cloacae, and hemipenes. The squamate system components and organizational pattern is similar to that of other terrestrial vertebrates with a few exceptions. The testis is comprised of seminiferous tubules which lead to the rete testis which is extra-testicular contrasting the intra-testicular rete testis of other terrestrial vertebrates. The rete testis then divides into the ductuli efferentes which converge at the head of the epididymis which is consistent among terrestrial vertebrates. The epididymis runs posteriorly over the kidney which in squamates (and a few other vertebrates) plays a crucial role in reproduction through secretions of the sexual segment. The sexual segment has been identified in all squamates studied to date but varies in its position within the nephron. However, with *Sphenodon* being the sister taxon

to the Squamata making the lepidosaurian clade, evolutionary and phylogenetic analyses cannot be accurately performed on squamates without data on the sister taxon. Few studies have attempted to describe portions of the reproductive system, but no study gives in depth coverage of the reproductive system as an entire unit or has heavily investigated these various portions. Here we investigate the morphology of the entire reproductive system in *Sphenodon punctatus* in comparison with the Squamata and other terrestrial vertebrates in an attempt to provide pertinent data within the field of reproductive biology.

0507 Poster Session I, Friday 8 July 2011

Alexandre C. Ribeiro², Flávio C.T. Lima¹, Édson H.L. Pereira³

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A New Genus and Species of a Minute Suckermouth Armored Catfish (Siluriformes: Loricariidae) from the Rio Tocantins Drainage, Central Brazil

A new genus and species of a miniature suckermouth armored catfish is described based on specimens collected from the karst region of São Domingos, upper rio Tocantins basin, Goiás State, Central Brazil. The new genus and species is unique among loricariids by presenting a unique reductive pattern of lateral dermal plates, with most of the body covered by only three series of plates (viz., dorsal, mid-ventral and ventral series). The new taxon is also unique within the family by displaying a combination of character-states traditionally used for recognizing both members of the Hypoptopomatinae and Hypostominae. Despite difficulties in elucidating the phylogenetical affinities of the new taxon based on the available published data for the family, we provisionally consider the new taxon as belonging to the subfamily Hypostominae. Achieving a maximum standard length of 22.2 mm SL, the new taxon is one of the smallest loricariids, and a discussion on the smaller known members of the family is presented.

0711 Poster Session I, Friday 8 July 2011

Stephen Richter, Schyler Nunziata

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Relationship between Genetic Variability and Survival in a Critically Imperiled Amphibian Species

Genetic studies of isolated populations typically discover reduced genetic variation and make recommendations for alleviating genetic deficiencies. Examining the relationship

between genetic variability and survival of individuals can provide more meaningful understanding of evolutionary potential and long-term viability of populations. We studied potential mechanisms for preservation of genetic variability in a population of endangered Dusky Gopher Frogs (*Rana sevosa*). We addressed the following mechanisms: (1) pairing of more genetically different mates (2) mortality of eggs based on relatedness of parents, and (3) differential survival of more genetically diverse offspring through metamorphosis. We used eight microsatellite loci to genotype individuals from three life-history stages within a single year (breeding adults, eggs, and emerging metamorphs) and compared standard measures of individual genetic variability. We found no significant differences in genetic measures between the adult population and egg clutches, suggesting that mating was random with respect to relatedness. We documented a negative association between survival at the egg stage and genetic variability, which is strong evidence for increased fitness of more outbred individuals. Finally, we found metamorphs had significantly higher SMD² values and significantly lower IR scores than did eggs indicating individuals surviving to metamorphosis had parents that were more genetically divergent than non-surviving counterparts. These results indicate that selection for outbred individuals should help to alleviate genetic stress and should prolong, at least temporarily, the persistence of this isolated population. However, genetic variability will continue to decline and extinction will occur in the long term, unless populations are established nearby.

0283 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Cyrena Riley¹, Richard Cloutier¹, Eileen Grogan²

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Ontogenetic Pattern of Mineralization in the Thorny Skate (*Amblyraja radiata*)

Skeletal development of organisms provides essential data for phylogenetic, evolutionary and biomechanical studies. Compared to osteichthyans in which chondrification and ossification sequence have been described for numerous species, the exact ontogenetic progression of prismatic mineralization (tesserae) in chondrichthyans is not well known. Two different types of tesserae arrangements have already been recognized in skates: (1) catenated, corresponding to long chains of single tessera and (2) crustal, corresponding to a continuous layer of tesserae. Patterns of direction of mineralization (e.g., proximo-distal, bidirectional) and patterns of distribution of mineralization (e.g., dorso-ventral, lateral), were analyzed using a cleared and double-stained growth series of 20 specimens (embryos and juveniles) of the thorny skate (*Amblyraja radiata*). Different distribution patterns occur simultaneously in different anatomical components within an individual. Pectoral fins exhibit catenated mineralization on the dorso-ventral surfaces of radials. Pelvic fins show two distinctly different patterns; on the crus, crustal mineralization is more important on the anterior

portion of the radials, while the non-crural part of the fin has crustal and catenated mineralization on the dorso-ventral surfaces of radials. The direction of radial mineralization follows a proximo-distal pattern while basal elements of pectoral fins follow a bidirectional mineralization pattern. The posterior portion of the vertebral column mineralizes first. Although a phylogenetic component is not discarded, the ontogenetic progression of mineralization in skates suggests that mechanical stress may influence the formation of mineralization. Skate developmental patterns will be compared to those present in immature and mature specimens of different elasmobranch species and in osteichthyans as well.

0477 Poster Session II, Saturday 9 July 2011

Julia Riley, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

Should I Stay or Should I go? The Influence of Environmental Factors on *Chrysemys picta* Hatchling Overwintering Strategy

In northern temperate areas, *Chrysemys picta* hatchlings spend their first winter either submerged in water after fall nest emergence, or within their natal nest chamber. The occurrence of these two strategies varies among populations throughout the species' range, and temporally within the same population; however, the natural factors that determine the strategy employed by a given clutch are not well understood. Subzero nest temperatures above -4°C can be survived by hatchlings using freeze-tolerance, but lower nest temperatures like those found in the temperate north can only be survived in a supercooled state. If overwintering strategy maximizes winter survival and is cued by environmental factors, then northern hatchlings should remain in nests when the environment promotes supercooling. Clutches that overwinter in-nest should experience lower fall nest temperatures, soil moisture and vegetation cover, higher nest soil organic content, and smaller nest soil particle size than clutches that experience fall nest emergence. In summer 2010, *C. picta* nests were caged (N = 26) in Algonquin Park, Ontario, and a data logger was placed in each to record temperature. Soil texture was quantified for each nest. Nest microhabitat variables were recorded at oviposition and monthly during incubation. In the fall of 2010, 12% of the nests emerged. From April to May 2011, spring emergence will be surveyed, and nest microhabitat data will be analysed. Knowledge of hatchling *C. picta* overwintering strategies is predominately based on laboratory studies; our study will contribute to understanding this phenomenon in nature.

**0492 SSAR SEIBERT CONSERVATION AWARD, Session II, Conrad B & C,
Friday 8 July 2011**

Julia Riley, Jacqueline Litzgus

Laurentian University, Sudbury, Ontario, Canada

**Too Hot, Too Cold, or Just Right: Evaluation of a Common Turtle
Conservation Technique, Nest-caging**

Conservation biology's primary goal is to mitigate anthropogenic impacts on natural ecosystems. It follows that conservation techniques themselves should not be detrimental to target species. Anthropogenic food resources increase predator numbers which can push turtle nest depredation to unnatural levels. Nest-caging, a widely-used conservation technique, counteracts this by protecting nests and promoting recruitment. Despite these benefits, shortcomings have been identified. Entrapment in cage wire can cause mortality, and anecdotal evidence suggests that some nest-caging methods may reduce incubation temperature. The first goal of this study is to examine the effects of nest-caging on nest micro-environment. The second goal is to determine if nest-caging has an effect on hatching success and hatchling morphology. In 2010 in Algonquin Provincial Park, Ontario, *Chrysemys picta* (N=31) and *Chelydra serpentina* (N=36) nests were assigned to one of two treatment groups or a control: above- or below-ground wire nest cages or no nest cage, respectively. A data logger was placed in each nest to record incubation temperature. Once hatching occurred, incubation duration, hatching success, and proxies of hatchling fitness were quantified. Preliminary analyses indicate that incubation temperature, incubation duration, hatching success, and the average number of deformities per hatchling per clutch did not differ among treatments. Hatchling body condition was better for below-ground cages in snapping turtles, but did not differ among treatments in painted turtles. In both species, righting response varied among treatments. Analysis of conservation techniques is crucial for effective recovery of at-risk species in order to comprehend their long-term population-level implications.

**0446 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C,
Thursday 7 July 2011**

Eric N. Rittmeyer, Christopher C. Austin

Louisiana State University, Baton Rouge, LA, USA

**Bio-invasion of the Pacific: Human-mediated Introduction and Systematics of
the *Carlia fusca* Complex in New Guinea and the Pacific**

The *Carlia fusca* group consists of 18 described species of moderate-sized, typically brown scincid lizards distributed throughout the lowlands of New Guinea and adjacent islands, as well as parts of northern Australia and eastern Indonesia. As a result of anthropogenic translocations following World War II, populations of *Carlia fusca* group skinks are also invasive on the Pacific Islands of Palau, Guam, and the Northern Marianas Islands. A recent morphological review of the species group proposed

numerous taxonomic changes, as well as the specific identity of the invasive populations in the Pacific: *C. tutela* (native to Halmahera) for the Palau populations, and *C. ailanpalai* (native to the Admiralty Islands) for the Guam and Northern Marianas Islands populations. However, due to the low levels of morphological divergence among species in the group, species delimitation was difficult and numerous populations could not be assigned to a species based on morphological data. We here use mitochondrial and multiple nuclear loci to examine the systematics of the species group, as well as to identify the sources for the invasive Pacific Island populations. Our findings demonstrate multiple cases of incongruence between the currently recognized species (based on morphological data) and the evolutionary lineages recovered (based on molecular data), as well as evidence for multiple waves of introductions that appear to be concordant with movements of Allied and Imperial Japanese forces in the Pacific during World War II.

0307 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY AWARD, Conrad B & C, Thursday 7 July 2011

Angela Rivera

Clemson University, Clemson, SC, USA

Evolution of Flapping in Turtles: A Comparative Examination of Forelimb Kinematics and Muscle Function across Three Lineages (Trionychidae, Carettochelyidae, Cheloniidae)

Evolution has resulted in a diverse array of limb-based locomotor strategies. Changes in muscle activation patterns can lead to new locomotor strategies. Aquatic turtles are an excellent group in which to test for such changes because species typically use one of two general swimming styles (rowing or flapping), both of which depend exclusively on limb-based propulsion. All but one freshwater turtle swims using asynchronous rowing of the limbs, whereas the Chelonioidae (sea turtles) swim using synchronous flapping of foreflippers. Additionally, a single freshwater species, *Carettochelys insculpta*, has converged on a flapping-like style of swimming using synchronous motions of foreflippers. To examine how different forelimb motions are produced across species with generally similar muscle arrangements, I compared high-speed video and electromyographic (EMG) data from *Carettochelys insculpta* and *Caretta caretta* (loggerhead sea turtle), as well as rowing *Apalone ferox* (a member of the Trionychidae, sister clade to Carettochelyidae). My study provides the first opportunity to evaluate whether the two 'flapping' lineages have converged on similar limb kinematics and/or motor patterns, and by including *Apalone*, provides a test of whether 'phylogenetic relatedness' or 'locomotor strategy' better predicts forelimb kinematics and motor patterns. My findings indicate that 'flapping' in *Carettochelys* is only superficially similar to flapping in *Caretta*, and is, in fact, more similar to rowing in *Apalone*. My data indicate a general conservation of motor patterns across the species. However, deltoideous serves a new function in sea turtles; interestingly, *Carettochelys*, with its intermediate kinematics, exhibits deltoideous activity intermediate to rowers and flappers.

0462 Poster Session III, Sunday 10 July 2011

Gabriel Rivera, McKenna Hansel, Dean Adams

Iowa State University, Ames, IA, USA

Evolution of Sexual Shape Dimorphism in the Shells of Emydid Turtles

Sex-based differences in shell shape have been identified in many species of turtle. Despite the functional effects of shell shape in turtles (e.g., ability to resist predatory attacks and influence on hydrodynamic resistance), sexual shape dimorphism (SShD) has received considerably less attention than sexual size dimorphism (SSD). In addition, most studies of SShD have focused on specific species rather than evolutionary patterns. In this study we examined sexual dimorphism in carapace shape from a broad sampling of emydid turtles, including at least one species from each genus. Three-dimensional coordinates were collected for landmarks from the shells of museum specimens and superimposed using the generalized Procrustes method, thereby removing all non-shape variation. Multivariate techniques were used to quantify the magnitude and direction of differences in shell shape between sexes. We also used the comparative phylogenetic method to map SShD magnitudes onto an existing phylogeny of emydid turtles. This approach provided insight into several evolutionary patterns related to SShD in emydid turtles, including (1) variation in the direction of shape differences between sexes, (2) the correlation between the magnitudes of SShD and SSD, and (3) a comparison of evolutionary rates for SShD and SSD. Implications of findings will be discussed.

0287 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Gabriel Rivera¹, C. Tristan Stayton²

¹*Iowa State University, Ames, IA, USA*, ²*Bucknell University, Lewisburg, PA, USA*

Habitat-associated Trade-off between Mechanical Strength and Hydrodynamic Efficiency of Shell Shape in the Freshwater Turtle *Pseudemys concinna*

Aquatic species can experience different selective pressures on morphology in different flow regimes. Species inhabiting lotic regimes often adapt to these conditions by evolving low-drag morphologies that reduce the likelihood of dislodgment or displacement. However, hydrodynamic factors are not the only selective pressures influencing organismal morphology, and shapes well suited to flow conditions may compromise performance in other roles. We investigated the possibility of morphological trade-offs in the turtle *Pseudemys concinna*. Individuals living in lotic environments have flatter, more streamlined shells than those living in lentic environments; however, this flatter shape may also make the shells less capable of resisting predator-induced loads. We tested the idea that "lotic" shell shapes are weaker

than "lentic" shell shapes, concomitantly examining effects of sex. Geometric morphometric data were used to transform an existing finite element shell model into a series of models corresponding to the shapes of individual turtles. Models were assigned identical material properties and loaded under identical conditions, and the stresses produced by a series of loads were extracted to describe the strength of the shells. "Lotic" shell shapes produced significantly higher stresses than "lentic" shell shapes, indicating that the former is weaker than the latter. Additionally, females had significantly stronger shell shapes than males, although these differences were less consistent than differences between flow regimes. We conclude that, despite the potential for many-to-one mapping of shell shape onto strength, *Pseudemys concinna* experiences a trade-off in shell shape between hydrodynamic and mechanical performance.

0041 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Jacques Robert¹, Guangchun Chen¹, Gregory Chinchar², Francisco De Jesús Andino¹

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

Complex Role of Macrophages in *Xenopus* Immune Defenses and Persistence of the Ranavirus FV3

We have established *Xenopus* as a reliable model to study host immune defense in controlling infection, pathogenicity, and transmission of ranaviruses like FV3. We have shown that adult *Xenopus* resist and clear FV3 infection by developing potent anti-FV3 antibodies and efficient CD8 T cell responses that utilize macrophages as antigen-presenting cells. Despite this strong response, we have detected FV3 DNA in seemingly healthy (not deliberately infected) *Xenopus*. This observation lead us to hypothesize that FV3 is capable of establishing covert infections as seen with certain insect iridoviruses, and to investigate the possible dual role of macrophages as immune effector and permissive hosts. Accumulation of peritoneal macrophages (pMc) began as early as 1 day post-infection and was correlated with an increased expression of IL-1 β and TNF α pro-inflammatory cytokines. pMcs were shown to be susceptible to FV3 infection as evidenced by active FV3 transcription, and the detection of viral particles by electron microscopy and multicolor fluorescent microscopy. However, FV3 infection of pMcs resulted in the generation of fewer infectious particles, and involved a lower fraction (<1%) of pMcs than kidney tissue, the main site of infection. Notably, viral DNA remained detectable in pMcs for at least 3 weeks post-infection, past the point of viral clearance in the kidneys. These results suggest that pMcs harbor quiescent virus that may contribute to asymptomatic infection. Future plans are to characterize permissive pMc subsets using available and newly generated antibodies, follow them *in vivo* using fluorescent tracers, and identify viral immune evasion genes by reverse genetics.

0689 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Mark Roberts, Joseph Quattro

University of South Carolina, Columbia, SC, USA

Phylogenetic Patterns in a Crustacean Model Suggest a Shared Region-Wide Evolutionary History Shaping the Coastal Southeastern United States

Grass shrimp along the Atlantic coast of the United States, particularly *Palaemonetes pugio* and *P. vulgaris*, are ecologically important estuarine invertebrates that are widely used as crustacean models for laboratory toxicological studies. Due to its high natural abundance and ease of culture in laboratory settings, *P. pugio* has become a 'sentinel species' in coastal ecosystems. Despite its extensive use in the laboratory, there have been relatively few attempts to describe phylogeographic patterns in the wild. We have examined sequence variation from individuals representing both species from throughout their range in an effort to examine their phylogeographic history. Our phylogenetic and population genetic analyses reveal a deep phylogenetic 'break' between Atlantic populations and those collected from the Gulf of Mexico for both *P. pugio* and *P. vulgaris*. As has been observed in phylogeographic studies of other coastal marine organisms in the Southeastern United States the genetic break occurs along the eastern coast of Florida, near Cape Canaveral. Interestingly, Atlantic populations of both species are nearly devoid of detectable variation at mitochondrial loci, while samples from the Gulf are comparatively highly diverse; however, both Atlantic and Gulf regions are quite diverse at a nDNA locus.

0774 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

Nathan Robinson¹, Sara Valentine², Pilar Santidrián Tomillo³, Frank Paladino¹

¹*Purdue University, West Lafayette, IN, USA*, ²*Indiana-Purdue Fort Wayne University, Fort Wayne, IN, USA*, ³*Drexel University, Philadelphia, PA, USA*

Effect of Population Demographics on the Nesting Phenology of the Leatherback Turtle (*Dermochelys coriacea*) at Playa Grande, Costa Rica

A 17-year analysis of the nesting ecology of leatherback turtles (*Dermochelys coriacea*) at Playa Grande, Costa Rica has shown that the median nesting date has retreated by approximately 1-day yr⁻¹ since 1994-95. The number of leatherback turtles nesting at this site has also declined from 465 to 57, resulting in a strong inverse correlation between the median nesting date and the number of nesting females each year. We hypothesise that the shift in median nesting date may be due to an increase in the time it takes for female turtles to encounter potential mates when the number of turtles at the breeding site is low. If there is a density-dependant effect of population size on median nesting date, the timing of the nesting season may continue to shift if the population continues to decline. The conservation implication is that hatching success tends to be lower later

in the nesting season. A shift in the median nesting date may form a negative feedback mechanism of population decline, in which low population size leads to later nesting and this leads to low reproductive success. However, the median nesting date for remigrant turtles is on average 18.19 days earlier than new turtles. While the current shifts in nesting phenology may not be attributable to a change in the percentage of neophyte turtles over this time, increased protection of remigrant turtles may help to offset the recent patterns in median nesting date.

0253 Poster Session II, Saturday 9 July 2011

Nicole Rocha, Todd Jackman, Aaron Bauer

Villanova University, Villanova, PA, USA

Comparative Phylogeography of Two Widespread Southern African Gecko Species (*Pachydactylus purcelli* and *Pachydactylus montanus*)

Once considered to be subspecies of *Pachydactylus serval*, the sister taxa *Pachydactylus montanus* and *Pachydactylus purcelli* have only been recently described. Both gecko species have a relatively wide distribution, spanning the Cape Province of South Africa up into the southern half of Namibia, with their ranges overlapping in the northern end of the distribution of *P. purcelli*. This makes *P. purcelli* and *P. montanus* ideal candidates for phylogeographic study, especially considering their morphological and ecological similarities. Representative samples of these species were taken from an array of localities across their ranges. Patterns of genetic variation within the two species and in comparison to one another were analyzed by obtaining molecular data for the mitochondrial gene ND2 and the nuclear genes PDC and RAG1. Results revealed *P. purcelli* to be relatively invariant across its range, in which all samples were similar for the genes employed with relatively little geographical substructure. *P. montanus* was far more diverse, with largely concordant differentiation of both mitochondrial and nuclear markers. Interestingly, the center of diversity of *P. montanus* is in the southern part of its range, suggesting subsequent northward expansion. This pattern is in contrast to other widespread southern African lizard species whose centers of diversity are in northern Namibia and show recent expansions to the south.

0017 Herp Ecology, Symphony I & II, Sunday 10 July 2011

John Roe¹, Steve Morreale², Frank Paladino³, James Spotila⁴

¹University of North Carolina, Pembroke, NC, USA, ²Cornell University, Ithaca, NY, USA, ³Indiana-Purdue University, Fort Wayne, IN, USA, ⁴Drexel University, Philadelphia, PA, USA

Predicting Hotspots of Interaction Between Leatherbacks and Fisheries in the Pacific Ocean

Fisheries bycatch is suspected to be a critical source of mortality for leatherback turtles (*Dermochelys coriacea*) in the Pacific Ocean, where populations have declined precipitously in recent decades. Using tracks from satellite telemetry and state-space models, we describe spatial and temporal use-intensity distributions of leatherbacks from 1992 - 2008, including individuals from nesting populations in the eastern and western Pacific. Turtle distributions were integrated with data on longline fishing effort to estimate the relative intensity of these interactions over space and time. We estimated a total of 31,074 positions for 135 turtles. In addition to areas of high use near nesting beaches, several distinct migratory routes and foraging areas were identified in both temperate and tropical regions of the Pacific. Areas of high predicted interaction between turtles and fisheries included the seas of the Western and Central Tropical Pacific, the North Pacific Transition Zone, and along the East Australian Current into the Tasman Sea. In the Eastern Pacific, areas of high predicted bycatch risk were identified between Central America and the Galapagos Islands, and extending along a broad arc from equatorial currents into the South Pacific Subtropical Gyre as far as 30°S. The locations of potential interaction hotspots shifted seasonally according to changes in turtle behavior, fishing effort, or both. Our models provide a tool that resource managers can use to plan the timing and location of fisheries activities, and to refine restrictions such as temporal closures or gear modifications aimed at reducing leatherback bycatch in longline fisheries.

0341 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Dawn Roje

American Museum of Natural History, New York, NY, USA

Evaluating the Effects of Non-neutral Molecular Markers on Phylogeny Estimation: Should We be Using Rhodopsin to Infer Fish Relationships?

Nucleotide substitution models used in molecular phylogenetics assume neutral evolution, yet neutrality is rarely tested for. If non-neutral markers violate models egregiously, it would be expected that their reconstructed topologies be incongruent with those inferred from neutral ones and conclusions made from those phylogenies should be reexamined. The use of rhodopsin as a phylogenetic marker has recently been called into question for exactly this reason. Rhodopsin is assumed to have evolved

under strong positive selection for organisms that inhabit similar aquatic environments making it unsuitable for the phylogenetics of aquatic organisms, but it is unclear what the effects of non-neutrality on phylogeny estimation are. To evaluate potential incongruence of neutral versus non-neutral markers, as well as the notion that rhodopsin should not be used in the molecular phylogenetics of fishes, a real molecular dataset of spiny-rayed fishes (Acanthomorpha) was analyzed. The final dataset was comprised of 78 acanthomorph taxa and sequences from the following four nuclear, protein coding loci: RNF213, MLL, IRBP and Rho. Z-tests of selection were carried out on the sequences; RNF213 was found to be neutral while the remaining three tests rejected the null hypothesis of neutrality. To determine topology congruence among trees inferred by individual neutral and non-neutral markers as well as the combined, total evidence tree, comparisons of distances among trees and hypothesis testing were carried out. Results of the tree distance metrics and the topology testing support the notion that neutrality alone does not determine topology congruence, and those data should not be excluded.

0109 Poster Session II, Saturday 9 July 2011

Jorge Arturo Rojo Vazquez, Enrique Godinez Dominguez, Salvador Hernandez Vazquez, Gabriela Lucano Ramirez, Salvador Ruiz Ramirez, Juan Ramon Flores Ortega

Universidad de Guadalajara, San Patricio-Melaque, Jalisco, Mexico

Changes in the Structure of the Demersal Fish Assemblage of the Continental Shelf from the Central Mexican Pacific

In order to analyze the marine fish diversity of the central Mexican Pacific, demersal fishes were sampled monthly using shrimp trawl nets, from May 1995 to December 1998. During each cruise were defined two sampling sites and at each site two depth strata (10-40 m and 50-80 m). 28 cruises were conducted for a total of 158 tows in which swept 184.6 ha. More than 144,000 organisms were caught, which weighed more than 6,500 kg, belonging to 230 species, 55 families and 18 orders. Overall, of the 230 species, only ten species accumulate about 60% of the biomass and 80% of the total abundance. The most important fish species were *Porichthys margaritatus*, *Syacium ovale*, *Cynoscion nanus*, *Diodon hystrix* and *Urotrygon asterias*. The catch by unit of area of the abundance (number of individuals by hectare) was from 495 organisms by hectare in the stratum two of the El Coco site, up to 1752 organisms in the stratum two of Navidad site. However the differences observed in the abundance among sites, strata or years were not significant, except for the stratum one of the El Coco ($F=2.87$, $p < 0.05$). The biomass stayed below the 75 kg/ha during the whole study, finding significant differences mainly among the strata of depth from both places (Navidad: $F=6.64$, $p < 0.05$; El Coco: $F=35.97$, $p < 0.05$), but don't between years. The Shannon index and species richness values showed differences between strata ($p < 0.05$). The highest diversity values were found in the shallower stratum.

0651 Invasive Species, Symphony I & II, Sunday 10 July 2011

Christina Romagosa¹, Melissa Miller¹, Bart Rogers¹, Ray Snow², Todd Steury¹,
Craig Angle¹, Terrence Fischer¹, Robert Gillette¹

¹Auburn University, Auburn, AL, USA, ²Everglades National Park, Homestead, FL, USA

Canine Detection as a Potential Tool for Python Management in Florida

The establishment of nonindigenous Burmese python (*Python molurus bivittatus*) in Florida is an ecological threat that has cost approximately \$2 million since 2005 for research and management. While it is unlikely that this species can be eradicated from all southern Florida habitats, land managers are looking for additional methods to help curtail the spread of this and other large constrictor species. Among vertebrates, snakes are the most difficult to detect, and additional methods to find and capture these nonindigenous snakes are worth investigating. Early Detection and Rapid Response (EDRR) efforts combine various tools to address newly introduced or established species. Detection dogs, which use additional cues beyond the visual cues used by humans, are among the potential tools being assessed for EDRR efforts. Everglades National Park and Auburn University EcoDogs are cooperating in a pilot program to evaluate the use of dogs for python detection and also to support the multi-agency search efforts for pythons in southern Florida. During field surveys for wild pythons, the detection dogs are encountering one python for every 7 hours of dog search time. The results of this pilot program have direct management application for identifying effective tools for the capture and removal of nonindigenous species in Florida. We discuss the challenges associated with detection dogs as an EDRR tool and how lessons learned from our efforts can be used to guide current and future efforts.

0052 Fish Morphology, Symphony I & II, Friday 8 July 2011

Drew Rosati, Ivy Baremore

National Marine Fisheries Service, FL, USA

Analysis and Validation of Fin Rays for Aging Gulf Sturgeon

Fin rays were collected to analyze band pattern formation in Gulf of Mexico Sturgeon *Acipenser oxyrinchus desotoi*. Transverse segments were sectioned at approximately 0.5 mm and viewed under a microscope. Each band pair (one thin opaque, one wide translucent) was counted as an annulus. Preliminary band counts of the second marginal pectoral fin ray from 19 individuals (46.0–187.5 cm fork length (FL)) produced a range of two to 14 annuli. One juvenile (108 cm FL, seven annuli) was sampled one year after it was tagged and injected with oxytetracycline (OTC). The sectioned fin ray showed a distinct opaque band at the time of first capture, which fluoresced under UV light, followed by one complete annulus. This confirmed our assumption of one

annulus formation per year. To further validate ages, sturgeon previously marked with OTC were targeted for recapture to determine whether annular band formation is consistent among sizes and sexes. This study authenticates the second marginal fin ray as a nonlethal aging structure and represents the first confirmed age validation for Gulf sturgeon.

**0496 Herp Ecology, Symphony I & II, Sunday 10 July 2011; ASIH STOYE
PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD**

Adam Rosenblatt

Florida International University, Miami, FL, USA

Isotope Turnover Rates in Multiple Tissues of the American Alligator

Stable isotopes are increasingly being used as an ecological tool for elucidating feeding relationships amongst organisms and determining food web structure and connectivity. However, the proper interpretation of stable isotope data is difficult because many factors can affect the isotope values exhibited by individual organisms and in most cases it is not possible to account for every factor. One important factor that needs to be considered when interpreting stable isotope data is tissue-specific isotope turnover rates, which are the rates at which isotopes become incorporated into tissues. Tissue-specific turnover rates are usually also species specific and have been investigated in many mammalian, avian, and fish taxa. However, little attention has been paid to reptiles in this regard. In this study, I quantified the turnover rates for three tissues (skin, red blood cells, and plasma) in American alligators (*Alligator mississippiensis*). For all three tissues, turnover rates exceeded 112 days, much longer than most mammalian, avian, and fish taxa, and comparable to turnover rates in the few other reptile taxa that have been studied. The results from this study further confirm that interpreting stable isotope data based on estimates of turnover rates from other species and families can lead to misleading results because many taxa have different metabolic rates and physiological mechanisms. This is the first study to quantify turnover rates in any crocodylian and will be useful in elucidating crocodylian feeding patterns around the world.

0313 Poster Session I, Friday 8 July 2011

Betsie B. Rothermel¹, Emilie R. Travis¹, Robert L. Hill², Debra L. Miller³

¹Archbold Biological Station, Lake Placid, FL, USA, ²Atlanta Botanical Garden, Atlanta, GA, USA, ³The University of Georgia, Tifton, GA, USA

Stream Salamander Occupancy and Pathogen Prevalence in a Protected Watershed in the Southern Blue Ridge Mountains, USA

Southern Appalachian ecosystems are being affected by multiple environmental stressors, with unknown consequences for the region's diverse salamander assemblages. To help address the urgent need for monitoring and disease surveillance of amphibians in the Southern Blue Ridge, we surveyed stream salamanders in the headwaters of the Tallulah River in northeastern Georgia and southwestern North Carolina from May-August 2010. With significant support from volunteer citizen-scientists, we implemented occupancy surveys based on cover-object searches of three 16-m² plots at each of 27 stream sites. We also collected samples from six stream-associated species for disease testing and followed biosecurity protocols, because both *Batrachochytrium dendrobatidis* (*Bd*) and *Ranavirus* are present in pond-breeding amphibians in this watershed. Naïve occupancy estimates ranged from 59% for *Desmognathus marmoratus* to ≥ 85% for *Eurycea wilderae*, *D. ocoee*, and *D. monticola*. Black-bellied Salamanders (*D. quadramaculatus*) were captured at every site. All of the salamanders we tested (n = 101) were *Bd*-negative according to skin swab-PCR assays. However, prevalence of *Ranavirus* infection (determined by PCR assays of tail clips) ranged from 10% in *D. quadramaculatus* to 50% in *D. monticola*. Our detection of *Ranavirus* in five species and 10 of 11 stream drainages with only minimal sampling suggests this pathogen is ubiquitous even within this relatively protected watershed. Although the Upper Tallulah drainage still appears to support diverse stream salamander communities, we recommend continued monitoring to investigate the potential interactive effects of disease and future environmental changes, such as the impending loss of eastern hemlocks and climate change.

0739 Poster Session III, Sunday 10 July 2011

John Rowe, David Clark, Darren Shaw, Lawrence Wittle

Alma College, Alma, MI, USA

Histological Basis of Substrate Color-induced Melanization and Reversal of Melanization in Painted Turtles (*Chrysemys picta marginata*)

Crypsis can be facilitated by dynamic color changes that are mediated by chromatophores of the integument. The histological bases of dynamic color changes are well understood for some reptiles, such as lizards, but less so for turtles. We used pixel counts from digital images of tail-tip sections to study histological changes that occur during substrate color-induced melanization, and reversal of melanization, in Midland painted turtles (*Chrysemys picta marginata*) during two companion studies. Melanization in *C. picta marginata* can be induced in light-skinned individuals when placed on a dark

substrate, and can be reversed in dark-skinned individuals when placed on a white substrate, but without the shedding of scutes. Therefore, we predicted that color change would involve variations in intracellular melanosome concentrations within melanophores, in the deepest living epidermal cells, or both. At hatching, and in individuals that were reared on a white substrate, mean pixel density was relatively low in the stratum spinosum and corneum. In contrast, melanosome densities of the melanophore layer, stratum spinosum, and stratum corneum were relatively high in turtles that were reared on a black substrate. In a second experiment, mean pixel counts of the epidermal layers of turtles reared on a black substrate and then switched to a white substrate, were relatively low when compared to turtles that were reared on a white substrate and then switched to a black substrate. Contrary to our expectations, melanosomes were deposited or degraded in both the living and non-living cells of the epidermis.

0032 Poster Session III, Sunday 10 July 2011

Tricia Rowilson¹, Scott Willard¹, Andy Kouba², Natalie Calatayud¹, Cecilia Langhorne¹

¹Mississippi State University, Mississippi State, MS, USA, ²Memphis Zoo, Memphis, TN, USA

The Effects of Arginine Vasotocin on Mating Behavior in the Boreal Toad

Arginine vasotocin (AVT) is a neuropeptide produced in the pineal gland of the amphibian brain. AVT can induce amplexus, (male clasping), in many amphibian species during the act of mating. Lutenizing hormone releasing hormone (LHRH) and human chorionic gonadotropin (hCG) are two hormones commonly used for inducing spermiation in a wide variety of amphibian species and are also used to induce amplexus. The goal of this project is to produce a successful hormone treatment regimen that can be used by captive breeding programs to help conserve the boreal toad (*Bufo boreas boreas*). The boreal toad is currently endangered in Colorado and New Mexico, and is a protected species in Wyoming. Therefore, the objectives of this project are to: (1) determine and compare the optimal concentrations of AVT and LHRH that induce amplexus (2) compare the effectiveness of AVT and LHRH when administered concomitant with hCG; and (3) ensure optimal spermiation is maintained while eliciting optimal amplexus. Following hormone administrations, males will be paired with females and the number, time and duration of amplexus recorded via motion activated digital photography. The results of this study will aid in the ex situ conservation of this species by providing captive breeding programs with a hormone treatment regimen that is successful in attaining optimal male amplexus and reproduction. Furthermore, this project will assist in the reintroduction and recovery of the endangered boreal toad, as well as further the understanding of basic amphibian reproductive ecology and mating behaviors.

**0327 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Lukas Rüber¹, Kevin Conway², Ralf Britz¹

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

***Paedocypris*, Not a Cypriniform?! An Evaluation of the Evidence. Part 2
Molecules**

In part 2 of our presentation (for part 1, see Britz, Conway & Rüber) we look at the molecular evidence presented in support of the hypothesis that the genus *Paedocypris*, which includes some of the smallest and most developmentally truncated fishes and vertebrates, is "neither a cyprinid nor a cypriniform." We re-analysed the published dataset comprising nucleotide sequence information from six nuclear genes. We show that the six genes analysed separately show greatly differing results between each other regarding the phylogenetic position of *Paedocypris*. We found that only one gene is responsible for the position of *Paedocypris* outside of all other Cypriniformes. We use additional methods to evaluate the quality of the DNA-sequence information. We conclude by presenting the most convincing hypothesis about the phylogenetic position of *Paedocypris*.

**0252 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July
2011**

Lukas Rüber¹, Tan Heok Hui², Britz Ralf¹

¹The Natural History Museum, London, UK, ²Raffles Museum of Biodiversity Research, Singapore, Singapore

Patterns and Processes of Evolutionary Diversification in Snakeheads

One of the most emblematic freshwater fish groups of Africa and Asia are the snakeheads (Channidae). They are highly specialized airbreathing, primary freshwater fishes comprising roughly 30 species distributed in the freshwaters of Africa and Asia with a centre of diversity in the Indo-Burma and Sundaland biodiversity hotspots. Systematics of snakeheads is difficult, riddled with taxonomic confusion, and their phylogenetic history remains largely unknown. Part of the taxonomic confusion is due to the dramatic colour changes that may occur between juveniles and adults, a factor unknown to early taxonomists that greatly relied on colour patterns for species diagnoses. They are generally voracious piscivorous thrust predators with a partly amphibious lifestyle that enables them to cross short distances over land. Their constrained within-drainage dispersal leaves a perceptible imprint on present species diversity and therefore they are particularly well suited to test a variety of long debated and highly controversial historic hypotheses at different spatial scales (inter continental, continental, regional) and temporal scales (e.g. "Gondwana drift-vicariance" hypothesis, Southeast Asia palaeo-drainage" hypothesis). A molecular phylogeny based on roughly

4,500 base pairs of mitochondrial and nuclear nucleotide sequences of over 250 specimens is used to address their systematics and biogeography.

0438 Poster Session III, Sunday 10 July 2011

Matt Rucker, Justin Sipiorski, Erik Wild

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

Excellence in Undergraduate Education in Herpetology & Ichthyology at the University of Wisconsin-Stevens Point

The University of Wisconsin-Stevens Point is one of 13 comprehensive universities in the UW System and consistently ranks highly among public midwestern universities by U.S. News and World Report. The UWSP Department of Biology comprises 23 faculty and serves over 700 undergraduate biology majors. The Department takes pride in providing a broad-based biology curriculum with an emphasis on undergraduate research. The Department's success is evidenced by its receipt of the UW Regents Award (1996) and ranking of second out of 579 by the Survey of Earned Doctorates (NSF, NIH, USDA, USDE) in the number of graduates (1989-98) that went on to earn a doctorate with an average of seven a year. In particular, the Department has a long history of excellence in undergraduate teaching and research in ichthyology and herpetology due to a decorated history, a broad-based biology curriculum, opportunities for undergraduate research experiences, outstanding teaching and research collections of the UWSP Museum of Natural History, international experiences, collaboration with programs of the College of Natural Resources, active student organizations, internal grant support, and modern infrastructure and facilities. These aspects of ichthyology and herpetology at UWSP will be detailed, and evidence of success in preparing students for a variety of careers, or for graduate study will be presented.

0048 Poster Session I, Friday 8 July 2011; ASIH STORER HERPETOLOGY AWARD

Samantha Rumschlag

Miami University, Oxford, OH, USA

The Interactive Effects of *Batrachochytrium dendrobatidis*, Pesticides, and Temperature on Larval Pacific Treefrogs (*Pseudacris regilla*)

Batrachochytrium dendrobatidis (Bd), pesticides, and temperature variability have been implicated as contributing causes to amphibian declines. Although Bd and pesticides are widespread in their occurrences, they seem to negatively affect populations in certain parts of the world. This variability may suggest that certain environmental conditions, such as temperature, are necessary for enigmatic declines to occur. We propose that multiple stressors interact to create conditions that cause negative effects on

populations. The interaction of these factors may be important for understanding patterns of declines in amphibians. Here, we studied the effects of multiple stressors including Bd, pesticides, and variable temperature on a larval species experiencing declines in nature (Pacific treefrogs, *Pseudacris regilla*). We performed a laboratory factorial experiment by exposing individual larvae to different treatments of disease, pesticides (carbaryl or malathion), and temperature (15 C, 20 C, 25 C, 15 to 25 C 12:12 hour cycle).

0663 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

Ronald Russell¹, John Gilhen²

¹*Saint Mary's University, Halifax, Nova Scotia, Canada*, ²*Nova Scotia Museum of Natural History, Halifax, Nova Scotia, Canada*

Stable Isotopic Relationships Among Forest Salamanders

Natural communities are structured by a number of biotic and abiotic mechanisms. Analysis of stable isotope ratios of carbon and nitrogen can be used to describe diets and thus ecological relationships among organisms. In this work, we use stable isotope ratios of ¹³C and ¹⁵N to describe the “isotopic niche” in a guild of five caudate amphibian species native to Nova Scotia, Canada. We analyzed terrestrial and aquatic forms of *Ambystoma maculatum* and *Notophthalmus viridescens*, and terrestrial forms of *Hemidactylium scutatum*, *Ambystoma laterale*, and *Plethodon cinereus*. Of the terrestrial caudates, *A. maculatum*, *P. cinereus*, and *N. viridescens* (red eft) exhibited strongly overlapping $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values indicating similar dietary and habitat preferences. *H. scutatum* showed similar ¹⁵N signatures as the above group but depleted ¹³C signatures, possibly due to the complex habitat requirements of this amphibian. There were significant differences in both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values between *A. laterale* and *A. maculatum*, consistent with differences in diet and habitat. Movements from the aquatic to terrestrial environment, and converse were accompanied by dramatic shifts in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ isotopic ratios. Extreme disturbance of the forest canopy resulted in changes in ground cover and soil conditions ultimately affecting the isotopic signatures of salamanders.

0028 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Mark Sabaj Pérez¹, José Birindelli², Leandro Sousa³, André Netto-Ferreira², Nathan Lujan⁴

¹The Academy of Natural Sciences, Philadelphia, PA, USA, ²Museu de Zoologia da Universidade de São Paulo, São Paulo, São Paulo, Brazil, ³Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil, ⁴Texas A&M University, College Station, TX, USA

Piscatorial Travelogue of the 2007 ACSI-PIPE Expedition to Serra do Cachimbo, Brazil

In 2007, with support from the All Catfish Species Inventory (NSF DEB-0315963), a team of three Brazilian and two American ichthyologists conducted a successful expedition to Serra do Cachimbo, an ancient eroded plateau on the northern Brazilian Shield that rises 600-700 m above sea level to form the major divide between middle stretches of the Tapajós and Xingu watersheds. The effort netted over 15,000 specimens (with 365 tissue samples) in two weeks from 24 sites in the three largest river systems draining the plateau: Curuá (Xingu Dr.), Jamanxim and Teles Pires (Tapajós Dr.). Of the approximately 250 species sampled, nearly half are new with 10 recently described. Highlights included rediscovery of a lebiasinid first reported by Lauro Travassos in 1956 and a new enigmatic cichlid apparently related to *Apistogramma* despite its large size (>11 cm TL). Molecular analyses by Mariangeles Arce (PUCRS) uncovered hidden diversity among doradid catfishes videlicet: an undescribed *Leptodoras* that had eluded previous morphological analyses. Clearwater falls cascade down Cachimbo's escarpment and facilitate vicariant speciation in isolated headwaters alongside opportunities to harness hydroelectricity. One collection coincided with diversion and dry down of the upper Curuá to construct a run-of-river dam, and yielded thousands of rheophilic fishes (mostly heptapterid catfishes). Fish diversity and biogeography will be vested in an image-rich travelogue of the expedition.

0698 Poster Session I, Friday 8 July 2011

Allison Sacerdote

Lincoln Park Zoo, Chicago, IL, USA

Smooth Green Snake (*Opheodrys vernalis*) Head-Starting and Recovery Effort

Opheodrys vernalis is a species in Greatest Need of Conservation in Illinois. Population declines are largely attributed habitat loss. Lincoln Park Zoo and Lake County Forest Preserve District are collaborating on a regional recovery effort pairing habitat restoration and population management. Fourteen sites were surveyed for *O. vernalis*, with intensive search and trapping efforts at four sites with historic records. *Opheodrys vernalis* encounters were low with a detection probability of 0.19. Eight wild-caught adults were transferred to the zoo for a breeding program. Two gravid females

produced clutches of seven eggs each. A communal nest of 84 eggs was discovered on a private lot slated for development, and was incorporated into the recovery effort. Hatching success across nests was 96%. As a comparison of head-starting approaches, half of the communal nest neonates were released into in situ field enclosures in one site with extant populations to examine growth and survival rates, and to increase site fidelity post-release. The remaining neonates began ex-situ head-starting, with a subset of neonates remaining active while the remaining snakes were brumated. All snakes survived a 2.5 month brumation period. Brumated snakes increased in mass an average of 182.3% from hatching through brumation. Active snakes increased in mass an average of 351.5% over the same initial 177 days. Comparative releases are planned for June 2011, examining survival, growth, and reproduction of *O. vernalis* using soft release and hard release approaches, and comparing success of brumated head-started snakes versus snakes that were kept active.

0703 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

Allison Sacerdote¹

¹Lincoln Park Zoo, Chicago, IL, USA, ²Northern Illinois University, DeKalb, IL, USA

Assessment of Amphibian Community Structure Following Flatwoods Wetland Restoration

MacArthur Woods, an Illinois State Nature Preserve and Lake County Forest Preserve District (LCFPD) site contains imperiled flatwoods wetland habitat characterized by ephemeral pools. The site was degraded by agricultural drainage tile, severe infestation of European buckthorn, and historic fire suppression. Amphibian richness and diversity were assessed in 1999-2000, prior to restoration, revealing a depauperate community. LCFPD implemented a five-year restoration to restore hydrology, remove invasive plants, and encourage regeneration of native species. I conducted post-restoration inventory and monitoring of amphibians from 2004-2009. Monitoring was coupled with reintroduction efforts for three extirpated species: spotted salamanders (*Ambystoma maculatum*), wood frogs (*Lithobates sylvaticus*), and spring peepers (*Pseudacris crucifer*). Post-reintroduction monitoring began in 2009 and is ongoing. Monitoring data were used to assess effects of restoration efforts on amphibian community structure and to determine if natural recolonization of extirpated species occurred following restoration. Relative densities of amphibians, corrected for detection probability, varied significantly by pond and year. There was an increasing trend in amphibian richness, evenness, and Shannon-Weiner diversity (H') in the post-restoration years, independent of reintroduced species. Amphibian diversity among individual ponds exhibited annual variation. However, overall site diversity steadily increased with time since restoration from 0.5 in 1999 to 1.3 in 2009. Natural colonization of restored habitat and increased amphibian richness and diversity may be considered a measure of restoration success.

0198 Invasive Species, Symphony I & II, Sunday 10 July 2011

Daniel Saenz, Cory Adams

Southern Resrach Station, Us Forest Service, Nacogdoches, TX, USA

Sub-lethal Effects of Chinese Tallow Leaf Litter on Aquatic Amphibians

Recent evidence suggests that invasive Chinese tallow (*Triadica sebifera*) is expanding its range and becoming more abundant where it occurs. This is particularly relevant to amphibian conservation considering that the species tends to invade wetlands and the leaf litter from this tree has been shown to reduce the survival of aquatic amphibians. Recent experiments have demonstrated that, at relatively low concentrations, Chinese tallow leaf litter kills anuran eggs and larvae by reducing the dissolved oxygen and pH of water. The lethal effect of Chinese tallow leaf litter is short lived and concentrated soon after leaf fall, typically December through February in the Gulf Coastal states. We were interested in determining the sub-lethal effects of Chinese tallow leaf litter on the behavior of overwintering anuran larvae. *Lithobates catesbeianus* and *L. clamitans* are two frog species that commonly overwinter as aquatic larvae and extensively overlap in range with invasive Chinese tallow, which may expose them to the deleterious effects of the leaf litter. We conducted experiments where we exposed tadpoles to four different concentrations of tallow leaf litter and recorded water chemistry and air gulping behavior. As tallow concentration increased, oxygen and pH decreased. The highest concentrations were nearly anoxic. Both anuran species responded similarly, where tadpoles swam to the water's surface to air gulp at a significantly higher rate in the treatments with greater tallow concentration. Such changes in behavior induced by Chinese tallow could have consequences on tadpole foraging efficiency and predator avoidance, ultimately reducing fitness.

0295 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Barbara D. Sanchez, Mark A. Steele

California State University, Northridge, Northridge, CA, USA

A Comparison of Growth and Fecundity of *Paralabrax nebulifer* (Barred Sand Bass) from Polluted and Unpolluted Sites in Southern California

Environmental stressors can have detrimental effects on fish populations by limiting the abilities of individuals to acquire resources for growth, reproduction, and survival. Pollutants such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and heavy metals can cause physiological stress in fishes, especially in areas of high pollutant concentrations, like harbors. This study evaluated the impacts of pollutants on growth and fecundity of a common coastal marine fish in Southern California. This study was conducted at four sites: two polluted sites within harbors and two relatively unpolluted sites located outside of harbors. Measures of growth and condition (weight-at-age and weight-at-length) did not differ between the polluted and unpolluted sites, implying that concentrations of pollutants in the harbors studied were

not high enough to affect growth rates. Hepatosomatic index did not differ between the polluted and unpolluted sites, suggesting that the level of pollutants is not high enough to induce a response. Gonadosomatic index did not differ between sites, but this is a relatively insensitive metric of reproductive potential in multiple batch spawning species. Thus, future work will measure batch fecundity, as well as measure tissue concentrations of pollutants in the fish sampled to further explore the possibility of sub-lethal effects of pollution and to evaluate the extent to which pollutants are accumulated in the tissues of this species in different habitats.

0476 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Michael Sandel

University of Alabama, Tuscaloosa, AL, USA

Comparative Phylogeography of Coastal Plain Fishes and Amphibians

The Gulf-Atlantic Coastal Plain represents one of North America's aquatic biodiversity hotspots. This observation is likely explained by regional geologic stability, cyclic climate change, long annual hydroperiods, and a range of habitats unique to the province. Habitats unique to the GACP have promoted adaptive evolution and maintenance of relictual aquatic lineages. Despite the evolutionary distinction of many coastal plain taxa, population level processes such as speciation, introgression, and adaptation remain relatively poorly understood for this regional fauna. This study assesses mitochondrial DNA variation among four codistributed aquatic vertebrates of the GACP, in order to contribute to a synthesis of a historical biogeography for this region. The Mud Sunfish (*Acantharchus pomotis*), Banded Pygmy Sunfish (*Elassoma zonatum*), Lesser Siren (*Siren intermedia*), and Tadpole Madtom (*Noturus gyrinus*) are the most widespread species within their respective genera, and are adapted to habitats primarily restricted to the GACP. Intraspecific genealogical concordance is assessed among these lineages using maximum likelihood phylogeny of mitochondrial DNA sequences. The cytochrome *b* gene is sequenced for multiple populations (n= 20-240) sampled throughout each species distribution, in order to compare topologies and divergence times. Species are assigned to a particular distribution "class" based on genealogical concordance with patterns drawn from literature. A historical biogeographic interpretation is offered for each class, and divergence estimates for various nodes are shown to correlate with the presumed geophysical history of the landscape. The limitations of mitochondrial data are discussed, and alternate strategies for incorporating nuclear data are presented.

**0744 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD,
Minneapolis Ballroom E, Thursday 7 July 2011**

Sheri Sanders², John Placyk¹

¹University of Texas at Tyler, Tyler, TX, USA, ²University of Notre Dame, Notre Dame, IN, USA

Re-evaluation of the Pseudogeographica Subgroup of Map Turtles (Genus: *Graptemys*)

Despite repeated attempts, the phylogenetic analysis of certain taxa resist clear prediction of evolutionary relationships. Map turtle (*Graptemys*) taxonomy has seen numerous changes since their original description and many studies conflict in the placement of the western most taxa. Numerous Map Turtles are under state protection, though the current, often contended, grouping of subspecies leaves some potentially distinct groups vulnerable. In order to elucidate these historically unclear relationships, a multipronged approach was conducted. First, the group was evaluated under the ecological species concept using habitat measures, which was successful in delimiting taxa and drawing significant correlations between ecological and morphological measures, identifying characters that may be selectively active and therefore introduce noise in morphological analyses. The effect of the inclusion of these traits was addressed with morphological phylogenetics, which successfully delineated the species and illustrated the effect of including ecologically correlated traits or the highly sexually dimorphic measures traditionally used in morphological analyses. Finally, one nuclear and two mitochondrial genes were used in the genetic analysis of the largest number of individuals in any *Graptemys* molecular study to date. Increased sample size did not fully clarify the molecular relationships, but allowed for population genetic approaches, which shows promise. All analyses support the elevation of the Sabine and Mississippi Map Turtles to species level, possibly allowing these less prolific taxa to garner protection. Using *Graptemys* as a case study, this project demonstrates the importance of taxa specific considerations and the need for synthesis between numerous approaches to define these problematic groups.

**0699 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011; NIA
BEST STUDENT PAPER AWARD**

Vivianne Sant'Anna, Roberto Reis

Pontifícia Universidade Católica, Porto Alegre/RS, Brazil

Total Evidence Analysis of Needlefishes (Beloniformes: Belonidae)

The Belonidae includes 48 species of fishes that share an elongated body, dorsal and anal fins displaced posteriorly and thin, elongate jaws with large conical teeth. Despite the great morphological homogeneity, molecular techniques have suggested that Belonidae is not monophyletic. In order to test the monophyly of Belonidae, this study was designed to perform a comprehensive, total evidence phylogenetic analysis of the

family. To accomplish that, we performed a maximum parsimony analysis, without differential character weighting, based on a matrix of 257 morphological characters and 4808 base pairs from seven DNA fragments encoded for 104 terminal taxa. The ingroup included all valid species of living and fossil Belonidae. The outgroup include almost all genera of Beloniformes and three representatives of the Cyprinodontiformes. The analysis resulted in nine most parsimonious trees with 8465 steps. Our results corroborate the monophyly of the families Exocoetidae, Scomberesocidae, and Zenarchopteridae, and refute the monophyly of the families Belonidae and Hemiramphidae. For this reason we propose a new composition for the family Belonidae, with the inclusion of the genera presently in Scomberesocidae. This new classification restores the monophyly of the Belonidae, which is strongly supported by 20 molecular and 19 morphological synapomorphies. The newly arranged family Belonidae consists of 14 genera distributed in four subfamilies: Beloninae, Platybeloninae, Potamorrhaphinae, and Strongylurinae. All belonid genera are monophyletic, with the exception of *Strongylura*, which needs to have its species allocated in four genera to be restored monophyletic: *Strongylura*, *Dorybelone*, and two new genera.

0188 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011

Juan Santos¹, David Cannatella¹

¹NESCent, Durham, NC, USA, ²University of Texas at Austin, Austin, TX, USA

Evolution of Aposematism and Scale in Poison Frogs

Aposematism has evolved multiple times in poison frogs (Dendrobatidae). However, other traits are involved in its origin. Most aposematic poison frogs are ant-specialists, from which they sequester defensive alkaloids. To characterize the aposematic phenotypic network, we analyzed trait correlations among its components: conspicuousness, chemical defense, diet specialization, body mass, and metabolic rates. Conspicuous coloration was correlated with all components except resting metabolism. We also found that aposematic species have greater aerobic capacity, also related to diet specialization. Structural equation modeling, based on trait correlations, recovered "aposematism" as one of two latent variables in an integrated phenotypic network, the other being scaling with body mass and physiology ("scale"). Chemical defense and diet specialization were uniquely tied to "aposematism" while conspicuousness was related to "scale." Our results suggest two scenarios for aposematic syndrome evolution in poison frogs: (i) chemical defense and conspicuousness preceded greater aerobic capacity, and (ii) assuming that prey are patchy, diet specialization and metabolic rates evolved in tandem, and both traits subsequently facilitated the evolution of aposematism.

0605 Fish Conservation, Symphony III, Saturday 9 July 2011

Beth Sanzenbacher, Audrey Aronowsky, Mark Westneat, Krystal Villanosa, Johanna Thompson

Field Museum of Natural History, Chicago, IL, USA

WhyReef: A Scientifically Accurate Digital Game Designed to Teach Youth about the Diversity and Ecology of Coral Reefs

WhyReef is a simulated coral reef in the free virtual world of Whyville.net, developed by the Field Museum of Natural History which is targeted at youth aged 8-16. WhyReef is a digital game designed to teach youth about the diversity and ecology of coral reefs and instill in them a desire to steward the environment. WhyReef launched on March 30, 2009 and in its first year had more than 140,000 unique users, all informal players logging in on their own time. Within WhyReef, players are able to “dive” on two reefs, count and identify 50 different coral reef species (including 25 fish), play food web games to learn who-eats-whom, and test ideas about healthy and degraded reefs using a simulation. Periodically, the simulated reefs were damaged by large disturbances such as overfishing of top predators or coral bleaching. Players were able to participate in a suite activities to identify the cause and rehabilitate the reef. Designs for the physical appearance and behavior of organisms, structure of the reef ecosystem and model for the reef collapse during disturbances came from 1) museum collections, 2) research and observations by museum staff and colleagues, 3) data from government agencies, and 4) the literature. Analysis of game play in WhyReef shows that the game’s scientific accuracy allowed players to 1) make realistic scientific observations about reef species, 2) mimic scientific and policy processes to find solutions to real world problems, and 3) provide scientific discovery moments and opportunities for higher-level engagement.

0364 SSAR SIEBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Daniel Scantlebury

University of Rochester, Rochester, NY, USA

Patterns of Adaptive Radiation in West Indian Dwarf Geckos (*Sphaerodactylidae: Sphaerodactylus*)

Adaptive radiation results when natural selection promotes an ancestral lineage to diversify into ecologically adapted descendant species. Many authors consider this process the source of most of Life’s diversity, yet only a few of the most spectacular examples of the phenomenon have been scrutinized. West Indian *Anolis* lizards are perhaps the most thoroughly studied radiation, yet it is unclear to what extent the unique geological history and paleogeography of the West Indies has contributed to shaping patterns of anole diversity and ecology, necessitating comparative studies with clades that have radiated simultaneously, in the same regions and habitats as anoles. The West Indian dwarf gecko genus *Sphaerodactylus* is broadly sympatric with *Anolis*,

and available evidence (i.e., phylogenies and fossils), suggests they have long cohabited and have experienced similar historical events. These geckos are one of the dominant components of the West Indian herpetofauna, yet essentially nothing is known about their ecologies. Here, I discuss patterns of ecological and morphological diversification in *Sphaerodactylus* as revealed through geometric morphometrics and associated comparative analyses, including a novel, phylogenetic implementation of partial least squares analysis. I address the extent of morphological adaptation to environmental variables and test if patterns of adaptation are replicated among islands, as they are in anoles.

0240 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Jake Schaefer

University of Southern Mississippi, Hattiesburg, MS, USA

Patterns of Variability in Topminnow (*Fundulus*) Developmental Time not Accounted for by Size or Temperature

In ectotherms, temperature and body size are the most influential and well studied variables affecting metabolic rate. Understanding the evolution of metabolic rates is crucial to broader ecological theory. The metabolic cold adaptation (MCA) hypothesis predicts elevated metabolic rates and faster development time in habitats that have shorter growing periods. Debate over the MCA has been spirited. Studies of developmental times for fishes have not supported the MCA and conclude that most, if not all, variability is accounted for by body size and temperature. We tested MCA predictions by quantifying developmental time for multiple populations of *Fundulus* sp. across six temperatures.

0635 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Rachel Scharer¹, William F. Patterson III¹, John K Carlson², Gregg Poulakis³, Michael Cochran¹

¹University of West Florida, Pensacola, FL, USA, ²NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL, USA, ³Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Charlotte Harbor Field, FL, USA

Examination of Smalltooth Sawfish Life History in South Florida via Vertebral Aging and Laser Ablation ICPMS Analysis

Smalltooth sawfish, *Pristis pectinata*, is the first marine fish species listed as endangered, yet basic life history data critical for conservation are lacking for this species. To address this lack of information, we first estimated age of smalltooth sawfish by counting

opaque zones in vertebrae of naturally deceased fish (n =12). Transverse sections were made through vertebral centra and read with transmitted light. Opaque and translucent zones were clearly defined in vertebral sections, and each section was read independently by two readers without any prior knowledge of fish size. Age ranged from zero to eight years for fish that ranged in size between 600 mm and 4,327 mm total length. A von Bertalanffy growth function fit to size at age data resulted in parameter estimates of 5.3 m for L_{∞} and 0.159 for K when t_0 was fixed at -0.42 y, which corresponds to the estimated gestation period of the fish. Analysis of vertebral sections with laser ablation inductively coupled plasma mass spectrometry also was conducted to estimate freshwater, brackish, and saltwater residency of fish. Patterns observed in Sr:Ca ratios indicate gestation and birth (inferred from natal marks in vertebral sections) most likely occurred in estuarine waters (i.e., intermediate to high Sr:Ca values). However, neonates likely migrate to lower salinity waters where they remain through their first summer of life. Sr:Ca ratios generally increased for older fish, mostly likely indicating euryhaline to marine residency, but intra-annual patterns indicate some migration in and out of estuaries likely occurs.

0293 Fish Morphology, Symphony I & II, Friday 8 July 2011

Robert Schelly, John Sparks

American Museum of Natural History, New York, NY, USA

A New Species of *Kaupichthys* (Anguilliformes: Chlopsidae), and a Morphological Assessment of Chlopsid Relationships

Chlopsidae is a family of small tropical and subtropical marine eels comprising eight genera and 24 species, which are commonly referred to as false morays. We report on a new species in the genus *Kaupichthys* (Anguilliformes: Chlopsidae) from nearshore reef habitats of Madagascar. An examination of chlopsid intrarelationships is presented based on morphological characters of the new species and representatives of the other chlopsid genera. Chlopsid affinities within Anguilliformes have been inconsistent across the few phylogenetic studies to date; the family has been aligned variously with muraenids, synphobranchids, nemichthyids, or even recovered as the sister group to a large assemblage of anguilliform families. Our comparative anatomical survey of chlopsids is expanded across anguilliforms to assess the placement of chlopsids within the order.

0022 Poster Session I, Friday 8 July 2011

Rick Scherer¹, Erin Muths², Barry Noon¹, Sara Oyer-McCance²

¹Colorado State University, Fort Collins, CO, USA, ²U.S. Geological Survey, Fort Collins, CO, USA

Genetic Structure in a Relict Population of Wood Frogs (*Lithobates sylvaticus*)

Habitat fragmentation and the associated reduction in connectivity between habitat patches are cited commonly as causes of genetic differentiation and reduced genetic variation in animal populations. We used eight microsatellite markers to test hypotheses regarding the genetic structure and levels of genetic variation in a relict population of wood frogs (*Lithobates sylvaticus*) in northern Colorado. We also tested for evidence of a recent population bottleneck and for isolation-by-distance. Results from the clustering algorithm in Program STRUCTURE indicated the population is partitioned into two genetic clusters and an estimate of F_{ST} provided strong evidence of differentiation between the clusters. Though a pattern of isolation-by-distance was supported, other processes may also affect genetic differentiation. Genetic variability in the population is low relative to variability reported in other studies of wood frogs, but we found no evidence that a recent bottleneck was responsible for this. Efforts to preserve wood frogs in this area and improve chances of the populations to persist could include increasing the size and spatial distribution of the populations and improving gene flow between the genetic clusters. These actions would be facilitated by the construction or restoration of wetlands in the landscape between clusters.

0765 Poster Session II, Saturday 9 July 2011

Victoria Schneider, Daniel Kashian

Wayne State University, Detroit, MI, USA

The Effects of Emerald Ash Borer-caused Tree Mortality on Desiccation Rates of Juvenile Wood Frogs (*Lithobates clamitans*) in Southeastern Michigan

Exotic insects may have indirect impacts on the population dynamics of sensitive species in animal communities as well as direct effects on their plant hosts. Emerald ash borer (EAB) is a wood-boring insect native to Asia first identified on ash species in the Detroit area in 2002. EAB is now found throughout Michigan as well as fourteen other states. EAB-caused mortality differs from the historical disturbance regime of the region because it creates many canopy gaps synchronized in time that have the potential to alter environmental conditions and thus sensitive animal populations such as amphibians at the forest floor. In particular, terrestrial habitat quality next to breeding ponds is important for juvenile populations because of amphibians' high surface area-to-volume ratio and thus high risk of desiccation. We compared water loss in juvenile wood frogs in ephemeral ponds beneath an open canopy due to EAB and a closed canopy unaffected by EAB. Water loss was significantly higher for juveniles beneath the open canopy, and was significantly higher within the first few hours compared to

juveniles in the closed canopy site. Soil moisture was significantly lower in areas of ash mortality. These results are significant because killed ash trees remain standing for 3-5 years after dying, delaying the creation of refugia for amphibians as coarse woody debris. Although desiccation is a mortal risk normally faced by juvenile amphibians, extensive tree mortality exacerbates this risk by quickly creating openings in forest canopy cover that alter the forest floor environment.

**0714 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Nalani K. Schnell¹, G. David Johnson²

¹ *Virginia Institute of Marine Science, Gloucester Point, VA, USA*, ² *National Museum of Natural History, Smithsonian Institution, Washington, DC, USA*

**Development of the Upper Jaw in Squirrelfishes and Soldierfishes
(Beryciformes: Holocentridae): A Unique Ontogenetic Trajectory**

The Holocentridae are nocturnal fishes inhabiting shallow to deep water coral and rocky reefs in tropical parts of the Indian, Pacific and Atlantic Oceans. Two subfamilies can be distinguished, the squirrelfishes (Holocentrinae) and the soldierfishes (Miripristinae). Unlike the adults, holocentrid larvae are pelagic and are characterized by elaborate head spination, including prominent rostral, supraoccipital and preopercular spines. The rostral spine, formed by ephemeral fusion of the paired nasals, can project far anterior to the mouth. The spine-bearing bones, the lower jaw bones and one set of upper jaw bones (maxillae) are the first to ossify (at SL: 1.4 mm) during early life history. In several cleared and double stained ontogenetic series of Holocentridae (SL: 1.4 mm - 35 mm) we found a unique ontogenetic trajectory of the other set of upper jaw bones (premaxillae). The premaxillae develop late, well after the other jaw bones and head spines are developed and most of the remaining skeleton is ossified (between 5.9 mm and 6.6 mm). Usually in larval fishes both sets of upper jaw bones as well as the lower jaw, the caudal fin and pectoral girdle are the first elements to ossify in order to ensure feeding and swimming mechanics. We address the questions of how feeding is managed without premaxillae, whether the rostral spine has a role in feeding in the absence of premaxillae and whether feeding changes during early life history. Furthermore we compare our results with jaw and rostrum development in other larvae exhibiting a rostral spine, e.g. tilefishes (Malacanthidae).

0120 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Danna Schock

Keyano College, Fort McMurray, Alberta, Canada

Amphibian Ranaviruses in Canada - Historical, Current and Future Research Directions

Ranaviruses have been documented in Canadian amphibian populations from British Columbia to Prince Edward Island, and as far north as Norman Wells in the Northwest Territories. On-going research in Canada falls under four broad categories: 1) field studies that examine host range and geographic range, usually as part of studies that also investigate the prevalence of chytrid fungus infections in provincially or federally listed amphibian species; 2) field + lab studies that seek to identify ecological and environmental correlates with disease outbreaks; 3) validating and improving non-lethal diagnostic tests; and 4) viral biology including annotating viral genomes and identifying mediators of gene expression. To date, most amphibian ranaviruses documented in Canada have been isolated from ranid frogs and appear to be FV3-like. A smaller number of studies have focussed on ranaviruses from tiger salamanders (*Ambystomatidae*) in Alberta, Saskatchewan and Manitoba, and thus far, all isolates have been identified as *Ambystoma tigrinum* virus (ATV). Comparatively little work has examined other families of salamanders or anurans. This is an important research need given the multi-host nature of ranaviruses. Studies that are needed for management and conservation purposes include long-term (10+ yr) studies that can address the effects of ranaviruses on long-term host population stability and persistence, the effects of ranaviruses on amphibian communities (not just populations of focal species), and studies that identify immunological and ecological correlates with disease outbreaks and effects of sublethal infections.

0755 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

James Schulte

Clarkson University, Potsdam, NY, USA

Overestimation of Bayesian Credibility Values with Nuclear DNA Data: An Example Using Liolaemini Lizards

Phylogenetic relationships among 134 species of South American Liolaemini lizards are examined using analyses of six nuclear DNA encoded genes. All major lineages within *Liolaemus* and *Phymaturus* are included. Over 10600 base pairs of nuclear DNA are analyzed separately and combined using maximum likelihood and several Bayesian estimation methods including standard MrBayes runs, reversible jump heterotachy models implemented in BayesPhylogenies, and Phycas with and without a polytomy prior assumed. Phylogenetic hypotheses generated from nuclear DNA are generally congruent with trees based on mtDNA data alone as are separate nuclear gene trees compared to the concatenated combined nuclear tree. Combined analyses provide

robust support for relationships among most major clades of Liolaemini lizards. However, the use of Phycas assuming a polytomy prior consistently identifies branches in the Liolaemini gene trees that would be incorrectly inferred to be strongly supported using MrBayes or BEAST that do not allow for polytomies in phylogenetic estimation. These results corroborate numerous previous studies indicating Bayesian credibility values can overestimate branch support. The use of maximum likelihood bootstrap values compared with Phycas polytomy prior credibility values both above 95% is recommended to be used for strongly supported branches in phylogenetic inference.

0093 Fish Conservation, Symphony III, Saturday 9 July 2011

Michael R. Schwemm, Anthony A. Echelle, Ron A. Van Den Bussche

Oklahoma State University, Stillwater, OK, USA

Conservation Implications of Fragmentation of the Threatened Leopard Darter, *Percina pantherina*

A history of low abundance and limited distribution has characterized *Percina pantherina*, a percid endemic to the Little River system, SE Oklahoma and SW Arkansas. Concerns of habitat fragmentation by reservoir construction and agricultural/silvicultural perturbations have been apparent since its federal listing in 1978. Here, we compare levels of heterozygosity and population subdivision and estimate genetic effective sizes to evaluate the potential loss of genetic variation. Genetic variation at eight microsatellite loci revealed relatively low levels of allele richness ($A_R = 3.74$ to 6.60) and heterozygosity ($H_e = 0.461$ - 0.636) within populations. Tributary streams (now separated by at least one reservoir) differed significantly in allele frequencies, with 10.2% of the genetic diversity attributable to differences among tributaries. Maximum likelihood (MIGRATE) and Bayesian (MSVAR) coalescence approaches indicate that current effective population sizes are similar with those from the summary statistic approach of LDNe, and about three orders of magnitude smaller than the ancestral population sizes and one order smaller than the long-term effective sizes. The point estimates of time since the start of the decline (69 to 398 yrs) and the associated 95% support limits are consistent with the hypothesis that low diversity is a result of fragmentation in the last century.

0328 Poster Session II, Saturday 9 July 2011

Arun Sethuraman, Morgan Becker, Fredric Janzen

Iowa State University, Ames, IA, USA

Cryptic Phylogeographic Patterns in Midwestern Populations of Blanding's Turtles (*Emydoidea blandingii*)

As part of a population genetics study of the imperiled Blanding's Turtle, we genotyped 212 turtles sampled across 18 populations in Iowa, Illinois, Nebraska and Minnesota using 8 microsatellite markers. Isolation by Distance analysis captured little of the overall genetic variance ($R^2 = 0.04$ in a plot of genetic versus geographic distance). Further investigation detected considerable structure among 5 distinct groups of populations, with populations typically structuring into groups that accord with expected patterns of post-glacial re-colonization of the upper Midwest. Unexpectedly, though, populations from Grant County, Nebraska grouped with turtles sampled from the Greater Chicago Metropolitan Area, a pattern detected at all levels of population structure ($K=1$ through 9) and with multiple statistical inference tools. Divergence and ancestral gene flow estimates reveal a split between *E. blandingii* populations in these two regions around 50000 years ago (95% CI of 39590-12025 years), with negligible bidirectional migration since. Sequencing of the microsatellite flanking regions and rebuilding the population phylogeny will reveal patterns of ancestral divergence and resolve whether the unexpected pattern resulted from convergent evolution or saturation of microsatellites, or from incomplete lineage sorting from a putative ancestor in the southern Great Plains between these populations.

0475 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

H. Bradley Shaffer¹, Robert Thomson¹, Phillip Spinks¹, Thomas Near²

¹*University of California, Davis, Davis, CA, USA*, ²*Yale University, New Haven, CT, USA*

How Old are the Living Turtles?

Turtle evolution and phylogenetics has benefitted from a large effort in the last decade, and many previously controversial issues are reaching resolution. However, two key issues in the deep evolutionary history of turtles remain unresolved. The first is the position of turtles within Amniota, although the recently completed painted turtle genome project is helping to solve this phylogenetic problem. The second, and the focus of this talk, is the age of the most recent common ancestor (MRCA) of living turtles. Traditionally, the age of fossil taxon *Proterochersis* have been taken as strong evidence that the living turtle MRCA is approximately 210 million years old. However, more recent paleontological and morphological analyses suggest that *Proterochersis* falls outside of the living turtles and therefore provides no evidence on their age. These analyses place a much younger, late Jurassic age on living turtles. Resolving this age is important, both for our basic understanding of the tempo of chelonian diversification

and for phylogenetic analyses of key conservation issues. To help resolve the age of turtles, we conducted phylogenetic analyses of a 10-gene, 143 morphological character data set of 28 living and 11 fossil taxa representatives of the major lineages of turtles and estimated the age of the living turtle MRCA. Our estimate was approximately 230 million years, nearly identical to the age based on *Proterochersis*, supporting the original estimate based on this early fossil specimen.

0550 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Amanda Shearin¹, Aram Calhoun¹, Cynthia Loftin²

¹University of Maine, Orono, ME, USA, ²U.S. Geological Survey, Cooperative Fish and Wildlife Research Unit, Orono, ME, USA

Automated Audio Recording Devices: Implications for Listener-Based Amphibian Surveys in Maine (USA)

Volunteer-based audio surveys are valuable tools for documenting trends in amphibian communities. Current sampling protocols are not region or species-specific, however, and they may not be suitable for detecting rare or audibly cryptic species. We used automated audio recording systems (ARS) to record calling amphibians at 12 lakes and four vernal pools in Maine, USA, during 2006-2009. These systems were programmed to record a 2-3 minute audio clip every hour from 30 minutes past sunset until sunrise. Individual audio clips selected from the sampling time period (30 minutes past sunset to 0100 h) described in the North American Amphibian Monitoring Program (NAAMP) detected fewer species than were detected during recordings for the entire night. Individual audio clips from the NAAMP sampling period underestimated the Calling Index for *Lithobates septentrionalis* and *L. clamitans* during 33 and 24%, respectively, of sampling nights. Time of maximum detection and full chorusing of *L. septentrionalis*, *L. clamitans*, and *L. palustris* occurred after the 0100 h NAAMP sampling end time. Julian date was the best predictor of calling occurrence for *Hyla versicolor*, *L. catesbeiana*, *L. pipiens*, *L. septentrionalis*, and *L. sylvatica*, however, additional environmental variables were needed to predict calling occurrence by *Pseudacris crucifer*, *L. clamitans*, and *L. palustris*. The sampling period described in the NAAMP protocol may result in omissions and misclassifications of chorus sizes for certain species. These potential errors should be considered when interpreting trends generated from generalized amphibian audio surveys.

**0169 Herp Genomics, Morphology & Development, Symphony I & II, Monday
11 July 2011**

Christopher Sheil, Sean Harrington

John Carroll University, University Heights, OH, USA

**A Comprehensive Study of Heterochrony Among Amphibians Using
PARSIMOV**

Studies of relative timing of formation and ossification of skeletal elements have shed light on the developmental and evolutionary origins of various aspects of the tetrapod skeleton. Recently, software has been developed that automates the process of inferring ancestral sequences of developmental events, thereby facilitating the study of heterochrony in these data. PARSIMOV is one such program. Ossification sequence data were collected from representatives of families within Anura, Gymnophiona, and Caudata to reconstruct ossification sequences of internal nodes within the phylogenetic hypothesis of Frost et al. (2006) to identify instances of heterochrony in various structural units of the skeleton of these amphibians.

**0357 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday
10 July 2011**

Donald Shepard¹, Frank Burbrink²

*¹University of Minnesota, Saint Paul, MN, USA, ²College of Staten Island-CUNY,
Staten Island, NY, USA*

**Local-scale Environmental Variation Generates Highly Divergent Lineages
Associated with Stream Drainages in a Terrestrial Salamander, *Plethodon
caddoensis***

Spatial and temporal environmental heterogeneity can have profound effects on species that are tightly linked to their environments. The Caddo Mountain Salamander (*Plethodon caddoensis*) inhabits a unique physiographic section of the Ouachita Mountains of Arkansas, a region in which Pleistocene climatic fluctuations have been implicated in driving lineage diversification in two other closely related salamanders. We examined *P. caddoensis* to determine whether it was similarly impacted by historic climatic changes and to test whether physiographic features unique to the area influenced its pattern of diversification. Using mtDNA, we found that *P. caddoensis* is composed of four highly divergent, geographically distinct lineages that abut one another along an east-west axis (8.3 - 10.9% mean uncorrected sequence divergence). Phylogeographic structure was significantly related to both geographic distance and stream drainage basins, indicating that connectivity of streams and stream-associated habitats influence patterns of interpopulation gene flow. Lineages originated during the Middle Miocene (9 - 11 mya) and population size decreased in all lineages during the Pleistocene. Surface geology and precipitation were the most important variables predicting the species distribution.

Our results show that the unique physiographic features of the region coupled with species response to climatic factors have driven lineage diversification and phylogeographic structure in *P. caddoensis*. Variation in responses to historic climatic fluctuations among salamander species in this region underscore the importance of integrating species ecology with other factors such as geology and hydrology in order to better understand the effects of climate change on species with close associations to their environments.

0033 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

David Shiffman¹, Bryan Frazier², John Kucklick³, Tracey Sutton⁴, Kristene Parsons⁴, Gorka Sancho¹

¹College of Charleston, Charleston, SC, USA, ²South Carolina Department of Natural Resources, Charleston, SC, USA, ³National Institute of Standards and Technology, Charleston, SC, USA, ⁴Virginia Institute of Marine Sciences, Gloucester Point, VA, USA

Detection of an Ontogenetic Shift in the Diet of the Sandbar Shark (*Carcharhinus plumbeus*, Nardo 1827) Using Minimally Invasive $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Stable Isotope Analysis.

The sandbar shark, *Carcharhinus plumbeus*, is a common and economically important species in the western North Atlantic. Additional diet and trophic level information would facilitate the creation of an ecosystem-based management plan. Diet analyses using stomach contents in other regions have revealed an ontogenetic shift in the diet of sandbar sharks in two different areas, but whether this shift takes place throughout their range is unknown. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope analysis is a minimally invasive and non-lethal method for determining diet and trophic level. Significant differences in $\delta^{13}\text{C}$ signatures were found between young-of-year and juveniles, suggesting that South Carolina sandbar sharks have a similar ontogenetic shift as sandbar sharks in other regions. Differences in total occupied niche area and $\delta^{15}\text{N}$ range indicated that young-of-year sharks have more diverse diets than juveniles. Data from suspected prey species is also described.

0019 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Natalia Shishova¹, Victor Uteshev¹, Svetlana Kaurova¹, Ludmila Kramarova², Robert Browne³, Edit Gakhova¹

¹*Institute of Cell Biophysics, Russian Academy of Sciences, Pushchino, Moscow Region, Russia*, ²*Institute of Theoretical and Experimental Biophysics, Russian Academy of Sciences, Pushchino, Moscow Region, Russia*, ³*Centre for Research and Conservation, Royal Zoological Society of Antwerp, Antwerp, Belgium*

Cryopreservation of Sperm for Conservation of Threatened Amphibians

At present, cryopreservation is unique and reliable technique for the long-term conservation of amphibian germplasm. In 1996 at the Institute of Cell Biophysics, Russian Academy of Sciences, we cryopreserved spermatozoa from the macerated testis of *Rana temporaria* and *Bufo bufo* using a cryodiluent of 15% DMSO, 10% sucrose, and 1% BSA, which proved both motile and fertile in producing substantial numbers of metamorphosis. Recently, protocols were developed for the cryopreservation of hormonally induced sperm (HIS) sampled through spermic urine. We induced spermiation in *R. temporaria* through the intraperitoneal administration of 50 µg LHRH and sampled HIS. We diluted spermic urine to a final concentration of 1×10^8 cell/ml in four cryodiluents to give a final concentration in cryosuspensions of: 1. DMSO, (½ ringer's solution (RS) with 10% sucrose and 12% DMSO); 2. DMSO/egg yolk, (cryodiluent 1. with 10% egg yolk); 3. dimethylformamide (DMFA), (½ RS, 10% sucrose, 12% DMFA); or 4. MIS (motility inhibiting saline)/glycerol, (MIS, 5% glycerol, 2.5% sucrose, 5% egg yolk). The cryosuspensions were then frozen in a simple apparatus over LN₂ vapour, then thawed and osmotically equilibrated. After thawing and equilibration the DMFA protocol produced significantly higher motility and membrane integrity. Egg yolk did not improve recovery and MIS/glycerol provided very low recovery. Although hatching rates were the same between cryodiluents, DMFA produced significantly higher survival of larvae 7 days post hatch. In conclusion, we developed reliable protocols for production and cryopreservation of HIS from *R. temporaria*, which may be transferable to many threatened Ranid species.

0280 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011

Brian Sidlauskas, Douglas F. Markle

Oregon State University, Corvallis, OR, USA

How We Learned to Stop Worrying and Love the Fire Marshal: A Practical Guide to Saving an Ichthyology Collection

Changing institutional priorities, high cost and a troublesome flammable preservative often threaten the stability and support of ichthyology collections despite their scientific importance. The Oregon State University Ichthyology Collection (OSUIC) has represented a major center of research and education since 1935, but nevertheless came

under substantial threat in 2009 when its building entered renovation and was found to be massively out-of-compliance with fire and seismic safety regulations. Initial proposed solutions, such as moving the collection to an off-campus warehouse, would have destroyed much of the collection's scientific and educational potential. This talk will detail the successful negotiation and good fortune that helped the OSUIC avoid that grim fate and parlay the crisis into substantial new growth. As a result of the trial by fire-suppression, the collection has secured funding for a renovated on-campus facility from OSU and the NSF. Post-renovation, the OSUIC will comply with all fire and seismic safety codes, enjoy a 43% increase in shelf space due to a new compact shelving system, and house its largest specimens in over 90 archival stainless-steel tanks. Imminent upgrades also include complete computerization of the catalog, the development of a digital teaching collection and online course on the Systematics of Fishes, and renewed growth resulting from expeditions to Guyana and the Oregon outback. With luck, other collections undergoing similar tribulations will be able to recapitulate the steps that led to the salvation of the OSUIC, for each collection that is deaccessioned or warehoused represents a major loss for biodiversity science.

0013 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Dustin Siegel¹, Kevin Gribbins², Robert Aldridge¹

¹*Saint Louis University, St. Louis, MO, USA*, ²*Wittenberg University, Springfield, OH, USA*

The Function of the Sexual Collecting Ducts in *Notophthalmus viridescens*

Kidneys with sexual function are rare in vertebrates and restricted to stickleback fishes, squamates (lizards and snakes), and salamanders. Little data exist on all aspects of sexual kidneys in salamanders. Recently we have reported the presence of sexual segments in at least Ambystomatidae, Plethodontidae, Rhyacotritonidae, and Salamandridae, described the morphology of the sexual segment in *Ambystoma maculatum*, and assessed the seasonal secretory activity of the sexual segment in comparison to other sexual glands in *Notophthalmus viridescens*. Here we present data indicating that the secretions from the sexual collecting ducts elicit undulations of the axial filament of sperm from *N. viridescens*. However, hypoosmotic shock of the spermatozoa is required for axial filament activation. Furthermore, hypoosmotic shock elicits vibration of the spermatozoa by activation of the marginal filament and subsequent motility of the undulating membrane. The axial filaments of "mature sperm" from the testis could not be activated indicating that sperm must complete the maturation process in either the extratesticular or Wolffian ducts to respond to the sexual segment secretions.

0018 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E,
Friday 8 July 2011

Aimee Silla

University of Western Australia, Perth, Western Australia, Australia

Effect of Multiple Priming Injections of Luteinizing Hormone-releasing Hormone on Spermiation and Ovulation in Guenther's Toadlet, *Pseudophryne guentheri*

In most vertebrates, gametogenesis and gamete-release depend on the pulsatile secretion of luteinizing hormone-releasing hormone (LHRH). Studies attempting to artificially stimulate ovulation and spermiation in frogs may benefit from mimicking the naturally episodic secretion of LHRH by administering multiple priming injections of a synthetic analogue. This study investigated the impact of multiple priming injections of LHRHa on gamete-release in the Australian toadlet *Pseudophryne guentheri*. Toadlets were administered a single dose of 2µg/g LHRHa without a priming injection (no priming), or preceded by one (one priming) or two (two priming) injections of 0.4µg/g LHRHa. No priming induced the release of the highest number of spermatozoa, with a step-wise decrease in the number of spermatozoa released in the one and two priming treatments respectively. No significant difference in sperm viability was detected among treatments. Control females failed to release oocytes, while those administered an ovulatory dose without priming exhibited a poor ovulatory response. The remaining two priming treatments (one and two priming) successfully induced 100% of females to expel an entire clutch. Oocytes obtained from the no, or two priming treatments all failed to fertilise, however oocytes obtained from the one priming treatment displayed an average fertilisation success of 97%. In conclusion, results from this study show that ovulation is most effectively induced in female *P. guentheri* by administering a single priming injection prior to a higher dose of LHRHa. In contrast, spermiation was most effectively induced by the administration of a single LHRHa injection in the absence of priming.

0330 Poster Session I, Friday 8 July 2011

Colin Simpfendorfer¹, Beau Yeiser², Tonya Wiley³, Gregg Poulakis⁴, Philip Stevens⁴, Michelle Heupel⁵

¹James Cook University, Fishing and Fisheries Research Centre, Townsville, Australia, ²Florida Fish and Wildlife Conservation Commission, Tequesta Field Laboratory, Tequesta, FL, USA, ³Haven Worth Consulting, League City, TX, USA, ⁴Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA, ⁵James Cook University, School of Earth and Environmental Sciences, Townsville, Australia

Environmental Influences on the Spatial Ecology of Juvenile Smalltooth Sawfish (*Pristis pectinata*): Results from Acoustic Monitoring.

To aid recovery efforts of smalltooth sawfish (*Pristis pectinata*) populations in U.S. waters a research project was developed to assess how changes in environmental conditions within estuarine areas affected the presence, movements, and activity space of this endangered species. Forty juvenile *P. pectinata* were fitted with acoustic tags and monitored within the lower 27 km of the Caloosahatchee River estuary, Florida, between 2005 and 2007. Sawfish were monitored within the study site from 1 to 473 days, and the number of consecutive days present ranged from 1 to 125. Residency index values for individuals varied considerably, with annual means highest in 2005 (0.95) and lowest in 2007 (0.73) when several *P. pectinata* moved upriver beyond detection range during drier conditions. Mean daily activity space was 1.42 km of river distance. The distance between 30-minute centers of activity was typically <0.1 km, suggesting limited movement over short time scales. Salinity electivity analysis demonstrated an affinity for salinities between 18 and at least 24 psu, suggesting movements are likely made in part, to remain within this range. Thus, freshwater flow from Lake Okeechobee (and its effect on salinity) affects the location of individuals within the estuary, although it remains unclear whether or not these movements are threatening recovery.

0234 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Phillip Skipwith, Aaron Bauer, Todd Jackman

Villanova University, Villanova, PA, USA

Multilocus Systematics and Divergence Times of New Caledonian Diplodactylids

Diplodactylid geckos represent one of two squamate lineages to have undergone a major radiation on New Caledonia. We used mitochondrial DNA (ND2 + 5 tRNAs) and five independent nuclear exons (KIF24, KIAA1549, RAG1, MXRA5, PDC) to re-examine the placement of the New Caledonian radiation within the Diplodactylidae as well as estimate times of divergence. Both mtDNA and nucDNA suggest that there is significant

species-level diversification within *Bavayia* and *Dierogekko* despite both genera being morphologically conservative. Additionally, all datasets agree that *Rhacodactylus* is non-monophyletic and is composed of several unrelated lineages. Despite the inclusion of more than 5,000 bp of molecular data, the base of the New Caledonian tree consists of relatively short branches and remains poorly resolved. The concatenation of nuclear genes results in improved support for certain nodes also recovered in the mtDNA phylogeny, but not seen in individual nuclear gene trees. Dating analyses suggest that this clade underwent a rapid diversification early in its divergence. Coalescent dating methods (both concatenation and species tree analyses) suggest that the New Caledonian radiation is younger than implied solely based upon suspect cladogenic geological events.

0278 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Gregory Skomal, John Chisholm, Steven Correia

MA Marine Fisheries, New Bedford, MA, USA

Implications of Increasing Pinniped Populations on the Diet and Abundance of White Sharks off the Coast of Massachusetts

Although the occurrence of the white shark, *Carcharodon carcharias*, is well documented in the North Atlantic, the species is relatively rare and much of what is known about its distribution and movements is based on historical sightings data. The advent of new tagging technology coupled with the existence of white shark "hotspots" near pinniped colonies have allowed researchers to investigate the ecology of this species in the Pacific and Indian Oceans, but its elusive nature in the Atlantic has hampered such studies in this region. However, the numbers of white shark sightings and white shark-pinniped predation events have been rising off the coast of Massachusetts in recent years and, in particular, near Monomoy Island on Cape Cod, which hosts a large growing population of gray seals (*Halichoerus grypus*). While the perceived increase in shark predation on gray seals can be attributed to several factors, it is feasible that white sharks, which were thought to primarily scavenge cetaceans in the Atlantic, are expanding their diet in response to regional changes in seal abundance. Based on documented changes in white shark populations exhibited in other parts of the world, we anticipate that the number of white shark sightings and seal interactions will continue to rise off the coast of Massachusetts.

0285 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Christopher E. Smith¹, Erica P. Hoaglund², Jeffrey B. LeClere³, Jim Scharosch⁴, Tony Gamble⁵

¹University of Minnesota, Saint Paul, MN, USA, ²Minnesota Department of Natural Resources, Division of Ecological and Water Resources - Nongame Program, Saint Paul, MN, USA, ³878 Galtier Street, Saint Paul, MN, USA, ⁴811 Boulder Drive, Center Point, IA, USA, ⁵University of Minnesota, Minneapolis, MN, USA

Two Naturally Occurring Intergeneric Hybrids from the Snake Tribe Lampropeltini (Squamata: Colubridae) from the Midwestern United States

Intergeneric hybridization in nature appears to be uncommon among squamates, with only one case (*Conolophus subcristatus* x *Amblyrhynchus cristatus*) confirmed using genetic data. This study describes two intergeneric hybrid snake specimens (both *Pituophis catenifer sayi* x *Pantherophis vulpinus*). The two specimens appear morphologically intermediate between the putative parental species, *Pituophis c. sayi* and *Pantherophis vulpinus*. Both originated from the midwestern United States, with one specimen collected from southeastern Minnesota and the other from southern Iowa. Hybrid status was verified by comparing DNA sequence data from each specimen with sequences from the likely parental species. Both hybrid specimens were found to possess *Pituophis c. sayi* mitochondrial DNA haplotypes. Further support for the specimen's hybrid status was obtained by the examination of a nuclear gene fragment (Vimentin intron 5), which showed that the hybrid specimens were heterozygous at most variable sites. We also collected and analyzed morphometric and meristic data from 12 *P. vulpinus*, 12 *P. c. sayi*, and the two hybrid specimens. Principal component analysis revealed the hybrid specimens to be morphologically intermediate between the parental species. These two individuals represent only the second and third confirmed specimens of naturally occurring intergeneric hybrids among squamate reptile species.

0700 Poster Session II, Saturday 9 July 2011

Gerald Smith¹, Thomas Dowling¹

¹University of Michigan, Ann Arbor, MI, USA, ²Arizona State University, Tempe, AZ, USA

Effect of Stream Captures on Evolution in Western United States Freshwater Fishes

Fish diversity is lower in the geologically unstable landscapes of western US compared to the stable east because of high extinction rates in the west. We test the hypothesis that captures of neighboring river drainages have consequences for genetic structure of populations. Many western drainages such as the Columbia and Colorado are composites of smaller drainages that existed before late Pliocene climate changes; the faunas may be larger depending on the duration of isolation prior to the connection. Stream captures and lake spillovers between drainage basins in extensional terrains such

as the Basin and Range may bring whole populations of previously isolated relatives into genetic contact. The prediction is that populations brought together in unequal numbers may merge genetically, with loss or gain of apomorphic traits, whereas sudden sympatry of equally large populations of relatives may result in ecological divergence. Where genetic contact consists of occasional immigrants from allopatric sister populations isolated by distance, as in stable drainages of the eastern US, divergence may be enhanced slowly by mate choice selection and behavioral isolating mechanisms. These lineages experience lower rates of introgressive losses of populations. Ecological divergence of sister species sometimes occurs as a consequence of stream capture and large-scale genetic contact, according to evidence from fossils and molecular cladistics.

0546 Poster Session I, Friday 8 July 2011

Kelcee Smith, John Carlson

National Marine Fisheries Service, Panama City, FL, USA

Status and Population Viability of the Alabama shad (*Alosa alabamae*)

Historically, Alabama shad have been recorded as far north as the Ohio River in West Virginia and were commonly found in other Mississippi River tributaries including the Red, Arkansas, Missouri, and Tennessee Rivers. Over the last several decades, habitat fragmentation as a result of locks and dams blocking access to spawning areas and altering hydrology and river substrates has resulted in declines in the range of Alabama shad. The habitat fragmentation and reduction in range caused the National Marine Fisheries Service to list this species as Species of Concern in 2004. We evaluated new sources of data to provide an update as to whether Alabama shad should be retained or removed from the Species of Concern list. Surveys from scientists at Universities, state and federal facilities, and non-profit organizations suggest that the population has undergone severe fragmentation, but spawning populations persist in the Suwannee, Choctawhatchee, Escambia, and Pascagoula Rivers, with the largest spawning population of Alabama shad in the Apalachicola River in Florida. Population Viability Analysis indicates populations could increase if favorable environmental conditions are restored throughout its range. Scenarios exploring increases in habitat availability and survivorship all resulted in increases in the number of spawners. Positive results such as these provide incentives to advance research and develop management plans to enable the species to increase in abundance and re-occupy historic systems.

**0673 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Leo Smith

The Field Museum, Chicago, IL, USA

Approaching the Percomorph Problem

Steps toward resolving relationships among the diversity of percomorph fishes remain highly contentious. Previous morphological attempts to resolve the percomorph bush have often failed to include sufficient taxon and/or character sampling to allow for substantive revisions to percomorph taxonomy. Recent molecular studies have addressed these problems with some success, but they have highlighted new issues regarding homoplasy and gene concordance. The bottom line is that progress will not be made without morphological and molecular studies testing each others hypotheses in an attempt to refine previous homology statements and propose new relationships based eventually on combined analyses. This talk will outline a first pass at molecular approaches to resolving the percomorph bush, including an example from one of the novel molecular groupings.

0589 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Matthew Smith

University of Arkansas, Fayetteville, AR, USA

Is the Trophic Morphology of Snakes Inducible by Variation in Prey Size and Abundance?

The trophic morphology of snakes is a complex mosaic of structures that interact and articulate to function as a spectacular unit capable of ingesting large prey items. Each of the disparate parts may vary in size, shape, and/or ontogenetic development; influencing the overall performance of an individual. I tested the hypothesis that trophic morphology of rattlesnakes is inducible by prey size and/or abundance. Juvenile prairie rattlesnakes (*Crotalus viridis viridis*) were manipulated to control for resource level, prey 'size', snake population of origin, and litter. Neonate rattlesnakes were fed a diet of thawed rodents or force-fed rodent homogenate for 15 months, while geometric morphometrics were employed to quantify shape and size of integrated components of trophic morphology. ANCOVA and MANCOVA procedures were used to test for differences in size and shape respectively. The ontogenetic relationship between body size (SVL) and trophic morphology was examined using Procrustes Trajectory Analysis (PTA). Results suggest that the litter effect, whether through maternal effects or genetic differences, far outweighs the influence of prey size and resource level. The relative contributions of all three factors can be examined in the context of previously documented patterns of geographic variation in morphology to provide insights into the ecology and population structure of these organisms. My results have improved on past research through the use of geometric morphometrics and the careful control of both

genetic and environmental factors. My study has revealed a more complete understanding of the relationships between trophic morphology and the factors that influence it.

0679 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Wade D. Smith, Jessica A. Miller

Department of Fisheries and Wildlife, Coastal Oregon Marine Experiment Station, Hatfield Marine Science Center, Oregon State University, Newport, OR, USA

The Effects of Temperature, Growth, and Water Concentration on the Elemental Composition of Elasmobranch Vertebrae

Otolith elemental signatures have proven to be valuable natural markers, providing insight into migratory patterns, population structure, and natal origin of many species. Sharks and rays lack the calcium carbonate otoliths of teleosts but possess mineralized vertebral cartilage that is typically deposited in an annual banding pattern and continues to grow throughout an individual's life. If the incorporation of elements in vertebrae is related to environmental conditions, the geochemical composition of cartilaginous vertebrae may also serve as natural tags and records of environmental history in elasmobranch populations. To determine the relationship between water and vertebral elemental concentrations, we conducted two controlled laboratory studies using round stingrays, *Urobatis halleri*, as a model species. First, we determined the extent of partitioning and quantified the effects of temperature (16°C, 18°C, 24°C) and growth rate on vertebral elemental composition (Li:Ca, Mg:Ca, Mn:Ca, Zn:Ca, Sr:Ca, Ba:Ca). Second, we further evaluated the relationship between water and vertebral elemental composition by manipulating the dissolved concentrations of barium in each tank. In the first experiment, vertebral elemental concentrations were significantly influenced by temperature. Temperature negatively affected the incorporation of Mg:Ca, Sr:Ca, and Ba:Ca. In the second experiment, vertebral Ba:Ca was positively correlated with water Ba:Ca. Elemental incorporation was not found to be effected by variable growth rates. This study represents the first validation experiment on elemental incorporation in elasmobranch cartilage, provides support for the assumption that vertebral composition reflects environmental variation, and highlights the potential use of elemental signatures in the vertebrae of elasmobranchs as natural markers.

0529 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Julie Sommer¹, Chenhong Li¹, Jeremy Brozek¹, Michael Bessert¹, Guillermo Orti¹,
Tim Berra²

¹University of Nebraska, Lincoln, NE, USA, ²The Ohio State University, Mansfield, OH, USA

Low Genetic Diversity in Nurseryfish, *Kurtus gulliveri* (Perciformes: Kurtidae), and an Appraisal of its Breeding System using Microsatellite Loci

The Nurseryfish, *Kurtus gulliveri*, is a freshwater fish distributed in northern Australia and southern New Guinea that exhibits forehead brooding, a unique form of male parental care. Microsatellite markers were developed for paternity analysis to study its reproductive life history in a population from the Adelaide River, Northern Territory, Australia. In 20 microsatellite loci tested, only two polymorphic markers were found. The microsatellite data are mostly consistent with the hypotheses that the putative egg-carrying male sired the egg mass and no multiple paternity occurred in the population examined. However, caution should be taken in interpreting the results, given the low genetic diversity and limited analytic power. The extremely low genetic diversity was also corroborated by control region sequences, the most variable fragment in the piscine mitogenome. Eighteen individuals from the Adelaide River were sequenced, revealing four polymorphic sites in the control region and five haplotypes in total, with an average p-distance of 0.001. Additional individuals from three other isolated populations in the Northern Territory (Daly River, the South Alligator River, and East Alligator River) were sequenced and found to be identical to one of the common haplotypes from the Adelaide River. Four samples collected from New Guinea represent a single haplotype that had 24.5 substitutions on average relative to the Australian populations.

0609 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Laurie Sorenson

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

Accommodating Incomplete Sampling in Shark Macroevolution

The extant Neoselachii are a relatively diverse group of chondrichthyans that form a well-supported monophyletic group. Extant sharks are of an ancient lineage and rapid diversification of these fishes during the Jurassic and Cretaceous is suggested based on fossil evidence, and the timing is in agreement with phylogenetic hypotheses. Several longstanding hypotheses have been suggested to explain shark diversity, including but not limited to ecological opportunity, reproductive strategy and body size. Testing macroevolutionary hypotheses is difficult in part due to incomplete sampling of trees. Here I use recently developed comparative phylogenetic methods that accommodate missing taxa to explicitly test evolutionary scenarios of shark lineage diversification and body size evolution in an incomplete phylogenetic framework. I used MEDUSA in

conjunction with a backbone phylogeny generated from DNA sequences for five loci (four mitochondrial and one nuclear) currently available in Genbank for 230 taxa, complemented with newly sequenced species. The inferred phylogeny was dated using a relaxed molecular clock approach and 15 fossil calibration points. The program MECCA, a new method based upon approximate Bayesian computation (ABC), was used to examine the role of phenotypic diversification (i.e. body size) in the evolution of shark lineages, and to quantify the tempo of body size evolution in sharks.

0690 Poster Session I, Friday 8 July 2011

Stephen Spear¹, Joshua Parker², Mark Anderson³, Douglas Keineth³, Charles Peterson⁴, Lisette Waits¹

¹The Orianne Society, Clayton, GA, USA, ²Clayton State University, Morrow, GA, USA, ³Wyoming Natural Diversity Database, Laramie, WY, USA, ⁴Idaho State University, Pocatello, ID, USA, ⁵University of Idaho, Moscow, ID, USA

Integrating Genetics and Habitat Modeling to Inform Conservation of Midget Faded Rattlesnakes (*Crotalus oreganus concolor*)

Fragmentation of habitat due to energy development is increasingly becoming a concern for the persistence of reptile populations, particularly in shrub or desert habitats. We used distribution models and genetic analyses to predict important habitat areas and assess connectivity in the midget faded rattlesnake (*Crotalus oreganus concolor*) in Wyoming. Known denning sites were used to develop a den model and radio-telemetry points from foraging snakes were used to model foraging sites. Model selection based on AIC indicated only two variables predicted denning areas: distance to rock outcrops and temperature range between warmest and coldest months. We conducted field surveys to validate predicted denning areas and found support for the two-variable model chosen by AIC. The foraging model also contained only two variables: distance to rock outcrops and mean temperature during the wettest quarter. Both models suggest climate change could impact location of suitable habitat. We also used 19 microsatellite loci to assess the genetic diversity and connectivity of 680 individuals across the study area. While expected heterozygosity across the entire study area was similar to other rattlesnake studies ($H_e = 0.65$), observed heterozygosity was much lower ($H_o = 0.45$), suggesting genetic fragmentation and loss of diversity due to drift across the Wyoming range. Genetic clustering also supported genetic differentiation, as we estimated 4-5 distinct genetic clusters. Examining spatial patterns of genetic structure suggested that recent anthropogenic barriers (reservoirs, roads) have recently disrupted formerly connected areas, and thus the snakes are susceptible to additional isolation if further development occurs.

0641 Poster Session III, Sunday 10 July 2011

Carol Spencer¹, Michelle Koo¹, David Bloom¹, Carla Cicero¹, John Wieczorek¹, Robert Guralnick², Town Peterson³, Laura Russell³, David Vieglais³, Nelson Rios⁴, Hank Bart⁴

¹University of California, Berkeley, CA, USA, ²University of Colorado, Boulder, CO, USA, ³University of Kansas, Lawrence, KS, USA, ⁴Tulane University, New Orleans, LA, USA

VertNet: Distributed Databases with Backbone

Alarm over global climate change and associated loss of biodiversity has resulted in international demand for quick, reliable access to high quality data on the spatio-temporal occurrence of species and their relation to environment. Responses to this demand have led to the development of four NSF-funded distributed database vertebrate networks (FishNet2, MaNIS, HerpNET, ORNIS), which currently include 171 collections from 12 countries and 52 additional collections (20 countries) committed to participation. Collectively, these networks have successfully demonstrated community data sharing and cooperative data management. Participation in each of these networks has far exceeded expectations, resulting in growing problems of scalability, performance, sustainability, and ability to incorporate new members. The proposed creation of VertNet will address these problems by using a cloud-based computing strategy to create a fast, cost-effective, and scalable data platform. This new platform will have capabilities and applications for data discovery, data quality improvement, and visualization that go beyond those of the current networks. Specifically, VertNet will (1) have new user interfaces with expanded search capabilities (keyword and full text, synonyms for search terms, phylogenetic browsing), (2) incorporate new kinds of data (paleontological), (3) provide improved, open methods for accessing data (via application programming interfaces that connect web browsers, mobile devices, and integrated applications), (4) enable customized change notifications, and (5) create novel annotation and user feedback services. This strategic combination of open access to data, new capabilities, and integration with other applications will transform the use of vertebrate biodiversity data for cross-disciplinary research and for conservation.

0754 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Christopher St. Andre, Stephen Richter

Eastern Kentucky University, Richmond, KY, USA

Annual Variation of Orientation and Timing of Amphibian Movements in South Central Kentucky

The upland habitat use of amphibian movements is poorly understood. To further our understanding of these processes for pond-breeding amphibians, an ephemeral pond was monitored at the Central Kentucky Wildlife Management Area, Madison County,

Kentucky. The study pond was completely enclosed using a circular drift fence and pitfall trap array, which was checked continually from January 2009 to March 2011 during peak periods of amphibian movement. Many species of amphibians used the pond for reproduction, including *Rana clamitans* (green frogs), *R. catesbeiana* (American bullfrogs), and *Ambystoma opacum* (marbled salamanders). However, two species of salamander *Ambystoma jeffersonianum* (Jefferson salamander) and *A. maculatum* (spotted salamander) were the primary species reproduced in the pond. Movements into and out of the pond by *A. jeffersonianum*, and *A. maculatum* varied among species, sex, age and year. Males of both species exhibited non-random movements exiting the pond (Jefferson $p=0.008$, Spotted $p=0.009$). Only female Spotted salamanders exited the pond in a non-random pattern ($p<0.001$). Although there was variation among the orientation of movements both species did show an affinity to move from or toward the connected forest, and closely isolated forest patches. Our data exemplify how amphibian movements can vary based on surrounding habitat and vary annually. Our research increases understanding of when amphibians move to and from breeding locations as well as the habitat they utilize to reach their destination. Understanding movement patterns through the environment will guide conservationists and land managers to structure and build more suitable upland habitat for amphibians around wetlands.

0440 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

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Do Convergent Means of Premaxillary Protrusion Produce Similar Flow Regimes during Suction Feeding?

Elucidating functional consequences of convergent morphologies allows construction of evolutionary hypotheses on how selection may independently generate similar forms. A protrusible upper jaw evolved multiple times across teleosts and is implicated in the success of the groups that possess this morphology. We use digital particle image velocimetry (DPIV) to evaluate suction flow dynamics in goldfish, a cyprinid, and compare our findings to bluegill, a centrarchid. These species represent independent evolutionary origins of jaw protrusion. Bluegill protrude the upper jaws via linkages to the opercular apparatus and lower jaw. Goldfish protrude the upper jaws via a novel sesamoid bone, the kinethmoid, a synapomorphy of Cypriniformes. Using DPIV, we contrast 1) the spatial pattern of flow in the two species, 2) the temporal relationship between flow and head kinematics with particular focus on the timing of flow with jaw protrusion, and 3) the contribution of jaw protrusion to forces exerted on prey. We find that the spatial pattern of flow is the same in the two species. However, we find that the timing of kinematics and suction flow is quite different; goldfish are slower to reach maximal excursions, but are able to sustain maximal flow longer than bluegill. Despite the differences in kinematic timings, jaw protrusion in these two distantly related

species has a fundamental performance advantage: to augment the hydrodynamic forces exerted on prey.

0294 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

Ralph Stearley¹, Gerald Smith²

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Neogene Fossil *Oncorhynchus* of Western Nevada and the Paleobiogeography of Cutthroat Trouts

During middle Miocene time, between 18 and 9 ma, what is now western Nevada was a high-altitude plateau undergoing transtensional faulting and incision by surrounding drainages. Numerous short-lived lakes occupied faulted basins with intermittent drainage connections, forming a N-S dispersal corridor presumably connected to SE Oregon and the western Snake River Plain. To the east, in eastern Nevada and western Utah, a rugged highland served as a drainage divide. Geologic data indicate probable drainage connections between western Nevada and the Pacific Ocean, which occupied what is now the Great Valley of California. Three plesiomorphic species of *Oncorhynchus*, similar to present-day cutthroat trouts, occupied these western Nevadan lakes, including a fossil trout from the Truckee formation discovered by Michael Bell. This trout shares derived anatomical features of *Oncorhynchus*, including dermethmoid and metapterygoid shapes, reduced lower limb of preopercle with rounded anterior margin, deep subopercle, and 3 epurals. It possesses mandibles with high coronary processes and straight maxillae. It differs from other Nevada Miocene *Oncorhynchus*, *O. esmeralda* and *O. cyniclope*, as well as recent *O. clarki* in the possession of a short, broad, heavily ornamented frontal, as well as other features.

0646 Fish Conservation, Symphony III, Saturday 9 July 2011

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A Comparison of Growth, Reproduction, and Tissue Production of Temperate Reef Fishes on Artificial and Natural Reefs

Artificial reefs are commonly used to mitigate damage to natural reefs, yet how well these artificial reefs function is still widely debated. One major question yet to be resolved is whether artificial reefs produce fishes at rates equivalent to those on natural reefs. We tested whether rates of reef fish growth, reproduction, and total tissue production on a large artificial reef (Wheeler North Reef) were comparable to those on

two nearby natural reefs. Adults from five of the most common rocky reef fishes in the Southern California Bight (California sheephead, kelp bass, barred sand bass, señorita, and blacksmith) were collected during the spawning season. Rates of growth, reproduction, and tissue production of each species were generally similar on the artificial and natural reefs, with rates on the artificial reef being most like those on the natural reef nearest to it. These generally similar rates of tissue production (somatic and reproductive) are congruent with similar foraging success (based on gut fullness) of fishes on the three reefs. The similar performance of fishes living on the artificial and natural reefs implies that well-designed artificial reefs can mitigate damage to natural reefs by enhancing production of reef fishes.

0662 Poster Session I, Friday 8 July 2011; SSAR POSTER AWARD

Anne Stengle¹, Maureen Murray², Tom Tynning³, Al Richmond¹, Paul Sievert¹

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Observations of Secondary Disease Agents in Timber Rattlesnake (*Crotalus horridus*) Populations in the Northeast

Isolated populations at the edge of their species' range are subject to many stressors, including reduced genetic variation, anthropogenic changes, habitat fragmentation and stochastic climate effects. Recent work has suggested a relationship between secondary disease signs, such as external fungal lesions, and a synergistic effect of these stressors in timber rattlesnake at the northern range limit. Results from four biopsied rattlesnakes captured during the 2009 and 2010 field seasons from separate northeastern populations displayed various fungal and bacterial agents, supporting the suggestion of a secondary disease problem and not a single infectious pathogen. These agents are primarily common soil species, and these lesions may be a normal stressor in timber rattlesnake populations. Observation of disease incidence has been primarily anecdotal, making it difficult to determine if numbers of affected individuals is increasing. Two biopsied snakes were from a metapopulation undergoing a radiotelemetry study assessing subpopulation connectivity and genetics. During the 2010 field season both snakes improved greatly after receiving little to no treatment, suggesting snakes are capable of overcoming the infection. Of thirty-six marked individuals from the metapopulation only those two showed lesions. These and other observations in the northeast will lead to future collaboration to launch a state and region-wide health survey. If there were a correlation between multiple stressors and increased secondary infections it would pose a serious problem to isolated, fragmented and possibly declining populations in the Northeast.

0524 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

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Phenotypic Responses of Amphibian Larvae to Prolonged Predatory Cues are Associated with Chronically Elevated Levels of Stress Hormone

The ability of an organism to undergo morphological and behavioral changes in response to predation (stress) may be important in determining future survival and fitness of larval amphibians. However, any changes might be accompanied by fitness trade-offs that appear during the stressful time or later in life. We present evidence of a physiological change in larvae of *Rana sylvatica* frogs that is concomitant with the morphological and behavioral changes of frog larvae chronically exposed to the chemical cues of a dragonfly predator (*Aeshna* sp.). Tadpoles exposed to caged dragonfly larvae that were fed conspecific tadpoles experienced a 2.5-fold increase in endogenous corticosterone (CORT), altered morphology (increased tail depth and length, decreased body length), and suppressed behavior (less active and visible) compared with no-predator control tadpoles. We also found that there was a positive relationship between the level of endogenous CORT and the degree of tail depth, and a negative relationship between endogenous CORT and body length. While elevated glucocorticoids may be responsible for creating and maintaining anti-predator morphology in tadpoles, this phenotypic response may come at the cost of immunosuppression and result in carry-over effects during their terrestrial phase.

0741 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Nathan Stephens, Stan Trauth, Carole Cramer, Maureen Dolan

Arkansas State University, Jonesboro, AR, USA

Molecular Ecology of Western Slimy Salamanders in the Spillway Mine, Garland Co., AR

Ten polymorphic microsatellite loci were developed for the western slimy salamander (*Plethodon albagula*). Nine tetranucleotide loci and one trinucleotide locus were optimized for PCR and identified in 20 salamanders from the Spillway Mine in Garland Co., AR. The trinucleotide locus displayed a confounding level of stutter and was excluded from analyses of polymorphism, heterozygosity, Hardy/Weinberg equilibrium (HWE) and the presence of null alleles. The other loci conformed to HWE and were without null alleles. These microsatellite markers were developed for the purpose of resolving the familial relationships of brooding females at specific nest-sites in ongoing research of salamander reproductive ecology in the mine. They will also be useful in population genetic analyses of this species including effective population size and genetic structure within and among populations. A minimally-invasive sampling technique was also developed to be used in conjunction with PCR-based molecular

analyses of these animals. Additionally, these loci were tested for cross-species transference to five other closely-related congeners endemic to the Ouachita Mountains of Arkansas and Oklahoma.

0385 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

Duane Stevenson¹, Christopher Kenaley²

¹NMFS, Alaska Fisheries Science Center, Seattle, WA, USA, ²University of Washington School of Aquatic and Fishery Sciences, Seattle, WA, USA

A Revision of the Caristiidae

The perciform family Caristiidae includes several species of mesopelagic fishes found throughout the tropical, temperate, and subarctic oceans of the world. Commonly known as manefishes or veifins, these fishes are characterized by large sail-like dorsal and anal fins, each of which can be retracted into a fleshy sheath on the dorsal or ventral surface of the body. There has been a great deal of taxonomic confusion surrounding these fishes since the early 20th century, and virtually every recent author dealing with caristiids has noted the desperate need for a taxonomic revision of the family. Here we present preliminary results of a worldwide revision of the Caristiidae based on examination of over 250 specimens. We recognize four genera, including two "small-mouth" genera and two "large-mouth" genera. The small-mouth forms have an upper jaw that extends approximately to midorbit and is almost completely covered by the thin bones of the suborbital series, a broad suborbital space, and lack palatine teeth, while the two large-mouth genera have a relatively long upper jaw extending to the posterior margin of the orbit, a narrow space between the orbit and the mouth, and both palatine and vomerine teeth. The small-mouth group contains a new genus and three new species, as well as two previously described forms, while the large-mouth group includes two previously recognized genera, three previously described species, and several new forms. We will present all recognized forms along with their distinguishing characteristics and geographic ranges.

0458 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Donald Stewart

SUNY Coll. Envir. Sci. & For., Syacuse, NY, USA

A New Species of *Arapaima* (Pisces, Osteoglossidae) from the Solimoes River, Amazonas State, Brazil

A new species of *Arapaima* has been discovered from the central Amazon of Brazil. This new taxon is readily distinguished from the syntype of *Arapaima arapaima* as well as reference population samples from Mamiraua Reserve (n = 29) and from Guyana (n=40) by its relatively slender body, short dorsal fin base, low pre-orbital depth, and elongate

fourth infraorbital bone. It is distinguished from the holotypes of *A. gigas*, *A. mapae* and *A. agassizii* by having over 30 total caudal fin rays (vs. less than 17 in the other species). It is further distinguished from the holotype of *A. gigas* by having a single row of mandibular teeth (vs. 2+ irregular rows) and a rounded posterior margin on pelvic fins (vs. retrose shaped pelvic fins). From *A. mapae* and *A. agassizii*, it is further distinguished by a relatively deep caudal peduncle. This new taxon also has the dorsal fin base encased in a distinctive fleshy sheath such that anterior dorsal rays are largely hidden. This species was collected near the confluence of the Solimoes and Purus Rivers in Amazonas State.

0090 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

James R. Stewart¹, Tom W. Ecaj¹, Benoit Heulin², Santiago P. Fregoso¹

¹East Tennessee State University, Johnson City, TN, USA, ²Station Biologique de Paimpont, Paimpont, France

Ontogeny of Calcium Transport by Chorioallantoic Membranes of Oviparous and Viviparous Embryos of the Lizard, *Zootoca vivipara*

The eggshell of oviparous lizards is a significant source of calcium for embryos, but when present, the eggshell of viviparous lizards contains little calcium. In view of the potential cost to embryonic nutrition occasioned by the loss of eggshell calcium, the large number of independent origins of viviparity among lizards is surprising. Concomitant evolution of viviparity and calcium placentotrophy would ameliorate loss of eggshell calcium, but a mechanism for this concurrence has not been discovered. *Zootoca vivipara*, a lizard with geographic variation in mode of parity, is an excellent model to study mechanisms of calcium transport to oviparous and viviparous embryos because each is highly dependent on calcium secreted by the uterus (eggshell or placenta) and ontogenetic patterns of embryonic calcium mobilization are similar. Embryonic uptake of calcium is mediated by the chorioallantoic membrane, which expresses the calcium transport proteins (calbindin-D_{28K} and plasma membrane calcium ATPase, PMCA). We compared developmental expression (immunoblotting) of calbindin-D_{28K} and PMCA in chorioallantoic membranes of oviparous and viviparous embryos to test the hypothesis that the mechanism of calcium transport does not differ between modes of parity. We found that the ontogenetic pattern of expression of both proteins is similar between reproductive modes and that expression of calbindin-D_{28K} is correlated with calcium uptake from the eggshell or placenta. This finding, which suggests that functional continuity is maintained in the transition between reproductive modes by conservation of structure and function of the chorioallantoic membrane, has implications for understanding independently derived similarity in the evolution of placentation.

0372 Poster Session III, Sunday 10 July 2011

Haley K. Stinnett¹, James R. Stewart¹, Tom W. Ecay¹, Rebecca A. Pyles¹, Michael B. Thompson²

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Developmental Expression and Localization of Calcium Transporting Proteins in the Chorioallantoic Membrane of a Placentotrophic Lizard

Pseudemoia pagenstecheri is a viviparous Australian scincid lizard with extensive placental transfer of nutrients; 90% of calcium in neonates is received via the placenta.

This species has a regionally differentiated chorioallantoic placenta characterized by an elliptical-shaped region, the placentome, with hypertrophied uterine and embryonic epithelial cells supported by dense vascular networks. The remainder of the chorioallantoic placenta is also highly vascularized but epithelia are thin. The structural and functional characteristics of the placenta provide a remarkable opportunity to study mechanisms of nutrient transfer in a placentotrophic squamate. We used immunohistochemistry and immunoblotting to test the hypothesis that the chorioallantoic placenta has discrete specializations for calcium transport. Calcium uptake by extraembryonic membranes of squamates is correlated with expression of the intracellular calcium binding protein, calbindin-D28K. Immunohistochemistry was used to localize calbindin-D28K expressing cells in the chorioallantois. Immunoblotting for calbindin-D28K and plasma membrane calcium ATPase (PMCA, an additional marker for active calcium transport) was used to assess changes in protein expression levels through development. We found support for our hypothesis because calbindin-D28K was expressed in the chorionic epithelium of the placentome, but not in the remainder of the chorioallantoic placenta. Calbindin-D28K and PMCA were expressed at low levels in early development and increased significantly prior to birth, when embryonic calcium demand peaks. These data suggest that placental calcium secretion occurs over an extended interval of gestation, with increasing activity as embryonic demand escalates in late development. Our results support the hypothesis that the structurally elaborate placentome is functionally specialized for calcium transport.

0268 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

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¹University of Massachusetts Dartmouth, Dartmouth, MA, USA, ²University of Rhode Island, Kingston, RI, USA, ³Ross University, Roseau, Dominica

Hyoid and Pharyngeal Arch Mechanics during Prey Processing in Elasmobranchs

The position of the hyomandibulae is related to prey capture in elasmobranchs; yet it is little understood how hyoid and pharyngeal arch morphology relate to prey processing

mechanics. The kinematics of the jaws, hyoid, and 2nd pharyngeal arches were quantified by sonomicrometry and pressure transducers during prey processing in bamboo sharks, *Chiloscyllium plagiosum*, spiny dogfish, *Squalus acanthias*, and little skates, *Leucoraja erinacea*. These species possess different cranial morphologies with short lateral, longer lateral, and anterior hyomandibular orientations, respectively. Similar to prey capture, in all species oropharyngeal expansions generated subambient pressures during suction processing, while compressions created superambient pressures during bite processing. Bamboo sharks generated the strongest subambient and superambient pressures during prey processing. The mechanism of cavity expansion and compression differed between species and behaviors, with hyoid and pharyngeal widths increasing or decreasing. In dogfish the hyoid distance expanded vertically and horizontally during suction and decreased during bite, differing from prey capture. Contrastly, in bamboo sharks and little skates the hyoid distance increased vertically and decreased horizontally during suction, which was similar to prey capture. Bamboo sharks continued to decrease hyoid width during bite, but hyoid width movement either increased or decreased in skates. Pharyngeal width movements were more variable in the three species. Bamboo sharks are mechanistic specialists and more stereotyped in behavior compared to dogfish and skates, which are generalist predators. It appears differences during prey processing may reflect different degrees of morphological constraint among the elasmobranchs.

0366 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Andrew Storfer, Karen Chojnacki, Jonathan Eastman

Washington State University, Pullman, WA, USA

Ranavirus-salamander Evolution: From Genes to Landscapes

Emerging infectious diseases threaten wildlife, livestock and humans, and are recognized as a leading scientific challenge for the 21st Century. Emerging infectious diseases are implicated in the global die-offs of amphibians, threatening many populations and species with extinction. Two critical questions arise when pathogens emerge. First - is the pathogen new or old? Second - what is the likelihood of spread? I will discuss the past 10 years of a multifaceted research program on coevolution of tiger salamanders and an emerging ranavirus throughout western North America to address these two questions. Using comparative phylogenetic methods, we show that tiger salamanders and viruses are coevolved, but human introductions of infected salamanders as fishing bait disrupts coevolutionary patterns. Due to increased densities of captive populations, increased virulence is observed in a virus strain isolated from a bait salamander population. Next, we show geographic variation in putative viral virulence genes. Using a cross-infection experimental design to test for local adaptation, we show that apparent viral adaptation is correlated with molecular evolutionary rates and particular amino acid changes in these genes. We also show that pathogen local adaptation is multi-faceted and requires estimates of infectivity, within-host growth, transmission and virulence, as opposed to the commonly used single measure of infectivity. Future studies will focus on genomic interactions of host and virus to better

understand the mechanisms underlying host resistance and pathogen evasion of host defenses.

0584 Poster Session I, Friday 8 July 2011

Joe Strande¹, Merlin Caldwell¹, Aimee Finley¹, Kiel Tietz¹, Gerrick Meyer¹,
Chenhong Li², Mike Bessert¹

¹UW-Stout, Menomonie, WI, USA, ²University of Nebraska, Lincoln, NE, USA

Conservation Genetics of *Fundulus sciadicus* (Fundulidae): A New Approach with Microsatellites

The plains topminnow (*Fundulus sciadicus*) is a freshwater killifish endemic to the Great Plains of North America. Rising concerns for future viability of this species have prompted recent changes in its conservation status. In a previous rangewide study, extremely low variation was detected at the mtDNA control region, a locus that is generally variable within populations. Despite low variation, it revealed distinct population structure. In order to extend this work, ascertain conservation target areas of greatest genetic diversity, and estimate gene flow among disjunct areas, we developed additional hypervariable nuclear (STR) loci. These markers have provided greater resolution in re-examining population structure among the previously collected sites plus four recently collected sites that filled sampling gaps (Minnesota and Colorado). Resulting measures of allelic richness and heterozygosity are particularly valuable as we study populations previously suggested for conservation (those with highest gene diversity). In addition, Bayesian techniques place previously undocumented disjunct populations (MN and CO) in an appropriate phylogeographic context and allow for estimation of recent and historical demography in the species.

0419 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Jeffrey Streicher, Eric Smith

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Systematics of Polymorphic Direct-Developing Frogs (Anura: Craugastoridae) from Mexico and Northern Central America

The *Craugastor rhodopsis* species series contains two species of leaf litter frog that occur in a variety of tropical habitats from central Mexico southward to El Salvador. These direct-developing frogs are known to display substantial levels of phenotypic polymorphism at the population level. Previous investigations in this group have recovered high levels of genetic variability between populations indicative of much more diversity than is recognized by the current taxonomy. In the present study we investigated relationships

in the species *C. loki* and *C. rhodopis* across the majority of each species geographic distribution. Using a fragment of mitochondrial DNA derived from 61 frogs sampled from 30 localities throughout three countries (Mexico, Guatemala and El Salvador) we attempted to characterize the evolutionary history of this group. Phylogenetic analyses revealed, as previously hypothesized, high levels of diversity across our sampling including a hitherto unrecognized group of *C. rhodopis* species series frogs inhabiting western Mexico. Within the populations currently referred to *C. loki* and *C. rhodopis* there appear to be two major mitochondrial lineages. One of these lineages is a widely distributed lowland group occurring at elevations below 1400 m and the other is a highland group occurring above 1400 m in the Sierra Madre Oriental of eastern Mexico. Since these clades are not consistent with the existing taxonomy we discuss the potential nomenclatural implications of our findings. Additionally, we discuss levels of color pattern polymorphism across this group and the putative ecological and phylogenetic factors associated with this phenomenon.

0775 Poster Session III, Sunday 10 July 2011

Masayuki Sumida, Naoki Satou, Shohei Oumi, Atsushi Kurabayashi and Mitsuru Kuramoto

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Inter- and intra-island Divergence in *Odorrana ishikawae* (Anura, Ranidae) of the Ryukyu Archipelago of Japan, with Description of a New Species

The endangered frog, *Odorrana ishikawae* (Anura, Ranidae), is a species endemic to the Amami and Okinawa Islands of the Ryukyu Archipelago, Japan. Vicariance of these islands has been considered to occur middle or upper Pleistocene. Our morphometric analyses revealed obvious differences between the Amami and Okinawa populations. Two distinct morphotypes were also recognized from the Amami population (Amami common and Amami large types). Furthermore, the Amami and Okinawa populations could be distinguished clearly by coloration and dorsal tuberculation. Based on 16S rRNA gene data, the Okinawa and Amami populations were phylogenetically separated but the genetic divergence (1.44 - 2.16%) was lower than the value suggested as species threshold in anurans (> 3% in 16S). Individuals of the Amami common and large types were nested within a single clade. Artificial hybridization experiments revealed normal hybrid viability between the two Amami types, with one exception. By contrast, between Okinawa females and two Amami type males, complete hybrid inviability was observed at early embryonic stages in the hybrids contrary to expectations from their low divergence in 16S. The reciprocal hybrids between two Amami type females and Okinawa males were viable, but spermatogenesis in the hybrid males showed some degree of abnormality. These results strongly indicate specific separation of the Amami population from the Okinawa population of *O. ishikawae*. Thus, we describe the Amami

population as a new species, which is readily distinguishable from *O. ishikawae* by smaller ruggedly edged dorsal spots and an immaculate ventral surface.

**0178 SSAR SEIBERT CONSERVATION AWARD, Session II, Conrad B & C,
Friday 8 July 2011**

Yik-Hei Sung, Nancy Karraker, Billy Hau

The University of Hong Kong, Hong Kong, Hong Kong

Impacts of Illegal Trapping on Endangered Big-headed Turtles (*Platysternon megacephalum*) in Hong Kong

Big-headed Turtles (*Platysternon megacephalum*) inhabit fast flowing streams at high altitudes in South-east Asia and is regularly recorded in the wildlife trade in China and Hong Kong. Its populations are experiencing drastic declines and this species is listed as Endangered in the IUCN Red List of Threatened Species. Given existing pressures on its populations and the rarity of this species in mainland China, there is an urgent need to understand the ecology and population status of this poorly-known species. In Hong Kong, where populations still exist, we used mark-recapture methods to investigate the impacts of illegal trapping on this species by comparing demographic characteristics between sites with trapping history and one site in a fully protected area. In addition, we conducted radio-telemetry to study their home range, movements and habitat use. Our results revealed that large adults were underrepresented in sites where traps were found in the past and this was likely caused by overharvesting. Long-term monitoring of populations of this species is essential to track immediate and long-term effects of illegal collection. The information obtained through this study will allow us to develop a plan that will aid local conservation efforts for this species in Hong Kong.

0225 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

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³*Reinhardt University, Waleska, GA, USA*

Differences in Microhabitat Use among Life Stages of the Japanese Giant Salamander

Understanding habitat use differences among organismal life stages is essential for longterm species conservation. In this study we used radiotelemetry to evaluate habitat use differences among larval, juvenile, and adult Japanese Giant Salamanders (*Andrias japonicus*). Our study was centered in two study sites within Hiroshima (Ikuritani River) and Tottori (Tsuchia River) prefectures, Japan. Salamanders were captured by turning over rocks during day and evening searches, and radiotransmitters were attached

externally to the tail of each individual by passing a small piece of monofilament fishing line through the tail and securing each end of the fishing line with small plastic disks and aluminum clamps. As salamanders radiotracked, we recorded location data and completed a maximum of three habitat plots per individual through a use-availability approach. During the three month study period, we were able to successfully monitor 25 total salamanders (5 larvae, 9 juveniles, and 11 adults) at both sites and were able to obtain approximately 300 locations and complete nearly 100 habitat plots at "used" and "random" locations. Overall, adult *A. japonicus* tended to use microsites that possessed large rocks (> 100 cm), deep pools (> 30 cm), and very little stream flow, whereas larval and juvenile *A. japonicus* used microsites with relatively small rocks (~ 40 cm), shallow water (10-20 cm), and distances closer to the stream bank compared to random sites. These short-term data provide considerable insight into habitat requirements of this fully aquatic salamander.

0224 Poster Session I, Friday 8 July 2011

William Sutton¹, Yong Wang², Callie Schweitzer³

¹University of Tennessee, Knoxville, TN, USA, ²Alabama A&M University, Normal, AL, USA, ³USDA Forest Service Southern Research Station, Normal, AL, USA

Amphibian and Reptile Responses to Prescribed Burning and Thinning in Pine-Hardwood Forests of Northwestern Alabama

Habitat disturbances such as forest management practices can have varied impacts on organismal population parameters. We evaluated herpetofaunal responses to forest management using a variety of techniques, including drift-fences, coverboards, and radiotelemetry. This experiment consisted of a 2 X 3 complete block design with three replications. Forest treatments consisted of three thinning levels (no thin, 11 m²/ha residual basal area [BA], and 17 m²/ha residual BA) and two burning levels (no burn and burn) resulting in 18 total treatments. Pre- and post-treatment data were collected for one year and two years, respectively. We captured 2,643 individual amphibians and reptiles representing 47 species (20 amphibians and 27 reptiles) during 3,180 trap nights using drift-fence arrays and 1,074 individual amphibians and reptiles representing 14 species (10 reptiles and 4 amphibians) during 173 sampling days (i.e., 73,664 board days) using coverboards. Overall, reptiles responded positively to thin and thin and burn forest treatments, whereas amphibians were not impacted by the disturbances implemented during this study. Lizards demonstrated species-specific responses, whereas larger snake species had greater captures in thinned plots during the second year post-treatment. Litter-dwelling snake captures increased in thin with burn plots during second year post-treatment surveys. Radiotelemetry of Copperheads (*Agkistrodon contortrix*) revealed that male snakes selected micro- and macrohabitat features different from random and tended to select sites that possessed an abundance of downed woody debris and deep litter. The cumulative results of this study demonstrate the need for multiple techniques to evaluate overall herpetofaunal community responses to landscape disturbances.

0263 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Christopher Swarth¹, Mike Quinlan¹, Joel Snodgrass²

¹Jug Bay Wetlands Sanctuary, Lothian, MD, USA, ²Towson University, Towson, MD, USA

Sex and Age Differences in Home Range and Habitat Use of Eastern Box Turtles (*Terrapene carolina carolina*)

The size and shape of an animal's home range are determined in part by the distribution and abundance of resources needed for survival. To understand eastern box turtle (*Terrapene carolina carolina*) preference for various habitats, we used radio telemetry from 2001 to 2007 to follow the movements of 38 female, 15 male and 8 juvenile turtles along a freshwater tidal wetland on the Patuxent River in Maryland. Forty-six turtles were tracked for one season and 15 were followed for 2-3 years. Turtles were located an average of 33 times between May and November. 95% kernel home ranges (mean \pm SD) for females were variable (8.3 ± 8.7 ha), but were significantly larger than those for males (1.5 ± 0.6 ha) and juveniles (1.0 ± 0.9 ha). Females used tidal and non-tidal wetlands (foraging areas) and fields (nesting sites) much more than did males or juveniles. Gravid females traveled long distances from mixed hardwood forests and wetlands to reach a limited number of suitable nesting sites; this accounts for the largest home ranges. Stable isotope analysis of turtle tissue, along with animal and plant diet items, revealed that females derived considerable nutrition from the tidal wetland ecosystem. Males and juveniles spent most of each season in the forest and most juveniles did not visit permanent water sources for at least three years. This study illustrates how the arrangement of habitats in the local landscape can be an important determinant of home range size and shape.

0463 Poster Session I, Friday 8 July 2011

Joshua Sweet, Christopher Beachy

Minot State University, Minot, ND, USA

Educational and Conservation Outreach Provided by the Amphibian Growth Project Website

The Amphibian Growth Project (AGP) website (<http://www.amphibiangrowthproject.org>) has two objectives: outreach and online data collection. For outreach, the site is structured to appeal to and inform four audiences including children, parents, researchers and institutions. For children and parents, specific pages present amphibian facts and husbandry information in an easy to understand format with applicable citations clearly stated on each page. For potential

researchers and institutions looking to become AGP partners, specific pages maintain links to current research projects and research archives. The archives contain files of previous talks and poster presentations. These give inquiring parties a good idea of the basic type of AGP research to which they can contribute. Online data collection is the second major objective. Online data collection is a critical aspect of amphibian tracking. Through online databases, AGP partners and independent enthusiasts separated by geographic location can compile and access standardized amphibian data in one place online. Geography is no longer a limitation in effective amphibian tracking. AGP standardized databases provide the ability to monitor and record crucial information including but not limited to relative and absolute species densities, individual and average sizes at specific locations, and migration patterns. This website supplement ongoing touring museum visits to rural K-12 school groups. In the past 24 months, members of the AGP have conducted 53 school visits that have included approximately 2000 students, and covered an 85 mile radius from Minot State University.

0671 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

John Szczepanski, Christina Lemnotis

University of Rhode Island, Kingston, RI, USA

Feeding Ecology of the Bullnose Ray, *Myliobatis freminvillii*, in Delaware Bay

Feeding habits of many batoid elasmobranchs (skates and rays) have been recorded but diets, prey selection, and resource partitioning within specific populations are not fully understood. Few studies compare diets of a species throughout its life history. During my research, I was able to collect a higher abundance of neonate and juvenile rays than expected allowing for a more comprehensive diet characterization than in past studies. Through gut content analysis, my research examines the feeding habits of the bullnose ray, *Myliobatis freminvillii*, to understand the diet and trophic role of this species in the estuarine ecosystem at various life stages. Specimens were collected over the course of two years through fisheries-independent trawl surveys. Prey items were identified to lowest taxonomic level, counted and weighed. Various diet metrics, importance indices, and multivariate analyses were used to incorporate the data from different sexes and size groups to identify important prey species and elucidate ontogenetic shifts. In addition to the feeding data, the increasing proportional abundance of smaller (and therefore younger) size classes through the summer months provides some evidence indicating that Delaware Bay may serve as a nursery area for the bullnose ray. Though recently proposed criteria characterizing shark nursery areas cannot fully be fulfilled by my data alone, the calculated trends along with the diet data shown can provide new information for future efforts in conservation, ecosystem-based management and modeling.

0368 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Milton Tan

Auburn University, Auburn, AL, USA

Molecular Phylogenetics of *Hypancistrus* (Loricariidae: Siluriformes)

Hypancistrus is a genus of loricariid catfishes, including six described and many undescribed species distributed in tributaries of the Amazon and Orinoco rivers of South America. Apart from variation in color patterns, species of *Hypancistrus* are morphologically conserved. A published phylogeny of *H. zebra* and three Venezuelan species found *H. zebra* to be the sister of the Venezuelan species, but the Venezuelan species were identical in their skeletal anatomy. A molecular phylogeny is inferred for Venezuelan species of *Hypancistrus* (*Hypancistrus contradens*, *H. debilittera*, *H. furunculus*, *H. inspector*, *H. lunaorum*) from mitochondrial *cytB* and nuclear *S7* genes. In addition, aquarium specimens were added to increase the number of species, including the type of the genus (*H. zebra*), and various undescribed, putatively Brazilian forms. Monophyly of the genus is tested and species relationships are documented.

0567 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Kevin Tang¹, Henry Bart², Masaki Miya³, Kenji Saitoh⁴, Andrew Simons⁵, Robert Wood¹, Wei-Jen Chen⁶, Tetsuya Sado³, Mary Agnew¹, Michael Dosey², M. Vincent Hirt⁵, Lei Yang¹, Richard Mayden¹

¹*Saint Louis University, St. Louis, MO, USA*, ²*Tulane University, New Orleans, LA, USA*, ³*Natural History Museum and Institute, Chiba, Chuo-ku, Chiba, Japan*, ⁴*National Research Institute of Fisheries Science, Kanazawa, Yokohama, Japan*, ⁵*University of Minnesota, St. Paul, MN, USA*, ⁶*National Taiwan University, Taipei, Taiwan*

Phylogenetic Relationships of the Cyprinid Subfamily Cultrinae (Teleostei: Cypriniformes)

The subfamily Cultrinae is a diverse group of cyprinid fishes, distributed across eastern Asia. The taxonomic composition of the subfamily and the relationships within it are still poorly understood. Recent phylogenetic studies have provided new insights into the relationships of Cultrinae, while also contradicting some earlier classifications. In an effort to better grasp the extent of this subfamily, sequence data from more than 120 cyprinid taxa were collected. Representative species were drawn from all major cyprinid lineages. Particular emphasis was placed on including taxa with historically uncertain phylogenetic affinities that may be putative cultrines, based on previous literature. Our analyses were conducted on sequences from two mitochondrial loci (*COI*, *cyt b*) and two nuclear loci (*RAG1*, *rhodopsin*), which were then evaluated using maximum likelihood and parsimony methods. Our results reveal interesting relationships, which will require revisions in classification to accommodate a monophyletic Cultrinae, changes that will

also affect other subfamilies of Cyprinidae. The relationships within the Cultrinae and its relationship to other cyprinid subfamilies will be discussed.

0565 Poster Session I, Friday 8 July 2011

David Taylor¹, William Crampton², Judith Szamosi¹, Nathan Lovejoy¹

¹University of Toronto Scarborough, Toronto, ON, Canada, ²University of Central Florida, Orlando, FL, USA

Molecular Systematics of the Neotropical Electric Fish Genus *Brachyhypopomus*

The electric "bluntnose knifefish" genus *Brachyhypopomus* (Ostariophysi, Gymnotiformes, Hypopomidae) is distributed in continental lowland tropical and subtropical freshwaters from as far north as Costa Rica to as far south as Uruguay. *Brachyhypopomus* are nocturnal predators of small aquatic invertebrates and typically mature at less than 200 mm total length (TL). Like all gymnotiforms, *Brachyhypopomus* species possess a dual electrogenic and electrosensory system (ESS) which permits active electrolocation and also electrocommunication. Ongoing field studies indicate that *Brachyhypopomus* diversity is considerably higher than the currently recognized 11 species, and final diversity is expected to reach 30-40 species. Here we present a molecular phylogenetic analysis of 25 *Brachyhypopomus* species based on nuclear and mitochondrial genes (rag2 and cytochrome *b*). We compare our topology to reconstructions based on morphology, and evaluate biogeographic implications of the molecular tree.

0257 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Rory Telemeco

Iowa State University, Ames, IA, USA

Effects of Incubation Temperature on Offspring Phenotype in the Southern Alligator Lizard (*Elgaria multicarinata*: Anguidae)

Developmental environment greatly affects offspring survivorship and phenotype. Temperature in particular has profound fitness-relevant effects in diverse organisms. Because most reptiles deposit their eggs in nests without further parental care, ambient thermal conditions within the nest greatly impact many reptiles. Understanding these effects illuminates important aspects of the ecology and evolution of these species, and is important for determining the likely effects of impending climate change. To date, no study has examined the effects of thermal variation during embryogenesis on any member of the Anguidae, a diverse and conspicuous family of lizards found throughout the northern hemisphere. To begin bridging this knowledge gap, I incubated southern alligator lizard (*Elgaria multicarinata*) eggs at three temperatures (26°C, 28°C, and 30°C). Hatchling size and performance were measured repeatedly over 6 months. In general,

temperature had a negative effect on offspring fitness, with lizards incubated at 26°C being larger, faster, and having greater survivorship than those incubated at warmer temperatures. My results suggest that 28°C is above the optimum temperature for incubation in *E. multicaudata* and that 30°C is near the critical thermal maximum for successful embryogenesis. Finally, *E. multicaudata* appear to be adapted to cooler incubation conditions than many lizards with which they are sympatric and therefore may be at increased risk of decline induced by ongoing climate change.

**0254 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD,
Minneapolis Ballroom E, Thursday 7 July 2011**

Rory Telemeco, Karen Abbott, Fredric Janzen

Iowa State University, Ames, IA, USA

Modelling the Effects of Climate-change Induced Shifts in Nesting Date on Sex Ratios in Species with Temperature-dependent Sex Determination: A Case Study Using Painted Turtles (*Chrysemys picta*)

Species with temperature-dependent sex determination (TSD) may be particularly susceptible to climate change induced decline because warming environments could skew sex ratios. Plasticity in nesting phenology may be a natural mechanism that buffers populations with TSD from climate change. However, shifting nesting date only allows direct maternal control of oviposition conditions, not temperatures later in development when sex is actually determined (thermo-sensitive period, TSP). Early nesting will only buffer progeny from sex-ratio shifts if temperature at the time of oviposition consistently predicts temperature during the TSP. Such constant predictive ability is unlikely in seasonal areas because the rate of seasonal warming is higher in spring than it is in summer. We developed a modified constant temperature equivalent (CTE) model that explicitly accounts for the interaction of oviposition date and seasonal thermal pattern on temperature during the TSP to examine whether advances in nesting date are likely to buffer populations with TSD from altered sex ratios induced by climate change. We then applied this model to a well-studied population of painted turtles (*Chrysemys picta*). Our results suggest that shifts in nesting date may buffer populations from skewed sex ratios despite warmer TSPs. The model also suggests that many nests should fail prior to sexes becoming significantly skewed if females track temperatures at oviposition. Therefore, the greatest threat of climate change on many species with TSD might be reduced survivorship and reproduction rather than skewed sex ratios.

0044 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Marisa Tellez

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

The Interaction of *Alligator mississippiensis* and Its Helminth Parasites

As one of the surviving reptilian archosaurs of an ancient phylogenetic lineage, it is probable that the interaction between *Alligator mississippiensis* and its parasites has developed into a near-commensal, and possibly mutualistic association. Yet, anthropogenic and environmental factors are perturbing this interaction, increasing alligators' susceptibility to parasite virulence. This may have serious consequences because the disruption of a potentially coevolved relationship between hosts and parasites can lead to disease dispersal, host population fluctuations, and host epidemic mortality. I am studying these intestinal helminths over a three year period to assess host-parasite distribution patterns in populations of *A. mississippiensis* in Louisiana in response to environmental and anthropogenic impacts. Intestinal tracts of alligators that vary in size, gender and geographic location have been collected during the Louisiana wild alligator harvest with the assistance of Louisiana Department Fisheries and Wildlife (LDFW). To date, specimens from two harvests have been collected and analyzed. Helminth prevalence, intensity, and abundance is found to be significantly higher in alligators of Eastern Louisiana wetlands, as well as in males. Parasitism is shown to have decreased from year one to year two, indicating an external factor is affecting parasite transmission, which can have a direct effect on alligator fitness. The alteration of normal parasitic alligator fauna can result in the invasion of novel pathogens, resulting in host morbidity and/or mortality. Continued data collection and assessment will be vital for wildlife and wetland management agencies as they deal with wetland restoration from past hurricane activity, and urbanization management.

0310 Poster Session II, Saturday 9 July 2011; STORER ICHTHYOLOGY AWARD

Kimberly Tenggardjaja

University of California, Santa Cruz, Santa Cruz, CA, USA

Comparative Phylogeography of Two Endemic and Two Widespread Damsel Fish Species across the Hawaiian Archipelago

A widely accepted paradigm in the study of marine populations has been that populations are "open" to the dispersal of larvae from remote sources. However, results from an increasing number of studies challenge this belief, suggesting that limits to marine dispersal exist. To shed light on larval dispersal and the extent of connectivity between marine populations, this study utilizes mitochondrial cytochrome *b* sequences to analyze levels of gene flow in populations of endemic (*Abudefduf abdominalis* and *Chromis ovalis*) and widespread (*A. vaigiensis* and *C. vanderbilti*) damselfishes across the Hawaiian Archipelago. Endemic species with their limited geographic ranges represent

“closed” systems that persist through self-recruitment. To address whether there is a trend for endemic species to exhibit more restricted dispersal, patterns of gene flow first will be compared between endemic and widespread species within each congeneric pair and then between congeneric pairs. A better understanding of dispersal in marine populations is important for the execution and evaluation of conservation efforts in marine protected areas. Knowledge about the extent of larval dispersal is critical in designing reserves that can be self-sustaining while allowing for additional transport of larvae into non-protected areas. This research will assess the degree of connectivity between the main Hawaiian Islands and the Northwestern Hawaiian Islands, which constitute the Papahānaumokuākea Marine National Monument. Recent studies indicate limited gene flow between the two regions. Knowledge on the extent of larval dispersal in endemic and widespread species will elucidate how conservation efforts within each region of the HA should be fine-tuned.

0509 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Shara Teter¹, Bradley Wetherbee², Dewayne Fox³, Chi Lam⁴, Dale Kiefer⁴, Paul Howey⁵, Mahmood Shivji¹

¹*Guy Harvey Research Institute, Nova Southeastern University, Dania Beach, FL, USA,*

²*University of Rhode Island, Kingston, RI, USA,* ³*Delaware State University, Dover, DE, USA,* ⁴*University of Southern California, Los Angeles, CA, USA,* ⁵*Microwave Telemetry, Columbia, MD, USA*

Migratory Patterns and Habitat Use of Sand Tiger Sharks (*Carcharias taurus*) in the Northwest Atlantic

Though there is concern over declines in sand tigers (*Carcharias taurus*) in the Northwest Atlantic Ocean, details of their habitat use and movement patterns in the open ocean are limited. We report on the vertical and horizontal movements of sand tigers off the US east coast using archival pop-up satellite transmitters. Transmitters were deployed on 13 sand tigers (168 - 232 cm TL) in Delaware Bay in late summer 2008. Duration of tracks ranged from 12-154 days (\bar{x} =105), allowing reconstruction of 12 horizontal tracks using light-level data and a Kalman filter state-space model. Seven of the males exhibited directed movements south along the US east coast to waters off North Carolina, whereas all three females initially moved eastward into deeper offshore waters and remained largely in waters off New Jersey to Virginia. While in Delaware Bay, sand tigers spent the majority of their time at depths of less than 10 m and at 19-22°C. During their migration south, males occupied deeper water, primarily 20-80 m (max depth 188 m), and upon arrival in North Carolina waters in late 2008 or early 2009, some males moved into shallower water. Female sharks generally inhabited shallower water during their migrations, remaining predominantly at depths < 50 m (maximum depth 92 m). Water temperatures occupied by sharks ranged from 13-26°C, with females averaging 21-23°C and males 19-24.5°C. These initial results suggest possible differences in the

movement behavior of male and female sand tigers, but need confirmation by tracking more animals of each gender.

0483 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Christopher Thawley¹, Ariel Rodriguez², Leslie Rissler¹

¹University of Alabama, Tuscaloosa, AL, USA, ²Instituto de Ecología y Sistemática, Havana, Havana, Cuba

Phylogeography and Invasive Spread of Two Cuban Anurans in the Southeastern United States

Invasive species are a major cause of extinctions in the U.S., and predicting the spread of invasions is a major conservation priority. The Cuban treefrog (*Osteopilus septentrionalis*) and the greenhouse frog (*Eleutherodactylus planirostris*) are two anurans native to Cuba and invasive in the southeastern U.S. We use a combination of phylogeography and ecological niche modeling to determine sources of invasive populations, analyze patterns of invasion and differences in genetic diversity between the native and invasive ranges. Portions of cytochrome b were sequenced for genetic analyses. Ecological niche models (ENMs) were constructed in Maxent using climatic data and point localities from natural history collections and field observations. In Cuban treefrog populations, two haplotypes are fairly evenly mixed across the southeastern U.S.; these haplotypes show high levels (approx. 4%) of pairwise divergence and correspond to distinct areas in western and central Cuba, suggesting at least two independent invasions. Mixing of these haplotypes in the invasive range results in higher average genetic diversity in invasive populations. Similarly two haplotypes have been identified in invasive greenhouse frog populations corresponding to areas in western central Cuba.

Preliminary data suggests extremely low diversity at most sites in the southeastern U.S compared to native populations. For both species, habitat suitability scores from ENMs constructed using invasive range data highlight areas in Cuba containing haplotypes corresponding to those in invasive populations. Our results suggest that using phylogeographic and ENM-based approaches in combination can aid in identification of source populations and refinement of predictions of invasive spread.

0726 Poster Session III, Sunday 10 July 2011

Benjamin D. Thesing, David E. Starkey

The University of Central Arkansas, Conway, AR, USA

Population Genetic Analyses of the Southern Redback salamander (*Plethodon serratus*) in the Ouachita Mountains

Recent studies on habitat fragmentation have centered on terrestrial amphibians due to their limited dispersal capabilities. The resulting restriction of gene flow is thought to cause a reduction in genetic diversity and a decrease in population health through genetic drift or inbreeding. In order to further address this issue, we examined the genetic variation of the Southern Redback salamander (*Plethodon serratus*) in the Ouachita Mountains. This study was initiated to determine if there is gene flow between localized populations across our study area. Our populations were defined as areas of 500 meters or less of continuous forested area, without any apparent barriers to gene flow. We selected 7 populations across the center of the Ouachita Mountains for analyses. Sample locations were between 7 and 56 kilometers apart. At each localized population between 10 and 20 samples were collected by overturning rocks or logs. Whole animals were collected or approximately 1 centimeter of tail was removed and stored in 95% ethanol for DNA analysis. Six of 13 dinucleotide microsatellites, previously developed for the Redback salamander (*Plethodon cinereus*), will be examined to investigate genetic diversity and gene flow between and within populations of *P. serratus*.

0613 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Richard Thomas

University of Puerto Rico, San Juan, Puerto Rico, Puerto Rico

Blindsnake Evolution: The Blindsnakes of Hispaniola (Typhlopidae and Leptotyphlopidae)

The species of Hispaniolan blindsnakes, their distribution, relationships and biogeography, are discussed, including newly discovered and cryptic species.

**0378 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH
STOYE GENERAL ICHTHYOLOGY AWARD**

Alfred Thomson

Florida Museum of Natural History, Gainesville, FL, USA

Molecular Phylogenetics of the African Catfish Family Amphiliidae (Teleostei: Siluriformes).

Catfishes of the family Amphiliidae are small to moderate-sized fishes native to small streams throughout sub-Saharan Africa. The phylogenetic relationships, monophyly, and limits of Amphiliidae have been the subject of considerable debate. The family was erected by Regan (1911), who divided it into two major groups. The genera *Amphilius* and *Paramphilius* were placed in the subfamily Amphiliinae, and the genera *Andersonia*, *Belonoglanis*, *Doumea*, *Paraphractura*, *Phractura* and *Trachyglanis* were placed in the subfamily Doumeinae. David and Poll (1937) proposed that the bagrid genus *Leptoglanis* was more closely related to species of Amphiliidae and included it in the family. Harry (1953) rejected the inclusion of *Leptoglanis* in the family, but Bailey and Stewart (1984) transferred *Leptoglanis* back to Amphiliidae and included *Zaireichthys*, a genus described by Roberts (1967) and thought to be closely related to *Leptoglanis*. The inclusion of *Leptoglanis* and *Zaireichthys* in Amphiliidae has been strongly supported by subsequent phylogenetic analyses, and three subfamilies are currently recognized in the family: the Amphiliinae, the Doumeinae, and the Leptoglanidinae. In the present study, mitochondrial and nuclear sequence data are used to test the monophyly of these three subfamilies, examine the relationships among the subfamilies, and test the monophyly of many of the amphiliid genera. Taxon sampling is especially strong for the genus *Amphilius*, and analyses recover several well supported clades consistent with morphology within *Amphilius*.

0720 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Alexander Tilley, Marie Smedley, John Turner

Bangor University, Wales, UK

Functional Ecology of the Southern Stingray (*Dasyatis americana*) in a Tropical Shallow Reef System

The Southern Stingray (*Dasyatis americana*) is one of the most common elasmobranch species in the Caribbean, found in shallow sand and seagrass habitats, yet its functional ecology within these systems is poorly understood. This study aimed to understand aspects of mesopredator ecology, and provide insight into the dynamics of top down control by working in an isolated reef, where the shark population is quantified. Movement patterns of *Dasyatis americana* were investigated at Glovers Reef Marine Reserve, Belize, using manual acoustic tracking & in-water follows, between June 2009 and August 2010. 15 rays (27-86cm DW) were tagged and manually tracked for 13-32 hours. Additionally, 45 hours of in-water follows for 86 rays for 1hr periods were

analyzed for fine-scale foraging behaviour. Analyses show that as with other elasmobranch species, southern stingrays exhibit ontogenic expansion of activity space, and that foraging patterns increased in organisation with age. Stingray movements and habitat use showed diel periodicity, with rate and linearity of movement of tagged animals correlating with night and day. Tagged animals remained in a very precise depth (0.5-7m) and habitat band (accumulated algae fields at the base of a sand slope), foraging only occasionally in shallower sandflat habitat, and avoiding deeper lagoon areas entirely. Understanding of the ecological role of this mesopredator is important in enhancing MPA and fisheries management systems in Belize and the wider Caribbean.

0291 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Jessica Tingle

Cornell University, Ithaca, NY, USA

Field Observations on the Behaviour and Ecology of *Langaha madagascariensis*

The purpose of this project was to study the behavior and ecology of the vine snake *Langaha madagascariensis* in the wild. The locations of the study were the littoral forest fragments of Mandena and Petriky in the southeast of Madagascar, but the snakes were observed only at Petriky. Snakes were found by walking through the littoral forest, both on and off trails. When an individual was found, it was observed for as long as possible and every behavior was recorded with its frequency and duration, and notes were taken on microhabitat. Behaviors observed included stalking, capturing, and consuming prey, flight, and resting. Times spent performing specific activities were quantified, as was the amount of time spent in each microhabitat. All 6 individuals found were males, and a total of 52.5 hours of observations were made. One male captured and consumed the terrestrial lizard *Chalarodon madagascariensis*, and another male captured and consumed the arboreal day gecko *Phelsuma modesta*. All individuals preferred between 0 and 2 m above the ground except for one male, and he spent most of his time above 4 m.

0190 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011; ASIH STOYE GENERAL ICHTHYOLOGY AWARD

Michelle Tipton

Wesleyan University, Middletown, CT, USA

Phylogeography of the Eastern Blacknose Dace, *Rhinichthys atratulus*

During the last ice age, much of North America as far south as 40° north was covered by glaciers (Hewitt 2000). About 20,000 years ago, as the glaciers retreated, the hydrologic landscape changed dramatically creating waterways for fish dispersal. The number of populations responsible for recolonization and the regions from which they recolonized

are unknown for many freshwater fishes living in New England and southeastern Canada. The Blacknose Dace, *Rhinichthys atratulus*, is an obligate freshwater fish species that recolonized this region. With over 500 individuals analyzed, phylogenetic analyses have begun to elucidate the recolonization routes and identify the glacial refugia for this species. For example, one identified likely route of recolonization for Connecticut's population is the temporary freshwater river that existed in Long Island sound ~17,000 years before present (Stone et al. 2005). From dates (calibrated with radiocarbon dating, paleomagnetism and varve chronology) of biogeographic events such as this and the chronology of New England's deglaciation, I have also calculated rates of divergence of >5% per my within the post-glacial populations. While this is higher than the commonly accepted rate of 2% for mitochondrial DNA, these results join a growing list of publications finding high rates of divergence for various taxa (Peterson & Masel 2009). For the greater New England region, our data suggests that it was recolonized by multiple genetically distinct populations that diverged prior to/ during the last ice age. The high genetic similarities suggest that they came from different refugia in the south.

0075 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Stanley Trauth¹, David Sever²

¹Arkansas State University, State University, AR, USA, ²Southeastern Louisiana University, Hammond, LA, USA

Proximal Genital Ducts and Their Ultrastructural Characteristics in Male Flathead Snakes (*Tantilla gracilis*)

We examined the proximal genital ducts of non-reproductive and reproductively-active male Flathead Snakes, *Tantilla gracilis*, using light microscopy (LM) and transmission electron microscopy (TEM). Snakes were collected from the Interior Highlands ecoregion of Arkansas between early April 2007 and mid-January 2011. Specimens were returned to the lab and sacrificed using sodium pentobarbital. The proximal genital ducts were excised and prepared for LM and TEM using routine histological and ultrastructural techniques, respectively. We focused this study on four distinct regions of the anterior genital duct system: the rete testis, the ductuli efferentes, the ductus epididymis, and the ductus deferens. More posterior genital segments of the system, known as the ampulla ductus deferentis, and the most caudal portion, the ampulla urogenital papilla, were previously examined by us. All of these ducts are involved in secretion and absorption, and secretory activity varies from merocrine to an apocrine discharge. Epithelial cells in the rete testis are low cuboidal cells and in the ductuli efferentes range from cuboidal to columnar. The ductuli efferentes is the only portion of the duct system that has ciliated cells. The ductus epididymis and ductus deferens are pseudostratified with non-ciliated, columnar principal cells and scattered basal cells. Sperm aggregates associate closely with the epithelial surfaces in all ductal regions. The functional significance of secretory products released by the epithelia within this duct system remains unresolved.

**0214 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E,
Friday 8 July 2011**

Vance L. Trudeau¹, Gustavo M. Somoza², Guillermo S Natale³

¹University of Ottawa, Ottawa, Ontario, Canada, ²Instituto de Investigaciones Biotecnológicas-Instituto Tecnológico de Chascomús, Provincia de Buenos Aires, Argentina, ³CIMA, Facultad de Ciencias Exactas, Universidad Nacional La Plata, Argentina

Induction of Spawning in Anura by the AMPHIPLEX Method

Amphibian declines and the need for captive bred frogs for physiological and toxicological studies motivated us to develop the AMPHIPLEX method for spawning induction in mature anura. The method is based on the injection of a combination of a gonadotropin-releasing hormone (GnRH) agonist and a dopamine antagonist in order to stimulate luteinizing hormone surges in both sexes. We have named this formulation AMPHIPLEX, which is derived from the combination of the words amphibian and amplexus. The main experiments to establish the method used *Lithobates pipiens*. It was used in-season, after short-term captivity and in frogs artificially hibernated under laboratory conditions. The AMPHIPLEX method was also effective in 3 Argentinian frogs, *Ceratophrys ornata*, *Ceratophrys cranwelli* and *Odontophrynus americanus*. This requires the combined injection of des-Gly¹⁰, D-Ala⁶, Pro-LHRH (0.4 micrograms/g body weight) and metoclopramide (10 micrograms/g BWt. MET). These results will be reviewed, and an outline for future use and improvement of the method will be presented.

**0753 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD,
Minneapolis Ballroom E, Thursday 7 July 2011**

Michael Tuma¹, Emily Kochert²

¹University of Southern California, Los Angeles, CA, USA, ²SWCA Environmental Consultants, Pasadena, CA, USA

Modeling Habitat for Desert Tortoises in the Northeastern Mojave Desert

We developed and tested a habitat model for desert tortoise populations inhabiting the Gold Butte-Pakoon Critical Habitat Unit in the northeastern Mojave Desert. We developed the model using a series of ecological parameters that describe components of desert tortoise habitat, as determined through existing knowledge of desert tortoise habitat preferences. We compiled existing spatial datasets for occurrence of these ecological parameters, including geomorphological, geological, pedological, climatological, and botanical data within the mapped study area. We scored the variability within each dataset and mapped the ranked scores for each ecological

parameter at scales appropriate for our modeled landscape, which allowed us to predict areas of relative habitat suitability. We tested the model using occurrence data; plot surveys that sampled a range of habitats; and long-term radio-telemetric field data collection. Appropriate desert tortoise habitat was modeled over most of the study area, and we determined areas of relative suitability. Desert tortoise occurrence data confirmed that our habitat model was useful in predicting suitable habitat. Plot surveys and radio-telemetric observations confirmed that certain modeled ecological parameters, particularly the occurrence of geological landforms and soils that contribute to the formation of exposed caliche (CaCO₃) deposits, provided areas of enhanced habitat suitability. We developed this habitat model as part of a larger effort to develop a spatially-explicit population model that will simulate and rank the effects of anthropogenic threats within the modeled landscape, allowing us to prioritize tortoise conservation and land management recommendations at a site-specific level.

0309 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

John A. Tupy

Western Carolina University, Cullowhee, NC, USA

Terrestrial Habitat Choice Of The Endangered Dusky Gopher Frog

Prescribed fire can result in a mosaic of habitat patches having different characteristics. Animals that have a small home range may select patches with particular characteristics within a fire maintained area because the animals require a specific microhabitat. We examined terrestrial habitat choice of dusky gopher frogs (*Rana sevosa*) in a longleaf pine forest managed with winter and early spring fires. We tracked 13 adult and 4 juvenile gopher frogs from a breeding/metamorphosing site to terrestrial burrows using radio telemetry. Average distance traveled, measured from the center of the pond, was 158.22m (std. dev. = 52.02, min = 94.3m, max = 239.6m). Habitat data were recorded in nested 1m x 1m and 15m x 15m plots centered on the burrows individual gopher frogs (n=17) were tracked to, or randomly selected points (n=20). Nonmetric multidimensional scaling of the nine 1m x 1m plot variables and % canopy openness revealed that the gopher frog homesites grouped together when plotted (Stress=14.141). Compared to random sites, gopher frog homesites had a higher percent cover of grass and bare ground and a lower percent cover of shrubs and leaf litter within 1m x 1m plots, more underground refuges available within 15m x 15m plots, and a more open canopy (all P<0.03). The habitat characteristics found at gopher frog homesites are associated with the effects of fire. The selection of characteristics influenced by fire suggests that more frequent or intense fires, or applying fire during the growing season, may increase the availability of preferred microhabitats.

0123 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Sharon Turk, Christopher A. Sheil

John Carroll, University Heights, OH, USA

Patterns of Formation, Chondrification, and Ossification of the Cranial and Postcranial Skeleton of *Graptemys kohnii* (Emydidae)

Patterns of ossification and chondrification are well-described for many species of turtles, but none exist for *Graptemys kohnii*. Using cleared and double-stained specimens, we describe the sequence of formation, chondrification, and ossification of the entire skeleton of *Graptemys kohnii*, the Mississippi Map Turtle. The chondrocranium of late-developmental stages of embryonic specimens will be described and compared with those of other species of turtles. Furthermore, a comparative approach will be used to examine sequences of ossification in the cranial and postcranial skeleton of *G. kohnii* to other species of *Graptemys*, emydids, and turtles in general. Patterns of formation of elements of the fore- and hind limb autopodium will be discussed.

0704 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Thomas Turner, Trevor Krabbenhoft, Corey Love

Museum of SW Biology, Univ New Mexico, Albuquerque, NM, USA

New Insights from Old Specimens: Effects of Intensive River Regulation in the Rio Grande Revealed from Stable Isotopes of Preserved Material

Stable Isotopes of naturally-occurring elements offer a new way to interpret specimens held in natural history collections. We examined trophic structure of the fish community in the Rio Grande, New Mexico by evaluating stable isotopes of carbon and nitrogen at four locations and over a time span of 80 years. At present, the Rio Grande is heavily regulated for irrigation and flood control. Prior to regulation, the Rio Grande had extensive overbank flooding and increased connectance to adjacent floodplain habitats. We predicted that energy source heterogeneity and trophic structure would be diminished as river habitats were homogenized through channelization. We tested this prediction using a new analytical framework that characterizes and tests for differences in dispersion, central tendencies, and trajectories of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values across space and time. Our analyses revealed that instream carbon sources predominately fueled both historical and contemporary fish food webs, but energy sources to the food web were less heterogeneous over time. There was concomitant reduction in dispersion in $\delta^{15}\text{N}$, suggesting homogenization of trophic structure in the fish community. Isotopic analysis of museum specimens indicates that the Rio Grande has suffered losses in ecological diversity and ecosystem function that coincide with habitat homogenization and loss of species diversity.

0723 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

John Tyminski¹, Robert Hueter¹, Rafael de la Parra²

¹Mote Marine Laboratory, Sarasota, FL, USA, ²Proyecto Domino, CONANP, Cancun, Quintana Roo, Mexico

Patterns in Diving Behavior of Whale Sharks Identified through Pop-up Satellite Archival Tagging in the Gulf of Mexico

Pop-up satellite archival transmitting (PSAT) tags were attached to 33 whale sharks (*Rhincodon typus*) off Mexico's northeast Yucatan Peninsula 2003-2010, to examine these sharks' long-term movement patterns and gain insight into the underlying factors influencing their habitat selection. Archived data were received from 26 PSATs on immature and mature sharks of both sexes (9 males, 17 females) with total lengths of 5.5-8.5 m. Seven of these tags were physically recovered facilitating their direct download and a detailed view into the sharks' vertical movements (range of 2-180 days). Analyses using the fast Fourier transform revealed a distinct diel pattern in diving behavior that can be explained by regular and conspicuous depth-change events often coinciding with sunrise or sunset. Whale sharks feeding primarily on fish eggs off Isla Mujeres initiated an extended period of surface swimming at sunrise that abruptly changed to a pattern of regular vertical oscillations in the mid-afternoon. When in oceanic waters, *R. typus* often demonstrated a pattern of repetitive epipelagic dives that were punctuated by very deep dives followed by ascents initiated almost immediately after reaching maximum depth. Analysis of these extreme dives (those exceeding 500 m; max 1,888 m) revealed a mean descent rate (36.6 m/min) that was significantly faster than the mean ascent rate (25.7 m/min). An additional 7m male whale shark tagged off the southwest Florida Gulf coast in 2010 displayed the deepest dive we have yet recorded, to 1,928 m in the northern Gulf.

0037 Poster Session II, Saturday 9 July 2011

Franz Uiblein

South African Institute of Aquatic Biodiversity, Grahamstown, South Africa

The Diversity of Goatfishes: a Comparative Phenotypic Approach

The diversity of goatfishes is still insufficiently explored. For instance, in the Western Indian Ocean (WIO) the number of reported species has increased from 21 species in 1984 to 41 known today. Eleven of the 20 WIO species added since have been described only during the last three years. The genera *Upeneus* and *Mulloidichthys* deserve enhanced attention in particular, as they show considerable intraspecific variation in colour and body form that needs to be disentangled from characters allowing robust species diagnosis. Detailed studies of meristic, morphometric and colour characters provide also important information about adaptive traits involved in diversification and evolution of goatfishes. Good examples are the tail-fin markings and lateral body stripes

in *Upeneus* that should facilitate the co-existence of otherwise ecologically rather similar species. Colour patterns alone however do not always warrant reliable species distinction. For instance, the characteristic dark lateral spot of *Mulloidichthys flavolineatus* can be switched "on" or "off" depending on context. To overcome taxonomic challenges deriving from a rather high variability in colour and a rather low variability in meristic characters, a large set of morphometric characters has been used successfully in inter- and intraspecific comparisons of both genera. This comparative phenotypic approach has the added advantages of being applicable to formalin-fixated samples and permitting simple field-identification keys to be prepared; however, this approach aims also at integrating molecular studies towards a deeper understanding of evolutionary processes and patterns.

0106 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

Franz Uiblein¹, Jørgen G. Nielsen², Peter R. Møller², Werner Schwarzhans³

¹*Institute of Marine Research, Bergen, Norway*, ²*Zoological Museum, University of Copenhagen, Copenhagen, Denmark*, ³*Ahrensburger Weg, Hamburg, Germany*

On the Evolution of Colour Patterns in the Ophidiid Genus *Neobythites*

Neobythites is the species-richest genus of the entire order Ophidiiformes with 51 currently known species. Many *Neobythites* species have conspicuous colour markings like vertical bars across the body and dark spots and/or margins on unpaired fins. In several species eye-spots or ocelli occur on the dorsal fin which consist of a black spot surrounded by a contrasting white ring. A recent comparative study of ocellus variation in *Neobythites* indicated adaptive significance of this character in predator avoidance and social communication. Here we examine the question which role colour patterns have played in the evolution of *Neobythites* using a phenotypic phylogenetic approach. A total of 62 external and internal characters including various otolith measurements were obtained from a large number of individuals representing the 51 *Neobythites* species and eight out-group species from seven ophidiid genera. Based on both qualitative and quantitative coding methods a data matrix was prepared. Parsimony analysis using Paup software resulted in 54 equally parsimonious trees with most branches fully resolved on the strict consensus tree. When mapping the different colour characters on the branches, we noted repeated occurrence with a tendency towards more frequent appearance of spots, ocelli and bars in species positioned at more distant branches, whereas dark fin margins do not reveal such a trend. From these data we conclude that, while all colour patterns seem to reflect some degree of homoplasy, spots, bars, and in particular the ocelli may have contributed to the high level of diversification in this deeper-shelf and upper-slope dwelling genus.

0760 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Yumi Une

Azabu University, Sagami-hara, Kanagawa, Japan

Emergence of Ranaviruses in Japan

Ranavirus was discovered in *Rana catesbeiana* (Rc) larvae in a mass die-off in October 2008 in Japan. By 2010, five outbreaks in wild *R. catesbeiana* were discovered within a 35-km radius. Mortality events involving Rc occurred between the end of September and the beginning of October, and continued for several weeks. Fish mortality was documented at 2 sites and ranavirus was detected in one of these cases. Additionally, an outbreak occurred in a protected colony of 80 *Hynobius nebulosus* after the introduction of newly collected animals; the entire colony was annihilated in two weeks. These ranaviruses were registered as Rc ranavirus (RCV-JP) and *H. nebulosus* ranavirus (HNV) based on sequences of the MCP gene. Subsequent surveillance of 1200 wild amphibians revealed RCV-JP infections in Rc (larva), *Cynops ensicauda* (adult), *Hyla japonica* (adult), and *Rhacophorus arboreus* (larva). A third ranavirus TFV was found in *Fejervarya limnocharis* (adult). All infected animals appeared healthy except for *H. japonica*. In ranavirus challenge experiments using 13 native species (8 salamanders and 5 frogs, $n = 486$ individuals), the mortality rates of RCV-JP were 100% in salamanders and 33 - 100 % in frogs. The mortality rate of HNV was 0-100 %, with high mortality in all salamander species except *H. nigrescens*. Additionally, mortality was greatest at elevated temperatures. The two ranaviruses reported here could pose a threat to native amphibian species in Japan. More studies are needed investigating the threat of these isolates to other Japanese species and the prevalence of ranaviruses in wild populations.

0410 Herp Population Genetics/Herp Coloration, Symphony I & II, Monday 11 July 2011

Shem Unger, Rod Williams

Purdue University, West Lafayette, IN, USA

Population Genetics of the Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) at Multiple Spatial Scales

The eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) is a large paedomorphic salamander experiencing population declines throughout its geographic range. Causes for declines include habitat destruction, degradation, and illegal harvesting. The genetic ramifications of these population declines are currently unknown. To this end, we developed a suite of 12 hyper-variable genetic markers (microsatellites) to examine levels of gene flow, genetic variation, and genetic structure at both local and regional scales. We collected 812 individuals from 47 rivers throughout 11 states from June 2008 to September 2010. Levels of genetic diversity were relatively high among all sampling locations. The number of alleles per locus ranged from 4 to 32 (mean of 8.79), while observed heterozygosity and expected heterozygosity averaged 0.812 and 0.831,

respectively among populations. We detected significant genetic structure across populations (F_{st} values ranged from 0.0009 between rivers within a single watershed to 0.2182 between states across their range). Understanding range-wide levels of genetic variation and differentiation will enable natural resource managers to make more informed decisions and plan conservation strategies for this cryptic, protected species.

0616 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Peter Unmack

NESCent, Durham, NC, USA

Using GIS to Predict Population Connectivity in Southwestern USA Rivers Based on Continental Shelf Width

The phylogeography of coastal rivers is an important topic that so far largely remains under exploited in terms of its full research potential. Salt water acts as a strong barrier to obligate freshwater species. Salt water barriers are highly dynamic in that they are controlled by sea level changes and coastal geomorphology. As sea levels fall, barriers are removed as formerly isolated rivers may coalesce together and allow dispersal. Therefore, when sea level is lowered, there is greater potential for dispersal to occur. As sea level rises again, barriers reform, isolating the fauna of each now separate river basin. Changes in sea levels occur in cycles, and at least throughout Pleistocene have occurred every 100,000-150,000 years and are thought to be strongly influenced by Milankovitch Cycles. Here I use GIS to map continental shelf width and low sea level drainage patterns to establish some hypotheses that can be tested by phylogeographic data. Broad continental shelves should allow greater opportunities for populations to mix than narrow continental shelves, as there is more opportunity for rivers to coalesce and for fishes to move between coastal floodplains. From this we can predict that fish populations present in coastal rivers that are separated by similar continental shelf widths should have similar genetic divergences, and that those divergences should be greater in narrow shelves and lower in broader widths. By using GIS to quantify potential limitations to gene flow, specific regions and species can be targeted to allow these hypotheses to be broadly tested.

0617 Poster Session II, Saturday 9 July 2011

Peter Unmack

NESCent, Durham, NC, USA

Using GIS to Predict How Do Changes in Sea Level Potentially Influence Phylogeographic Patterns in Freshwater and Coastal Marine Fishes

Most research within phylogeography has concentrated on first identifying a biogeographic pattern from their phylogenetic results and then explaining this pattern due to some earth history event. My goal is to shift the focus in the opposite direction. That is, to map relevant aspects of earth history across the landscape and then see how consistent these earth history patterns are relative to the phylogenetic data. If these aspects of earth history are important in determining biogeographic patterns then phylogeographic patterns should be fairly consistent with them. If the patterns are not consistent then it suggests that we need to find alternative explanations for the observed phylogeographic patterns and that the earth history factors are not strong forces with broad impact. Here I present two examples using different aspects of continental shelf width to predict phylogeographic patterns. The first quantifies the relative degree and difficulty of movement of obligate freshwater organisms between drainage basins via low sea level connections. The second aspect of this research is to quantify potential habitat for coastal marine fishes at different sea level heights to contrast potential changes in population size since the last low sea level stand. Using GIS I have developed datasets that allow researchers to visualize and quantify continental shelf width for any region of the world. I provide some examples that demonstrate the utility of this approach.

0561 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

James Van Tassell¹, Luke Tornabene¹

¹*American Museum of Natural History, New York, NY, USA*, ²*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*

A New Deep-reef Goby from the Caribbean: a New Genus or Bizarre Basal *Bollmannia* (Gobiidae: Gobiosomatini)?

A new species of American seven-spined goby (tribe Gobiosomatini) is described. This species has been referred to as the "sabre goby" and the "filamentous goby" since it was first recorded in 1974, yet it has remained undescribed for over three decades. It is abundant on rocky reefs and talus slopes at depths of 90-200m in several locations through the Caribbean, where it occurs in groups ranging from 4-10 individuals to large schools consisting of dozens of gobies. Several past molecular analyses have suggested that this species belongs within the *Microgobius* group of the Gobiosomatini, perhaps as the basal member of a clade containing all other *Bollmannia* species. We discuss the

systematics of this species in light of previous molecular analyses and recent osteological examination.

0212 Poster Session III, Sunday 10 July 2011

Carrie Vance¹, Andrew Kouba², Scott Willard¹

¹Mississippi State University, Mississippi State, MS, USA, ²Conservation and Research Department, 2000 Prentiss Place, Memphis, TN, USA

Use of Near Infrared Reflectance Spectroscopy (NIRS) for Gender Determination in Amphibians: Applications for Sexing Monomorphic Species and Juvenile Animals

Many amphibians exhibit clear sexual dimorphism via color variation, physiological morphology, or calling behaviors; however, monomorphic species and juveniles may not. Evidence exists that some anurans exhibit sexually dimorphic chemical profiles in skin peptides, such as the Australian frog *Litoria splendida* where specialized peptides are present only in the skin secretions of the male. Our purpose is to develop a Near Infrared Reflectance (NIRS) spectroscopic approach towards distinguishing gender in amphibians with specific application to monomorphic species and juveniles in which traditional dimorphic physical and behavioral characteristics are not readily apparent. Gender discrimination by NIRS was tested with (20.37) *Bufo boreas* and (24.24) *Bufo fowleri* housed at the Memphis Zoo and Mississippi State breeding research colonies.

Full Vis-IR spectrum scans, ranging from 350-2500 nm, were obtained from live animals using a surface contact probe placed on the abdomen of the individual, and VisIR light reflectance captured using an ASD FieldSpec3® NIR Spectrophotometer. Chemometric analysis of spectra using GRAMS9.0® software utilized a 2-block PLS1 discriminant calibration after data processing for scattering inhomogeneity. Calibration and validation spectral sets were developed at an 80/20 ratio, and validation unknowns tested against the spectral libraries. For *B. fowleri* and *B. boreas*, 93% and 95% of individual animals were correctly classified by gender against the spectral calibration libraries, respectively. Thus, NIRS has great potential for non-invasive gender discrimination of amphibians, with over 90% reliability. Furthermore, the portable NIRS system would be applicable to field studies for *in situ* gender determination.

0540 Herp Behavior, Symphony I & II, Monday 11 July 2011

Terry VanDeWalle, Joshua Otten, Bob Doherty

Stantec Consulting, Independence, IA, USA

Homing Behavior of *Graptemys geographica* and *Chrysemys picta* in Michigan

Following an oil spill in the Kalamazoo River, over 2700 turtles, from eight species, were captured in a 48 km stretch of the river as part of a wildlife rescue and recovery effort.

Oiled turtles were cleaned of oil, rehabilitated and released at several locations inside and outside of the spill zone. Prior to release, turtles greater than 100 g were PIT-tagged for identification. A total of 293 *Graptemys geographica* and eight *Chrysemys picta* were recaptured, including multiple recaptures of some individuals. Members of both species exhibited homing behavior. Distances moved by individual recaptured turtles ranged from no movement to more than 16 km.

0747 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Alejandro Vélez, Mark Bee

University of Minnesota, St. Paul, MN, USA

Finding a Mate at a Cocktail Party: Dip-listening Improves Acoustic Mate Recognition in Cope's Gray Treefrogs

Dip-listening refers to our ability to catch brief “glimpses” of speech when the background noise momentarily dips to low levels. This mechanism allows us to solve the “cocktail-party problem,” which describes the difficulty we have following one conversation in noisy, multi-talker social environments. Nonhuman animals that communicate in dense social aggregations also face cocktail-party-like problems. We currently know relatively little about how nonhuman animals may be adapted to exploit various acoustic features of signals and noise to facilitate signal recognition in noisy environments. In this study of Cope's gray treefrogs (*Hyla chrysoscelis*), we asked whether female frogs listen in the dips of background noise to recognize male mating calls. In female phonotaxis experiments, we tested the hypothesis that temporal amplitude fluctuations in chorus-like noise influence thresholds for recognizing male mating signals. Compared to an unmodulated control, signal recognition thresholds were ~4dB lower when noise dips were long enough to include “glimpses” of nine or more consecutive pulses of the mating call. We did not find evidence for dip-listening when noise dips included five or less consecutive pulses. In quiet conditions, calls comprising six to nine pulses were necessary to elicit female response. These results suggest that the ability of female frogs to listen in the dips may be constrained by neural mechanisms underlying temporal pattern recognition. Because the sounds of frog choruses are often modulated at slow rates, female frogs might benefit from dips in the background noise to recognize signals in natural social environments.

0256 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Matthew D. Venesky¹, Richard J. Wassersug², Matthew J. Parris¹

¹The University of Memphis, Memphis, TN, USA, ²Dalhousie University, Halifax, NS, Canada

Missing Teeth Alters Feeding Kinematics in Pond-dwelling Tadpoles

The keratinized mouthparts of tadpoles play an integral role in feeding; yet, few data exist on how tadpoles feed when these structures are damaged and/or missing. We conducted a series of experiments using high-speed videography to explore how missing labial teeth alters the feeding kinematics and foraging performance of pond-dwelling tadpoles. We examined: (1) tadpoles with a high degree of tooth loss from *Batrachochytrium dendrobatidis* infection, (2) overwintered tadpoles with similar patterns of natural tooth loss, and (3) a controlled pattern of tooth loss by surgically removing one row of teeth from otherwise normal larvae. In each experiment, we measured two kinematic variables associated with feeding: the duration of: (1) the entire gape cycle and (2) time the teeth were in contact with an algal covered substratum. We observed similar effects on tadpole feeding kinematics despite different causes and patterns of tooth loss across experiments – the mouths of tadpoles with missing teeth slipped off the surfaces on which tadpoles grazed and were in contact with the substratum for a shorter duration in each gape cycle. In a follow-up experiment, we found that tadpoles with a row of surgically removed teeth obtained similar amounts of food as tadpoles with intact mouthparts. However, tadpoles with missing teeth completed approximately 25% more foraging bouts per unit time, suggesting that they needed to expend more energy to consume similar amounts of food. Collectively, our data indicate that tadpoles missing labial teeth forage less effectively than tadpoles with undamaged dentition and tadpoles.

0367 Poster Session II, Saturday 9 July 2011

Maria das Neves Silva Viana¹, Luciana Santos Viana¹, Tomas Hrbek¹, Paulo Cesar Machado Andrade², Richard Carl Vogt³, Izeni Pires Farias¹

¹Universidade Federal do Amazonas - ICB, Manaus, Amazonas, Brazil, ²Universidade Federal do Amazonas - ICA, Manaus, Amazonas, Brazil, ³Instituto de Pesquisas da Amazonia, Manaus, Amazonas, Brazil

Genetic Diversity of *Podocnemis sextuberculata* (Chelonia; Podocnemididae) Populations in the Brazilian Amazon

Podocnemis sextuberculata has a geographic distribution in the Amazon basin of Brazil, Peru and Colombia. Currently, it is classified as vulnerable by the IUCN Red List, with the principal threat being human consumption of eggs and meat. Exploitation of this species has caused changes in densities and structure of populations, as well as changes in sex ratio. In this study, we analyzed the genetic diversity of *P. sextuberculata* utilizing

the control region of the mitochondrial DNA and five nuclear DNA microsatellite loci, characterizing ten and five localities along the Amazon River, respectively. Results both from control region and microsatellite loci showed lack of differentiation among all sampled localities with the exception of comparisons involving individuals from the Nhamundá River. For this locality, the data also showed limited gene flow (Nm). Considering that the differentiation of the Nhamundá River from other localities in both data sets does not have an obvious biological or geographic explanation, and considering the low genetic diversity within the Nhamundá River locality which could be the results of sampling of related individuals, the result of the differentiation of the Nhamundá River should be interpreted cautiously. In both data sets, genetic divergence between localities is not correlated with geographic distance between them. Results are also concordant in revealing heterogeneity in genetic diversity among localities that is not correlated with anthropogenic actions. Given the existence of panmixia within *P. sextuberculata*, it may be possible to augment genetic diversity in depaupered populations via introduction of animals from selected appropriate localities.

0421 Poster Session II, Saturday 9 July 2011; STORER ICHTHYOLOGY AWARD

Kirill Vinnikov

University of Hawaii at Manoa, Honolulu, HI, USA

How Many Species Are Within the Genus *Pseudopleuronectes* (Teleostei: Pleuronectidae)?

According to the last revision of pleuronectids made by Cooper and Chapleau (1998), genus *Pseudopleuronectes* Bleeker, 1862 includes the following species: *P. americanus*, *P. herzensteini*, *P. obscurus*, *P. schrenki* and *P. yokohamae*. Most inferences about their relationships were obtained from the cladistic analysis of the osteological characters and ecological data. Specimens of *P. obscurus* were not analyzed, but the authors have suggested inclusion of this species based on the literature data. The last four species are endemics for the Sea of Japan and only *P. americanus* is the usual flounder for the US North Atlantic coast. I made comparison for both type and field collected specimens by the standard metric and meristic morphological characters with the addition of osteological information and molecular data from the mitochondrial COI and CytB gene sequences and over 300 RAPD-PCR markers for nuclear DNA. Both morphological and RAPD-PCR traits represented closer position of *P. obscurus* to *Pseudopleuronectes* than to its previous genus *Liopsetta*. Bayesian tree reconstructions based on mtDNA gene sequences showed close relationship of this species to *P. americanus*. All comparisons revealed intraspecific similarity between *P. yokohamae* and *P. schrenki*. Also no robust differences by the morphological characters, which are provided in the literature for these species, were found in type specimens and in field samples. On the contrary, distinct sexual dimorphism and size-related differences were observed. Therefore, I propose synonymy of these species and *P. yokohamae* (Gunther, 1879) as senior synonym. Identification key for all *Pseudopleuronectes* species and close related taxa is provided.

0244 Poster Session I, Friday 8 July 2011

Richard Vogt, Camila Ferrara, Rafael Bernard, Virginia Diniz-Bernardes,
Fernanda Rodrigues, Adriana Terra, Fabiano Waldez, Romildo Sousa

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

**Bottom Up -Top Down, a New Strategy in the Battle for the Conservation of
Giant Amazon River Turtles in Brazil**

Conservation efforts aimed at preserving populations of Giant Amazon River Turtles, *Podocnemis expansa*, have centered around police state actions against the riverine people who sell turtles to the middle men and environmental education programs with these same people aimed at changing their way of livelihood. Through the program of Petrobras Ambiental we are working from both ends of the food chain, from the turtle poacher (bottom up) to the city dweller buyer (top down). If the city dweller can be convinced to only buy legally raised turtles then the lucrative black market should recede. Simultaneously we will be giving classes on conservation and environmental awareness to school children and adults in the riverine communities on the Trombetas River. At the same time we will be hosting alternative production work shops, helping these people to change their life styles to gain income from sustainable use of the forest products available to them. School children and adults in Manaus will be given environmental awareness courses in hopes of changing their life styles of turtle consumption. In order to succeed we are constructing a turtle conservation and research center, which in addition to a class room and research facilities will also have all the species of Amazon turtles on display in large aquaria. Student guides will lecture people about conservation efforts as they are observing the turtles. With an active program at both ends of the food chain it may be possible to reap success.

0171 Invasive Species, Symphony I & II, Sunday 10 July 2011

Hardin Waddle

U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, USA

**Brown Anole Presence Reduces Occupancy of Green Anoles in Southern
Florida Natural Areas**

Since the introduction of Brown Anoles (*Anolis sagrei*) into Florida, numerous authors have noted the high densities that Brown Anoles achieve, especially in disturbed or in dry, sparsely vegetated habitats. The colonizing success of Brown Anoles has appeared to coincide with a decline in the occurrence of Green Anoles (*A. carolinensis*). The high density of Brown Anoles along with evidence of asymmetrical interspecific interactions is presumed to account for an apparent replacement of Green Anoles with Brown Anoles in some areas. I analyzed data from herpetofaunal surveys conducted at 180 sites in national parks and other protected areas in southern Florida from 2000 to 2008. The

effects of habitat and distance from the nearest road on occurrence were investigated for both anole species. Both species were found to have habitat specific occurrence probabilities; Brown Anoles were more likely to occur in forested habitat and Green Anoles were more likely to occur in open and wetter habitats. Considerable evidence was found that Brown Anole occurrence is negatively associated with distance from roads. Models of species interaction including both anole species indicated that the presence of Brown Anoles at a site has a negative effect on the occurrence of Green Anoles. These results indicate that Brown Anoles have invaded natural areas in south Florida, but are still most abundant near roads. Although Green Anoles do co-occur with Brown Anoles, there is now evidence from the field to support anecdotal observations that Brown Anole presences reduces the probability of occurrence of Green Anoles.

0719 Poster Session I, Friday 8 July 2011

Hardin Waddle, Brad Glorioso

U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, USA

Estimating the Power to Detect a Trend in Occupancy Monitoring Studies: Comparison of VES and Vocalization Surveys

The goal of most wildlife monitoring programs, often implied, is to determine if there is a trend in the population (i.e. is it declining?). Amphibian monitoring is difficult because detection of individuals is often imperfect and population abundance can fluctuate. Occupancy modeling provides a methodology suitable for monitoring amphibians that compensates for both imperfect detection and fluctuations in abundance, but determining the power to detect a trend in occupancy is a problem that has largely been overlooked. We used computer-simulated monitoring based on detection probabilities estimated from field data of four species from southern Louisiana to estimate the power to detect a trend using two standard methodologies: visual encounter surveys (VES) and vocalization surveys. We simulated 10,000 observation matrices for each species and analyzed the data using a standard occupancy model. We used model selection based on AIC to determine if the true model (the one with the decline) would be selected as the best model. Probability of detecting a 33% decline in site occupancy based on vocalization surveys was <25% for all four species, but power to detect the same trend using VES ranged from 80-100%. Detection probabilities were generally lower for vocalization surveys compared to VES which accounts for lower power to detect a trend and higher degree of uncertainty in occupancy estimates. Monitoring programs that sample species with low detection probabilities should be aware of decreased power to detect trends. Increasing the number of samples or altering methods to increase detection are possible solutions to this problem.

0365 Poster Session I, Friday 8 July 2011

Robert Wagner¹, Josh Pierce², Craig Rudolph², Richard Schaefer², Dwayne Hightower¹

¹Quantitative Ecological Services, Rosepine, LA, USA, ²USDA Forest Service, Southern Research Station, Nacogdoches, TX, USA

A Landscape-scale Model of Potential Louisiana Pine Snake (*Pituophis ruthveni*) Habitat

Ongoing surveys suggest that the Louisiana Pine Snake (*Pituophis ruthveni*) is declining; and currently occupied habitat is limited to a few small, isolated blocks of degraded and fragmented habitat. Research suggests that the species requires frequently burned sites with a well developed herbaceous understory capable of supporting populations of its primary prey, Baird's Pocket Gopher (*Geomys breviceps*). Baird's Pocket Gophers are associated primarily with sandy, well-drained soils. However, past attempts to identify the relationship between soil attributes and Louisiana Pine Snake occurrence at local and landscape scales were marginally successful. To develop a landscape-scale model of potential habitat, which is required for species management and recovery, we developed a resource selection function to predict suitability across the species range based on soil characteristics. We evaluated 26 *a priori* models consisting of different combinations of candidate SSURGO soil variables to explain the distribution of used and available resources at 162 individual historic snake locations. Of the models considered, the model consisting of hydrologic group (hydgrp) alone best fit the data. Hydrologic group is a categorical measure of runoff potential, incorporating water table depth and soil permeability. We used a dataset of 22 radio-tagged snakes to validate the model, both within and across individuals. Recently this model was used to rank potential sites for an ongoing reintroduction effort, to select potential conservation areas on private lands, and to identify suitable acres on federal lands.

0298 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F, Monday 11 July 2011

Peter Wainwright¹, Jose Tavera², Samantha Price¹

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Living on Reefs Promotes Faster Evolution of Feeding and Locomotor Traits in Haemulid Fishes

Reefs are known to harbor exceptional biodiversity but it is unclear what processes produce this pattern. We studied the impact of reefs on rates of morphological evolution in 50 New World species of Haemulidae, a group of shallow water marine fishes that have successfully radiated into many soft-bottom and reef niches. In each species, we measured 11 functional traits associated with the feeding mechanism and 13 traits that characterized body and fin shape and are thought to affect locomotor performance. Using an ultrametric phylogeny of haemulids and a Brownian motion model of trait

evolution we compared rates of evolution in the 24 traits between haemulid lineages that live on reefs and those that live in soft-bottom habitats. Rates of evolution were significantly faster in reef haemulids in 9 of 11 trophic characters and 5 of 13 body shape and locomotor traits. Rates were never faster in soft-bottom lineages. Overall, rates of evolution on reefs was 5.2 times faster in trophic traits and 2.1 times faster in body shape and locomotor characters. Reef lineages have also invaded novel regions of morphospace and adopted feeding niches not founding soft-bottom taxa. The causes of these results are not certain, but the biological richness found on reefs may provide a more complex adaptive landscape for haemulids than soft-bottom habitats, while the high species richness found on reefs may increase opportunities for character displacement. Both of these factors could result in faster trait diversification.

0371 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Christina J. Walker¹, James J. Gelsleichter¹, J. Marcus Drymon²

¹*University of North Florida, Jacksonville, FL, USA*, ²*Dauphin Island Sea Lab, Dauphin Island, AL, USA*

Assessing the Impacts of the Deepwater Horizon Oil Spill on Sharks Caught off the Coast of Alabama

The Deepwater Horizon oil spill (DHOS) is considered to be the largest offshore oil spill in U.S. history and the resulting contamination of the Gulf of Mexico (GOM) has posed health threats to many pelagic species that live in these waters. Studies on wildlife following past oil spills (i.e., Exxon Valdez oil spill) have provided evidence of population-level effects in some species following exposure to the toxic constituents, including polycyclic aromatic hydrocarbons (PAHs), of oil. However, these assessments are often difficult to perform based on the lack of baseline data on oil exposure in wildlife. Therefore, in response to the DHOS, this study will employ a biomarker approach in order to compare levels of PAH exposure in fifteen species of elasmobranchs caught both before and after the GOM oil spill from various locations off the coast of Alabama. Cytochrome P4501A1 (CYP1A1) activity, a reliable biomarker for PAH exposure, will be measured in the livers of these sharks (n≈700). It is expected that baseline levels of PAH exposure (CYP1A1 activity) in sharks collected prior to the oil spill, or prior to coming in contact with oil, will be lower than sharks collected near areas contaminated with oil from the spill.

0717 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Cathy Walsh, Carl Luer, Stephanie Leggett, Theresa Cantu, Jodi Miedema, Jennifer Yordy

Mote Marine Laboratory, Sarasota, FL, USA

Shark Immune Cell-derived Factors Induce Apoptosis (Programmed Cell Death) in T-cell Leukemia Cells

Research in our laboratory has demonstrated that protein factors secreted into the surrounding medium by short-term cultures of shark epigonal cells (epigonal conditioned medium, ECM) will kill human tumor cells *in vitro* by inducing apoptosis (programmed cell death). Studies presented here were designed to contribute to our understanding of the molecular mechanism through which ECM destroys tumor cells. Using a T-cell leukemia cell line (Jurkat) as the target cells, key enzymes in the apoptotic pathway are activated in Jurkat cells treated with ECM for 24 h compared with untreated control Jurkat cells. Both an initiator caspase (caspase-9) and an effector caspase (caspase-3) are converted from precursor forms to active enzyme forms as visualized using Western blots. These conversions are accompanied by several-fold increases in enzymatic activity for both caspase-9 and caspase-3. Enzymatic activity of another initiator caspase (caspase-8) is also increased in ECM treated Jurkat cells. In addition, Western blots confirmed that lysates of ECM treated Jurkat cells contain fragments of PARP (poly ADP-ribose polymerase), a nuclear enzyme responsible for DNA repair. Inactivation of PARP by caspase-3 cleavage in a specific domain of the enzyme allows DNA damage to go unrepaired and apoptosis to proceed. Molecular sizes of PARP fragments are consistent with caspase-3 cleavage and further support induction of apoptosis in Jurkat cells by ECM.

0582 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Thomas Waltzek¹, Bruce Drecktrah², Jeff Briggler³, Beth MacConnell⁴, Crystal Hudson⁵, Lacey Hopper⁵, Susan Yun¹, Kirsten Malm¹, Scott Weber¹, Ronald Hedrick¹

¹University of California at Davis, Davis, CA, USA, ²Blind Pony State Fish Hatchery, Missouri Department of Conservation, Sweet Springs, MO, USA, ³Missouri Department of Conservation, Jefferson City, MO, USA, ⁴Headwaters Fish Pathology, Bozeman, MT, USA, ⁵Bozeman Fish Health Center, Bozeman, MT, USA

Isolation of Frog Virus 3 from Pallid Sturgeon Suggests an Interclass Host Shift

During July - September 2009, juvenile pallid sturgeon (*Scaphirhynchus albus*) at the Blind Pony State Fish Hatchery (BPSFH) in Sweet Springs, Missouri experienced mortalities of over 500 individuals/day at water temperatures between 16 - 26 C.

Histological exams revealed necrosis of the hematopoietic tissues. A viral replicating agent was observed in cell culture and confirmed by electron microscopy. Experimental infection studies revealed the virus is pathogenic to pallid sturgeon – a federally endangered species. Analysis of the major capsid protein revealed that it was identical to the type species of ranavirus, *Frog Virus 3* (FV-3), and to a previous BPSFH isolate. This suggests that recurring infections or carryover of the virus from prior groups of sturgeon may have maintained the virus at this facility. Inasmuch as the BPSFH draws water directly from nearby Blind Pony Lake without disinfection, entry of ranavirus-contaminated water into the facility cannot be ruled out. However, liver samples collected from adult and larval American bullfrogs (*Lithobates catesbeianus*) and plains leopard frogs (*Lithobates blairi*) during the fall of 2009 and 2010 in nearby wetlands were negative for FV-3. The potential for reciprocal FV-3 infections (i.e. amphibian to fish and vice versa) has only been reported in sympatric populations of threespine stickleback (*Gasterosteus aculeatus*) and red-legged frog tadpoles (*Rana aurora*). Future research will focus on discovering the source of the virus at the facility (e.g. contaminated water supply, broodstock, etc...) as well as testing the host specificity and pathogenicity of the virus across a suite of poikilothermic vertebrates.

0599 Poster Session I, Friday 8 July 2011

Emily Warchol, John Waters, Johanna Imhoff, George Burgess

Florida Museum of Natural History, University of Florida, Gainesville, FL, USA

An Investigation of Internet Based Sale of Sawfish (Pristidae) Rostra

The worldwide decline in populations of critically endangered sawfish species is of considerable concern. Bycatch mortality is the predominant threat to sawfishes, but there is also a market for their fins and rostra. Rostra are sold as curios and trophies, used as religious offerings, in traditional medicine, in cockfights, as clothing pins, and made into tools. Fishers seldom target sawfish solely for rostra, but removal of the rostra is commonplace when removing bycaught sawfishes from nets. These rostra and fins provide supplemental income to fishers. While CITES listings make it illegal to trade in pristid fins and rostra, there are few data available concerning the internet-based sale of sawfish rostra. Records were collected from July 2010 to date using an internet alert for the sale of sawfish rostra and closely related products. In a few cases, individuals provided information on origin and/or ownership history of rostra. Information was gathered on individual rostra including origin of sale (website), seller country, sale price (USD), reported origin location (if provided), length of rostrum, etc. If photos were provided, the identification of species was made and number of rostral teeth counted. Relationships between price and length, between price and species, species composition, and points of origin will be discussed. Over 100 documented records indicate the sale of rostra is still an active trade. It is vital for sawfish rostra sales to be documented and efforts made to halt internet sales of this globally threatened group.

0124 Poster Session II, Saturday 9 July 2011

Daniel Warner, Timothy Mitchell, Fredric Janzen

Iowa State University, Ames, IA, USA

Sex-Specific Effects of Incubation Temperature on Hatchling Phenotypes of the Painted Turtle

Nest temperature determines offspring sex in many reptiles, but its sex-specific effects on offspring fitness are poorly understood, particularly in long-lived species. Models for the adaptive significance of temperature-dependent sex determination posit that egg incubation temperature differentially affects the fitness of male versus female offspring, thereby enabling each sex to develop under their own optimal thermal conditions. To address this hypothesis in a long-lived organism, we studied the sex-specific effects of incubation temperature during early life-history stages in the painted turtle (*Chrysemys picta*). By using hormonal manipulations, our experimental design enabled us to produce both sexes across a range of incubation temperatures (26°C, 28°C, and 30°C). Both sex and temperature contributed to morphological variation of hatchlings. Male hatchlings were smaller than females and were notably small when incubated under a female-producing temperature. Cool incubation temperatures (male-producing) induced relatively rapid growth rates after hatching, but this effect did not result in treatment differences in body size at one and two years of age. Hatchling turtles were also released into outdoor arenas to measure performance during simulated terrestrial dispersal from nests to water. Cool-incubated turtles reached arena perimeters more quickly than those from the other incubation treatments, but males and females did not differ. These results provide evidence that incubation temperature affects fitness-relevant traits of hatchlings independent of intrinsic differences between sexes. Our ongoing research will address the sex-specific effects of incubation temperature on other aspects of fitness (survival and reproduction) during adult stages.

0545 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Jason R. Warner, Robert E. Espinoza

California State University, Northridge, Northridge, CA, USA

Getting High and Chillin': Cold Hardiness of Liolaemid Lizards Living along an Elevational Gradient

Despite the thermal challenges imposed by cold environments, reptiles have evolved a diversity of behavioral and physiological strategies to cope with subzero temperatures. These include freeze avoidance, supercooling, and freeze tolerance. Freeze avoidance is a behavioral strategy usually involving taking refuge below the frost line. By supercooling, reptiles physiologically maintain body fluids in their liquid state at temperatures below the freezing point of water. Freeze tolerance allows some reptiles to recover after a significant portion of their tissues have frozen. We hypothesize that species of liolaemid lizards that have invaded cold habitats (>3000 m elevation) will

have either retained or evolved greater capacities to supercool and tolerate freezing while low-elevation species will have never evolved, or if ancestral, lost cold-hardiness abilities. To test my hypotheses, we are characterizing the thermal environments experienced by a diversity of *Liolaemus* species with operative temperature models. We will test physiological responses to cold by determining crystallization points (minimum body temperature attained before body fluids freeze) accomplished via supercooling, freeze tolerance abilities, and cryoprotectant concentrations in body tissues of each species. In sum, this study will use an explicit phylogenetic framework to test whether the cold-coping strategies of several species of *Liolaemus* vary as a function of the ecological pressures imposed by the high-elevation regions the lizards inhabit or are the result of phylogenetic conservatism. Habitat data confirms the lizards' need to survive extreme temperature fluctuations but preliminary data suggest no difference between the points of crystallization of low- and high-elevation species.

0338 Poster Session III, Sunday 10 July 2011

Mel Warren¹, Brooks Burr¹

¹USDA Forest Service, Oxford, MS, USA, ²Southern Illinois University, Carbondale, IL, USA

North American Freshwater Fishes: Natural History, Ecology, and Conservation

Over 1,200 native freshwater fish species occur on the North American continent, comprising the largest temperate, freshwater fish fauna on Earth. The importance of North American freshwater fishes in ecosystem function, their value economically and as providers of ecological services, and the increasing need and means to conserve this fauna cannot be emphasized enough. In the last 30 years, major advances have occurred for these fishes in disciplines of systematics, genetics, physiology, behavior, autecology, community ecology, and conservation. These advances, however, are marked by increased specialization and resulting fragmentation of knowledge about the diverse North American fish fauna. Our book will be the first-ever published, fully-illustrated multi-volume work synthesizing all that is known about the diversity, natural history, ecology, and biology of 52 families of North American freshwater fishes (including several marine families with species occurring in fresh water). The coverage includes Canada, the coterminous United States, and Mexico (south to about the Isthmus of Tehuantepec). Chapter authors will synthesize information on a set of standard topic areas for each family with emphasis on the generic level. We are striving for a near-comprehensive synthesis of existing information on North American freshwater fishes. The book also will have non-taxonomic chapters including syntheses on evolution and ecology of fish communities, mating behavior, status and effects of foreign fishes, and conservation. Currently, we have 71 authors engaged in the book. Volume 1 is anticipated to go to Johns Hopkins University Press in August 2011 followed by Volumes 2 and 3 at one-year intervals.

0552 Poster Session I, Friday 8 July 2011

John Waters¹, George Burgess¹, Felipe Carvalho², Gregg Poulakis³, Tonya Wiley-Lescher⁴

¹ Florida Museum of Natural History, University of Florida, Gainesville, FL, USA, ²School of Forest Resources and Conservation, University of Florida, Gainesville, FL, USA, ³Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA, ⁴Haven Worth Consulting, League City, TX, USA

Spatiotemporal Distribution of Smalltooth Sawfish, *Pristis pectinata*, in Florida Waters

The National Sawfish Encounter Database (NSED) documents all known encounters of the federally endangered smalltooth sawfish (*Pristis pectinata*), and the equally threatened largetooth sawfish (*Pristis perotteti*). Encounters, sightings and captures, are reported to the NSED from researchers and the general public. Data generated include the length of the fish, location based on a qualitative confidence scale, date, and water depth. Distance from shore was acquired by sampling encounter locations using ArcGIS. A Generalized Additive Model (GAM) was used to identify potentially important biological and environmental factors that could influence sawfish distribution and habitat use. A subsequent GAM using penalized regression splines was fitted to Florida encounters having confident locations assigned using the *mgcv* package in R statistics, optimizing the degree of smoothing estimated by the generalized cross-validation criterion. Model predictions of sawfish distribution with regard to maturity, season, and recovery region were then mapped in ArcGIS to visualize trends in spatial distribution. Hypotheses were tested to determine if there are spatial trends among sawfish maturity stages, seasonal distribution patterns, and determine the environmental variables that influence sawfish habitat use.

0276 Poster Session I, Friday 8 July 2011; NIA BEST STUDENT POSTER

Linet Cynthia Watson, Donald Stewart

SUNY-College of Environmental Science and Forestry, Syracuse, NY, USA

Population Genetics of the Giant *Arapaima* in South Western Guyana: Implications for its Management

The *Arapaima* is one of the most heavily exploited and threatened freshwater fishes in Guyana. Unregulated harvesting over the past 30 years has reduced the population to about 800 individuals over 1-m in length, but more recently, the number has increased to about 3,000. The population genetic structure of *Arapaima* was inferred with 11 microsatellite loci using samples collected from five locations in the Essequibo and Branco River basins in Guyana. Population structure was detected at different spatial

scales. Using a Bayesian approach that does not define the populations a priori three clusters were observed: (1) Rio Branco, (2) Apoteri, Iwokrama, Rewa, and (3) Karanambu. At the smallest scale, significant genetic differentiation was detected between most sampled locations through pairwise differentiation index (F_{ST}). Genetic variation was low with average heterozygosity of each sampling location ranging from 0.08 (Iwokrama) to 0.20 (Karanambu) and the overall average was 0.15. Intense harvesting over the past 30 years may explain the low genetic diversity observed. The results can be used to delineate management units. The Rio Branco population is most distinct, yet it is nearly extirpated and, presently, is receiving the least management attention.

0648 Herp Behavior, Symphony I & II, Monday 11 July 2011

Robert Weaver

Central Washington University, Ellensburg, WA, USA

Ants as Competitors for Refugia Sites with Pacific Northwest Dipsadine Snakes

Among the many abiotic factors that affect the lives of snakes is the presence (or absence) or suitable refugia. In the case of small, cryptic species, such refugia are small scattered rocks, downed limbs, or may be artificial in the form of discarded sheets of wood or metal. Rocks utilized by these snakes may be thick and deeply embedded into the substrate, multi-layered, or thin with just a portion embedded. Rocks provide protection, sites for thermoregulation, egg laying sites and in many cases, ambush sites for actively hunting snakes. The importance of these microhabitat types has been documented for all three species of dipsadine snakes native to the Pacific Northwest, the Desert Nightsnake (*Hypsiglena chlorophaea*), Ring-necked Snake (*Diadophis punctatus*), and the Sharp-tailed Snake (*Contia tenuis*). In this talk I present experimental data that shows ant of the genera *Pogonomyrmex*, *Formica*, and to a lesser extent *Camptonotus* can prevent these small snakes from selecting otherwise suitable refugia. During experimental trials the presence of live ants and odor of adult/larvae prevented both adult and juveniles of all three species from occupying a site. I also discuss how this may impact the laying of artificial cover when surveying for these species, as well how it may impact survey efforts and the ability to detect these species in areas with an abundance of these ant genera.

0647 Poster Session III, Sunday 10 July 2011

Robert Weaver¹, Daniel McEwen², William Clark³

¹Central Washington University, Ellensburg, WA, USA, ²Minnesota State University Moorhead, Moorhead, MN, USA, ³Western Wyoming Community College, Rock Springs, WY, USA

Odor Cues Allow the Desert Nightsnake, *Hypsiglena chlorophaea* (Colubridae: Dipsadinae) to Assess Prey Size

We tested to see if desert nightsnakes (*Hypsiglena chlorophaea*) can chemically discriminate between two prey size classes (small and large). Twenty-one adult individuals of *H. chlorophaea* (mean snout-vent length = 364 ± 14.3 SD) were collected in 2008 from a site in Washington State, U.S.A. We obtained odors assays of a known prey item, the western terrestrial gartersnake (*Thamnophis elegans*) collected at the same site as *H. chlorophaea*. The two size classes were a small *T. elegans* (164 mm snout-vent length, SVL) and a large *T. elegans* (640 SVL). We presented odors on pre-moistened 15-cm cotton swabs held 2.5 cm in front of snake's snout. For each trial we recorded the number of tongue flicks in 60 seconds, and the latency to first tongue flick. We compared these responses to each size class, as well as to separate odor controls (water and cologne). Analysis showed no statistically significant difference in latency times when comparing cologne to water, or small snake odor to these controls. In terms of tongue flicks, snakes responded the strongest to the small snake odor. Our study is the first to show that a species of snake can chemically discriminate between sizes of prey.

0515 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Denita M. Weeks, Robert E. Espinoza

California State University, Northridge, Northridge, CA, USA

When Warmer Isn't Better: Subzero Tolerances and Performance Eurythermy for the World's Southernmost Gecko

The biological consequences of predicted warming can be modeled if we know how species respond to temperature over their geographic range. Reptiles that rely on the availability of favorable temperatures to function may be particularly sensitive to warming. *Homonota darwinii*-the world's southernmost gecko-is broadly distributed from central to southern Argentina where cold climates likely pose a thermal challenge for this nocturnal species. We tested the null hypothesis that thermally dependent processes of this widespread species match its thermal environment over its broad latitudinal range. We predicted that the species would exhibit the greatest thermal mismatch to local thermal conditions in the coolest environments that *H. darwinii* occupies. We measured thermal tolerances (critical thermal minimum, CT_{min} and panting threshold, PT) and temperature-dependent sprint performance, resting metabolic rate (RMR), and evaporative water loss (EWL) at 10, 15, 25, 35, and 40 °C for four populations of *H.*

darwinii spanning most of the latitudinal range of the species. CT_{\min} differed across populations, but not latitudinally as anticipated. Remarkably, some populations had subzero CT_{\min} indicating supercooling—the first time this phenomenon has been reported for any gecko. Annual operative temperature data indicate gecko retreats play a crucial role in surviving harsh surface temperatures (<0 or >50 °C). Our sprint, RMR, and EWL data suggest *H. darwinii* is eurythermic, yet differences in physiological performance exist throughout the range. Ultimately, these data will be incorporated into biophysical and climate models to predict the future distribution of this lizard following predicted changes in regional temperature.

0612 Fish Physiology, Minneapolis Ballroom G, Monday 11 July 2011

Nicholas Wegner¹, Chugey Sepulveda², Scott Aalbers², Jeffrey Graham¹

¹*Scripps Institution of Oceanography, La Jolla, CA, USA*, ²*Pfleger Institute of Environmental Research, Oceanside, CA, USA*

Adaptations for Fast Swimming and Ram Ventilation: Gill Fusions in Scombrids and Billfishes

For ram-gill ventilators such as tunas and mackerels (family Scombridae) and billfishes (families Istiophoridae, Xiphiidae), fusions binding the gill lamellae and filaments are used to prevent gill deformation by a fast and continuous ventilatory stream. For scombrids, a progressive increase within the family for reliance upon ram ventilation correlates with the elaboration of gill fusions. This ranges from mackerels (tribe Scombrini), which only utilize ram ventilation at fast cruising speeds and lack gill fusions, to the most derived tunas (Tribe Thunnini) of the genus, *Thunnus*, which are obligate ram ventilators and have two distinct fusion types (one binding the gill lamellae and a second connecting the gill filaments). The billfishes appear to have independently evolved gill fusions that rival those of tunas in terms of structural complexity.

Examination of a large body-size range of some scombrid and billfish species shows that gill fusions begin to develop as small as 2.0 cm fork length, perhaps indicating the use of ram ventilation at the small juvenile stage. Materials testing of gill filaments with and without gill fusions suggests that these structures do not increase gill stiffness. Rather, gill fusions are likely used to maintain the spatial configuration of the gill sieve and may also increase branchial resistance to slow and streamline ventilatory flow produced by fast and continuous swimming to create optimal flow conditions past the respiratory exchange surfaces.

0503 Poster Session III, Sunday 10 July 2011; ASIH STORER HERPETOLOGY AWARD

Beck A. Wehrle

California State University, Northridge, Northridge, CA, USA

Eat Poop and Thrive: Testing the Role of the Lizard Lounge for Transferring Digestive Microbes

Researchers first attempted to identify the sources of the gut microbes harbored by herbivorous reptiles >30 years ago. These endosymbionts are needed to digest plant fiber (primarily cellulose and hemicellulose) and contribute substantially to their host's energy budget. *Iguana iguana* are herbivorous throughout life, yet emerge from their eggs with sterile guts. How do they acquire their gut microflora? Although rare in lizards, social interactions are a hypothesized route of microbe transfer via direct contact and/or eating feces of conspecifics. Early attempts to characterize this microbial community in hatchling iguanas provided crude assessments of turnover. Our study will be the first to characterize the spatial and temporal variation of these vital communities using modern genomic techniques. Over two hatching seasons we observed juvenile iguanas in social lounges on Barro Colorado Island, Panamá. Of the 128 focal observations of hatchlings, 41% were of social aggregations (mean group size = 2.9). Grouping hatchlings averaged 1 m from their nearest neighbor (range = 0–6 m), although densities varied among sites. We also collected microbe samples from iguanas over the first 60 d post-hatching. Microbial DNA will be isolated from samples and pyrosequenced to characterize the microbe communities of iguanas over space and time. We expect microbe communities to be most similar among proximate hatchlings and to increase in diversity over time.

0316 Fish Conservation, Symphony III, Saturday 9 July 2011

Stuart Welsh¹, Melissa Braham³, Dave Smith², Mary Mandt²

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Migration and Dam Passage of Yellow-Phase American Eels in the Shenandoah River of the Potomac River Drainage, USA

Information on migration and dam passage is important for the conservation and management of American eels. Size, age, and upstream migration of American eels were examined at an eel ladder, Millville Dam, Shenandoah River, from 2003 to 2011. About 15,000 eels were counted at the Millville Dam eel ladder since 2003. Eels using the ladder ranged primarily from 200 to 550 mm in length, and 3 to 10 years in age. Upstream movements of eels during spring, summer, and fall were associated with an increase in river flow and darker nights on or near the new moon. Monitoring of the eel ladder at Millville Dam will continue, with plans for additional ladders at dams farther upstream

allowing a more comprehensive study on eel movements within the Shenandoah River watershed.

0659 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Kevin Weng¹, Chris Lowe¹, Oscar Sosa-Nishizaki¹, John O'Sullivan¹

¹*University of Hawaii at Manoa, Honolulu, HI, USA*, ²*California State University - Long Beach, Long Beach, CA, USA*, ³*Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Ensenada, Baja California, Mexico*, ⁴*Monterey Bay Aquarium, Monterey, CA, USA*

Connectivity of US and Mexican White Shark Populations in the Eastern Pacific

In the eastern Pacific, aggregations of adult and subadult white sharks are known from the Farallones and Ano Nuevo in California, USA, and at Isla Guadalupe, Mexico. Interchange between these apparent population centers by adult sharks appears to be very low, with mixing occurring only in offshore waters. Genetic studies indicate a single population of white sharks in the eastern Pacific. One explanation of these apparently contradictory findings is that mating occurs in the offshore area, maintaining genetic panmixia. Another, related possibility is that both 'US' and 'Mexican' white sharks share a common, mixed nursery region. Parturition is thought to occur in the Southern California Bight and in Pacific waters of Baja California. Movement patterns of early juvenile life stages reveal consistent migrations from the Southern California Bight into Mexican waters of Baja California and the Gulf of California. Therefore, young-of-the-year and juvenile white sharks born in separate pupping grounds appear to share the same large nursery region. The recruitment into separate adult population centers may therefore be based not on ancestry, but instead on stochastic, environmentally mediated, density dependent, or facultative processes. Once an animal becomes associated with an aggregation, it shows fidelity through its lifetime, thereby maintaining two separate, but genetically homogenous groups.

0672 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

Bradley Wetherbee¹, Guy Harvey², Neil Burney³, Choy Aming³, Shara Teter², Mahmood Shivji²

¹University of Rhode Island, Kingston, RI, USA, ²Guy Harvey Research Institute Nova Southeastern University, Ft. Lauderdale, FL, USA, ³Bermuda Shark Project, Bermuda, Bermuda

Are Tiger Sharks Reef Sharks or Pelagic Sharks? Movements of Tiger Sharks in the Western North Atlantic

The tiger shark (*Galeocerdo cuvier*) is a large, far-ranging species that exhibits a variety of movement patterns depending on location and season. These sharks are managed by NMFS as part of the "large coastal" species complex under the Atlantic Highly Migratory Species Fishery Management Plan, but are occasionally observed far at sea and caught in pelagic fisheries. To investigate movements of tiger sharks, we tagged 26 individuals in Bermuda in late summer of 2009 and 2010 with fin-mounted "spot" satellite transmitters. Although a number of sharks made fairly rapid (~2 weeks) and straight-line moves from Bermuda to the Bahamas, other sharks followed meandering paths eventually reaching the Bahamas after several months. Several smaller individuals remained in Bermuda over the winter. Some sharks spent the winter months moving within relatively small, near shore areas within the Bahamas, and subsequently moved north into pelagic waters where they remained during summer months. Other sharks left the Bahamas a short time after arrival, moving into pelagic waters during winter months. Several individuals tracked over consecutive winters (>19 months) occupied similar wintering areas within the Bahamas. North-south seasonal movements for many sharks appeared to be related to water temperature, with the majority of time spent at 24-28°C. Most sharks demonstrated the ability to seamlessly shift between pelagic and insular habitats spending approximately equal time in both environments. Although movements vary substantially among individuals, tiger sharks demonstrate high mobility trophically connecting widespread and disparate marine ecosystems in the Western North Atlantic.

0432 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Matthew White, Greg Scott

Ohio University, Athens, OH, USA

Mitochondrial DNA Variation in the American Brook Lamprey

The American Brook lamprey (ABL) is a non-parasitic species with a broad distribution in eastern North America. It has a three to four year larval phase. Sequencing of the mitochondrial control region (Non-coding I) was performed on 35 individuals from 14 localities. Included in these samples were individuals of the so-called giant phenotype. Additional sequences were obtained from likely sister taxa. Our data identified almost no variation in either gene region throughout the range of the ABL. In addition, the

giants did not demonstrate any sequence divergence with normal phenotype ABL. This suggests that the giants may constitute a population that has retained a parasitic lifestyle or has reverted to a parasitic lifestyle. Our data suggest that the ABL colonized eastern North America since the retreat of the Wisconsinan glacier approximately 10KYA. Our data also identify Alaskan Brook lamprey as the most likely sister-taxon.

**0674 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD,
Minneapolis Ballroom E, Thursday 7 July 2011**

Steven Whitfield¹, Kelsey Reider¹, Jacob Kerby², Lydia Gentry³, Sasha Greenspan⁵, Sonia Ghose⁴, Maureen Donnelly¹

¹Florida International University, Miami, FL, USA, ²University of South Dakota, Vermillion, SD, USA, ³Washington State University, Pullman, WA, USA, ⁴Occidental College, Los Angeles, CA, USA, ⁵University of Maine, Orono, ME, USA

Pattern and Process in Amphibian and Reptile Declines at La Selva Biological Station, Costa Rica

Amphibian populations are declining even in pristine areas in many parts of the world, and in the Neotropics most such enigmatic amphibian declines have occurred in mid- to high-elevation sites. However, amphibian populations have also declined at La Selva Biological Station in the lowlands of Costa Rica, and similar declines in populations of lizards have occurred at the site as well. Herein, we assess the impacts of multiple, non-exclusive hypotheses that may explain these declines. We illustrate that climate- or mesomammal-related changes to dynamics of leaf litter, a critical resource for both frogs and lizards, strongly regulates population densities of frogs and lizards with the highest decline rate. Although lowland forests are generally believed to be too warm for presence or adverse population effects of chytridiomycosis, we present evidence for seasonal patterns in infection prevalence with highest prevalence in the coolest parts of the year. We evaluate toxicity of major current-use pesticides in Costa Rica to amphibians to illustrate that pesticide contamination within the La Selva reserve resulting from aerial transport from nearby agricultural zones is unlikely to directly affect amphibian survival. Our work illustrates that sites that are assumed to be pristine are likely impacted by a variety of stressors and we discuss links between faunal declines at La Selva and more typical amphibian decline events in the region.

0470 Poster Session I, Friday 8 July 2011

Benjamin Whitmore¹, Nicholas Whitney¹, Harold Pratt¹, Adrian Gleiss²

¹Mote Marine Laboratory, Sarasota, FL, USA, ²Swansea University, Swansea, UK

Design and Performance of a Release and Recovery System for Data-Logging Tags on Sharks.

The rapidly expanding use of high-resolution data-loggers to study marine vertebrates presents a wealth of new opportunities for understanding the behavior, physiology, and ecology of these animals *in situ*. It also presents a number of new logistical challenges, one of the biggest of which is the need to physically recover the tag in order to download data. We designed and tested a logger release and recovery package consisting of a microsphere-resin float, VHF transmitter, and galvanic timed release that allowed loggers to remain on animals for several days before being released. Upon release, tags would float to the surface and be located using a VHF receiver. Galvanic timed release duration was found to be correlated with water temperature, which meant that the tag packages of animals that swam in deeper (cooler) water stayed attached longer than those of animals that stayed in shallow, warmer water. This method produced recovery rates of 86% in nurse sharks (*Ginglymostoma cirratum*) over periods of 1-5 days and distances up to 7 km, and has been recovered at distances of 16 -27 km in other shark species. This represents a cost-effective method for recovering data-loggers from sharks. Logistics of float design and counter-weighting are also presented.

0465 Poster Session I, Friday 8 July 2011

Nicholas Whitney¹, Kristen Hart², Michael Cherkiss³, Michael Rochford³, Frank Mazzotti³

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Activity and Putative Feeding Behavior of Invasive Burmese Pythons (*Python molurus bivittatus*) from Acceleration Data-Loggers

The establishment of a population of Burmese pythons (*Python molurus bivittatus*) in Everglades National Park has been a considerable cause for concern due to their impact on the ecosystem via consumption of native birds, mammals, and reptiles. Efforts to control this population are underway but are hampered by a lack of information about the activity cycles and behavior of snakes in the wild. We conducted a pilot study using acceleration data loggers (ADLs) to continuously record the movements and body posture of captive and free-living pythons in Everglades National Park. Captive trials indicated that acceleration data could be used to easily distinguish between moving and resting, as well as different types of locomotion (e.g. concertina, rectilinear, etc.). Results from a free-living snake showed the animal to be most active at night, typically starting to move just after sunset. Sudden rolling behavior was detected on one morning shortly

after sunrise and continued for several minutes, after which the animal did not move significantly for the next six days, suggesting a successful feeding event followed by digestion. Deployment of an ADL in conjunction with a GPS data logger showed that animal movement did not coincide with periods of high variance in GPS fixes, illustrating the potential pitfalls of inferring fine-scale movement from GPS data alone.

0691 Poster Session III, Sunday 10 July 2011

Kellie Whittaker¹, Michelle Koo¹, Carol Spencer¹, Joyce Gross¹, Vance Vredenburg², David Bloom¹, David Blackburn³, David Cannatella⁴, David Wake¹

¹*University of California, Berkeley, CA, USA*, ²*San Francisco State University, San Francisco, CA, USA*, ³*University of Kansas, Lawrence, KS, USA*, ⁴*University of Texas, Austin, TX, USA*

AmphibiaWeb: On the Cutting Edge of Herpetological Biodiversity Informatics

Amphibians comprise the most endangered group of vertebrates, with nearly one-third of the world's amphibian species under threat of extinction. Hence there is a particularly urgent need to facilitate research into amphibian biodiversity, and for distributional data to be widely available. AmphibiaWeb provides access to information on the natural history, conservation, declines, and taxonomy of amphibians, contributed by herpetologists from around the world. AmphibiaWeb partners with HerpNet and VertNet to provide a dynamic mapping tool by retrieving individual vouchered, georeferenced specimen records from 55 institutions, and overlaying these data as markers onto IUCN's expert range estimations, with satellite or USGS topoquad base maps. In addition, AmphibiaWeb uniquely reports new published species and maps their holotype localities to produce valuable metrics on amphibian discovery. IUCN has re-partnered with AmphibiaWeb, and IUCN summary accounts are again available for species where there is not yet an AmphibiaWeb account. Site usage has grown tremendously, to an average of 19,730 specific queries/day for 2010. AmphibiaWeb is always interested in collaborating with university research projects and other educational institutions to make more information and photographs available on amphibians and the global amphibian crisis. Herpetologists may want to be aware that in some cases, data contributions to AmphibiaWeb can also help fulfill the "broader impact" requirements of NSF grants.

0127 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

E O Wiley, Michael Doosey

University of Kansas, Lawrence, KS, USA

Teleost Epurals and Homology

Epurals have traditionally been counted sequentially from anterior to posterior. Teleosts typically have three epurals; however, epurals can vary from zero to five depending on the group and intraspecific variation. In basal teleosts, the typically three epurals are associated with the caudal skeleton proper, i.e. with specific ural centra. However, Arratia and Schultze have demonstrated that epurals may be associated with ural or preural centra. Their observations indicate that simple numbering can cause category mistakes in phylogenetic homology assignment. Work on model organisms (e.g. *Danio* and *Oryzias*) indicates that there is a decoupling of epural, notochordal, and hypural segmentation. A survey of epural variation including larvae of several euteleost species suggests that the plesiomorphic pattern of three epurals associated with the caudal skeleton has been variously modified. These variations may be useful as a source of new phylogenetic characters.

0059 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Michelle Wilkes-Martin¹, Judy Cole¹, Jennifer Germano², Andy Kouba²

¹*University of Memphis, Memphis, TN, USA*, ²*Memphis Zoo, Memphis, TN, USA*

Frequency of Exogenous Hormone Administration Affects Sperm Characteristics in the Fowler Toad (*Bufo fowleri*): Implications for Captive Breeding

Amphibian populations have been rapidly declining across the globe due to habitat loss, the spread of chytrid fungus, and environmental stressors. To prevent many species from going extinct captive assurance colonies have been established for conservation management. Zoo and university scientists have been examining different reproductive technologies in order to maintain the genetic diversity of these founder populations. It is critical that we determine the optimal frequency for hormone administration and sperm collections to improve current protocols for assisted breeding so that the number of males can be used to produce large numbers of offspring for reintroductions. To our knowledge, no studies have assessed the effect of numerous hormone treatments on the quality of sperm. Therefore, the purpose of this study was to assess sperm motility, forward progression, and concentration as a function of the frequency of hCG injections in Fowler's toads (*Bufo fowleri*). Four experimental groups of toads received 300 IU of hCG injections either twice a week, once a week, every other week, or every three weeks. This study showed a significant decline in the percentage of motile sperm and in sperm concentration in toads that received hormone treatments twice a week. Toads

that received injections given every two or three weeks appear to have no detrimental effect on their sperm quality. Overall, these results allow for future improvement in breeding programs in endangered *Bufo* species.

0766 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Jim Williams

Florida Museum of Natural History, Gainesville, FL, USA

Pleistocene River Drainages of Florida: Evidence from Fossil Fish and Mussels

During the Pleistocene, a span of 2.6 million years, the four glacial and three interglacial cycles drastically altered the landscape of Florida. During the most recent glacial maximum, about 18,000 years ago, the approximately 300-m drop in sea level exposed a vast land area off the west coast increasing the peninsular region to about twice its present width. The expanse of land off the east coast was far more limited especially in the southern portion of the peninsula. Examination of Pleistocene fossil freshwater fishes and mussels reveals the presence of a river drainage that connected Florida streams, as far west as the Apalachicola and Ochlockonee drainages, with the southern end of the peninsula. The presence of a large interconnected river drainage in peninsular Florida provided a dispersal route for aquatic organisms extending from the Panhandle to the southern tip of the peninsula during the Pleistocene.

0350 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

L. Jay Williams², James Sulikowski¹

¹*University of New England, Biddeford, ME, USA,* ²*Auburn University, Fairhope, AL, USA*

An Assessment of Seasonal and Individual Variation in Reproductive Hormones from a Captive Population of Female Little Skates

In order to successfully manage an elasmobranch species it is essential to understand the reproductive biology. Previous studies suggest that the little skate, *Leucoraja erinacea*, exhibits a continuous reproductive cycle however, discrepancies exist surrounding the timing and quantity of reproductive peak(s). An effective non-lethal technique which has been used to describe the reproductive cycle in elasmobranch species is the analysis of circulating steroid hormones. Although an accurate technique, the ability to clearly interpret correlations between steroid hormones and the reproductive cycle has been limited in some continuously reproducing species due to high variability amongst individuals. Thus, the goal of this study was to address problematic aspects of previous studies by using circulating steroid hormones to define both the reproductive cycle and

degree of individual variability in the little skate. Weekly blood samples were collected from 2008-2009 in a captive breeding population of little skates and analyzed for circulating levels of E₂ and P₄, by radioimmunoassay. Circulating levels of E₂ and P₄ ranged between 93.85 to 8,857.85 pg/ml and 12.5 to 12,817.96 pg/ml and varied greatly within individual skates, E₂ (i.e. 3196.85 ± 2073.89 SD) and P₄ (i.e. 689.59 ± 1864.51 SD). Similarly, variability in hormone levels between skates within each sampling week (i.e. E₂ 304 vs. 5,986 pg/ml) and month (i.e. E₂ 157 vs. 8,858 pg/ml) remained high suggesting an asynchrony in ovulation amongst females. The results from this study suggest that the little skate continuously reproduces throughout the year and lacks a reproductive peak in hormone concentrations.

0342 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

John Willson¹, William Hopkins¹, Christine Bergeron¹, Brian Todd²

¹Virginia Tech, Blacksburg, VA, USA, ²University of California, Davis, Davis, CA, USA

From Individual-level Effects to Population-level Responses: The Missing Link in Amphibian Ecotoxicology

Widespread concern about the role of environmental contaminants in global amphibian declines has prompted extensive experimental evaluation of contaminant effects in a variety of amphibian taxa. However, most ecotoxicological studies focus on effects on pre-metamorphic life stages, and few studies have attempted to translate these effects to the population level. We use our research on the effects of mercury (Hg) on *Bufo americanus* as a model for bridging the gap between individual-level contaminant effects and amphibian population dynamics. We synthesize the results of field surveys, and laboratory, mesocosm, and terrestrial enclosure experiments examining the effects of maternal and dietary Hg throughout the life cycle of *B. americanus* and use a demographic population model to mechanistically evaluate the population-dynamic consequences of Hg effects in the context of important amphibian population drivers such as larval density-dependence and environmental stochasticity. We demonstrate that embryonic effects and sublethal effects that delay maturation have minor effects on adult population size or extinction probability, whereas contaminant effects that reduce late-larval or post-metamorphic survival have important population-level consequences. We then parameterize the model to comprehensively incorporate Hg-effects, demonstrating that excessive Hg exposure through maternal transfer or larval diet, alone, has minor effects on *B. americanus* populations, whereas simultaneous maternal and dietary exposure results in reduced population size and a dramatic increase in extinction probability. Our results suggest that environmental contaminants can influence amphibian population viability, but that highly integrative approaches are needed to interpret the population-level consequences of individual-level effects observed in experimental studies.

0099 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Anthony Wilmes¹, Jan Crowley², David Gruenewald¹, Parth Shah¹, Robert Aldridge¹

¹*Saint Louis University, St. Louis, MO, USA*, ²*Washington University School of Medicine, St. Louis, MO, USA*

Identification of the Female Sex Pheromone in the African Brown House Snake, *Lamprophis fuliginosus*

Sex pheromones are chemical compounds emitted by animals that elicit sexual behavior among conspecifics. In squamates, these chemical cues are often secreted through the skin of females and picked up by male conspecifics using olfactory and vomeronasal senses. Identifying the chemical makeup of a snake sex pheromone has only been performed once in which the non-volatile pheromone of the red-sided garter snake, *Thamnophis sirtalis parietalis*, was identified as a combination of many different long chain methyl ketones. In this study we used the African Brown House Snake, *Lamprophis fuliginosus*, as our model. Using male courtship behavior as the bioassay for presence of sex pheromones, earlier work in our lab established that female sex pheromones were non-volatile. Females secrete this non-volatile sex pheromone through their skin, which is then transferred to the substrate when the female moves. Male snakes then use this pheromone trail to track and locate the female. Using high performance liquid chromatography and mass spectrometry we compared skin secretions of attractive females, non-attractive females and male snakes in order to identify chemicals specific to attractive females. Lathosterol, a steroid similar to cholesterol, was present only in attractive female skin secretions. Behavioral experiments were performed using artificially manufactured lathosterol (5a-Cholest-7-en-3b-ol) to determine if this steroid was indeed the female sex pheromone. Lathosterol induced male courtship behavior toward unattractive females in 6 of 10 trials.

0346 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Robert Winokur

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

The Chelonian Skin - More Variable than You Thought

Although features of the skin of turtles and tortoises are familiar, detailed discussion of chelonian skin is largely lacking in comparative anatomy texts, and it's the turtle shell and its scutes that have captured the attention of vertebrate morphologists. Although the skin of reptiles exhibits significant topographic variation (such as that between the dorsal and ventral surfaces of lizards and snakes), turtles exhibit more extreme topographic variation in skin structure than usually acknowledged. Functionally the skin can be a simple barrier that protects against mechanical intrusions and evaporative water loss, or it may be a surface for respiratory gas exchange, (reminiscent of amphibians). It may produce pheromones or defensive foul smelling secretions from

specialized holocrine glands. In some respects chelonian skin can be more mammalian-like than any non-mammal and non-hairy mammalian skin and smooth scale-less skin in chelonians can appear similar. Chelonian skin exhibits a variety of sensory receptors including tubercles, barbels, and keratinized pores. Too often the skin is discussed in texts as an “organ”, but it is better considered an organ system containing an array of organs. Chelonian skin demonstrates convergent evolution, especially between Asian and North American freshwater turtles. Convergences in texture, scalation and rather specific color patterns can be readily discerned. Other skin convergences include plastral hinges, and perhaps barbels. The existences of these convergences point to the diverse importance of the skin to chelonians. Future investigations of turtle integument should reveal more about basic chelonian biology, behavior, ecology, and evolution.

0260 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Megan Winton¹, Enric Cortés², David Ebert¹, Gregor Cailliet¹

¹Moss Landing Marine Laboratories, Moss Landing, CA, USA, ²NOAA Southeast Fisheries Science Center, Panama City, FL, USA

Comparative Demography of Two Populations of the Roughtail Skate, *Bathyraja trachura* (Gilbert, 1892), in the Eastern North Pacific

The roughtail skate, *Bathyraja trachura*, is among the longest-lived, latest maturing, and slowest growing skate species reported to date. Results of life history studies may indicate a latitudinal pattern in size and growth of the species, with individuals from the eastern Bering Sea (EBS) growing more slowly and reaching higher maximum ages than previously reported for the species off the United States west coast from the California Current ecosystem (CC). Age-structured demographic models were constructed based on empirical estimates of longevity and maturity from both ecosystems to investigate how observed differences in life history parameters affect population growth rates, to identify portions of the population most important from a management perspective, and to estimate the species' relative vulnerability to exploitation. Monte Carlo simulations were used to incorporate uncertainty in vital rates and generate mean estimates of demographic parameters and elasticities for each scenario. Mean annual population growth rates were higher for *B. trachura* from the CC ($\lambda = 1.184 \text{ yr}^{-1}$) than from the EBS ($\lambda = 1.003 - 1.072 \text{ yr}^{-1}$), with corresponding population doubling times ranging from 7.3 to 38.9 years. Elasticity analyses indicated that population growth rates of *B. trachura* are more influenced by juvenile and adult survival than either egg case survival or fecundity. The results of this study suggest that *B. trachura* is relatively unproductive with a limited harvest potential compared to other elasmobranchs.

**0061 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis
Ballroom F, Thursday 7 July 2011**

Lynea R. Witzak, Jackie C. Guzy, Steven J. Price, J. Whitfield Gibbons, Michael E. Dorcas

Davidson College, Davidson, NC, USA

Variation in Survivorship and Recruitment of *Malaclemys terrapin* Over Three Decades

Diamondback terrapins (*Malaclemys terrapin*) are a species of conservation concern and throughout their range populations have experienced noticeable declines. Threats include crab trapping, roads and human-subsidized predators. Mark-recapture studies have been conducted on terrapins at Kiawah Island, SC since 1983. All terrapins captured are measured and individually marked. Since the early 1990's, populations have declined and indications are that crab trapping plays a role in this decline. Continued evaluation of spatial and temporal variation in survivorship and recruitment is necessary to fully understand factors causing the decline and its impacts on the population. In this study, we used data from this long-term study to test four hypotheses related to survivorship and recruitment in terrapins: 1) population decline as a result of crab-trapping will cause a decline in male survivorship over time while female survivorship remains relatively constant; 2) population decline as a result of road mortality will result in a decline in female survivorship and constant male survivorship; 3) nest predators will lead to low recruitment while adult survivorship remains relatively constant; and 4) creek-specific population declines will be reflected in different levels of survivorship among the creeks. Using program MARK, survivorship was estimated using open-population models and recruitment was estimated using Pradel models. Variation in survivorship and recruitment was examined both spatially and collectively over three decades. Results from this study are essential for understanding terrapin population status and conservation needs and can act as a reference for turtle conservation and coastal ecosystem management.

0062 Poster Session II, Saturday 9 July 2011

Lynea R. Witzak, Courun J. Williams, Steven J. Price, Michael E. Dorcas

Davidson College, Davidson, NC, USA

Population Densities of Semi-Aquatic Turtles in Rural, Urban and Golf Course Ponds

Landscape composition varies among urban, rural and golf course ponds and such variation may affect population densities of semi-aquatic turtles inhabiting these ponds. Greater population densities may indicate higher quality habitats, therefore indicating which pond types are most suitable for maintenance of populations. Our objectives were 1) estimate turtle population sizes at 20 study sites, 2) determine population

densities at each site, and 3) evaluate variation in densities among urban, rural and golf course ponds. Species examined in this study included *Chrysemys picta*, *Trachemys scripta*, *Kinosternon subrubrum*, *Chelydra serpentina*, *Pseudemys concinna* and *Sternotherus odoratus*. We set 10 hoop traps at 5 rural, 5 urban and 10 golf course ponds which were checked every other day for 10 days. All turtles were given an individual code and measured. Population sizes were estimated using closed population capture-mark-recapture methods. Population sizes and densities varied among the pond types, with rural ponds having the highest densities. No correlation was found between pond size and population densities. To support greater turtle population densities, those managing ponds should have open nesting space around ponds, shallow areas with emergent vegetation suitable for young turtles and minimal anthropogenic disturbance.

0376 Poster Session III, Sunday 10 July 2011; ASIH STORER ICHTHYOLOGY AWARD

Jeremy Wright

University of Michigan, Ann Arbor, MI, USA

Adaptive Significance of Venom Glands in the Tadpole Madtom (*Noturus gyrinus*)

Studies of piscine venom glands have implicitly assumed them to be anti-predatory adaptations, but direct examinations of the potential fitness benefits provided by these structures have historically been lacking. The only previous experiments attempting to address this question in catfishes did not present alternative phenotypes to ecologically relevant predators, and their results are potentially confounded by the presence of sharp, bony fin spines in these species, which are also likely to represent significant deterrents to predation in addition to any benefit provided by venom glands. I presented an ecologically relevant predator (*Micropterus salmoides*) with Tadpole Madtoms (*Noturus gyrinus*) having one of several fin spine phenotypes (intact, stripped, absent), in order to demonstrate that the venom glands of this species do provide a significant fitness benefit, relative to individuals having fin spines lacking venom glands, or no spines at all. Intact madtoms were forcefully rejected by the predatory species, and were almost never consumed, while alternative phenotypes were always consumed, although those with stripped fin spines showed increases in predator handling time relative to spineless madtoms and control minnows (*Pimephales vigilax*). Experiments were also performed using a less venomous catfish species (*Ameiurus natalis*), which was demonstrated by toxicological and compositional examinations to possess an alternate venom phenotype to *N. gyrinus*. These results allow for the examination of adaptation at multiple levels of biological organization, and indicate that a single protein present in the venom of *N. gyrinus* may be responsible for providing the significant selective advantage conferred by the venom glands of this species.

**0409 Fish Evolution, Phylogeny & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Jeremy Wright, Reeve Bailey

University of Michigan, Ann Arbor, MI, USA

**Systematic Revision of the Formerly Monotypic Genus *Tanganikallabes*
(Siluriformes: Clariidae)**

The monotypic genus *Tanganikallabes*, endemic to Lake Tanganyika, is a poorly known member of the family Clariidae. Examination of 142 specimens housed in museum collections has revealed the presence of at least two additional species in this genus. *Tanganikallabes* sp. 1 is distinguished from all congeners by the length of its pelvic fins, the presence of a depigmented vertical bar on the opercular margin, and a combination of additional morphometric (pectoral spine length, preanal length, body depth at anus) and meristic (dorsal and anal-fin ray counts) characters. *Tanganikallabes* sp. 2 is distinguished from all other *Tanganikallabes* species by having a relatively shorter, incomplete lateral line, and shallow body depth at the anus, as well as shorter prepelvic and preanal lengths and a longer anal fin with a higher number of fin rays. A combination of several morphological characters, as well as cytochrome *b* and 18S-ITS1-5.8S-ITS2-28S rDNA sequence data indicate that *Tanganikallabes* constitutes a monophyletic group within the Clariidae and supports the recognition of additional species diversity. The monophyly of *Tanganikallabes*, coupled with the geographical isolation of this group to a single lake, satisfy the requirements for its classification as a true species flock, the latest to be described from Lake Tanganyika.

0026 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Yunke Wu, James Hanken

Harvard University, Cambridge, MA, USA

**Pre-Quaternary Climate Changes Promote Lineage Diversification and
Extinction in Chinese Stout Newts (Salamandridae: *Pachytriton*)**

Montane amphibians are ideal models to study lineage diversification at both spatial and temporal scales. We present a phylogeographic study of the stout newts, a genus of salamanders endemic to southeastern China. They live and reproduce in small montane streams at elevations from 50-1800 m. We use molecular and geographic data to understand the formation and distribution of genetic lineages under the influence of paleoclimatic changes. A mitochondrial genealogy was obtained for 24 populations that include all three described species and the taxonomically unnamed *Pachytriton* B. Based on molecular dating estimates, incipient speciations within *Pachytriton* occurred in the late Miocene, which coincides with a substantial intensification of the East Asian summer monsoon 7-10 Ma (million years ago). Subsequent lineage diversifications occurred mostly after 3.6 Ma, along with further strengthening of the summer monsoon. Heavy summer precipitation cause overflows of montane streams and may promote

dispersal into adjacent mountains followed by isolation and divergence. Contrasting phylogeographic patterns are found among species with hypotheses of directional expansion and/or local extinction. Using distribution data as a proxy for physiological tolerance of high temperatures in these cold-adapted salamanders, we build a temperature buffer-zone model that suggests large scale population decline or even extinction as a consequence of early Pliocene warming. Supported by NSF (EF-0334846, AmphibiaTree) to JH.

**0693 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis
Ballroom F, Thursday 7 July 2011**

Amy Yahnke¹, Alexandra Troiano¹, Christian Grue¹, Marc Hayes², Julie Tyson²

¹University of Washington, WACFWRU, Seattle, WA, USA, ²Washington Department of Fish and Wildlife -- Habitat Program, Olympia, WA, USA

Amphibian Phenology and Aquatic Weed Management in the Pacific Northwest United States

Timing of amphibian development and habitat use is critical to determining the potential effects of pesticide application in aquatic environments. Current restrictions on aquatic applications are based on salmonid life histories, but little is known about amphibians. We investigated amphibian species and life stages in wetland habitats invaded by reed canarygrass (*Phalaris arundinacea*) to determine the potential for exposure to herbicides used to control this invasive. Weekly surveys were conducted on two sites supporting Oregon Spotted Frog (*Rana pretiosa*) breeding populations encompassing the weed control season: May-September. One of the sites included plots that were mowed the previous year. Amphibians were generally more frequently observed in mowed plots, but the basis of this difference is unclear as treatment-specific detectability is unknown. Amphibian presence for all life stages was correlated with water depth in each of the habitats. Tadpoles of Oregon Spotted Frogs, Northern Red-Legged Frogs (*Rana aurora*), and Pacific Treefrogs (*Pseudacris regilla*) were found in all habitats, the last tadpole was detected on 24 August. The first metamorphic frogs were observed on 8 June and the metamorphic interval for all anurans lasted until 9 September. Northwestern Salamander (*Ambystoma gracile*) larvae were the most frequently observed salamander species and life stage. Salamander larvae were present throughout the sampling period. Metamorphic Northwestern Salamanders were found between 1 July and 9 September and metamorphic Rough-Skinned Newts (*Taricha granulosa*) were found until mid-August. Amphibians were present during the entire weed management season. Information on sensitive life stages may be useful in guiding management timing.

0301 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Atsuko Yamaguchi, Keisuke Furumitsu, Takeshi Ito, Shigeki Fujiwara, Yuki Minei, Gen Kume

Nagasaki University, Nagasaki, Japan

Reproductive Biology of Shortspine Spurdog, *Squalus mitsukurii*, around Ishigaki Island, Okinawa, Japan

Size at sexual maturity, reproductive cycle, and fecundity of the shortspine spurdog, *Squalus mitsukurii* (Jordan and Snyder, 1903), were examined based on specimens collected around Ishigaki Island, Okinawa, Japan from November 2006 until October 2010. Size [total length (TL)] ranged from 435 mm to 702 mm for males and from 430 mm to 945 mm for females, respectively. Females reached sexual maturity at a larger size than males (TL at 50% sexual maturity: males, 560 mm; females, 727 mm). Monthly gonadosomatic indices of males decreased from February to September. Nearterm embryos were observed in females with preovulatory ova from February to August. Uterine eggs, which were recognized as recently fertilized, were observed around the same time. Accordingly, parturition period is lengthy, which occurred from February to August, immediately followed by mating, ovulation, and fertilization. Based on monthly variations of size frequencies of embryos and ovarian ova, the gestation period was estimated to be approximately 1 year although previous studies suggested that it would take two years. Fecundity increased with TL and ranged from 1 to 5 (mean, 3.1) embryos per litter.

0386 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Bruce Young, Jessica Dumais

University of Massachusetts Lowell, Lowell, MA, USA

Propulsive Mechanics during Swimming in Water Monitors (*Varanus salvator*)

Monitor lizards swim similar to (the better studied) crocodilians and snakes, though with a functional complex that is distinct from both clades. This study attempted to generate a reasonably complete mechanical analysis of aquatic thrust production in *Varanus*. Electromyography was performed in the epaxial muscles at four levels of the vertebral column (two anterior and two posterior to the pelvis), the hypaxial muscles at two different vertebral levels within the tail, and from the caudofemoralis. All emg recordings were taken from semi-adult specimens freely swimming within a flow tank and were synchronized to high-speed videographic records. Water monitors trail their limbs passively while swimming, so the kinematic analysis involved quantification of the lateral undulations (wavelength, amplitude, etc.) of the trunk and tail. A morphological data set (projected area, mass, muscle cross-sectional area, etc.) of the trunk and tail segments was determined through dissection, photography, and MRIs.

Combination of the electromyographic, kinematic, and morphological data enabled an exploration of the mechanistic basis and efficiency of aquatic propulsion in *V. salvator*. Our analysis revealed that propulsive force was generated almost exclusively by the tail, and that there were marked regional differences in thrust production along the length of the tail. The mechanics of swimming in monitor lizards offer insights into analyses of the evolutionary radiation and hydrodynamic specialization of mosasaurs.

**0161 Poster Session II, Saturday 9 July 2011; STORER HERPETOLOGY
AWARD**

Melissa Youngquist

Miami University, Oxford, OH, USA

**The Curious Case of Blanchard's Cricket Frogs: Population Structure in a
Fragmented Landscape**

Dispersal between populations is vital for species persistence because it allows for colonization of new areas and for the rescue of populations on the brink of extinction. The probability of a population being rescued depends on the habitat matrix and how permeable different habitats are to dispersing individuals. In areas with high levels of fragmentation, individuals may encounter a variety of habitats which differentially affect successful dispersal and colonization. Southwest Ohio, historically deciduous forest, has a landscape composed primarily of farmland (row-crop, pasture land, hay fields) dotted with towns and small forest patches. Blanchard's cricket frog (*Acris blanchardi*), once one of the most abundant species in the eastern U.S., is experiencing enigmatic declines. Cricket frogs have an average life span of 4 months with complete turnover in about 16 months; thus this species is highly susceptible to local extirpation and may be reliant on successful dispersal events for population persistence. To determine how a landscape fragmented by anthropogenic land uses affects cricket frog dispersal, I surveyed 28 ponds in Butler and Preble counties, OH for presence of this species. Where observed, I collected tissue samples for genetic analysis using microsatellite markers. Utilizing tools afforded by population genetics and global information systems (GIS), I examined how the habitat and landscape matrix correlate with genetic diversity and population structure.

0122 Poster Session III, Sunday 10 July 2011

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Anatomy of the Fully Formed Chondrocranium of *Podocnemis unifilis* (Pelomedusidae), a Pleurodiran Turtle

The chondrocranium is a cartilaginous structure that forms around and protects the brain and sensory organs of the head. Through ontogeny, the chondrocranium may become more elaborate, remodeled and reabsorbed, and/or ossified. Though considerable attention has been given to the formation of the chondrocranium, and a great amount of data has been gathered on the development of this structure among many craniate groups, the anatomy of this structure in turtles often is neglected. We describe the mature chondrocranium of the pleurodiran turtle, *Podocnemis unifilis* (Pelomedusidae), and compare it to those of previously-described cryptodiran turtles (*Apalone spinifera*, *Pelodiscus sinensis*, *Chelydra serpentina*, *Macrochelys temminckii*, *Trachemys scripta*, *Chrysemys picta*, and *Eretmochelys imbricata*) to identify possible differences in anatomy observed among these taxa. Anatomy of the chondrocranium was described by examination of cleared and double-stained specimens.

0398 Poster Session I, Friday 8 July 2011

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Age and Growth of Yellownose, *Dipturus chilensis* (Guichenot, 1848), in the Southwestern Atlantic (34°- 55°S)

The yellownose *Dipturus chilensis* inhabits the southeastern Pacific and southwestern Atlantic Ocean. It is extensively exploited in both targeted fisheries and as by catch in the southwestern Atlantic. This study contributes to the knowledge of the age and growth of *D. chilensis* providing biological information that is essential for developing sustainable fisheries management strategies. Age and growth was studied based on vertebral analysis of 415 specimens collected on the Argentinean continental shelf (34oS - 55oS). Males specimens ranged from 24 to 110 cm (n=203), while females specimens ranged from 24 to 115 (n=211). Sectioned vertebrates were stained with cobalt chloride. The marginal increment analysis (MIA) supported the hypothesis that *D. chilensis* produces one growth band pair each year, which ends during autumn. Maximum estimated age was 21 and 25 years for males and females, respectively. The von Bertalanffy growth function was selected based on the best fit to the age-length data to males ($L_{\infty}=114.32$ cm; $k=0.10$ years⁻¹; $t_0=4.95$ years) and females ($L_{\infty}=149.05$ cm; $k=0.07$ years⁻¹; $t_0=-8.11$ years). Significant difference was detected between male and females growth parameters. Females reach larger size than males. These results indicate that *D.*

chilensis is a long-lived and slow growing species. Therefore, it is particularly vulnerable to over-exploitation by fisheries.

0692 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

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Comparative Gliding Performance of *Anolis carolinensis* and *Anolis sagrei*

The *Anolis* genus is composed of over 400 species, partitioned traditionally into six ecomorphs distributed from the ground to the tree crown. Because controlled aerial behaviors is suspected for many arboreal lizard species that either jump or fall from the tree canopy, vertical division of the arboreal niche among *Anolis* species makes them a prime subject for study of gliding abilities. Additionally, most members of the *Anolis* genus has little to no obvious morphological adaptations for controlled descent. I evaluated gliding performance of a trunk-crown species, *Anolis carolinensis*, following initial observations by Oliver (1951), and compared its performance to that of *Anolis sagrei*, a trunk-ground species. Parameters used to compare gliding performance were horizontal distance covered, translational speeds and accelerations. *Anolis carolinensis* adopts a far more flattened posture than *Anolis sagrei*, and its posture is reminiscent of the *Ptychozoon* geckoes and other known gliding species. In comparison to *A. sagrei*, *Anolis carolinensis* also has shallower glide angles. These results substantiate the existence of gliding and controlled falling in arboreal lizards with few or no obvious adaptations for aerial performance, and indicates that body posture plays an important role in gliding capacity.