

0547 Poster Session II, Saturday 9 July 2011

Shea Lambert

University of Rochester, Rochester, NY, USA

Molecular Systematics of Hispaniolan Crown-giant Anoles

Hispaniolan crown-giant anole diversity consists of three recognized species and eighteen total subspecies, indicative of extensive geographic variation. I present a multi-locus phylogenetic analysis of the group using one mitochondrial and nine nuclear loci. Sampling is fairly comprehensive for the Dominican Republic, comprising sixty-six total individuals from twenty-seven populations, with representatives from all three species and eleven subspecies. I use traditional concatenation, Bayesian, and maximum-likelihood approaches to infer phylogenetic relationships. I also include more recently developed analyses for inferring species trees from gene trees.

0029 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E, Friday 8 July 2011

Cecilia J. Langhorne¹, Natalie E. Calatayud¹, Tricia M. Rowlison¹, Andrew J. Kouba², Carrie K. Vance², Jennifer M. Germano², Kevin Thompson³, Elaine Davinroy³, Scott T. Willard¹

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Sperm Motility and Hormonal Induction Timing in the Boreal Toad (*Bufo boreas boreas*)

In recent years the southern Rocky Mountain population of boreal toad (*Bufo boreas boreas*) has experienced dramatic declines, therefore captive assurance colonies have been established to safeguard genetic diversity and facilitate reintroductions. Boreal toads can be difficult to breed naturally in captivity and exogenous hormones are being used to initiate spermiation and ovulation to assist with reproduction. Sperm induction in *B. boreas* can be achieved through treatment with hCG; however, further investigation of sperm quality parameters is required in order to optimise this protocol. Therefore, our objective is to characterise hormone dose requirements for spermiation by evaluating sperm production over time in response to administration of 100, 300 or 500 IU hCG. Urine was collected at 0, 2, 3, 5, 7, 9, 12 and 24hr post-injection and variables measured include: concentration; % motility; % forward motility; forward progressive movement and morphology. We will also explore the potential for short-term cold storage of spermic urine and recovery of viable sperm by investigating the process of sperm motility activation. These studies will allow us to develop breeding programmes to increase numbers and maintain high genetic diversity of captive populations of *B. boreas* and, ultimately, contribute to the re-introduction and recovery of this species. Further

studies include determining hormone protocols for stimulating egg production and exploring cryopreservation as a means of long-term gamete storage and genome security.

0685 Poster Session II, Saturday 9 July 2011

Matthew Lattanzio, Donald Miles

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Multiple Effects of Disturbance on Intraspecific Variation in Tree Lizard (*Urosaurus ornatus*) Populations: Behavioral and Isotopic Evidence

Individuals faced with altered thermal regimes and habitat structure due to broad-scale disturbance may respond in three ways: 1) shift in distribution, 2) exhibit plastic or evolutionary responses (behavioral compensation, phenotypic plasticity, or response to selection), or otherwise 3) fail to adapt and go extinct. Most often, species must attempt to maintain populations in a shifting environment by relying on the second choice. In particular, population persistence may be facilitated if individuals within the populations differentially use available resources (i.e., exhibit resource polymorphisms) and minimize potential competition. The success of this strategy however is contingent on external factors including both spatial and temporal resource availability and disturbance frequency. In addition, these polymorphisms may be associated with other behaviors and possibly variation in fitness. Here, we will discuss on-going findings of our research investigating the demographic, performance, and behavioral components of tree lizard (*Urosaurus ornatus*) populations across sites in southeast Arizona that differ significantly in resource availability and disturbance frequency. In 2009, we found evidence of resource polymorphisms among existing morphs (yellow, orange, and blue throated lizards, $\chi^2=7.869$, $P = 0.02$). Since then, we have also accumulated evidence that intraspecific behavioral and morphological variation is also associated with the variation in diet selection that contributes to these polymorphisms. Data will be presented from both 2009 and 2010 study seasons to more fully illustrate the effects of disturbance on this species.

0324 Poster Session II, Saturday 9 July 2011

Katie May Laumann, Casey Dillman, Eric Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, USA

Development of the Jaws of the White Sturgeon, *Acipenser transmontanus* (Acipenseridae)

The jaw morphology of sturgeons is distinct from that of other actinopterygians, and includes such specialized characters as the complete loss of the maxilla and premaxilla, the rotation of the palatoquadrate such that the left and right sides meet in a palatine

symphysis, complete loss of dentition as adults, the decoupling of the anterior part of the suspensorium from the neurocranium, and the presence of a post-palatoquadrate cartilaginous structure, the palatal complex. This reorganization results in a largely ventrally directed jaw apparatus. Despite this, and the intrinsic interest in sturgeons in the context of actinopterygian systematics, developmental studies of the jaw of sturgeons are rare. White sturgeon (*Acipenser transmontanus*) are native to North America, distributed from Alaska to central California, and east to northwestern Montana. In this presentation we will present new data on the development of the jaw in *A. transmontanus* based on a closely spaced growth series of hatchery-reared specimens ranging from 15 to 140 mm TL; in addition, skeletal specimens of adults (>1500 mm TL) were examined. In larvae there are well-developed teeth present on the dentary and dermopalatine; these are extremely reduced by about 45 mm TL. The shift from a forward facing to ventrally oriented set of jaws is nearly complete by 125 mm and complete by about 140 mm TL. We will draw on the published literature on behavior and ecology of early life history stages of sturgeons to test for correlation between ecology and developmental osteology.

0057 Poster Session III, Sunday 10 July 2011

Anne-Claire Lautredou¹, Cyril Gallut¹, Christina Cheng², Arnaud Couloux³, Guillaume Lecointre¹, Agnes Dettai¹

¹MNHN, Paris, France, ²University of Illinois, IL, USA, ³Genoscope, Centre National de Sequenc, age, Evry, France

Antarctic Radiations: The Trematominae (Notothenioidei, Teleostei)

Many studies have argued that the adaptive radiation of the suborder Notothenioidei (Teleostei) is equivalent to the species flocks of the African cichlids. The Trematominae are a particularly interesting subfamily within the suborder. Trematomus species occupy a large range of ecological niches, extremely useful for evolutionary and biogeography studies in the Antarctic Ocean. The genus contains eleven species but is monophyletic only when the two species *P. borchgrevinki* and *P. brachysoma* are included in the group. Moreover, a recently described species, *Cryothernia amphitrete*, appears to also belong within the subfamily. Even if Trematominae are well studied, relationships between these fourteen species are still unclear. Several recent studies have tried to resolve these relationships, but a low number of insufficiently variable markers, as well as incomplete lineage sorting problems, have precluded the attainment of stable results. The only repeated results place *T. scotti* as the most divergent species and *T. loennbergii* and *T. lepidorhinus* always in the same clade. We analyze here four nuclear markers and a mitochondrial marker with several approaches to get a better insight of the complex history of this possible recent radiation.

0056 General Ichthyology, Minneapolis Ballroom F, Sunday 10 July 2011

Anne-Claire Lautredou¹, Cyril Gallut¹, Corinne Cruaud², Guillaume Lecointre¹, Agnes Dettai¹

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Exploring the Relationships among Serraniformes (Teleostei)

Since the beginning of the 21st century, thanks to important Japanese, French and American molecular studies, the phylogeny of Acanthomorpha is getting better resolved. Some groups are repeated from one study to another and from one marker to another. This is the case for the "clade X", first identified by Dettai & Lecointre (2004, 2005), then confirmed by other studies and named « Serraniformes » by Li et al. (2009). Serraniformes include groupers (Serranidae), perches (Percidae), sticklebacks (Gasterosteidae), searobins (Triglidae) or « super families » like icefishes (Notothenioidei), sculpins and snailfishes (Cottoidei), eelpouts (Zoarcoidei) and scorpionfishes (Scorpaenoidei). Within this group, some clades are repeated among independent molecular data and are therefore considered as reliable, but many of the relationships are not resolved convincingly yet. In order to better resolve relationships among Serraniformes, we have tested two new nuclear markers, MC1R and MC4R (melanocortin-1 receptor and melanocortin-4 receptor) in addition to the datasets already in use in the lab. By including as many families as possible from Scorpaeniformes and Perciformes, and multiple outgroups, we provide a clearer picture of which are included in Serraniformes, and what the relationships within this group are.

0721 Poster Session II, Saturday 9 July 2011

J.P. Lawrence, Gerald Urquhart

Michigan State University, East Lansing, MI, USA

Population Demographic Changes Due to Addition of Artificial Rearing Sites in the Strawberry Poison Dart Frog (*Oophaga pumilio*)

Limiting resources have often been used for determining species distributions across a landscape. These resources not only determine species assemblages, but can also influence male and female distributions in relation to these resources. The Strawberry Poison Dart Frog, *Oophaga pumilio*, is a small, territorial species of frog that has shown a great divergence in color in the Bocas del Toro region of Panama. Given the diversity there, effective conservation methods are needed in order to preserve the genetic diversity in the species. Addition of limiting resources may provide effective methods of promoting population growth. We established six year-long quadrats (with three replicates) with manipulations of rear sites, leaf litter addition, and leaf litter removal. The rearing sites used were large diameter drinking straws folded in half to mimic bromeliads. Quadrats were monitored in June 2009, July 2009, August 2009, May 2010, and June 2010. Leaf litter addition and removal were not found to have any effect on

population density, but addition of rearing sites was found to have a large difference; on average, the addition of rearing sites doubled the population. This strong dependence to rearing sites offers insight to the possibility of effective conservation of populations in threat of extirpation, whether from overcollection or from habitat loss. The use of large diameter drinking straws can be utilized by managers as a cheap and effective method for supplementing small dendrobatid populations that are in threat of being lost.

0322 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Lisa Marie Leclerc², Christian Lydersen¹, Tore Haug³, Lutz Bachmann⁴, Aaron T. Fisk⁵, Kit M. Kovacs¹

¹Norwegian Polar Institute, Tromsø, Norway, ²University of Tromsø, Department of Arctic and Marine Biology, Tromsø, Norway, ³Institute of Marine Research, Tromsø, Norway, ⁴National Centre for Biosystematics, Natural History Museum, University of Oslo, Oslo, Norway, ⁵University of Windsor, Windsor, Ontario, Canada

Analyses of Gastro-intestinal Tracts of Greenland Sharks (*Somniosus microcephalus*) from Svalbard, Norway

Gastrointestinal tracts (GITs) from 45 Greenland Sharks (*Somniosus microcephalus*) collected in Svalbard, Norway, in 2008 and 2009, were analyzed to study the diet of this sleeper shark. The role of these sharks as potential seal predators was of particular interest in this study. The sharks ranged from 229-381 cm (fork length) and 136-700 kg (body mass), and all were sexually immature. Seal and whale tissue were found in 42.3% and 18.2% of the GITs that had contents (N = 33), respectively. The dominant seal prey species found in the sharks was ringed seal (*Phoca hispida*) while bearded seal (*Erignathus barbatus*) and hooded seal (*Cystophora cristata*) tissues were each found in a single GIT. Ringed seal tissues found in the sharks were derived from both pups and adult animals. All of the whale tissue was from minke whales (*Balenoptera acutorostrata*) that had been harvested in the commercial fishery near Svalbard. The sharks also ate various fish species, with Atlantic cod (*Gadus morhua*), Atlantic wolffish (*Anarhichas lupus*) and haddock (*Melanogrammus aeglefinus*) being the most important prey species. The largest fishes swallowed whole were an Atlantic wolffish (8.6 kg) and an Atlantic cod (4.2 kg). Strong circumstantial evidence suggests that the sharks actively preyed on the seals and fishes, in addition to eating carrion such as the whale tissue. Active predation on seals, in combination with the apparently high numbers of Greenland sharks in the Svalbard area, makes this predator a potentially significant source of mortality for seals that is generally neglected.

**0193 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Guillaume Lecointre¹, Marie Fisler¹, Anne-Claire Lautredou¹, Cyril Gallut¹,
Arnaud Couloux², Corinne Cruaud², Bruno Chagnet¹, Agnès Dettai¹

¹UMR7138, Museum National d'Histoire Naturelle, Paris, France, ²Genoscope, Evry,
France

Acanthomorph (Teleostei) Phylogeny and Classification

Acanthomorph fish represent one third of the known extant vertebrates. The last ten years have been rich in results. We will focus on the state of the art of our knowledge of their phylogeny, including new results obtained from new nuclear markers. The consequences of the recent unexpected phylogenetic relationships for acanthomorph classification have not been fully measured and taken into account. The list of polyphyletic groups is growing (Perciformes, Percoidei, Scombroidei, Trachinoidei, Labroidei sensu lato, Scorpaeniformes, Gasterosteiformes sensu lato, Zeiformes sensu lato...), that have not yet been fully transformed into new monophyletic groups. All the 314 acanthomorph families have not yet been included in a single matrix, whether for the morphology (although the Phenoscope project is building in this direction), nor for the molecules. Further discoveries are therefore expected.

0502 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Joël Leduc, Pierre Échaubard, David Lesbarrères

Laurentian University, Sudbury, Ontario, Canada

**Metal-Induced Fitness Response of Leopard Frog (*Lithobates pipiens*) Larvae
in Tailings Wetlands: A story of Trace Metals Mingling with the Ranavirus**

Within the past decades, we have witnessed an increase in mass die-offs of amphibians through the Americas, Europe and Asia. Two causal stressors of these mass mortalities are metal contaminants and emerging infectious diseases. In one instance, trace metals can have a subtle, yet indirect impact on an organism's survival by inducing a decrease in its immune response and nervous system. Meanwhile, the Ranavirus is becoming a prevailing explanation for mass die-offs of amphibian communities which makes it an imminent cause for concern. Given these considerations, we hypothesize that the immune depletion from smelting trace metal contaminants would allow the emergence of infectious diseases to easily and more adversely affect an already stressed amphibian population. The objectives of this study are, thus, to assess the survivorship effects of several sub-lethal concentrations of Cu²⁺ and Ni²⁺ trace metals on leopard frog tadpoles (*Lithobates pipiens*) and to investigate the impact of these trace metals on the tadpole's fitness response and ultimately how it influences their susceptibility to the Ranavirus within tailings wetlands. Leopard Frog tadpoles from three different metal contaminated wetland environments (severe, moderate and no contamination) were

subjected to a trace metal acclimation period followed by an acute Ranavirus infection; therefore, investigating the synergistic effects between metal exposure and Ranavirus infection. In line with recent advances in the ecological literature, synergistic functionalities are becoming increasingly important in understanding how to forecast and control the epidemiology of these newly emerging diseases on wild populations, especially in highly stressed ecosystems.

0058 SSAR SIEBERT PHYSIOLOGY & MORPHOLOGY AWARD, Conrad B & C, Thursday 7 July 2011

Jose Lefebvre¹, Stephen W. Mockford¹

¹Dalhousie University, Halifax, Nova Scotia, Canada, ²Acadia University, Wolfville, Nova Scotia, Canada

Tickle-Me Softly: A New Non-Invasive Technique for Sperm Extraction in Male Freshwater Turtles.

The reproductive cycles of Blanding's turtles (*Emydoidea blandingii*) are poorly understood; the male reproductive cycle has never been studied. Both sexes show promiscuity during reproduction and females can store sperm for long periods. Because of the above factors, multiple paternity within single clutches has a high frequency in this species. However, the frequency of this phenomenon is much lower in the populations of Nova Scotia. Previous work showed only 4-33% multiple paternity within clutches. Algorithm models suggest a low male contribution to the gene pool (2-5%). Low fertility is one of the hypotheses to explain this phenomenon. There are three recognized methods for sperm collection in turtles; flushing of the oviducts of females, removal of the epididymis and electroejaculation. The first method doesn't allow the identification of the donor, and the last two are invasive or lethal. Nova Scotia's populations are small, and designated under COSEWIC, and we are aiming in a less invasive method to apply on a Species At Risk. During notching of carapace on new captures, it was noticed that the vibration produced an erection. I hypothesized that slightly stronger vibration applied at a specific location could induce ejaculation. The method was tested on male Blanding's turtles, using a vibrator, first applied to the plastron to induce an erection, and then to the vial where the hemipenis was inserted. The method was successful in inducing ejaculation, was fairly quick to minimize handling time, and did not require any intrusion or removal on the specimens.

0105 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Bryan Legare¹, Bryan DeAngelis², Richard Nemeth¹, Simon Pittman³, Greg Skomal⁴

¹University of the Virgin Islands, St Thomas, VI, U.S. Virgin Islands, ²NOAA Restoration Center, Narragansett, RI, USA, ³NOAA Biogeography Branch, St Thomas, VI, U.S. Virgin Islands, ⁴Massachusetts Division of Marine Fisheries, New Bedford, MA, USA

Site Fidelity, Residency, and Movements of Juvenile Blacktip (*Carcharhinus limbatus*) and Lemon (*Negaprion brevirostris*) Sharks in Nursery Areas of St John, USVI.

Nearshore areas utilized by juvenile sharks are under increasing amounts of anthropogenic stresses globally. Characterizing and quantifying the extent to which sharks utilize nearshore areas is important for conserving populations. Fish Bay and Coral Bay on the island of St John, United States Virgin Islands, have been identified as supporting large numbers of juvenile and neonatal lemon (*Negaprion brevirostris*) and blacktip (*Carcharhinus limbatus*) sharks; both embayments are impacted by land-based development. We examined the temporal and spatial movement patterns of juvenile and neonatal lemon and blacktip sharks in these two bays and the surrounding coastal waters of St John. During the summers of 2006-2010, we surgically implanted acoustic transmitters into 25 lemon sharks (42.5-68.0 cm FL) and 48 blacktip sharks (48.0-81.3 cm FL) in Fish Bay (25 blacktips; 15 lemons) and Coral Bay (23 blacktips; 10 lemons). Local movements were tracked by an acoustic array of 32 receivers in and outside of these embayments. Only 8% of lemon sharks and 14.5% of blacktip sharks exhibited long-term residency (> 180 days) within the bays while most of the sharks moved out by the fall and early winter months. Although several sharks were detected outside of Fish and Coral bays and a few (5 blacktips) traveled between the two bays, each species exhibited strong site attachment to the bay in which they were tagged. Efforts to examine intra- and inter-specific patterns of habitat use as they relate to the biotic and abiotic characteristics of each embayment are ongoing.

0175 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

John Legler

University of Utah, Salt Lake City, UT, USA

Turtles: A Paradigm of Versatility and Venerability

The chelonian Bau Plan is the most specialized to have evolved in tetrapods. The axial skeleton, fused to certain dermal elements, forms a shell that contains or surrounds the appendicular skeleton. This unique specialization has existed for at least 200 million years with few and relatively minor modifications. Turtles have survived and prospered

where other specialized tetrapods have become extinct. Although the protection offered by the shell has always had a high selective value, certain aspects of life history have also played an important role in this venerability. Dietary versatility is discussed as one such factor.

0451 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

David LeGros, Brad Steinberg, David Lesbarrères

Laurentian University, Sudbury, Ontario, Canada

Logging Roads, Road Effects and Mitigation Techniques for Amphibians in a Central Ontario Forest

Habitat fragmentation is a serious threat to wildlife in many regions including Canada. There are extensive networks of roads that fragment habitat even in remote areas. For amphibians, which are small and slow moving with specific environmental requirements, roads are a physical barrier that prevent migration and dispersal. In Algonquin Provincial Park, Ontario, we have the opportunity to study the impacts of roads on amphibians without vehicular traffic causing road mortality. We sampled forest amphibians perpendicular to roads of different sizes to determine the extent of road effects. Attempts to mitigate road mortality using tunnels have been successful, however they would be too costly to be used on logging roads. As there are no vehicles currently using the roads, permanent structures are not needed, so we are testing semi-permanent mitigation treatments using natural materials applied to the road in two habitats; forest and wetland-adjacent roads. Using brush, rotten timber and mulch we can test and determine if these provide a suitable area for amphibians to cross. In the first field season, 10 species were captured, for a total of 3507 individuals. Total capture were similar between both habitats (Forest 1701, Wetland-adjacent 1806), but did vary considerably in species composition with *Notophthalmus v. viridescens*, *Pseudacris crucifera*, *Plethodon cinereus*, being most common in the wetland-adjacent portion of the study. *Anaxyrus americanus* and *Lithobates clamitans* were most commonly encountered on the forest road portion of the study.

0281 Poster Session II, Saturday 9 July 2011

Edgar Lehr¹, Alan Brus¹, Alessandro Catenazzi², Cindy Gregory¹, Rudolf von May³

¹Illinois Wesleyan University, Bloomington, IL, USA, ²Gonzaga University, Spokane, WA, USA, ³University of California, Berkeley, CA, USA

New Anurans (Hemiphractidae, Strabomantidae) from the Río Abiseo National Park in Peru

We studied the amphibian fauna of the Río Abiseo National Park. This national park is located in the eastern Andes at 7°45'S and 77°30'W in the San Martín Region of Peru between the Marañón and Huallaga rivers. The park covers an area of approximately 2,745 square kilometers including 70% of the Abiseo river basin. Elevations inside the park reach from 350 m to 4200 meters. We examined museum specimens collected during biological expeditions to puna and montane habitats in the Río Abiseo National Park between 1987 and 1999. Our examination of these specimens revealed several new hemiphractid and strabomantid frogs. We present two new species of *Gastrotheca*, and two new species of *Pristimantis* and provide data on trombiculid mites (*Hannemania* sp.) parasitizing the skin of one species of *Pristimantis*.

0318 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

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Five Years of Life on the Edge: Results from a Long-Term Monitoring Program for Blanchard's Cricket Frog (*Acris blanchardi*)

While once a common frog in the Midwestern United States, Blanchard's cricket frog (*Acris blanchardi*) is now rare or absent in much of the northern portion of its range. However, little information is available on the causes of this decline and whether it is ongoing. To assess distributional change in this species, we established a long-term monitoring study in three regions of western Ohio, U.S.A. that straddle the presumptive range edge. We monitored 315 randomly selected aquatic sites using chorusing surveys from 2004 to 2008. These 315 sites were sampled a total of 1,807 times over this five year period to document occupancy patterns, establish detection probabilities and analyze turnover dynamics. While only approximately 15% of all sampled sites were occupied overall, the trends in occupancy over time markedly increased during the study period. In south-western Ohio, the number of occupied sites increased from eight in 2004 to 18 in 2008 (an increase of 125%). In west central Ohio, the number of occupied sites increased from four in 2004 to seven in 2008 (an increase of 75%). In north-western Ohio the number of occupied sites increased from 17 in 2004 to 28 in 2008 (an increase of 65%).

Further, there was some evidence of eastward expansion towards portions of Ohio that historically had cricket frogs but currently do not. While what the future holds is

uncertain, our results suggest that presently cricket frogs in Ohio are not continuing to decline.

0223 Poster Session III, Sunday 10 July 2011

Lee Lemenager, Richard Tracy

University of Nevada, Reno, Reno, NV, USA

Seat Patch Water Potentials of Two Anuran Species, *Lithobates pipiens* and *Pseudacris cadaverina*.

The water potentials of the seat patches of two anuran amphibians (Northern leopard frog, *Lithobates pipiens*; and California Treefrog, *Pseudacris cadaverina*) were inferred from experiments of water exchange between frogs and environments in which the water potential was controlled. Water exchanges of frogs were inferred from changes in their body mass when they were allowed to exchange water with sucrose solutions differing in water potential. Rates of water exchange by frogs were plotted against the osmotic potentials of experimental solutions, and the x-intercept of this graph was taken to be the water potential of the seat patch of the frogs (the point at which the water potential of the environment is equal to the water potential of the seat patch). Seat patch water potentials for *L. pipiens* were different from the water potential of their blood, and this implies that individuals of this species have some control of water uptake. Seat patch water potentials for *P. cadaverina* were similar to the water potentials of blood implying that they have no control of water uptake.

0211 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Christian Lenhart¹, John Nieber¹, Jason Naber²

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Impact of Prolonged High Summer Streamflow Duration on Turtle Nesting Success in Minnesota Rivers

The smooth softshell (*A. mutica*) and wood turtle (*G. insculpta*), are two rare species threatened by alteration of streamflow regime, particularly the ability to nest successfully on river sandbars. Recent research shows that there has been a prolonged duration of high flows during the nesting season of June and July in Minnesota potentially reducing nesting success. We assessed streamflow change using the Indicators of Hydrologic Alteration (IHA) software, changes to geomorphology using field metrics and historic channel change using aerial photos on five rivers: the Cannon, Minnesota, Root, Kettle and St. Louis. Using USGS stream gauge data and aerial photos, we developed a river stage-sandbar area relationship to determine the effect of prolonged high flow duration on nesting success. Based on the fact that most turtle eggs

cannot survive > 2 days of submergence, we were able to identify the frequency of suitable nesting conditions in June and July over the 1940-2009 time period. Suitable water levels have declined in the 1980-2009 time period compared to the pre-1980 time span in the agricultural watersheds of southern Minnesota (Root, Cannon and Minnesota) meaning that turtle hatchlings are likely delayed and/or have lower survival rates. There was no significant change in the Kettle and St. Louis River streamflow and sandbar availability during the nesting season. Widespread hydrologic alteration could mean that there is reduced reproductive success of these riverine turtles in many southern Minnesota Rivers. Enhanced management of the riparian corridor and maintenance of longitudinal connectivity could help to mitigate impacts on these rare turtle populations.

0247 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Corissa Lennon, Joshua Mantooth, Jacob Grace, Donald Schneider, Kevyn Wiskirchen, Lauren Ross, Melissa Wright, Chad E. Montgomery, Michael I. Kelrick

Truman State University, Kirksville, MO, USA

Distribution and Habitat Characteristics of the Wood Frog (*Lithobates sylvaticus*) in the Cloud Peak Wilderness, Bighorn National Forest, Wyoming

Populations of wood frogs (*Lithobates sylvaticus*) in Wyoming are genetically distinct and isolated from other populations in the Rocky Mountain Region. *L. sylvaticus* exists as isolated, relict populations at high elevations in the Bighorn National Forest. Despite existence as isolated relictual populations, there is a paucity of information on the number of populations or status of individual populations across the Bighorn National Forest. The purpose of our study was to determine the distribution of *L. sylvaticus* in the northern portion of the Cloud Peak Wilderness within the Bighorn National Forest, Johnson County, Wyoming. Our goal was to create a predictive model for presence versus absence and breeding versus non-breeding sites for *L. sylvaticus*. We surveyed 39 potential *L. sylvaticus* sites located using topographic maps or incidental encounter. We recorded biotic and abiotic characteristics based on those used for amphibian surveys in the Greater Yellowstone ecosystem. We captured *L. sylvaticus* individuals by hand or dip-net and any uncaptured frogs were listed as observed. We identified individuals by sex, body length, and age class, and tadpole numbers were estimated where present. Wood frogs were present at 11 sites and 6 of these were breeding sites. We used multivariate analysis to determine influential variables on presence versus absence and breeding versus non-breeding.

0141 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

David Lesbarrères

Laurentian University, Sudbury, ON, Canada

Ranaviruses and Amphibians: Outside the Box of Host-parasite Relationships

Pathogens are known to affect their hosts in a variety of manners and ranaviruses are no different. Traditional investigation of host-parasite relationships have focused on host life-history traits and have used the variation in those traits to assess pathogen virulence. However, the dynamic nature of adaptation and counter-adaptation between the host and the parasite may be particularly sensitive to environmental influence. Here, I will focus on the role of potential abiotic and biotic mechanisms such as temperature, larval developmental stages, and competition for resources on the prevalence and virulence of the virus. For instance, I will show that ranavirus virulence is likely density-dependent, with the effect of ranavirus infection being relatively more severe in animals held in low density. I will also present the relative susceptibility of amphibians during their different life-history stages and the potential consequences of egg infection for disease screening and experimental studies. Additionally, amphibian species differ in their susceptibility to ranaviruses and significant isolates within different strains (ATV, FV3) are numerous. An investigation of the host-pathogen genotypic interactions, in the environmental context, is needed to improve our understanding of ranavirus virulence. Ranavirus is a serious threat to amphibian populations throughout the world; therefore there is a need to investigate the environmental factors that influence its virulence so that we might begin to understand the epidemiology of ranaviral diseases and forecast disease outbreaks.

0383 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Timothy Lewis¹, John Moriarty², Erin Curran¹

¹*University of St Thomas, St Paul, MN, USA*, ²*Ramsey County Parks, Maplewood, MN, USA*

A Long Term Study of a Metropolitan Minnesota Lake Population of Painted Turtles (*Chrysemys picta*)

Painted Turtles (*Chrysemys picta*) inhabit both lakes and rivers in Minnesota and much of North America. Long-term monitoring of long-lived species is helpful for management of wildlife resources. This study was conducted in a 5.5 ha lake in the Minnesota Twin Cities metro area from 2003 to 2011. Turtles were captured during summers using 12 basking traps at fixed locations throughout the study period. Turtles were measured, weighed, marginal cutes were drilled or notched, and beginning in 2010, PIT tagged. Ten turtles were radio-tagged in 2010 and followed throughout the winter of 2010-11. Turtles were sexed based on body size, location of cloaca, plastron shape, and claw length. Annual population size was estimated two ways: by the minimum number of

turtles alive each year based on direct captures and by using the Lincoln-Petersen mark-recapture analysis. A total of 462 different turtles were captured and uniquely identified. Sex ratios varied from 1:2.03 (F:M) in 2005 to 1:0.80 in 2006. The population of the lake seemed to be increasing over this period of time with LP estimates ranging from a low in 2003 of 90 to over 1000 in 2010. Turtle winter locations were consistent with fall locations, with movements less than 50 m per day under the ice.

0579 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

Chenhong Li¹, J. Andrés López², Tuuli Makinen², Richard Broughton³, Guillermo Ortí⁴

¹University of Nebraska, Lincoln, NE, USA, ²University of Alaska & Museum, Fairbanks, AK, USA, ³University of Oklahoma, Norman, OK, USA, ⁴The George Washington University, Washington, DC, USA

Ostariophysan Phylogeny: Characiformes and Siluriformes are Sister Taxa

The Ostariophysi is group of fishes that includes the orders Gonorynchiformes plus Cypriniformes, Gymnotiformes, Siluriformes and Characiformes. Close relationships of ostariophysans with Clupeiformes and Alepocephaliforms have been proposed but remain poorly defined. In contrast relationships among ostariophysan taxa have been well defined by a landmark study of their morphology (Fink and Fink, 1981) and remained uncontested for over 15 years. The first molecular phylogenetic studies, with few genes and taxa, did not support this hypothesis and were inconclusive, but more recent efforts based on whole mitochondrial genome sequences have challenged previous results. Contra Fink and Fink, these studies proposed a sister group relationship either between characiforms and gymnotiforms or between characiforms and siluriforms. In this study, we collected and analyzed DNA sequences from 10 nuclear loci (10,653 bp) from 59 taxa to test these competing hypotheses. Our data are congruent with a monophyletic Ostariophysi and support a sister group relationship between siluriforms and characiforms with the gymnotiforms as the sister group to this clade. Alternative hypotheses of relationship among siluriforms, gymnotiforms and characiforms were significantly rejected. The evidence presented as synapomorphies and the methodology used by Fink and Fink are discussed. Finally, our results also show with high confidence that Alepocephaliformes (formerly placed within Euteleostei) is the sister-group to the Clupeiformes and should be included in the supraordinal taxon Ostarioclupeomorpha.

**0071 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Chenhong Li, Gavin Naylor

College of Charleston, Charleston, SC, USA

**Target-enrichment and Next-generation Sequencing for Assembling the
Chondrichthyan Tree of Life**

An important objective of various Assembling the Tree of Life projects is to sequence many independent loci to reconstruct the phylogenies. PCR-based methods and Sanger sequencing are still the most commonly used techniques for this purpose, but involve considerable lab work and do not lend themselves well to high throughput approaches. Furthermore they often yield data sets that contain a large proportion of missing data, and sometimes paralogs amplified in different groups. To circumvent these problems, we developed a target-enrichment and next-generation sequencing strategy to collect the data from hundreds of genes and species simultaneously. Single-copy nuclear coding sequences were identified from genomes of six vertebrates, including a Chimaeriform ghost-fish. Baits totalling 400 kb were designed based on those genomic sequences and used to capture the putative orthologous sequences in target species. Eighteen chondrichthyans in addition to ten other vertebrate species were tested in this study. Different hybridization temperature and enrichment protocols were compared. The implication of our new strategy for reconstructing the Chondrichthyan Tree of Life is discussed.

0533 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Ana Liedke¹, Sergio R. Floeter²

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**Feeding Ecology of the Banded Butterflyfish *Chaetodon striatus* along Its
Range of Distribution**

The degree of gene flow among populations is defined as genetic connectivity. For the successful establishment of a species with tropical affinities in peripheral (and colder) subtropical areas, it is crucial that, at least, favorable biotic factors, like habitat availability and food resources, are present. Understanding the balance between ecological plasticity and gene flow among populations along all the distribution range is fundamental to identify ecological and evolutionary patterns. The banded butterflyfish (*Chaetodon striatus*) was chosen as a model system because it occurs in two distinct reef systems: tropical coral reefs in the Caribbean and NE Brazil and subtropical rocky reefs in southern Brazil. Samples were collected in Puerto Rico and in four localities along the Brazilian coast (two localities per reef system). We obtained feeding data through 3min. focal animal observations of approximately 80 individuals per site as well as 20

individuals sampled for gut contents and population genetic analyses. The benthic cover was estimated through the photoquadrat method using the software CPCe 3.5. The electivity index - IvLev - was applied to check if there is selectivity of specific items on the benthic coverage. To evaluate the phylogeographic patterns, mitochondrial and nuclear genes are going to be amplified. Preliminary results show that the mean number of bites/3min in all localities ranges between 4 and 6.5. Benthic cover composition and food consumption varied among localities. Food consumption by *Chaetodon striatus* was also found to be disproportional to its availability, suggesting selective feeding habits.

0522 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011

Flávio C.T. Lima

Museu de História Natural "Adão José Cardoso", Universidade Estadual de Campinas, Campinas, SP, Brazil

A Revision of the Cis-andean Species of the Genus *Brycon* Müller & Troschel (Characiformes: Characidae)

A revision of the cis-andean species of *Brycon* is presented. Twenty-two *Brycon* species (including *B. pesu*) are recognized: *Brycon stolzmanni* Steindachner, from the Río Marañon basin, Peru; *Brycon coxeyi* Fowler, from the Río Marañon basin, Ecuador; *Brycon polylepis* Moscó Morales, from the Lago de Maracaibo, Río Orinoco, upper rio Amazonas, and rio Tocantins basins; *Brycon coquenani* Steindachner, from the upper Río Caroni, Río Orinoco basin, Venezuela; *Brycon insignis* Steindachner, *Brycon vermelha* Lima & Castro, *Brycon ferox* Steindachner, and *Brycon opalinus* (Cuvier), from coastal river systems of eastern Brazil; *Brycon nattereri* Günther, from the upper rio Paraná, rio São Francisco, and upper rio Tocantins basins; *Brycon orthotaenia* Günther, from the rio São Francisco basin; *Brycon orbignyianus* (Valenciennes), from the rio Paraná and rio Uruguai basins; *Brycon hilarii* (Valenciennes), from the rio Paraguai, middle rio Paraná, and upper rio Amazonas basins; *Brycon whitei* Myers & Weitzman, from the Río Orinoco basin; *Brycon amazonicus* (Agassiz), from the Río Amazonas and Río Orinoco basins; *Brycon gouldingi* Lima, from the rio Tocantins basin; *Brycon melanopterus* (Cope), from the western and central rio Amazonas basin; and *Brycon falcatulus* Müller & Troschel, from the the rio Amazonas, Orinoco, and guyanese basins. Four new species are described, one from the Río Marañon basin in Peru and three from coastal rivers from eastern Brazil. All species are redescribed and illustrated, and a key to the species is provided. Comments on the diagnosis of the genus *Brycon*, the biogeography of the cis-andean species, and their current conservation status, are made.

0614 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Conrad B & C, Thursday 7 July 2011

Charles Linkem

University of Kansas, Lawrence KS, USA

Species Tree Despite Gene-Tree Incongruence in Large Datasets: The Phylogeny of the Sphenomorphus Group (Squamata: Scincidae)

Advances in molecular techniques have allowed researchers to quickly collect multiple independent genes across large taxonomic groups. When the coalescent history of the individual gene trees are significantly different (ie. Support for alternative clades) then analyses incorporating gene-tree incongruence are necessary. These methods become computationally difficult as the number of species increases, and an alternative strategy is warranted for large data matrices. The Sphenomorphus group consists of approximately 500 species in 30 genera distributed throughout Australia, the West Pacific Islands, Indonesia, the Philippines, Indochina, Asia, and North and Central America. This large group has substantial morphological and physiological variation making it interesting for comparative studies. This project uses 350 samples from the Sphenomorphus group and six independently evolving genes to resolve the species phylogeny of this diverse clade. Using a combined approach, I explore different methods for overcoming gene-tree conflict in large datasets.

0523 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

Shawn E. Liston¹, Jerome J. Lorenz¹

¹*Audubon of Florida, Corkscrew Swamp Sanctuary, Naples, FL, USA*, ²*Audubon of Florida, Tavernier Science Center, Tavernier, FL, USA*

Fish in Forests: Seasonal Dynamics of South Florida's Freshwater Forested Wetland Fish Communities

Freshwater forested wetlands are notably understudied compared to their graminoid counterparts, yet they provide critical habitat for fish and macroinvertebrate communities. An important part of the regional hydrologic system of the greater Everglades, the Big Cypress Swamp encompasses a large area of interior southwestern Florida and provides nesting and feeding sites for threatened wading bird populations who rely on an aquatic prey base. The marked seasonal variation in hydrology that is characteristic of this sub-tropical region creates a dynamic environment for aquatic fauna and intra-annual pulses in productivity. We describe variation in the community structure and abundance of fishes and macroinvertebrates in freshwater forested wetlands based on five years of data collected in Big Cypress National Preserve. These data reveal a shift from a crayfish-dominated aquatic prey community early in the hydrologic year, to a fish-dominated aquatic prey community throughout the dry season. The microtopography of this region typically causes dry-season fish populations

to concentrate, becoming high-density (up to 3,000 fish/m²) prey patches that are a critical food source for nesting wading birds. Atypical dry-season rain events (or water management activities) can significantly disrupt this pattern, raising water levels and drastically reducing fish density and availability to wading birds. Improving our understanding of the connections between these wetlands, their hydrology, and the trophic interactions of native species will help in guiding western Everglades restoration efforts and environmentally-responsible development in the Big Cypress region.

0473 Poster Session III, Sunday 10 July 2011

Robert Litterman, Kevin Wenceslao, Amanda Harris, Sarah Luchtel, Jennifer Neuwald, Nicole Valenzuela

Iowa State University, Ames, IA, USA

The Effect of Thermal Variance on Plastic Growth Rate Responses in TSD Turtles

The adaptive value and maintenance of environmental sex determination (ESD) remains a biological enigma with molecular, ecological, and evolutionary implications. To understand why this trait has persisted throughout evolutionary time it is essential to uncover the effects that developmental plasticity imparts to ESD organisms. In this study, we tested the hypothesis that incubation conditions with varying degrees of temperature fluctuation induce differentially plastic responses with respect to juvenile growth rates in males and females of *Chrysemys picta* turtles, a species with temperature-dependent sex determination. Eggs were incubated under thermal profiles encompassing controlled fluctuations, natural male- and female-producing profiles, as well as natural profiles with increased mean and variance. Hatchlings were reared under common-garden conditions and weighed periodically. The effect of incubation temperature and sex were analyzed with respect to weight and growth rate. We detected significant differences in growth rates among treatments in a more complex manner than expected by the sex ratios produced by the incubation conditions. We discuss the implications of these findings for the evolution of ESD and the response of ESD taxa to climate change.

0349 Fish Ecology I, Symphony I & II, Friday 8 July 2011

Caitlyn Little¹, Devin Flawd², James Sulikowski¹

¹*University of New England, Biddeford, ME, USA*, ²*NOAA, Pascagoula, MS, USA*

Analysis of Habitat Utilization and Reproductive Potential of Atlantic Sturgeon, *Acipenser oxyrinchus*, in the Saco River, ME

The Atlantic sturgeon inhabits river systems and coastal waters along much of the eastern coast of North America. However, anthropogenic fishing pressures and habitat

degradation have caused reductions in population sizes of this once prolific species. This decline in abundance has led to the listing of the Atlantic sturgeon as federal species of concern throughout its range in the United States. Until recently, Atlantic sturgeon were not known to inhabit the Saco River and its estuary in Maine. Their sudden appearance in this river in the fall of 2008, and the subsequent appearance of the endangered shortnose sturgeon in the summer of 2009, has raised many questions about sturgeon populations inhabiting the river. This study utilizes a variety of methods to examine habitat use of these species within the river and its estuary. Internal acoustic transmitters have been implanted in 39 Atlantic and one shortnose sturgeon to monitor movement within the river. Data obtained from acoustic receivers is being compared to tidal cycles and salinity at the mouth of the river to determine if these environmental conditions influence sturgeon movement patterns within this system. Additionally, gastric lavage has been utilized to obtain stomach contents to examine the food habits of captured sturgeon in this region. Finally, radioimmunoassay techniques have been utilized to quantify circulating levels of estradiol and testosterone in blood plasma. These values are coupled with ultrasound imaging in an effort to determine the reproductive status and sex of sturgeon in the river.

0215 Fish Conservation, Symphony III, Saturday 9 July 2011

Ken Longenecker, Ross Langston

Bishop Museum, Honolulu, HI, USA

Population Characteristics of Exploited Fishes from Hawaii's Mesophotic (50-100 m) Coral Ecosystems

We describe population characteristics of six fishes expected to occur at depths between 50 and 100 meters, and compare these to shallow-water (<50 m) results. Our ultimate goal is to compare depth-specific biomass production and reproductive output of these exploited species. This information will allow resource managers to determine whether deep reefs act as refugia for fishery species. To date, we have not encountered *Acanthurus triostegus* or *Mulloidichthys flavolineatus* on mesophotic (deep) reefs. Mean densities of *Centropyge potteri*, *Ctenochaetus strigosus*, *Dascyllus albisella*, and *Parupeneus multifasciatus* on deep reefs are not statistically different from those on shallow reefs. Mean lengths of *C. potteri* and *C. strigosus* on deep reefs do not differ from shallow areas, but *D. albisella* and *P. multifasciatus* are significantly shorter on deeper reefs. Length-weight relationships for *C. potteri* and *P. multifasciatus* are similar in both habitats, however, body condition indices for *C. strigosus* and *P. multifasciatus* on deep reefs are less than those calculated for shallow areas. To date, our results suggest fish production on deep reefs does not exceed that of shallow reefs. However, results from ongoing efforts to describe growth rates, mortality, size-at-maturity, fecundity, and size-specific sex ratios are likely to influence our final estimates and will be discussed.

0414 Poster Session II, Saturday 9 July 2011

Sarah Longo, Amy McCune

Cornell University, Ithaca, NY, USA

Evolution of the Actinopterygian Swimbladder: Insights from High Resolution 3D Images of the Arterial Vasculature of Basal Osteichthyans

The prevailing hypothesis since the mid-nineteenth century has been that lungs and swimbladder of vertebrates are homologous. Because sarcopterygians and a basal actinopterygian, *Polypterus*, have lungs, lungs are considered to be the primitive condition of the air-filled organ (AO) and a synapomorphy of Osteichthyes. Comparative studies seeking to understand the morphological transformation from paired respiratory lungs to an unpaired buoyancy-regulating swimbladder often refer to characteristics of the AO blood supply in basal osteichthyan fishes that possess either lungs or respiratory swimbladders. However, previous studies have excluded extant Acipenseriformes (sturgeon and paddlefishes), which are phylogenetically embedded in this array of air-breathing fishes, and as such must be considered when attempting to distinguish between conserved, derived, and convergent circulatory traits among basal actinopterygians. This study uses micro-CT analysis of fish with barium-injected vessels to reevaluate the arterial characters associated with the AOs of basal osteichthyans including *Protopterus*, *Polypterus*, *Polyodon*, *Acipenser*, *Lepisosteus*, and *Amia*. Digitized images reconstructed from the scans were used to make readily comparable diagrams of the arterial circulation associated with the AOs of these fishes. The ability to examine the circulatory system in high-resolution 3D offers new insights into the evolution of pulmonary arteries in actinopterygians and highlights a previous oversight in the literature: the grouping of sturgeon and paddlefish as circulatory equivalents with little to add to the discussion of early swimbladder evolution.

0426 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

J. Andres Lopez

University of Alaska Museum, Fairbanks, AK, USA

Common and Contrasting Phylogeographic Patterns in *Aphredoderus* and *Esox*

Esox americanus and *Aphredoderus sayanus* share a strikingly similar geographic distribution. A subspecies within each of these taxa is found east and west of the Appalachian range and populations with uncertain subspecific membership inhabit the coastal plains of the southeastern U.S. producing a continuous U-shaped distribution in each of the two species. In both species, phenotypic data suggests that southeastern coastal plain populations represent varying mixtures of the subspecific forms. Based on the observed distribution of phenotypic variability, it has been hypothesized that these mixed populations are the product of a secondary contact zone formed by the meeting between incipiently differentiated lineages. The secondary contact hypothesis invokes

glacial cycling and concomitant sea level changes as the underlying vicariant event leading to population isolation and subsequent formation of the subspecific forms. Analyses of genotypic variability across the range of both species reveal patterns in the level of genetic diversity and its spatial distribution that are incongruent with expectations derived from the secondary contact hypothesis. The genotypic data supports a more complex model where differentiated groups subdivide eastern subspecies and where considerable genetic diversity is endemic to the southeastern coastal plains. This last observation is incompatible with a scenario where sea transgression extirpates coastal plain populations in the recent past.

0457 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

J. Andres Lopez¹, Michael Sandel¹

¹*University of Alaska Museum, Fairbanks, AK, USA*, ²*University of Alabama, Tuscaloosa, AL, USA*

Pattern and Process in the Distribution of Freshwater Biodiversity in Southeastern Coastal Drainages: A Review

The coastal plain drainages that span across the Gulf of Mexico to the Atlantic coast are home to a large proportion of North America's freshwater biological diversity. Understanding the processes that have shaped the origin and distribution of that diversity motivated the pioneering studies of molecular-based phylogeography that uncovered broad scale biogeographic partitions and guided hypotheses of their formation. We review classical phylogeographic studies for Gulf-Atlantic coastal plain freshwater faunas in the context of more recent developments in population and landscape genetics. We identify and describe the following open questions regarding the evolution and distribution of freshwater fishes in this region: 1) What are common patterns in the level and distribution of genetic variability? 2) What are the relative roles of geological and ecological processes in the establishment of population and species level spatial structure? 3) To what extent do phenotype- and genotype-based geographic partitions differ?

0302 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY

Erin Loury

Moss Landing Marine Laboratories, Moss Landing, CA, USA

Diet of the Gopher Rockfish (*Sebastes carnatus*) Inside and Outside of Marine Protected Areas in Central California

No-take marine reserves are predicted to increase the density of fishes within their boundaries, which may in turn cause changes in predation or prey availability. In 2007, a series of no-take marine reserves was established along the central California coast.

During the summers of 2007-2009, the California Collaborative Fisheries Research Program collected a total of 1,018 gopher rockfish (*Sebastes carnatus*) for stomach content analysis inside and outside of reserves at Año Nuevo, Point Lobos, Piedras Blancas and Point Buchon. A highly diverse diet of mostly invertebrate taxa was observed for the 710 fish with prey in their stomachs. Prey types with the highest Index of Relative Importance values included brittle stars, and crabs of the family Pisidae and the genus *Cancer*. Diet composition was highly similar inside and outside of the Point Lobos State Marine Reserve, the oldest of all reserves (74.5 percent similarity index). Although fish inside the reserve appeared to have more specialized diets than outside, the high extent of overlap suggests similar feeding habits in the protected and unprotected sites. Similar analyses are currently underway for the three other marine reserves.

0683 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Corey A. Love, Ayesha S. Burdett, Thomas F. Turner

University of New Mexico, Albuquerque, NM, USA

The Feeding Habits of Larval Fishes: Abiotic Influences and Food Web Impact

Larval fishes are often underrepresented in aquatic food web studies. Their small size and great numbers tend to complicate the identification process and make it difficult to include larvae at all. However, to completely disregard larvae likely generates a severe mischaracterization of trophic dynamics. We hypothesize that larvae play a major role due to initial abundance and rapid growth. A two-year mesocosm experiment was conducted to assess the effect of larval fishes on invertebrate populations and subsequent effects on overall food web dynamics. Larval fishes were stocked in mesocosms adjacent to the Rio Grande main channel at the Sevilleta National Wildlife Refuge, New Mexico. Fish and invertebrates were collected biweekly for six weeks. We found that allochthonous inputs play an important role in the overall composition of invertebrate communities. In addition, gut content analysis and invertebrate abundance data confirm that fishes are consuming invertebrates in proportion to what is available. Together, these results suggest that feeding habits of fishes are largely subject to abiotic factors, an important finding in a variable desert system. This study demonstrates the

necessity of incorporating larval fishes in aquatic food web studies and the importance of understanding the links between biotic and abiotic components of an ecosystem.

0727 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

Elliot Love, Mark Bee

University of Minnesota - Twin Cities, St. Paul, MN, USA

A Co-evolutionary Mismatch Between Signaler Behavior and Receiver Preference in Noise in Cope's Gray Treefrog (*Hyla chrysoscelis*)

Animals that communicate acoustically must cope with the problem posed by environmental background noise. One strategy signalers may use to ameliorate this problem for receivers involves changing characteristics of the signal itself to make it stand out against loud background noise. Frogs provide an excellent model organism for studying this problem because they call in dynamic and noisy social environments. We used Cope's gray treefrog (*Hyla chrysoscelis*) to investigate whether changes in male signaling behavior in noise match female preference under similar conditions. In one experiment, we investigated how males change their calling behavior in the presence of background noise. Males increased the duration of their calls (pulses/min) while decreasing calling rate (calls/min), thus maintaining a constant pulse effort (pulses/min). In a second experiment, we tested the hypothesis that, when pulse effort is similarly held constant, females preferred long duration calls produced at a slow rate over short duration calls produced at a fast rate in both quiet and noisy conditions. Interestingly, females actually preferred short calls at a fast rate as opposed to long calls at a slow rate. The changes male gray treefrogs make to their advertisement calls in noisy environments are opposite of what the females really prefer. It appears that, in the case of gray treefrogs, there is a co-evolutionary mismatch between signaler behavior and female preference under noisy conditions.

0631 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Robert Lovich¹, Michael Lannoo², Chris Petersen³, Priya Nanjappa⁴, Christopher Phillips⁵

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Do Frogs Still Get Their Kicks on Route 66? Transcontinental Department of Defense Transect Reveals Spatial and Temporal Patterns of *Batrachochytrium dendrobatidis* Infection

The chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), has been devastating amphibian populations globally. Two general scenarios have been proposed for the nature and spread of this pathogen: 1) Bd is an epidemic, spreading as a wave and wiping out individuals, populations, and species in its path; and 2) Bd is endemic, widespread throughout many geographic regions on every continent except Antarctica. Resolving these hypotheses requires broad-scale studies using standardized techniques. We conducted a transcontinental transect on United States Department of Defense (DoD) installations from California to Virginia. We addressed the following questions: 1) Does Bd occur in amphibian populations on secure and protected DoD environments? 2) Is there a spatial pattern to the presence of Bd? 3) Is there a temporal pattern to the presence of Bd? and 4) Do our results shed light on whether Bd is acting as an epidemic or endemic infection across North America? This study represents the most geographically extensive survey for Bd conducted to date, and included 10% of United States amphibian species. Half the amphibian species surveyed (15/30) were Bd positive. There was a strong spatial component – the ten eastern temperate DoD installations had higher rates of Bd infection (18.9%) than the five bases situated in the arid west (4.8%). There was also a strong temporal (seasonal) component. In total, 78.5% of all positive samples came in the first (spring/early-summer) sampling period. These data support the conclusion that Bd is now widespread, and argues that Bd can today be considered endemic across much of North America, extending from coast-to-coast, with the exception of remote pockets of naïve populations.

0467 Poster Session III, Sunday 10 July 2011

Ben Lowe, Kenneth Kozak

University of Minnesota, St. Paul, MN, USA

Molecular Characterization of Hybrid Zones between Southern Appalachian *Plethodon*

Hybrid zones represent model systems for studying the causes and consequences of gene exchange between closely-related evolutionary lineages. The salamanders *Plethodon shermani* and *P. teyahalee* show remarkable variation in the extent to which they hybridize along different elevational gradients in the southern Appalachian Highlands. In this study, we address whether timing of secondary contact alone can explain variation in the genetic structures of these replicate hybrid zones. Using a novel, coalescent-based method, we disentangle gene tree incongruencies to estimate the timing of secondary contact. These estimates are used in concert with estimates of dispersal and generation time to estimate expected width of a hybrid zone under a model of neutral diffusion, and then are compared to actual hybrid zones. These analyses reveal that at least in some instances, hybrid zones between *P. shermani* and *P. teyahalee* have been in existence longer than expected under a model of neutral diffusion. Furthermore, they reveal that some variation in hybrid zone width may be explained by variation in the timing of secondary contact. These findings are important, as they confirm that divergent lineages are capable of maintaining their evolutionary distinctiveness indefinitely despite ongoing gene flow with heterospecific populations.

0405 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

William Ludt¹, Moises Bernal¹, Brian Bowen², Luiz Rocha¹

¹*University of Texas Marine Science Institute, Port Aransas, TX, USA*, ²*Hawaii Institute of Marine Biology, Kane'ohe, HI, USA*

Sea Level Fluctuations and Genetic Diversity in Two Habitats: Comparisons of Two Lagoon and Two Seaward Reef Wrasses (Genus: *Halichoeres*)

Glacial cycles and associated sea level changes during the Pleistocene have been known to affect the distribution of plants and animals both in terrestrial and marine environments. These sea level fluctuations exposed the continental shelf in many areas during the last glacial maxima, restricting reefs to vertical or steep slopes and limiting the habitat area for shallow water species. Currently it is thought that species inhabiting lagoons or other shallow habitats went through population bottlenecks, resulting in present day low genetic structuring across populations. Contrary to this, species inhabiting steep, seaward reefs should not have been limited by habitat during glacial periods, allowing these species to build up genetic differences between populations. This study examined this process on an entire ocean basin scale using four different wrasses in the genus *Halichoeres*. *H. trimaculatus* and *H. margaritaceus* inhabit lagoons and

shallow habitats, whereas *H. claudia* and *H. ornatissimus* inhabit seaward reefs throughout the Pacific. Two different mitochondrial markers were used (cytochrome oxidase I and control region) to determine population structure among species, along with haplotype and nucleotide diversities. Haplotype and nucleotide diversity were similar among all four species. Furthermore, across the range of *H. margaritaceus* and *H. trimaculatus*, *H. claudia* showed less genetic structuring than the former two shallow water species. These results do not agree with the current hypotheses and suggest that those species maintain high levels of population differentiation and genetic diversity despite sea level fluctuations that potentially affected their habitat.

0537 Poster Session III, Sunday 10 July 2011

Alissa L. Luken, Jason R. Warner, Denita M. Weeks, Beck A. Wehrle, Robert E. Espinoza

California State University, Northridge, Northridge, CA, USA

Sprint Speed is Not Altered by Diel Cycle in a Nocturnal Gecko: Implications for Performance Studies

Performance typically differs between nocturnal and diurnal ectotherms because of differences in the body temperatures they can achieve during their respective activity periods. However, other factors, including diel cycles, may also influence performance. Comparisons between nocturnal and diurnal species have revealed that the time of testing can significantly alter performance, but insufficient comparative data are available to ascertain whether this phenomenon is widespread. We tested the hypothesis that nocturnal geckos will sprint at similar rates when tested at night vs. by day. We measured the sprint speed of 10 adult *Ptychozoon kuhli* (Gekkonidae) at four ecologically relevant temperatures (15, 23, 30, and 40 °C), both during the day (0800–1700 h) and at night (1800–0300 h). We found that sprint speed did not differ between nocturnal and diurnal testing periods for *P. kuhli* at any of the temperatures tested. If confirmed in a diversity of other species, such results would suggest that the time of testing is not a critical factor in performance studies. Comparable studies are planned that include a diversity of nocturnal as well as diurnal gecko species.

**0459 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH
STOYE GENERAL ICHTHYOLOGY AWARD**

Daniel Lumbantobing

The George Washington University, Washington, DC, USA

Morphology and Molecules in the Phylogenetic Study of the Genus *Rasbora sensu lato* (Teleostei; Cyprinidae)

The genus *Rasbora sensu lato* is one of the most species-rich groups of freshwater fishes distributed throughout South and Southeastern Asia. Although phylogenetic studies of *Rasbora* have been conducted, the systematics of the group is still problematic. Here, I report on the phylogenetic systematics of the genus *Rasbora s. l.* using both morphology and molecules. One hundred forty six morphological characters (77 newly-described characters) from 72 taxa (5 outgroups) were used, which resulted in a consensus of most parsimonious trees revealing the monophyly of *Rasbora s. l.* supported by two novel synapomorphies: the dorsomedial membranous tendon of the adductor mandibulae A1 muscle and the the socket-like structure of the anteroventral joint of the quadrate connecting with the angulo-articular. Four mitochondrial markers (COI, 16S rRNA, cytochrome-b, and d-loop region) and four nuclear genes (RAG1, rhodopsin, and 2 EPIC markers) were sequenced from 98 taxa (7 outgroups). The concatenated alignment of sequences of eight markers was analyzed using Maximum Parsimony and Maximum Likelihood methods. Both molecular methods resulted in similar topologies, which do not support the monophyly of *Rasbora s. l.*, contradicting the morphological phylogeny. Both molecular and morphological trees show agreement on the split of two major clades, the basal Indian clade and the more derived Indochina-Sundaland clade. Also, both approaches resulted in the topologies supporting the monophyly of several species-group of *Rasbora s. l.*, such as: the *R. argyrotaenia*-group, the *R. einthovenii*-group, and the *R. sumatrana*-group.

**0508 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday
10 July 2011**

Amy Luxbacher, Kenneth Kozak

University of Minnesota, St. Paul, MN, USA

Inferring Past Demographic Patterns of the Montane Salamander, *Plethodon jordani*

Climate fluctuations during the Pleistocene altered species distributions, but the number and location of climatic refuges in topographically complex areas in eastern North America are not well understood. I use the Red-cheeked Salamander (*Plethodon jordani*), a species that is endemic to Great Smoky Mountain National Park, to investigate how past climate has shaped contemporary patterns of population genetic structure. Preliminary results suggest several distinct evolutionary lineages within the current

geographic distribution of this narrow-ranging species. I will present research that integrates physiological data, models of variation in microclimate over time, and phylogeographic data to explore how *P. jordani* responded to past changes in climate. Because past changes in geographic distributions should be coupled with changes in population size, I also evaluate evidence for past demographic changes in each lineage. Understanding how past climate explains geographic genetic structure in this species offers broad insight into how climatic processes influence the formation of evolutionary lineages and will guide efforts to mitigate the effects of climate change on distributions and genetic diversity.

0658 Poster Session I, Friday 8 July 2011

Kady Lyons, Gwen Goodmanlowe, Christopher Lowe

California State University Long Beach, Long Beach, CA, USA

Organochlorine Contaminants in Round Stingrays (*Urobatis halleri*) from Southern California

While contaminant concentrations have been reported for elasmobranchs around the world, very few have monitored levels for southern Californian species despite the high volume of industrial and residential inputs into the coastal environment. The round stingray (*Urobatis halleri*) is a local benthic species that forages near areas of high organochlorine contamination and represents a good model to monitor contaminant accumulation in local elasmobranchs. PCBs, DDT (and metabolites), chlordanes, and PBDEs were measured and compared in juvenile male and female and adult male stingrays from areas in southern California. Organochlorine contaminants were extracted and cleaned via gel chromatography and analyzed using an Agilent gas chromatograph equipped with a mass selective detector. Juveniles and adult males from Seal Beach, California were found to have higher mean concentrations of PCBs (4803 ± 2300 ng/g, lw) than chlordanes (316.87 ± 120 ng/g, lw), PBDEs (284.66 ± 130 ng/g, lw), DDE (145.26 ± 102 ng/g, lw). Preliminary data did not show significant differences in contaminant concentrations between juveniles and adult males for any of the contaminants; however, there was high variability in contaminant concentrations among individuals, which may be influenced by the round stingray's migratory patterns. Conversely, male and female stingrays collected from Santa Catalina Island had significantly lower mean concentrations of PCBs (257.62 ± 125 ng/g, lw; $P < 0.003$), chlordanes (6.1 ± 15 ng/g, lw; $P < 0.0001$), and DDE (9.93 ± 22 ng/g, lw; $P < 0.02$). The large difference in contaminant concentrations between animals from these two areas may suggest that stingrays from the mainland could be affected more by contaminant impacts than stingrays from Catalina Island.

0192 SSAR SIEBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Chui Ying Ma, Nancy E. Karraker, Billy C.H. Hau

University of Hong Kong, Hong Kong SAR, Hong Kong

Managing Amphibians in Agricultural Wetlands in South China: Effects of Fertilizers on Tadpole Performance

Agricultural practices have altered natural wetland habitats, and this is particularly true in lowland areas of Southeast Asia. Recently, decreasing area of arable land and increased use of chemicals may limit the persistence of lowland amphibian populations. We investigated how the management of the wet agricultural farms helps to promote amphibian biodiversity. As one part of this study, we examined fertilizer use in traditional and organic farmlands, and in field mesocosm experiments, compared the effects of a chemical fertilizer (granular urea) and an organic fertilizer (peanut cake) on the survival and growth of hatchlings of the brown tree frog (*Polypedates megacephalus*) and marbled pygmy frog (*Microhyla pulchra*). Experiments assessed fertilizers at low, manufacturer-recommended, and high levels, and after 21 days we measured survival, snout-vent-length, and the weight. Survival of *P. megacephalus* and *M. pulchra* was extremely low (0%) in the chemical fertilizer at the recommended level. Conversely, survival was 98% for *P. megacephalus* and 55% for *M. pulchra* at the recommended level for the organic fertilizer. All tadpoles showed significantly increased growth in elevated concentrations of organic fertilizer. In fact, *P. megacephalus* were three times larger in mass in low concentration and seven times larger in high concentration. Similarly, increased growth in *M. pulchra* in all organic treatments resulted in abbreviated time to metamorphosis. For South China, our study suggests that where conservation of amphibians is a priority, chemical fertilizers should be avoided, and land managers should encourage the use of the organic fertilizer on long-term water crops.

0418 Herp Community Ecology, Minneapolis Ballroom E, Monday 11 July 2011

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¹Florida International University, Miami, FL, USA, ²John Carroll University, University Heights, OH, USA, ³Auburn University, Auburn, AL, USA

Amphibians and Reptiles at Ponds at the La Selva Biological Station, Costa Rica: Assemblage Variation through Space and Time

Swamp-breeding anurans form conspicuous components of many tropical forest sites, yet very little is known about the ecology of these systems. We analyzed a long-term data set to describe patterns of species composition and habitat use of amphibians and reptiles from two ponds at the La Selva Biological Station, northeastern Costa Rica. In addition, we describe long-term population-level trends in hylid frog relative abundance at a pond at La Selva and discuss whether these patterns are indicative of population declines. Results will be presented at JMIH 2011. In light of evidence that populations of

terrestrial amphibians and reptiles have experienced declines at this lowland site, knowledge of patterns of pond-breeding anuran assemblage structure is particularly critical at the present time.

0444 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Laura Macesic, Gary Gillis

Mount Holyoke College, South Hadley, MA, USA

Avoid Falling Flat on your Face: A Lesson from Toads

In contrast to a typical frog, which often lands on its belly or face after a hop, the cane toad (*Bufo marinus*) is exemplary at landing. Toads use their forelimbs to balance the body for extended periods after impact as the hindlimbs are rocked into contact with the ground. Recent investigations of antagonistic muscles acting at the elbow demonstrated that both the timing and intensity of pre-landing electromyographic (EMG) activity are tuned to hop distance. Longer hops lead to more intense pre-landing EMG activity, and in elbow extensors the onset of activity occurs at a nearly fixed interval before landing, regardless of the length of the hop. In this study, we report results from antagonistic muscles acting at the wrist and shoulder joints to test whether pre-landing recruitment patterns of muscles acting more proximally and more distally to the elbow also change in response to hop distance. Preliminary data from wrist flexors (palmaris longus and flexor carpi ulnaris) show similar patterns of tuning with distance in both pre-landing activation timing and intensity. Likewise, an antagonistic wrist extensor (palmaris carpi radialis) also exhibits tuned pre-landing activity patterns. This study demonstrates the importance of forearm muscles in stabilizing and controlling whole body movements of the toad during landing and provides a model system for understanding motor control strategies for controlled deceleration more generally.

0363 Poster Session II, Saturday 9 July 2011

Jessica Maciel¹, Maribel Pinon¹, David Zaragoza², Gerardo Antonio Cordero¹, Lorin Neuman-Lee³, Jeramie Strickland⁴, Shannon Thol¹, Daniel Warner¹, Timothy Mitchell¹, Aaron Reedy², Fredric Janzen¹

¹Iowa State University, Ames, IA, USA, ²Kelly High School, Chicago, IL, USA, ³Utah State University, Logan, UT, USA, ⁴U.S. Fish & Wildlife Service, Thomson, IL, USA

Planting a TREE: Designing a Program to Facilitate Ecological Research, Outreach, Education, and Mentoring for Underrepresented Students

There is a serious dearth of female and minority representation in the sciences. To help remedy this problem in the field of ecology, we carefully developed a program called

TREE (Turtle Camp Research and Education in Ecology). We seeded the program with an economically and racially diverse group of high school students from rural Iowa and Illinois, as well as Des Moines and Chicago, along with undergraduate and graduate student mentors from four different institutions. Participants converged at a field site known as “Turtle Camp” in June of 2007-2010 (totaling 22 high school students, 10 undergraduate students, 8 graduate students, and 2 post-doctorates over the four years). All students worked toward four main goals at Turtle Camp: research experience, local outreach, education, and mentoring. The program utilized the extensive local diversity in reptiles to allow students to receive hands-on experience with research and related activities. Overall, TREE provides an excellent environment for advancing interest in, and knowledge of, science and for positively influencing career plans of the participants. We hope that this program can serve as a model to help other organizations develop programs to expose students from diverse background to the benefits of ecological research, outreach, education, and mentoring.

0435 Fish Physiology, Minneapolis Ballroom G, Monday 11 July 2011

Samantha Macks, Heather Masonjones

University of Tampa, Tampa, FL, USA

The Effects of Temperature on the Reproductive Behavior and Metabolic Rates of the Dwarf Seahorse (*Hippocampus zosterae*)

Oceans all over the globe, including shallow coastal ecosystems, are increasing in average sea surface temperature due to global warming. Dwarf seahorses (*Hippocampus zosterae*) occupy seagrass beds along the shallow coasts of the Gulf of Mexico, and given their low mobility and high site fidelity, the effect of increasing sea surface temperatures on this coastal marine species may be devastating, because of their inability to move to cooler microhabitats to avoid high temperatures during the peak summer months. The purpose of this experiment was to measure the mating behavior and routine metabolic rates of dwarf seahorses in both the non-breeding and breeding condition at 27.5°C and 31°C, temperatures commonly found during the spring and summer months in Florida seagrass beds. Our findings suggest there was no significant increase in mass-adjusted metabolic rate due to increasing temperature, but females were observed to have a higher metabolic rate than males in the non-breeding state, which switched to a higher male metabolic rate during breeding. Increasing temperature did have a dramatic effect on successful pregnancies, with no successful offspring produced at the higher temperature. Although this study, using animals collected in the Florida Keys, indicated no significant changes in metabolic rate, pilot data collected on dwarf seahorses collected in Tampa Bay indicated a significant increase in metabolic rate with temperature, with behavioral cues suggesting severe stress at 31°C. We plan to explore this difference in future studies to identify potential local adaptations to increased temperatures across the latitudinal range of this species.

0380 Amphibian Ecology, Minneapolis Ballroom E, Sunday 10 July 2011

Jami E. MacNeil, Rod N. Williams

Purdue University, West Lafayette, IN, USA

The Effects of Timber Harvests on Terrestrial Salamanders

Terrestrial woodland salamanders are widespread and abundant in eastern US forests and play a key role in nutrient cycling in forest ecosystems. These small, lungless salamanders are sensitive to environmental change and may serve as indicators of ecosystem health. We sought to assess the immediate effects of timber harvests on terrestrial salamanders within the context of experimentally manipulated forests. We monitored the relative abundance and species richness of plethodontid salamanders via wood cover objects among nine experimental units (three even-aged, three uneven-aged, and three controls). We sampled 1980 cover objects representing 66 grids bi-weekly during the fall of 2007 and the spring of 2008, prior to the implementation of harvests. We continued to monitor these and an additional 540 cover objects (i.e. 18 grids) for four seasons post-harvest (spring and fall 2009-2010). The pre-harvest sampling seasons yielded 5092 encounters, with an average of 8.6 individuals per sampling occasion, while post-harvest seasons yielded 11,273 encounters, with an average of 7.9 individuals per sampling occasion. Pre-harvest captures of the most commonly detected species differed significantly among some study sites but not among designated treatment types. Species richness ranged from two to five per grid for both pre- and post-harvest periods, but post-harvest sampling detected a total of nine species while pre-harvest detected five. We quantified additional site and habitat components such as slope aspect, downed woody debris, precipitation, and temperature in order to determine how these factors influence relative abundance and detection probability of the most commonly encountered species.

0518 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Anabela Maia¹, Cheryl D. Wilga¹, George V. Lauder²

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Shark Dorsal Fin Function: an Integrated Functional Morphological Approach

Dorsal fins have diverse morphologies among shark species. However, little is known about the ability of sharks to control fin movements. White-spotted bamboo sharks, *Chiloscyllium plagiosum*, and spiny dogfish, *Squalus acanthias*, are two unrelated species that occupy different niches and have distinct dorsal fin morphology. During steady swimming, the first dorsal fin of *Squalus* moves independently of the body with higher lateral amplitudes at lower speeds, indicating a stabilizing function. The dorsal fins in *Chiloscyllium* move in synchrony with the trunk with relatively higher lateral range of motion than dogfish at both speeds. Electromyography data show simultaneous muscle

activity on both sides of the first dorsal fin in *Squalus* regardless of speed, indicating active stiffening. The second dorsal fin in *Squalus* and both dorsal fins in *Chiloscyllium* have left and right alternating muscle activity, indicating active beating. Flow acceleration and vortex shedding in the wake of the second dorsal fin of *Squalus* and both dorsal fins in *Chiloscyllium* was revealed by particle image velocimetry. The first dorsal fin in *Squalus* contributes to stability while the second dorsal fin, as well as both dorsal fins in *Chiloscyllium*, contribute to thrust production. During maneuvers, the dorsal fin muscles are active on both sides in both species. *Squalus* have longer burst duration on the contralateral side, consistent with opposing resistance to the medium. In *Chiloscyllium*, activation might be insufficient to counteract the water resistance. Function of dorsal fins is more flexible and diverse than first thought and might underlie the morphological diversity.

0424 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

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Decadal-Scale Shifts in the Isotopic Signatures of Predatory Sharks in the Western Indian Ocean

Because the elemental signatures in the tissues of consumers predictably reflect those of their diets, stable isotope analysis has proven useful as an alternative to dietary analysis in elucidating food web architecture, as well as temporal, spatial and ontogenetic trends in species' diets. Using a time series of vertebrae from sharks caught in the protective nets off KwaZulu-Natal, South Africa, we investigated trends in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ signatures across ontogeny, and over a 20-year time period, for seven predatory shark species. While $\delta^{13}\text{C}$ values were highly variable within species and showed only weak patterns over time, larger sized individuals of *Carcharhinus limbatus*, *C. brevipinna*, *Carcharias taurus* and *Isurus oxyrinchus* exhibited stepwise declines in $\delta^{15}\text{N}$, and an overall reduction in $\delta^{15}\text{N}$ range across ontogeny, between 1985 and 2004. A single species, *Sphyrna lewini*, showed a stepwise increase and concomitant expansion of $\delta^{15}\text{N}$ range over ontogeny, during the same period. No such patterns were observed in the isotope signatures of *Carcharhinus leucas* and *Galeocerdo cuvier*. Our results therefore suggest tropho-dynamic shifts in sharks that exploit a relatively narrow range of prey guilds. Food web restructuring, resulting from fisheries and/or climate change impacts, is the most likely driver of change in shark prey populations the western Indian Ocean. Our study provides a novel method by which broad-scale ecological change may be measured over time in marine ecosystems.

0112 Poster Session III, Sunday 10 July 2011

Margaret Malone, Terry Grande

Loyola University Chicago, Chicago, IL, USA

Applying Foraging Theory and Giving-Up Densities to the Secondary Invasion of Round Goby, *Neogobius melanostomus*, into Tributary Streams

Foraging theory has traditionally been used to model behaviors in competition and predation in predator prey interactions of mammal species. Recently, these theories have been applied to fishes to monitor behavior on different spatial scales, as well as to gain insight on optimal habitat in freshwater ecology. In this study we use foraging theory techniques to assess the giving-up density (GUD) of the invasive round goby, *Neogobius melanostomus* with respect to the native Johnny darter, *Etheostoma nigrum*, and rainbow darter, *Etheostoma caeruleum*, in stream habitats. Much has been studied on *N. melanostomus* behavior in lake habitats, but little is known about the effects of the secondary invasion of *N. melanostomus* in tributary streams. Round goby invasion is hypothesized to negatively impact Johnny and rainbow darter populations in stream habitats, where they at present coexist. Through our behavioral experiments we hope to test these hypotheses. Preliminary data suggests that the round goby is able to out compete with the Johnny darter and rainbow darter for primary patch use. Therefore, in our experiments patch use showed evidence of direct effects of an invasive species on native organisms via competition. The results of this study provide support to the validity of GUD use in fluvial habitats. The insights from behavioral mechanisms of the invasive round goby in streams provides a basis for understanding the impact the round goby will have on native stream species.

0709 Poster Session I, Friday 8 July 2011

David Marancik¹, Aimee Berliner², Tonya Clauss², Al Dove², Julie Cavin², Alvin Camus¹

¹*University of Georgia, College of Veterinary Medicine, Athens, GA, USA*, ²*Georgia Aquarium, Atlanta, GA, USA*

Disseminated Fungal Infections in Two Species of Captive Sharks

There are limited numbers of case reports describing fungal infections in elasmobranchs and most have involved cutaneous, rather than disseminated disease. We characterize the lesions associated with two cases of systemic mycosis in captive sharks demonstrated by histopathology and culture. These cases were progressive, and ultimately culminated in terminal disease. *Paecilomyces lilacinus*, an uncommon pathogen in human and veterinary medicine, was associated with areas of necrosis in the liver and gill in a great hammerhead shark (*Sphyrna mokarr*). Fungal growth was observed from samples of kidney, spleen, spinal fluid, and coelomic cavity swabs. A dual fungal infection caused by *Exophiala pisciphila* and *Mucor circinelloides* was diagnosed in a juvenile zebra shark (*Stegostoma fasciatum*). Both fungi were present in the

liver, with more severe tissue destruction associated with *E. pisciphila* than *M. circinelloides*. *E. pisciphila* was also associated with significant necrosis in the spleen and gill while *M. circinelloides* was present in the heart with minimal tissue changes. Fungal cultures from liver, kidney and spleen were positive for both *E. pisciphila* and *M. circinelloides*. These cases, and a lack of information in the literature, highlight the need for further research and diagnostic sampling to further characterize the host/pathogen interaction between elasmobranchs and fungi.

0708 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

David Marancik¹, Donald Champagne¹, Alistair Dove², Alvin Camus¹

¹University of Georgia, College of Veterinary Medicine, Athens, GA, USA, ²Georgia Aquarium, Atlanta, GA, USA

Elasmobranch Infestations by the Marine Leech *Branchellion torpedinis* in Aquarium Settings

The marine leech *Branchellion torpedinis* is a parasite exclusive to elasmobranchs. When inadvertently introduced into aquaria, infestations have proven to be difficult to manage due to the leech's direct life cycle, high reproductive capability, and a lack of proven chemotherapeutants. Infestations on the skin, gill slits, oropharynx, and cloaca can be severe, resulting in ulceration, lethargy, anorexia, anemia, and death. Secretory proteins of the *B. torpedinis* salivary gland are thought to be directly involved in the feeding mechanism of the leech and a main contributor to lesion development in elasmobranch tissue. Genetic sequencing of bioactive salivary gland compounds reveals proteins potentially involved in lesion development including proteases, anticoagulants, and thrombocyte inhibiting proteins. This data correlates with gross and microscopic lesions observed in elasmobranchs at leech attachment sites. The objective of this study is to investigate the pathologic potential of *B. torpedinis* with the goal that it will lead to better prevention and treatment techniques in aquarium, aquaculture, and natural environments.

0201 Poster Session II, Saturday 9 July 2011

Elizabeth Marchio, Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Phylogeography of the Pike Livebearer *Belonesox belizanus* (Poeciliidae)

The Pike livebearer, *Belonesox belizanus* (Poeciliidae), occurs on the Atlantic slope from southern Mexico and throughout Belize, Guatemala, Honduras, and northern Costa Rica. Kner described *Belonesox belizanus* in 1860 from Belize. The subspecies *B. belizanus maxillosus* was described by Hubbs from the Yucatan in 1936. The subspecies

designation of *maxillosus* is due to more robust anterior features including greater average head length, beak length and beak width in comparison to populations elsewhere. Hubbs' data shows there is preliminary evidence for splitting the monotypic genera into two separate taxa; however, no comprehensive study has been conducted to assess the degree of morphological or genetic variation within *Belonesox*. At present, cytochrome *b* sequence data has been obtained from individuals from Honduras and southern Mexico. Preliminary analysis of 932 bp of cytochrome *b* recovered two deeply divergent clades based on maximum parsimony analysis. On average, genetic divergence between these clades was more than 7.1%, with little to no genetic structure within clades. These results suggest that *B. belizanus* may indeed be more diverse than currently recognized. However, these preliminary results suggest the genetic differences do not conform to currently recognized subspecific designations within *Belonesox*. Future work will focus on investigating taxonomic diversity within this species using morphological data including geometric morphometric and meristic analyses.

0036 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

Julie Marin¹, Blair Hedges², Steve Donnellan³, Mark Hutchinson³, Paul Doughty⁴, Nicolas Vidal¹

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Blindsnake Evolution: Tracing the History and Biogeography of an Australian Radiation

Worm-like snakes (scolecophidians) are small, burrowing species with reduced vision. A recent analysis showed that blindsnakes (typhlopids) reached Australia about 28 (19-39) Ma, apparently by oceanic dispersal from Southeast Asia or Indonesia. There are 43 living species resulting from this colonization, but the streamlined and simplified external morphology of these snakes makes recognition of species a challenging task. A dense sampling of three species (*Ramphotyphlops bituberculatus*, *R. nigrescens*, and *R. ammodytes*) allowed us to show evidence of cryptic diversity. These results suggest that the species number of Australian typhlopids is underestimated. The major environmental change that has shaped the Australian biota since the approximately Late Oligocene arrival of blindsnakes is the onset of arid conditions. Typhlopids appear to be one of several Australian squamate lineages with tropical-humid origins that successfully adapted to the expansion of open, then arid, environments during the Miocene and now show evidence of relatively recent evolutionary radiation across Australia.

**0516 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011; ASIH
STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY AWARD**

Tricia Markle

University of Minnesota, St. Paul, MN, USA

Ecophysiological Analysis of Species Variation in Geographic Range Size

Understanding the factors that limit species' geographic distributions is a fundamental question in the fields of ecology and evolution. It is also central to predicting whether species ranges will shift, contract, or remain stable in response to rapid climate change. Yet, despite far-reaching implications, it is poorly understood why some species have very restricted distributions while others are more widespread. In this study, we use eastern North America's species-rich plethodontid salamander fauna to dissect the causes of one of the most widespread and poorly understood patterns in biogeography – the tendency of species' latitudinal extents to increase from the equator to the poles. This pattern may be caused by greater seasonal variation towards the poles driving the evolution of broader climatic tolerances (climate variability hypothesis). Alternatively, the presence of fewer competitors at higher latitudes could allow species to achieve greater latitudinal range sizes in the absence of variation in thermal-tolerance breadth (leading-edge hypothesis). We compared thermal-tolerance breadth (measured as CTMax – CTMin) with latitudinal extent for 20 species of plethodontid salamanders. We found a significant correlation between thermal-tolerance breadth and latitudinal extent, a result that lends support for key predictions of the climate variability hypothesis.

**0637 Neotropical Ichthyology, Symphony I & II, Thursday 7 July 2011; NIA
BEST STUDENT PAPER AWARD**

Arlen Marmolejo, Donald J. Stewart

State University of New York, Syracuse, NY, USA

**Community Assemblage Patterns of Inland Fishes in Southern Regions of the
Dominican Republic**

The fish community assemblage patterns were analyzed for selected lagoons and rivers (-30 to 735 m of altitude) of the southern area of the Dominican Republic from June to August, 2010, using various standard collecting gears. The study area encompasses Enriquillo Lake, an endorheic, hypersaline system that is below sea level. Multivariate methods of Detrended Correspondence Analysis (DCA) and cluster analysis (Ward's Method) revealed community patterns that corresponded primarily to water salinity and secondarily to altitude. Tributaries of Enriquillo Lake were more similar to the lake than to other fluvial sites in the Yaque del Sur river basin. Within the Yaque del Sur basin, patterns reflected a gradient from lowland lagoon to the mainstream river plus a reservoir on the mainstream, and finally to an upland tributary. Rivers and freshwater lagoons had relatively high diversity and evenness, while Enriquillo Lake had intermediate values, and the reservoir had the lowest diversity. The Yaque del Sur River

mainstream had the highest species richness, while Enriquillo Lake had more characteristic species. This study provides critical data to determine the conservation status of the native fish fauna of the area. It can be applied to establish conservation priorities and to enhance public outreach and educational programs. It also provides a baseline from which future changes in fish assemblages might be evaluated as human populations and related habitat effects increase.

0046 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Rachel E. Marschang¹, Anke Stöhr¹, Silvia Blahak², Tibor Papp³, Maria Filomena Caeiro⁴, Antonio Pedro Alves de Matos⁶, Jawad Nazir¹

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Ranaviruses in European reptiles

In Europe, ranaviruses have been isolated from chelonians and lizards. There are three reports of ranavirus infections in tortoises in Europe, two in Hermann's tortoises (*Testudo hermanni*) and one in a leopard tortoise (*Geochelone pardalis*). All of the tortoises were kept in captivity and developed disease. In two cases, disease spread from one animal to another and one recent case has been associated with an outbreak among several different collections of tortoises and spread from Hermann's tortoises to other species. Ranaviruses have also been isolated from lizards in Europe. In one case, a virus was isolated from a gecko (*Uroplatus fimbriatus*) kept in a private collection. In another, a ranavirus was isolated from an Iberian rock lizard (*Lacerta monticola*). The second is the only documented case of ranavirus infection in a wild reptile in Europe.

Characterization of the ranavirus isolates obtained from these reptiles has been carried out by various methods, making a direct comparison between the European reptile ranaviruses somewhat difficult. Sequencing parts of the genomes of several of these viruses is ongoing. Available sequence data show that the reptilian ranaviruses are each more closely related to various described amphibian ranaviruses than to one another. However, available restriction enzyme analysis of some of the reptilian ranaviruses does show considerable differences between these and specific amphibian isolates. Future research directions include further comparison of ranaviruses from reptiles, environmental persistence of reptilian, amphibian, and fish ranaviruses, and screening of reptiles for ranavirus infections by virus and antibody detection.

0222 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Edie Marsh-Matthews, Rosemary Knapp, David McCauley, Eric Lee

University of Oklahoma, Norman, OK, USA

Brood Reduction in Response to Stress in Western Mosquitofish: Implications for the Trexler-DeAngelis Model of Matrotrophy Evolution

The ability of females to abort embryos and reclaim nutrients for distribution to the remaining brood is a key assumption of the Trexler-DeAngelis model of matrotrophy evolution, which posits that females may initiate development of more embryos than can be provisioned by post-fertilization nutrient transfer if maternal resources decline during gestation. Several studies in livebearing fishes have examined brood reduction in females exposed to food limitation imposed during gestation, but results have been equivocal. We examined brood reduction in Western Mosquitofish (*Gambusia affinis*) exposed to the stress hormone cortisol, which is known to reduce energy stores in some fishes. Females were exposed every 3 days to one of five treatment levels of cortisol (0.05, 0.1, 0.5, 1.0, or 2.0 mg/l) or to a control treatment (ethanol or water) delivered directly into the water housing the female. Females exposed to the highest doses of cortisol had reduced somatic lipids and the highest number of late stage embryos showing arrested development and decomposition. Numerous females also showed evidence of early stage brood reduction as evidenced by the presence of yolkless embryo remnants. These yolkless embryos suggest that females can rapidly reclaim nutrients from embryos early in development. Yolkless embryos were observed in control as well as cortisol-treated females, but numbers were higher in females exposed to the highest cortisol doses. These results suggest that females are able to reclaim, and presumably redistribute, nutrients to the remaining brood under stressful or other conditions that affect the resources available for post-fertilization provisioning.

0209 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Heather Marshall¹, Richard Brill², Peter Bushnell¹, Greg Skomal⁴, Diego Bernal⁴

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Preliminary Assessment of Differences in Fishing-induced Stress Response between the Sandbar (*Carcharhinus plumbeus*) and Dusky (*C. obscurus*) Sharks (Family Carcharhinidae)

In recent years, exploitation of many shark species has incited management organizations to revise commercial fisheries management plans (FMPs) with the hopes of conserving shark populations. Specifically in the western Atlantic, amendments to the Consolidated Highly Migratory Species FMP demand the post-capture release of several coastal species, including the sandbar (*Carcharhinus plumbeus*) and dusky (*C.*

obscurus) sharks (Family Carcharhinidae). Although these FMPs are designed to conserve populations, they result in an increased number of sandbar and dusky sharks released after capture. The assumption is that 100% of these sharks will contribute to future population growth. However, recent research on capture-related stress indicates that the extent of survival is not well understood. This preliminary study aims to create a better understanding of the differences in stress response between sandbars and dusky and investigate the likelihood of post-release mortality. Hematological secondary stress parameters (electrolytes, metabolites, and heat shock protein 70) were collected from longline captured sandbar and dusky sharks and compared to baseline “unstressed” blood values collected from sandbar sharks. Preliminary analysis reveals a clear physiological effect of longlining on both species, with elevated blood parameters (e.g., lactate and glucose, $p < 0.05$), as well as a species-specific difference in response, with the dusky showing a higher magnitude of stress than the sandbar. Data show that longline capture results in physiological disruption, possibly leading to post-release impairment or mortality. The interspecific difference found in stress response highlights the need for species-specific fisheries management.

0481 Reptile Evolution & Systematics, Symphony I & II, Saturday 9 July 2011

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¹University of Texas at Tyler, Tyler, TX, USA, ²Mount Mercy University, Cedar Rapids, IA, USA

Range-wide Molecular Phylogenetics of the North American Box Turtles (*Terrapene*)

The current classification of the North American box turtles (*Terrapene*) is based primarily on morphological data with the analyses that have utilized genetics being characterized by incomplete taxon sampling, small sample sizes with restricted geographic representation, and limited types of genetic markers. Therefore, a more thorough molecular phylogeographic study using a variety of genetic markers is warranted to support or reject the current classification scheme. We sampled all currently recognized *Terrapene* subspecies/species from across their ranges and used both mitochondrial and nuclear sequence data in an attempt to resolve the evolutionary history of the group. Our results strongly support the division between the western (*T. ornata*) and eastern (*T. carolina*) groups, but subspecific classifications within these groups do not necessarily conform to the current classification scheme. In addition, the current placement of the historically more distantly related spotted box turtle (*T. nelsoni*) and Coahuilan box turtle (*T. coahuila*) is called into question. Based on our data, the *Terrapene* genus requires substantial taxonomic revisions and we provide suggestions in this regard. In addition, since the *Terrapene* are of conservation concern throughout much of their range and since conservation efforts are typically species-based, this work may have significant conservation management implications.

0759 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

David Martin

Canorus Ltd., San Jose, CA, USA

Forensic Identification of Reptile Species Using Scale Morphology

The legitimate international trade in wildlife and wildlife products is estimated to be worth 20 billion US dollars a year. A significant percentage of this trade includes products manufactured from reptile skins and other reptile body parts. Products range from entire tanned skins to manufactured goods to "native craft" objects to traditional medicines and food products. This legitimate trade is predicated on the killing of 10-15 million reptiles a year with most being harvested from the wild. Over 40 species of reptiles are regularly recorded in the trade. Unfortunately, the extent of the illegal trade in reptile skins and products is nearly impossible to quantify, but it includes many protected species. The prosecution of smuggling suspects requires a forensic identification of the species involved. Proper species identification of products such as leather requires a working knowledge of the variation in scale morphology between and within species. Wildlife products are often imported with little information regarding the origin. The species identification, if provided, is often questionable, and products often consist of a small portion of the animal. In such cases, traditional methods of identification, such as distribution and physical characteristics, e.g., scale counts, are lost or incomplete, thereby, making species identification practically impossible using traditional methods. Further complicating the identification task is the likely destruction of genetic material during processing into leather. Thus, scale morphology is often the only clue to species identification. This talk will review current knowledge of scale morphology and discuss the information gaps that must be filled.

0216 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

F. Douglas Martin, Ben J. Labay, Adam E. Cohen, Dean A. Hendrickson

University of Texas, Texas Natural History Collection, Austin, TX, USA

Exploring Recent Range Changes for Some Stream and Marsh Fishes on the Texas Coastal Prairie

Changes in species range may reflect changes in the local environment, events that alter the ability of a species to disperse and, sometimes, evolution of tolerance for new habitats previously inhospitable. The coastal prairies of Texas have a number of river basins in close proximity to each other with unimpressive barriers to interbasin dispersal. Additionally, the Fishes of Texas Project has comprehensively compiled historical records for this region going back to 1851, and provided MaxEnt distribution models that map extent of suitable habitat, making this area a good laboratory for examining recent species range changes. We examined changes in species ranges for seven stream and marsh fish species in this area and compare them to five others with

static ranges. Many species appear to have successfully invaded habitats that the MaxEnt models indicated to be suitable.

0528 Poster Session III, Sunday 10 July 2011

Jennifer Martin, Eric Hilton

Virginia Institute of Marine Science, Gloucester Point, VA, USA

A Taxonomic Revision of Lampridiform Genera

The taeniosomous lampridiforms, a putatively monophyletic group including five families (Stylephoridae, Radiicephalidae, Lophotidae, Regalecidae, Trachipteridae) and nine genera, are rare mesopelagic fishes distributed in all oceans. Despite their striking appearance, numerous issues arise with regards to genus-level identification. In some cases, taxa are even misidentified at the family-level. This is because of their rarity, combined with inadequate type descriptions and specimens, incomplete diagnoses, and the conservative morphology displayed within some families (particularly the genus *Trachipterus*), all of which has greatly confounded taxonomy. This lack of taxonomic clarity constrains identification and basic research on biogeography and phylogeny. While working through lampridiform material for a new genus-level phylogenetic analysis of the order, new morphological observations were obtained from larval, juvenile, and adult life stages of all putative genera. A synthesis of these data, combined with published information, will be presented, and updated differential diagnoses for taeniosome genera will be formulated.

0493 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Karen Martin, Jennifer Raim

Pepperdine University, Malibu, CA, USA

Avian Predation on Runs of Beach Spawning California Grunion, *Leuresthes tenuis*

Spawning aggregations of marine fishes attract predators, but actual take and kills are rare during spawning rushes. On the other hand, egg predators may be highly successful when pelagic eggs are released during spawning rushes. It has been suggested that beach spawning in *Leuresthes tenuis*, the California Grunion, evolved as a way to avoid egg predation, because the embryos are buried under sand on shore. However beach spawning is synchronized with the highest semilunar tides. Thus, spawning takes place within a narrow window of time, requiring mass aggregations of potential spawners in a specific area with appropriate substrate. Tidal cycles are readily predictable and most marine animals are well aware of tidal rhythms. Beach spawning fishes are forming aggregations at a predictable time in a particular place. This may

seem to indicate an increased likelihood of predation on the adults. We have observed numerous predators on both spawning adults and nests over a wide area of the habitat range of this species. In particular, avian predators target the spawning runs in certain locations. We hypothesize that avian predation on *L. tenuis* during spawning runs and eggs after the runs is site-specific and learned, possibly culturally transmitted.

**0656 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011; ASIH
STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY AWARD**

Natalie Martinez-Takeshita

California State University, Northridge, Northridge, CA, USA

The Global Genetic Diversity of *Seriola lalandi* (Yellowtail)

The Yellowtail (*Seriola lalandi*), one of the most important sport and commercial species off southern California, is the largest member of the Jack family (Carangidae). These cosmopolitan fish can be found in subtropical and temperate waters. *Seriola lalandi* are commercially fished, recreationally fished, and farm raised in the regions they occupy, thus providing an important food source and a sizeable economic impact for the people in these countries. DNA samples were collected from California (Channel Islands, Catalina Island & San Clemente Island), the Pacific Coast of Baja California, the Gulf of California, New Zealand, Japan, South Africa and Chile. A mitochondrial DNA analysis using the d-loop was used to determine the population structure and genetic variation between distinct sites. It may also be possible to identify subspecies and changes in population structure due to fishing pressures, as well as, migratory patterns of this global species. The genetic analysis will provide valuable information to help properly manage and sustain these fish populations in the future.

0490 Poster Session II, Saturday 9 July 2011

Heather Masonjones

University of Tampa, Tampa, FL, USA

Site Fidelity and Population Estimates of Dwarf Seahorses (*Hippocampus zosterae*) in Tampa Bay, Florida, USA

We investigated the site fidelity and spring population size estimates of dwarf seahorses (*H. zosterae*) in a Tampa Bay, Florida (USA) estuarine system. The main purposes of this work were to increase the precision of our earlier population estimates of this species and to determine their home range size to identify reasonable conservation targets to better manage their populations on a landscape level. Eight permanent transects were established in a small bay off the South Tampa peninsula, and were sampled at least weekly during the late winter and early spring of 2011. On each census date, fish were collected either by hand or by pushnet from each 12-20 m² transect (varying based on

the shape/size of the seagrass patch). Each animal was marked with latex dye under the skin, photographed for body size and reproductive condition estimation, and returned either to the location from which they were visually captured or to a flag at the center of the transect. Recapture rates increased dramatically over our previous study, going from 0.4% in our previous study to over 30% recaptured with this smaller scale sampling design. No gender differences were observed in movement patterns, but males were more often recaptured than females. With the restriction of *H. zosterae* to the Gulf of Mexico region, accurate population estimates and a thorough understanding of their patchy distribution is critical to management of their population in the wake of the oil spill in April 2010 off of the coast of Louisiana, USA.

0114 Poster Session II, Saturday 9 July 2011

Wilfredo Matamoros, Matthew Davis, Prosanta Chakrabarty, Caleb McMahan
Museum of Natural Science, Louisiana State University, Baton Rouge, LA, USA

Historical Biogeography, Divergence Times, and Diversification Patterns of New World Poeciliid

Fishes of the family Poeciliidae are distributed throughout tropical and subtropical America and Africa, the majority of new world poeciliids are livebearers in the subfamily Poeciliinae. This group is one of the most examined groups of Cyprinodontiformes, due in large part to their use as model organisms in sexual and natural selection studies. We estimate divergence times and patterns of diversification using one nuclear (RAG1) and two mitochondrial (Cyt B and ND2) genes in order to reconstruct the evolutionary and biogeographic history of new world poeciliid fishes. Taxonomic sampling was robust and included 138 species from almost all major lineages from North America, Middle America, South America, and the Greater and Lesser Antilles. Using this phylogeny and detailed data on extant distributions, we reconstructed the historical distribution of the new world poeciliids in a temporal framework. This time-calibrated phylogeny allows for the assessment of the tempo and mode of diversification within new world poeciliids using lineage-through-time plots and tests to detect rate-shifts. Our analysis suggests that the subfamily expanded from Northern Middle America during the late Cretaceous/Paleogene and radiated to Nuclear and Southern Middle America and to the proto-Greater Antilles.

0269 Herp Behavior, Symphony I & II, Monday 11 July 2011

Alicia Mathis, Michael Lampe, Adam Crane

Missouri State University, Springfield, MO, USA

Behavioral and Metabolic Responses of Ozark Zigzag Salamanders (*Plethodon angusticlavius*) to Alarm/stress Secretions from Heterospecific Members of the Same Prey-guild

When different species have common predators, selection should favor individuals that respond to alarm/stress cues of the other species. Ozark zigzag salamanders (*Plethodon angusticlavius*) are often found under rocks and logs during wet conditions, but they also use subterranean borrows during harsh environmental periods. By using the vomeronasal organ, these salamanders can assess chemical cues in their environment, including cues from predators and alarm/stress cues from conspecifics. Earthworms (*Lumbricus terrestris*) are abundant, syntopic to zigzag salamanders, and are vulnerable to the same predators. We tested whether salamanders would respond to alarm/stress cues from earthworms in ways that are consistent with antipredator behavior. We obtained alarm/stress cues from earthworms by simulating a predatory attack (grasping them with forceps) and collecting the secretions in water. Salamanders significantly increased their time spent in escape behavior, decreased their chemosensory behavior, and increased oxygen consumption when exposed to cues from stressed earthworms, whereas their responses to cues from unstressed earthworms were similar to responses to blank water. These results suggest that salamanders can recognize alarm/stress cues from earthworms as dangerous.

0305 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Philip Matich, Michael Heithaus

Florida International University, North Miami, FL, USA

Ontogenetic Shift in the Habitat Use and Diet of Juvenile Bull Sharks in a Coastal Estuary

Ontogenetic niche shifts are experienced by a variety of species and numerous factors have been found to be important drivers. Yet, we lack a strong understanding of the ecological importance these shifts may have on both the species and ecosystem(s) they reside within, especially for large, aquatic predators. We investigated the potential drivers of shifts in the habitat use and diet of juvenile bull sharks during their growth within a nursery, and their potential ecological impacts. Acoustic tracking and quantitative longline fishing revealed that sharks expanded their use of the estuary as they grew until reaching a size of 135 cm total length or greater, at which time they inhabited coastal waters adjacent to the Gulf of Mexico. Stable isotope data suggested that bull shark diet also changed with size, and their role within the trophic systems of the estuary shifted from that of a freshwater predator to a marine predator. Environmental factors, such as salinity, may be important drivers of juvenile bull shark

behavior, but these size-based shifts were most likely influenced by site-specific competition and predation risk. This ontogenetic niche shift helps shape the role of juvenile bull sharks within this coastal ecosystem, and provides a functional link between the freshwater and marine habitats through trophic interactions within our study area. As predator populations continue to decline and climate change alters ecosystems, it is important that we continue to investigate the drivers of ontogenetic niche shifts, especially in highly mobile predators, and their ecological importance.

**0428 Fish Ecology I, Symphony I & II, Friday 8 July 2011; ASIH STOYE
GENERAL ICHTHYOLOGY AWARD**

Joie Matillano

SUNY ESF, Syracuse, NY, USA

Biodiversity of Cyprinids in Northern Palawan, Philippines

This study aimed to update the taxonomy, distribution patterns, and conservation status of the endemic cyprinid populations of Palawan Island, Philippines. The study sites include one endorheic lake and five of the largest river basins in the city of Puerto Princesa and the towns of Taytay and Roxas, in northern Palawan. Morphometric and meristic characterization was used for taxonomic studies while for distribution, GIS tools were utilized to map out the extent of occurrence and area of occupancy of cyprinids. For conservation status, the threatened status of these endemic fishes were evaluated according to the criteria set by International Union for Conservation of Nature. Results of the study revealed that the cyprinid life of Palawan is more diverse than previously thought. At least one undescribed species from genus *Barbonymus* was collected, which is also a new genus record for Palawan and the Philippines. In addition, several morphotypes of the genus *Puntius*, *Rasbora* and *Nematabramis* were caught. For distribution patterns, at least two species of *Puntius* are found in a single locality in Lake Manguao, while one *Rasbora* species is so far recorded only from the town of Taytay. Based on IUCN criteria, the conservation status of at least four cyprinid species should be elevated to either Critically Endangered or Endangered category. This research highlights the needs for conservation of the endemic cyprinid life in Palawan, which to date has no protected inland wetland habitats for wetland biodiversity.

0317 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

William Matthews¹, Edie Marsh-Matthews², Ginny Adams³, Reid Adams⁴

¹University of Oklahoma, Norman, OK, USA, ²University of Oklahoma, Norman, OK, USA, ³University of Central Arkansas, Conway, AR, USA, ⁴University of Central Arkansas, Conway, AR, USA

Flood of the Century in Piney Creek -- It Happened Again!

In December 1982, Piney Creek, IZard County, Arkansas, experienced a physically destructive "flood of the century", but the fish community in August before (1982) and after (1983) the flood was very similar, as documented in Copeia 1986:388-397. In March 2008, Piney Creek again experienced an erosive flood of magnitude comparable to that of 1982, followed by another equally deep "back flood" from the White River in April 2008. In May 2008 we documented flood heights from debris lines and interviewed local residents, confirming that floodwaters reached levels as much as 12 meters above baseline, and that the entire watershed suffered severe erosion and habitat disturbance. We had sampled fish at 12 localities throughout the watershed in summer 2006, providing a "before" survey, and we re-sampled six of those sites in summer 2008 and again in 2010. We now summarize the effect of this second catastrophic flood on the fish community of Piney Creek, and compare the effects of this springtime flood to that of the winter flood in 1982. In general, the fish community was resilient to both these extreme floods, but details differ between these two events.

0040 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Rolando Mazzoni

Universidade Federal de Goiás, Goiânia, Goiás, Brazil

Current Understanding of Ranaviruses in South America

Knowledge on ranaviruses in South America is scarce. Ranaviruses have been detected in Venezuela (Zupanovic et al., 1998), Argentina (Fox et al., 2006), Uruguay (Galli et al., 2006) and Brazil (Galli et al., 2006; Mazzoni et al., 2009). Wild amphibians from Venezuela appear to be infected with at least two different ranaviruses, one isolated from toads (*Bufo marinus*) and the other from *Leptodactylus* frogs. In Argentina, one ranavirus has been detected in *Atelognathus patagonicus*, which showed 100% homology with FV3 and other family members within a 500 base pair fragment of the major capsid protein. In Brazil, a ranavirus was detected in morbid tadpoles (*Lithobates catesbeianus*) originally imported from North America. For this isolate, the sequences for the complete MCP coding region, and partial regions of the RNA polymerase DNA dependent gene, and of the immediate early protein-ICP 18 were highly homologous to FV3. These results suggest that importation of *L. catesbeianus* may have introduced ranavirus into Brazil. Despite detection of ranaviruses in captive and wild amphibians in some South American countries, no ranavirus infections or disease have been reported in fish and

reptiles but few pathogen surveillance programs exist. A major research need in South America is to understand the current distribution of ranaviruses and their threat to native ectothermic vertebrate populations. Controlled studies also are needed that challenge native species with ranavirus isolates known to occur in South America.

0510 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Michael McCallister, Ryan Ford, Christina Walker, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

A Survey of the Shark Fauna in Northeast Florida Estuaries: Abundance, Distribution, and Identification of Potential Nursery Habitat

It is widely accepted that essential fish habitat (EFH) plays a crucial role in the life-history of many marine species. For many shark species, EFH includes nearshore and estuarine waters that serve as nursery habitat where sharks are born and/or juveniles spend the early part of their life. Examination of the literature shows the presence of shark nurseries in most major estuaries along the Atlantic and Gulf Coasts of the United States, however, there is a noticeable gap in data from the Northeast region of Florida. In May 2009 a long term bottom longline survey was initiated to assess the use of estuaries in Northeast Florida as shark nursery habitat. A total of 204 longlines were set in Nassau and Cumberland Sounds from June 2009 - October 2010 and 506 sharks, comprising 10 species, were caught. Atlantic sharpnose sharks (57.48% and 55.28%), blacktip sharks (15.35% and 19.88%), and bonnethead sharks (11.81% and 9.32%) were the most abundant species in both Cumberland and Nassau Sounds. Young of the year and juvenile individuals were caught for 9 of the 10 species. The data from this survey represents the first attempt to characterize the abundance and distribution of sharks in northeast Florida waters and to identify potential shark nursery habitat in this area.

0345 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Heather McCann¹, Aaron Fisk¹, Sabine Wintner², Jeremy Cliff², Sheldon Duffy², Mike Meyer³, Brian Fryer¹, Nigel Hussey¹

¹*Great Lakes Institute for Environmental Research, University of Windsor, Windsor, ON, Canada*, ²*KwaZulu-Natal Sharks Board, Umhlanga Rocks, KwaZulu-Natal, South Africa*, ³*Department of Environmental Affairs & Tourism, Marine & Coastal Management Branch, Cape Town, Western Cape, South Africa*

Trophic Ecology and Movement Dynamics of South African White Shark (*Carcharodon carcharias*) Inferred from Stable Isotope Profiles in Vertebrae

The white shark (*Carcharodon carcharias*) is a large, highly mobile keystone predator that is known to prey on pinnipeds and spend associated periods of residency at seal haul

outs interspersed with coastal and oceanic migrations. Understanding trophic dynamics of regional populations, both at the individual (i.e. over ontogeny) and population level is important for species-specific management plans. Elasmobranch vertebrae grow incrementally and record a seasonal 'isotopic diary' ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$) throughout ontogeny, providing a measure to examine trophic ecology and coarse level movement patterns. White shark vertebrae from KwaZulu-Natal, South Africa (55), and Kenya (1) were serially sampled and analyzed for stable isotopes. Sharks ranged in size from 124cm to 487cm PCL. Stable isotope values varied across individuals and ontogeny, $\delta^{13}\text{C}$ values ranged from -17.68 to -10.59‰ and $\delta^{15}\text{N}$ values ranged from 10.96 to 18.67‰. For animals <200 cm PCL, $\delta^{13}\text{C}$ values were more variable compared to sharks > 200 cm PCL. Additionally $\delta^{15}\text{N}$ values increased at approximately 220-280 cm PCL (~4 years of age), indicating a shift to higher trophic level prey in agreement with stomach content data and previous stable isotope work on Pacific and North Atlantic populations. The $\delta^{13}\text{C}$ values of a large near-term pregnant female (487 cm) declined in the year before capture and then increased in the year of capture which supports an offshore migration and a return to coastal waters while pregnant. These data demonstrate that trophic ecology and habitat use vary widely across ontogeny, which needs to be considered in regional management plans.

0629 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Katelyn McCann, Kevin Wood, Patrick McNeal, Jeff Forrester, Charles Zwemer, Scott Boback

Dickinson College, Carlisle, PA, USA

Analyzing a Predator-Prey Interaction: Muscular Performance in Boas (*Boa constrictor*) and Cardiovascular Response in Rats during Constriction

Constricting snakes must balance the energetic cost of constriction with the potential danger in releasing their prey too early. Therefore, it would be advantageous for these snakes to possess a mechanism to determine the minimum pressure and duration required to ensure that a prey item has been subdued and no longer capable of inflicting harm. We hypothesized that Boas (*Boa constrictor*) modulate their constriction based on endogenous cues from their prey such as a heartbeat. In previous work we demonstrated that Boas respond to a simulated heartbeat in a deceased rat model by constricting with greater pressure and duration than when constricting rats without a simulated heartbeat. We extend this work in the current study by testing how Boas respond to a more realistic model; a rat whose cardiovascular system fails during the constriction event. We presented snakes with rats with a simulated heartbeat that "failed" halfway into the constriction. Preliminary analysis of these data suggests that Boas respond to this failed heart model differently than our continuous heart model by rapidly decreasing total constriction pressure when the simulated heart is turned off. We have also initiated experiments to test the snake's response while constricting live, anesthetized rats. This system allows us to observe the snake's response to an actual rat

heartbeat while simultaneously monitoring cardiovascular function in the rat during the constriction.

0591 Poster Session III, Sunday 10 July 2011; ASIH STORER HERPETOLOGY AWARD

Pamela McClain

Emporia State University, Emporia, KS, USA

Correlating Corticosterone Levels to Leukocyte Ratio for Five Snake Species in Kansas

Stress hormones, such as corticosterone, have routinely been used by researchers as a measure of stress that an animal is experiencing. The rise in corticosterone is a direct physiological reaction to being exposed to stress in all vertebrate classes. Stress hormones are known to affect an animal's physiology and behavior, requiring that a "non-stressed" level of these measures be established. Currently, the most commonly used method to measure the change in hormones is with a blood assay (EIA) kit. The use of an EIA kit requires that the user be skilled in the technique, and also requires a number of safety precautions. We have validated a simpler method of measuring change in stress hormone using a less invasive and inexpensive method; the ratio of two types of white blood cells (heterophils to lymphocytes, or H:L) in reptiles. No less than 5 individuals from 5 species of snakes were captured at rest. Blood samples were taken immediately after capture and after one week to establish H:L ratios. Ratios were calculated using a stained 100 cell count from a blood smear slide. Corticosterone levels from the same samples were analyzed using a blood assay. Corticosterone levels and H:L ratios in "pre-stressed" and "post-stressed" conditions were correlated for each species.

0096 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

Mikki McComb-Kobza¹, Tamara Frank¹, Robert Hueter³, Stephen Kajiura²

¹Harbor Branch Oceanographic Institute at Florida Atlantic University, Fort Pierce, FL, USA, ²Florida Atlantic University, Boca Raton, FL, USA, ³Mote Marine Laboratory, Sarasota, FL, USA

Temporal Resolution and Spectral Sensitivity of the Visual System of Three Coastal Shark Species From Different Light Environments

Elasmobranchs have radiated into nearly every aquatic habitat on earth including the deep benthos, brightly lit coral reefs and even the murky freshwaters of the Amazon. As such, they experience tremendous variability in ambient lighting conditions which have resulted in remarkable adaptations within the visual system. Therefore, elasmobranchs represent an excellent group with which to compare and contrast visual function.

Elasmobranch eyes rival higher vertebrates in function and complexity and aspects of the visual system are correlated with environmental factors. In this study, the visual temporal resolution (eye speed) and scotopic spectral sensitivity of three coastal shark species (bonnethead *Sphyrna tiburo*, scalloped *Sphyrna lewini*, and blacknose shark *Carcharhinus acronotus*) were investigated by electroretinogram. Temporal resolution was quantified under photopic and scotopic conditions using response waveform dynamics and maximum critical flicker-fusion frequency (CFF). Photopic CFFmax was significantly higher than scotopic CFFmax in all species. The bonnethead had the shortest photoreceptor response latency time (23.5 ms) and the highest CFFmax (31 Hz), suggesting that its eyes are adapted for a bright photic environment. In contrast, the blacknose had the longest response latency time (34.8 ms) and lowest CFFmax (16 Hz), indicating its eyes are adapted for a dimmer environment or nocturnal lifestyle. Scotopic spectral sensitivity revealed maximum peaks (480 nm) in the bonnethead and blacknose sharks that correlated with environmental spectra measured during twilight, which is a biologically relevant period of heightened predation.

0060 Fish Morphology, Symphony I & II, Friday 8 July 2011

Amy McCune, Mark Riccio, Amanda Cass, Sarah Longo, William Bemis

Cornell University, Ithaca, NY, USA

A Fantastic Voyage Through the Lungs and Swimbladders of Basal Osteichthyans

Swimbladders have been regarded as a modification of osteichthyan lungs since the middle of the 19th century (Owen 1846). A classic figure by Bashford Dean (1895), based on the work of Burt Green Wilder (1977), shows cross-sectional and lateral views of the air-filled organs (swimbladders and lungs) of *Amia*, *Lepisosteus*, *Acipenser*, *Polyodon*, *Hoplias*, *Protopterus*, *Lepidosiren*, *Neoceratodus* and tetrapods. Dean's figure has been reproduced in textbooks, such as Romer (1970), and it continues to influence ideas about the evolution of lungs and swimbladders. CT scans yield excellent high resolution 2D and 3D images, even of internal structures, that are difficult or impossible to view with traditional dissection techniques, and critical for gas-exchange in many of these fishes. Our CT studies of air-filled organs in the taxa illustrated by Dean (1895) reveal new insights into internal features, vascularization, overall shape and size, and connections with the pharynx. We find that Dean's often-reproduced figure, while visionary for its time, is, in many ways, inaccurate. This will be an image-rich presentation in which we view the structure of osteichthyan air-filled organs in anatomical context and take a 3D voyage deep inside these remarkable organs.

0596 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Sara McCutcheon, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Efficacy of Lanthanide Elements as Shark Repellants

Sharks make up the largest portion of bycatch in most of the world's longline fisheries and their prevalence as bycatch is problematic for several reasons. Their life history characteristics make them vulnerable to overfishing, the loss of large apex predators can have adverse ecological consequences, and shark bycatch is an economic burden to commercial longline fishermen. Naturally electrogenic lanthanide metals have been proposed as a method to reduce shark bycatch by deterring sharks from biting at treated bait. We quantified the voltage produced by several lanthanide metals and alloys and determined that neodymium and praseodymium produced the greatest voltage per gram ($1.9 \pm 0.57 \mu\text{V/g}$ and $1.4 \pm 0.27 \mu\text{V/g}$ at 10cm respectively). Dissolution time varied significantly among metals with xxx lasting the longest in seawater. Upon factoring in voltage, dissolution time, cost, and difficulty to machine, neodymium was determined to be the most promising metal for subsequent trials. The efficacy of neodymium as a repellent was tested in behavioral trials with bonnethead, *Sphyrna tiburo*, and lemon sharks, *Negaprion brevirostris*. For bonnethead sharks tested individually, bait was removed from the neodymium significantly less than from the control treatments (lead, stainless steel, acrylic). However, for bonnetheads tested in groups the Neodymium provided no significant repellent effect, and for lemon sharks tested in groups significantly more bait was removed from the neodymium treatment. Lanthanide metals provide mixed results as shark bite deterrents with efficacy varying by species and school size.

0311 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Suzanne McGaugh

Duke University, Durham, NC, USA

Population Genetics of Two Endemic Turtles from Cuatro Ciénegas, Coahuila, Mexico

Cuatro Ciénegas is one of the most diverse ecosystems in North America. This ecosystem is extremely stressed, and many of the endemic plant and animal species are at risk of extinction. Local extinctions throughout the valley have been documented, and this is especially true for some of the most genetically diverse populations. Among those affected, three endemic species of turtle, with ancestral distributions across the valley, are rapidly becoming restricted to the eastern lobe of the basin. We assayed genetic diversity and population structure of *Apalone ater* and *Trachemys taylori* using microsatellite markers and mitochondrial DNA. For both species, striking population structure across the basin exists, and some of the most genetically diverse areas are those at most risk of environmental degradation.

0449 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Jeanette McGuire¹, Justin Congdon², Kim Scribner¹

¹Michigan State University, East Lansing, MI, USA, ²University of Georgia, Savannah River Ecology Laboratory, Aiken, SC, USA

Mating System, Male Reproductive Success, and Population Connectivity of Blanding's Turtles (*Emydoidea blandingii*)

Data on the habitats needed to complete life-history functions (core habitat) combined with reproductive data facilitates the quantification of population connectivity. Long-term mark-recapture (spanning 50 years) and nesting ecology data (32 years) on Blanding's turtles (*Emydoidea blandingii*) were used to identify individuals that were residents of two major wetlands on the E. S. George Reserve (ESGR) in southeastern Michigan (650 ha) and to define their core habitat. Many non-resident individuals use ephemeral wetlands and nesting areas on the ESGR. We used genetically-determined parentage and estimates of reproductive success of males and females based on 77 nests collected over 7 years (1999-2006) to 1) characterize the mating system, 2) quantify sources of variation in male reproductive success, and 3) quantify the frequency of successful matings between resident and non-resident individuals. Males and females had multiple mates within and among years. Incidence of multiple paternity was high and variable among years (mean = 47.6%, Min-Max = 15.4% - 55.6%). Repeated paternity was observed among years (mean = 46.7%, N=15 among-year comparisons). Male reproductive success varied as a function of the number of mates and clutches sired. Resident and non-resident females were equally likely to have offspring sired by non-resident males. The core habitat data and the reproductive data establish that the population of Blanding's turtles includes individuals from areas beyond the ESGR. Given the species' propensity for frequent and extensive terrestrial movements, the integrity of aquatic and terrestrial habitats are crucial to the persistence of the population.

0750 Phylogeography Gulf-Atlantic Symposium, Symphony III, Friday 8 July 2011

Anna McKee¹, Lora Smith², John Maerz¹, Travis Glenn¹

¹University of Georgia, Athens, GA, USA, ²Joseph W. Jones Ecological Research Center, Newton, GA, USA

Landscape Predictors of Genetic Diversity in Amphibians with Differing Dispersal Abilities

Amphibian species that exist as metapopulations rely on dispersal for maintaining population genetic diversity. Habitat alteration can affect amphibian dispersal

capabilities, thereby affecting genetic diversity within their populations, however the effect of habitat alteration on amphibian dispersal and genetic diversity is likely to depend on species dispersal capabilities and habitat preferences. We investigated the relationship between landscape features in a region that has undergone major habitat changes and genetic diversity within populations of two amphibian species with differing dispersal abilities and habitat preferences. A total of 350 *Lithobates sphenoccephalus* and 278 *Eurycea quadridigitata* were collected from 11 and 9 isolated wetlands, respectively, located on Ichauway, an 11,800 ha longleaf pine habitat reserve surrounded by center-pivot agriculture, in Baker County, Georgia. Species were screened at 16 and 11 microsatellite loci, respectively. Landscape composition was characterized for buffers surrounding sampled wetlands at scales relevant to the dispersal abilities for each species (0.5, 1, and 2.5km for *E. quadridigitata*; and 1, 2.5, and 5km for *L. sphenoccephalus*). Model selection was used to determine which features at each scale best predicted population heterozygosity for each species. For *E. quadridigitata*, heterozygosity was positively correlated with forested wetlands and/or negatively correlated with row crops at scales up to 1km, and at 2.5km evergreen forest (positive correlation) and row crops (negative correlation) were the best predictors. Heterozygosity in *L. sphenoccephalus* was negatively correlated with commercial/industrial/transportation (roads) at each scale. These patterns suggest that genetic diversity in both species is lower in habitat with greater anthropogenic alterations.

0627 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Jennifer McKinney, Eric Hoffmayer, Wei Wu, Richard Fulford

University of Southern Mississippi, Ocean Springs, MS, USA

Predicting Suitable Habitat for Whale Shark, *Rhincodon typus*, Aggregations in the Northern Gulf of Mexico

Whale shark, *Rhincodon typus*, aggregations have been documented in large numbers in the northern Gulf of Mexico since 2003 through the Gulf Coast Research Laboratory Whale Shark Sighting Survey. Species distribution modeling provides a unique approach to analyzing this presence data. Due to their protected status, understanding critical habitat for whale sharks is essential on a regional basis for proper management. The goal of this study was to describe the probable distribution of whale shark aggregations in the northern Gulf of Mexico using Maximum Entropy (MaxEnt) and Ecological-Niche-Factor-Analysis (ENFA), two algorithms designed for predicting species distribution. Models were developed using sightings locations with feeding animals (>2 individuals) for the temporal period of June through September of 2008 and 2009 with the following predictor variables: bathymetric slope, distance from physical features and remotely sensed sea surface temperature, chlorophyll concentrations and sea surface height anomalies. Cohen's kappa and the area under the receiver operating characteristic curve (AUC) were used to evaluate model performance with an external

testing dataset. Kappa values ranged from 0.28 - 0.69 and AUC values ranged from 0.73 - 0.80, indicating that the predicted distribution had a fair to substantial agreement with the testing data. Distance to continental shelf edge, petroleum platforms and chlorophyll were the predominant contributors to model output, likely due to an associations with high food availability. The spatial distribution of suitable habitat is dynamic; therefore, a long-term study is recommended to delineate trends in distribution and consistent areas of high suitability.

**0097 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011; ASIH
STOYE GENERAL ICHTHYOLOGY AWARD**

Caleb McMahan

LSU Museum of Natural Science, Baton Rouge, LA, USA

Investigating the Tempo of Diversification among Major Cichlid Lineages

Cichlids are well known for their remarkable diversity, and this diversity has been attributed to potentially increased rates of diversification in relation to potential adaptive radiations. However, the tempo and mode of cichlid diversification has rarely been quantitatively addressed. Recent studies exploring diversification rate variation in New World cichlids suggest that Heroini (the tribe comprising the majority of Middle American cichlids) did not undergo a burst of diversification upon invading Central America. In this study, I utilize the likelihood based MEDUSA method to analyze New and Old World cichlids in an effort to detect significant shifts in birth and death rates among the major lineages (Cichlinae, Pseudocrenilabrinae, Ptychochrominae, Etroplinae). A time-calibrated phylogeny was constructed with Bayesian methodology from nuclear and mitochondrial sequence data that includes all major lineages of cichlids. Multiple calibration points were assigned based on fossil cichlid taxa, as well as several outgroups. Species richness information for the major cichlid lineages was integrated with the resulting chronogram to perform the MEDUSA analysis. I use the results of this study to address whether any cichlid lineage has undergone a significant increase or decrease in diversification rates over time and to examine notions of adaptive radiation among cichlids.

0633 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

Tamara McPeck, Michelle Boone

Miami University, Oxford, OH, USA

**Effect of Exposures to Common Pesticides During Multiple Aquatic Life
Stages of Spotted Salamanders (*Ambystoma maculatum*)**

Pesticides are considered to be a risk to amphibians, but their impact on salamander species is poorly understood. Pools that spotted salamanders rely upon for reproduction

are being threatened by contamination with common pesticides such as the herbicide atrazine and the insecticide carbaryl. This study aims to determine how metamorphosis in spotted salamanders is affected by exposure to pesticides at different life stages. Additionally, I will investigate how alterations in metamorphosis due to pesticide exposure may alter growth and survival in the terrestrial environment. Animals were exposed to pesticides during either the embryonic, larval, or both life stages in a mesocosm experiment. These pesticide concentrations are considered to be sublethal to salamanders, represent realistic exposure concentrations in the environment, and can affect the aquatic food web. Salamanders' time to metamorphosis, SVL, and mass at metamorphosis were monitored; additionally, we monitored the phytoplankton and zooplankton communities. After metamorphosis, juveniles were reared in terrestrial enclosures until the following spring. Mass and SVL measurements of juveniles will be taken this spring. Current results from this experiment have shown that the animals exposed to the insecticide during the larval stage had decreased mass at metamorphosis. SVL at metamorphosis and time to metamorphosis were unaffected in all treatments. Furthermore, I hypothesize that these impacts on metamorphosis will impact terrestrial growth and survival. Understanding how pesticides may affect amphibians in the embryonic, larval and juvenile stages will help determine which amphibian life-stage is at greatest risk to contaminants.

0091 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

Romney McPhie¹, Jackie King¹, Sandy McFarlane¹, Heather Brekke¹

¹Pacific Biological Station, Nanaimo, British Columbia, Canada, ²Fisheries and Oceans Canada, Vancouver, British Columbia, Canada

Have You Seen This Shark? Successes and Challenges in Monitoring the Endangered Basking Shark (*Cetorhinus maximus*) in British Columbia Waters through a Sightings Network

The Basking Shark (*Cetorhinus maximus*) is the second largest fish in the world, and one of the most imperilled. Historically, large groupings of this gentle, plankton-feeding giant were observed along the coast of British Columbia (B.C.), Canada, during the summer months; however, the entire northeast Pacific Ocean population ranging from Mexico to northern B.C. now numbers less than approximately 500 individuals. In February 2010, the Pacific population of Basking Shark was listed as endangered under Canada's *Species at Risk Act*. Broad strategies and approaches to recovery were identified by Fisheries and Oceans Canada, including Communication and Outreach, Monitoring and Inventory, and Stewardship. Integral to each of these strategies is the on-going implementation of a Basking Shark Sightings Network. Outreach materials are distributed yearly, and on-line, phone or e-mail reports of possible sightings are received from the public to determine how many Basking Sharks remain in B.C. waters and their potential for recovery. Since 2008, 58 reports have been made of both historical

and current sightings, with 13 recent sightings (1996-2010) being confirmed. Future successes in connecting and cooperating with marine users in remote regions where Basking Sharks were historically abundant will ultimately determine the fate of this large - yet little-known - shark.

0632 Poster Session I, Friday 8 July 2011

Doreen McVeigh¹, Drew Ferrier¹, Susan Carney¹, John Morrissey², Claire Hudson³

¹Hood College, Frederick, MD, USA, ²Sweet Briar College, Sweet Briar, VA, USA, ³Society for Ocean Sciences, Damascus, MD, USA

Development of Genetic Markers for Analysis of Cownose Ray (*Rhinoptera bonasus*) Populations in the Northern Chesapeake Bay.

Cownose Rays, *Rhinoptera bonasus* (Rhinopteridae), are elasmobranchs found in the Western Atlantic from Brazil to Massachusetts. In the spring and early summer months, large schools of Cownose Rays migrate into the Chesapeake Bay to forage. In addition, the rays use the Bay as a nursery ground young-of-the-year pups. *Rhinoptera bonasus* quickly becomes the most abundant elasmobranch found throughout the Chesapeake Bay during the summer months. Throughout the summer Cownose Rays separate into subgroups, but it is not currently known if these are genetically isolated subgroups. In this study, we have begun to develop and characterize variable mitochondrial and microsatellite DNA markers to assist in the understanding of Cownose Ray population structure. DNA was extracted from tissue samples collected from St. George Island, Maryland to develop the genetic markers, which will be characterized in at least 30 individuals to identify patterns of variable nucleotides and shared alleles. These data will be analyzed to assess the population structure of Cownose Rays to determine relatedness of subpopulations in the Chesapeake Bay.

0464 Poster Session II, Saturday 9 July 2011

Jesse Meik¹, Jeffrey Streicher¹, Estrella Mociño-Deloya², Kirk Setser²

¹The University of Texas at Arlington, Arlington, TX, USA, ²Universidad de Granada, Granada, Spain

Shallow Phylogeographic Structure in the Declining Mexican Lance-Headed Rattlesnake, *Crotalus polystictus*

We investigated matrilineal relationships among populations of the Mexican lance-headed rattlesnake (*Crotalus polystictus*), an enigmatic pitviper inhabiting high elevation valleys of the densely populated southern Mexican Plateau. A fragment of the mitochondrial ATPase 6 and 8 genes revealed comparatively low levels of genetic diversity, with few nucleotide polymorphisms across the portion of the geographic

distribution sampled. The shallow intraspecific sequence divergence (< 1%) in *C. polystictus* ATPase 6 and 8 genes contrasts with the divergences observed within other montane rattlesnake lineages from the Mexican highlands. We posit that low genetic diversity in *C. polystictus* compared to other highland rattlesnakes may reflect fundamental ecological differences resulting in a different evolutionary response to shared Pleistocene climatic events. The high sequence divergence between *C. polystictus* and a large selection of other North American pitvipers supports the premise that *C. polystictus* represents an ancient branching event in rattlesnakes, and understanding its relationship to other species will likely be hindered until considerable comparative data have been amassed. Our finding of apparently low genetic diversity in *C. polystictus* highlights the importance of conservation initiatives to protect high elevation grasslands in central Mexico, and may inform management decisions targeted specifically to protect this species from further decline.

0525 Fish Morphology, Symphony I & II, Friday 8 July 2011

Marcelo Melo

Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, Brazil

Morphology and Innervation of the Lateral-Line Organs in Deep-Sea Swallowers (Chiasmodontidae: Teleostei)

The family Chiasmodontidae is composed of four genera and 32 species of meso- and bathypelagic fishes: *Chiasmodon*, *Dysalotus*, *Kali* and *Pseudoscopelus*. Characteristic of the family is the presence of numerous superficial neuromasts on head, lower jaw, dorsal part of body between the supraoccipital and first dorsal fin, and along the lateral line. Neuromasts are mechanoreceptors that form part of lateral line system in aquatic vertebrates; they are generally enclosed in canals but can also be found on the surface of skin. Canal neuromasts are present in all four genera of chiasmodontids. Superficial neuromasts vary in shape among chiasmodontids: circular, in *Chiasmodon*, *Dysalotus* and *Pseudoscopelus*; oval, in *Chiasmodon* and *Pseudoscopelus*; and rod-like, exclusively in *Kali*. The superficial ophthalmic ramus of anterodorsal lateral-line nerve innervates the supraorbital, otic, the two posterior infraorbital canal neuromasts and three superficial neuromasts on frontal bone. The buccal ramus of anterodorsal lateral line nerve innervates remaining infraorbital canal neuromasts and the superficial neuromasts on tip of snout. The anteroventral lateral-line nerve innervates the preopercular and mandibular canal neuromasts, and superficial neuromasts on opercle, cheek and lower jaw. The middle lateral line nerve innervates the lateral line, temporal, supratemporal, and postotic canal neuromasts, and the superficial neuromasts along the lateral line, between head and first dorsal fin, and remaining neuromasts on cranium. Some patterns of morphology and innervation of superficial neuromasts in chiasmodontids are unique to the group and others vary among its different subgroups. This paper explores the implications of neuromast characters on the relationships among chiasmodontids.

0710 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011

Abebe Ameha Mengistu¹, Peter Nagel¹, Abebe Getahun², Samy Saber³, Breda Zimkus⁴, Michele Menegon⁵, David Gower⁶, Rafael de Sá⁷, Simon Loader¹

¹University of Basel, Basel, Switzerland, ²Addis Ababa University, Addis Ababa, Ethiopia, ³Al-Azhar University, Assiut, Egypt, ⁴Harvard University, Museum of Comparative Zoology, Cambridge, MA, USA, ⁵Museo Tridentino di Scienze Naturali, Trento, Italy, ⁶The Natural History Museum, London, UK, ⁷University of Richmond, Richmond, VA, USA

Phylogeography of *Leptopelis* and *Ptychadena* (Anura, Amphibia) in the Ethiopian Highlands: Implications for Taxonomy and Conservation

About one-third of the 63 known species of Ethiopian amphibians belong to the genera *Leptopelis* and *Ptychadena*, represented by six and thirteen species, respectively. Following field sampling between 2006 and 2010 from several localities, mainly on plateaus across the Rift Valley, phylogeographic assessment was conducted for the first time using partial mitochondrial gene sequences. Phylogenetic relationships were reconstructed using Maximum Likelihood methods. Morphological observations were made on fresh collections, holotypes and non-type museum materials. The reconstructed phylogenetic relationships show endemic monophyletic highland species and populations within Ethiopian *Leptopelis* and *Ptychadena*. Cryptic diversity of highland endemics was revealed, highlighting some candidate species awaiting description: four species of *Leptopelis* and four species of *Ptychadena*. Two other species of *Ptychadena* from lower altitudes are interpreted to be conspecific with widely distributed African species. Wide overlaps in several morphological features made it difficult to identify specimens of geographically and genetically distinct populations within these clusters. Relatively small evolutionary distances among species could explain a possibly very recent radiation. We observed congruence of phylogenetic groups with clear patterns of geographic distribution allowing us to identify distinct biogeographic categories that can potentially serve as units for conservation of Ethiopian amphibians. The highland *Leptopelis* and *Ptychadena* comprise more diverse endemic species than known before, contributing substantially to the biodiversity value of the Ethiopian Highlands. Unfortunately, the current findings shrink substantially ranges proposed previously for some endemic species, implying an urgent need for revision of the conservation status of these taxa in rapidly changing environments.

0273 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Tricia Meredith, Stephen Kajiura

Florida Atlantic University, Boca Raton, FL, USA

Electrophysiological Evidence for Multiple Types of Amino Acid Olfactory Receptors in Elasmobranchs

Marine environments contain a vast number and variety of dissolved chemicals that may be detected by the olfactory systems of the resident organisms. In vertebrates, odorants are detected when they bind to molecular olfactory receptors (ORs) on olfactory sensory neurons (OSNs). Each OSN expresses primarily a single type of OR, each OR can detect multiple odorants, and each odorant can be detected by multiple ORs; therefore, the discrimination of odorants results from the activation of different combinations of ORs and OSNs. Cross-adaptation experiments with teleost fishes, which aim to determine whether two agonists interact with independent or overlapping OR populations, found 4-6 OR types that detect particular groups of amino acid odorants based on their side-chain structure. The olfactory system of elasmobranch fishes is highly stimulated by amino acids; however it is unknown whether they possess similar amino acid OR types as teleosts. We performed cross-adaptation experiments with two distantly related elasmobranch species, the bonnethead shark (*S. tiburo*) and Atlantic stingray (*D. sabina*) (n≥8 each), by testing their electro-olfactogram (EOG) responses to ten test amino acids delivered separately over five background regimes. Under all adapting regimes, the test EOG responses were reduced in varying degrees compared to the unadapted state. The major cross-reactivity between adapting and test stimuli occurred when they shared side-chain characteristics, whereas amino acids with distinct side-chains evoked less cross-reactivity. Our preliminary results suggest that elasmobranchs, like teleosts, possess different ORs for neutral, basic, and aromatic amino acids. Further testing may reveal additional amino acid OR types.

0129 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Debra Miller

University of Tennessee, Knoxville, TN, USA

Comparative Pathology of Ranaviral Disease among Amphibians, Reptiles and Fish

Pathogens within the family Iridoviridae have been identified as etiologic agents in amphibian, reptile and fish morbidity and mortality events throughout the world. In many cases, the pathogens of concern belong to the genus *Ranavirus*. In amphibians, gross lesions associated with ranaviruses can include swelling, erythema, ulceration and hemorrhage. Microscopic lesions in amphibians include renal tubular, hepatocellular and splenic necrosis. Although larval amphibians are most often affected, ranaviral disease has been reported in adults of some species, especially in captivity and in wild

populations in Europe. In adult amphibians, hemorrhages and cutaneous ulcerations are most often reported. In reptiles, juveniles and adults can be affected. Lesions in reptiles are frequently reported in the digestive tract, but also can include erythema and ulcerations in the skin, nasal cavities and, in chelonians, the shell. In fish, erythema and hemorrhage can be seen grossly, and necrosis of the hematopoietic tissue and occasionally other organs can be seen microscopically. In all cases, intracytoplasmic inclusion bodies are seen variably. We are just beginning to understand the cells and organs that ranaviruses target, which may differ among viral types and host species. Future research directives should include the use of advanced molecular techniques, such as *in situ* hybridization and immunohistochemistry, to elucidate the pathogenesis of ranaviruses among species. We need to further explore the possibility of vertical transmission in hosts and investigate the likelihood of interclass disease transmission. Finally, vaccine development is an important research need for control of ranaviral disease in captive populations.

0564 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Mark Mills¹, Jacob Haley¹, Nicole Wallace¹, Colton Zirkle²

¹Missouri Western State University, St. Joseph, MO, USA, ²Central High School, St. Joseph, MO, USA

Population Ecology of Turtles on the Campus of Missouri Western State University: Year Two

Over the past two years we have marked 60 turtles of four species on the campus of Missouri Western State University: 29 *Chelydra serpentina*, 22 *Chrysemys picta*, 8 *Trachemys scripta*, and 1 *Apalone spinifera*. Based on mark-recapture estimates, we have at least 100 turtles living in the nine ponds on campus, with estimates ranging from 2-24 turtles per pond. One individual, a female painted turtle, moved between two ponds, a distance of about 200m. In the summer of 2010 we captured no turtles or invertebrates in Pond 3, perhaps as a result of ongoing construction near this pond. Our invertebrate samples during the summer of 2010 revealed a negative correlation between turtle species richness and invertebrate abundance. We had the opportunity to conduct necropsies on two turtles, and we documented nematodes in the lung of a snapping turtle and the intestine of a painted turtle. The same painted turtle was carrying 10 shelled eggs and 10 unshelled eggs.

0197 Poster Session II, Saturday 9 July 2011

Timothy Mitchell, Jessica Maciel, Fredric Janzen

Iowa State University, Ames, IA, USA

Experimental Analysis of the Influence of Nest-site Choice on Offspring Survival, Phenotypic Development, and Sex Ratio in *Chrysemys picta*

In oviparous taxa, nest-site choice is a maternal effect that influences the early life environment experienced by developing offspring. By selecting nests with particular attributes, females can improve survival and partially control developmental trajectories experienced by offspring. By experimentally manipulating *Chrysemys picta* nests, we explore whether microhabitats of maternally-selected nest sites differ from random sites, and what consequences any differences have on offspring survival and phenotype, particularly sex ratio because *C. picta* has temperature-dependent sex determination (TSD). To do this, we split clutches between nests constructed in the maternally-selected site and a random site nearby for incubation. Subsequently, hatchlings were redistributed for hibernation, such that some spent both life stages in the maternally-selected nest, some spent both stages in a random nest, and some spent one stage in each. This design allowed us to determine how nest-site choice affects survival and development across both stages by decoupling summer and winter nest environments.

Maternally-selected nests had less overstory vegetation cover at oviposition and were warmer during incubation than random nests, yet egg survival and offspring morphology did not differ significantly between treatments. Sex ratios, post-hatching survival, and neonatal morphology after hibernation will be assessed when nests are excavated this spring. If we find no survival difference between treatments, but a difference in sex ratio, then our field study would provide the first experimental evidence that sex-ratio selection is an important component of nest-site choice in a species with TSD.

**0196 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD,
Minneapolis Ballroom E, Thursday 7 July 2011**

Timothy Mitchell, Daniel Warner, Fredric Janzen

Iowa State University, Ames, IA, USA

Phenotypic Effects of Clutch and Nest-site Choice Revealed by Cross Fostering during Two Life-history Stages

Identifying the relative contributions of genetic, maternal, and environmental factors to generating phenotypic variation is critical for evaluating how phenotypic traits may evolve in response to selection. In oviparous organisms, offspring phenotypes are a result of genetic effects, maternal effects, and the environmental conditions experienced by embryos. We employed a cross-fostering experiment using eggs of the painted turtle (*Chrysemys picta*) to evaluate the relative contributions of clutch (i.e., maternal identity) and maternally-chosen nest site to variation in embryo development, hatchling

morphology, and performance during hatchling migration to water. Moreover, because hatchling *C. picta* overwinter inside nests, we used a double-cross-fostering design to decouple the effects of the summer nest (during egg incubation) with that of the overwintering nest. Maternal identity and the nest in which eggs incubated contributed substantially to variation in incubation duration, egg water uptake, and offspring morphology. Although maternal identity contributed to the variation in all post-winter hatchling variables, the effects of the incubation and overwintering nest site varied among traits. The effect of 'nest of incubation' on hatchling mass did not persist through winter and most of the variation in post-winter body mass was due to the overwinter nest site regardless of maternal identity or pre-winter body size. Both summer and winter nest sites contributed to variation in mass loss during the overwinter period, but only the overwinter nests affected mass loss during spring migration to water. These results suggest that adaptive nest-site choice must involve complex interactions between summer and winter nest conditions.

0135 Poster Session II, Saturday 9 July 2011

Masaki Miya¹, Masanori Nakatani², Kohji Mabuchi², Kenji Saitoh³, Mutsumi Nishida²

¹Natural History Museum and Institute, Chiba, Chiba, Chiba, Japan, ²Atmosphere and Ocean Research Institute, University of Tokyo, Kashiwa, Chiba, Japan, ³National Research Institute of Fisheries Science, Yokohama, Kanagawa, Japan

Evolutionary History of Otophysi (Teleostei), a Major Clade of the Modern Freshwater Fishes: Pangaeon Origin and Mesozoic Radiation

Freshwater harbors approximately 12,000 fish species that correspond to 43% of all modern fish diversity. Surprisingly, a single ancestral lineage evolved into about two thirds of this enormous biodiversity (≈ 7900 spp. placed in four orders, 64 families and 1068 genera), and is currently distributed throughout the world's continents except Antarctica. Despite such remarkable species diversity and ubiquity, the evolutionary history of this major freshwater fish clade – Otophysi – remains largely unexplored. To provide an overview of the history of otophysan diversification, we constructed a timetree based on whole mitogenome sequences across 110 species representing 55 of the 64 families. Partitioned ML analysis confidently recovered monophyly of Otophysi and the two constituent subgroups (Cypriniformes and Characiformes). Within the latter clade that comprises three orders (Gymnotiformes, Characiformes, Siluriformes), Gymnotiformes was placed as the most basal clade. One of the two suborders in Characiformes (Characoidei) was reproduced as more closely related to Siluriformes than to its own suborder (Citharinoidei), rendering the characiforms paraphyletic. A relaxed molecular-clock Bayesian analysis of the divergence times and reconstruction of ancestral habitats on the timetree suggest that a common ancestor of the Otophysi entered freshwater around the end-Permian (251 Ma) when mass extinction events dramatically altered the ecological structure of marine communities under super anoxic conditions. Furthermore the timetree demonstrates that survival of the ancestral lineages

through the two consecutive mass extinctions on Pangaea and subsequent radiations during the Jurassic through early Cretaceous shaped the modern familial diversity of otophysans.

**0297 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Masaki Miya¹, Tetsuya Sado¹, Kenji Saitoh², Michael H. Doosey³, Henry L. Bart, Jr.³, Ignacio Doadrio⁴, Yazdan Keivany⁵, Jiwan Shrestha⁶, Vachira Lheknim⁷, Rafael Zardoya⁴, Mutsumi Nishida⁸, Richard L. Mayden⁹

¹Natural History Museum and Institute, Chiba, Chiba, Japan, ²National Research Institute of Fisheries Science, Kanagawa, Japan, ³Tulane University, New Orleans, LA, USA, ⁴Museo Nacional de Ciencias Naturales, Madrid, Spain, ⁵Isfahan University of Technology, Isfahan, Iran, ⁶Nepal Academy of Science and Technology, Kathmandu, Nepal, ⁷Prince of Songkhla University, Songkhla, Thailand, ⁸Atmospheric and Ocean Research Institute, University of Tokyo, Chiba, Japan, ⁹Saint Louis University, St. Louis, MO, USA

The Mitogenomic Supermatrices to Resolve Cypriniformes Tree of Life: An Empirical Approach Based on 472 Complete and 2171 Partial mtDNA Sequences

Fishes of the order Cypriniformes are almost completely restricted to freshwaters and comprise over 4,000 species placed in 6+ families, each with poorly defined subfamilies and/or tribes. This study attempts comprehensive resolution of the cypriniform phylogenies by combining a mitogenomic tree as a backbone constraint for the robust higher-level relationships and numerous partial sequences downloaded from GenBank for the reconstruction of lower-level relationships within the constrained clades. The mitogenomic tree is based on 472 sequences (including 6 outgroups) and the resulting best-scoring ML tree is congruent with the previous molecular phylogenies based on both mitogenomes and nuclear genes. A total of 17,057 partial sequences from cypriniforms were available from GenBank and they were sorted into 9 mitochondrial genes from 1138 species, of which 1039 species were those from the *cyt b* gene alone. Thus we constructed two matrices comprising 1) *cyt b* gene only (CB dataset: 1134 bp from 1511 spp.; missing data 2.53%) and 2) all 9 genes (ALL dataset: 9784 bp from 1610 spp.; missing data 57.6%) and the two matrices were subjected to partitioned ML analyses with the mitogenomic tree as a backbone constraint. The best-scoring ML tree based on the CB dataset derived from 24 runs using a fast bootstrap (BS) option in RAxML places all species from the partial sequences (1039 spp.) in reasonable positions, with 62.2% of the internal branches being supported by $\geq 80\%$ BS probabilities. The ALL dataset is currently analyzed in a similar manner and the preliminary results will be presented.

**0085 Amphibian Conservation Tools Symposium, Minneapolis Ballroom E,
Friday 8 July 2011**

Frank Molina¹, Dianne Gleeson¹, Edward Narayan², Jennifer Germano³, Alison Cree⁴, Phil Bishop⁴, Richard Jakob-Hoff⁵, John Cockrem⁶

¹Landcare Research, St Johns, Auckland, New Zealand, ²Griffith University, Southport, Queensland, Australia, ³Memphis Zoo, Memphis, TN, USA, ⁴University of Otago, Dunedin, New Zealand, ⁵Auckland Zoo, Grey Lynn, Auckland, New Zealand, ⁶Massey University, Palmerston North, New Zealand

Building the Anuran Reproductive Technology Toolbox - Progress from New Zealand

The foremost value of developing reproductive technologies is for understanding species-specific reproductive mechanisms. Contemporary techniques have been used for managing and even conserving wildlife, including a recent anuran example where tadpoles produced from an endangered species were released to the wild. Of New Zealand's four extant endemic frogs (*Leiopelma* species), three are classified nationally as 'threatened' and one 'at risk'. Three introduced *Litoria* species are also abundant although two are threatened in their country of origin (Australia). Low technical approaches have formed the basis of much anuran reproductive technology work in New Zealand. To date urinary hormone analysis has been developed in four anurans (including the monomorphic Maud Island frog) to non-invasively assign sex and/or monitor the hormones of reproduction or stress. These will be key tools for assisting current captive breeding efforts and the same is planned for Archey's frog and Hochstetter's frog, inclusive of exploring a DNA-based sexing approach if required. While methods have been attempted to induce release of sperm and oviposition in native New Zealand frogs, there is a need to establish robust repeatable procedures. In the longer term, these will underpin development of assisted breeding techniques like liquid- and frozen-storage of sperm (the latter through establishment of a properly managed GRB) and artificial fertilization. These techniques will significantly increase our knowledge of native frog reproduction and offer much promise as tools to improve production of genetically valuable offspring bred in captivity for release to restored ecosystems and secure genetic repositories for future restoration needs.

0067 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Don Moll, Jean Elbers

Missouri State University, Springfield, MO, USA

**Ingestion By a Freshwater Turtle Alters Germination of Bottomland
Hardwood Seeds**

Seed dispersal by animals is well documented in many habitats; however, this knowledge is depauperate in bottomland hardwood forests. The alligator snapping

turtle (*Macrochelys temminckii*) is a large freshwater turtle of the southeastern United States that consumes primarily fish but also eats vegetation, including seeds of trees. To evaluate the role this species may play as a seed disperser in bottomland hardwood systems, we investigated the effect of ingestion by *M. temminckii* on germination of seeds of the following trees: common persimmon (*Diospyros virginiana*), water tupelo (*Nyssa aquatica*), and willow oak (*Quercus phellos*). Captive turtles were presented seeds of these three species in a series of feeding trials. Ingestion had no effect, reduced, or increased the proportion of seeds that germinated compared to uneaten controls for *N. aquatica*, *D. virginiana*, and *Q. phellos* respectively. Ingestion had no effect, reduced, or increased how quickly seeds germinated compared to uneaten controls for *D. virginiana*, *N. aquatica*, and *Q. phellos* respectively. This study suggests *M. temminckii* could play some role as a disperser of *Q. phellos*, *N. aquatica*, and *D. virginiana*; however, information on post-dispersal seed fate is needed to completely assess this species and other freshwater turtles as dispersers of wetland vegetation.

0130 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Edward Moll

Eastern Il University, Charleston, IL, USA

Field Biology Legler Style

In the field of turtle biology, John Legler has been a leader, an innovator, a curator and a teacher. He has contributed to his discipline in subjects as diverse as taxonomy, ecology, anatomy and reproductive physiology. However, if one should ask him how he would most like to be remembered, I suspect 'field biologist' would be his characterization of choice. Over a 40 year period Legler carried out extensive field studies of turtles in the US, Mexico, Central America, and Australia. As his graduate student from 1963 to 1968, I experienced field biology Legler style on projects in Mexico, Nicaragua, and Panama and lived to tell about it. Legler-style field work might best be categorized as adventure. In the course of these studies, I was bitten by snakes, turtles, and a multitude of dipterans, threatened with guns and divorce, thrown out of the chalet of the top general of Nicaragua, had one associate decapitated, and made a harrowing nocturnal trip down the Rio Chagres to try and find a hospital that would treat knife wounds of an illegal Columbian. My final and most difficult challenge was to complete an acceptable draft of my dissertation. In the end it was all worth it and I left the University of Utah, a confirmed field biologist having been trained by one of the best - John Legler.

0146 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Chad Montgomery¹, Scott Boback², Robert Reed³, Stephen Green¹

¹Truman State University, Kirksville, MO, USA, ²Dickinson College, Carlisle, PA, USA, ³USGS, Fort Collins, CO, USA, ⁴University of Kent, Canterbury, Kent, UK

Body Size, Growth, and Demography in the Dwarf *Boa constrictor* in the Cayos Cochinos Archipelago, Honduras

The *Boa constrictor* in the Cayos Cochinos Archipelago, known as the Hogg Island Boa, is an insular-endemic form and morphological variant of *B. c. imperator*. From June, 2004 to December, 2010 we have been examining the natural history of the boa populations on the two land mass islands within the archipelago, Cayos Menor and Cayos Grande. As part of the long term monitoring of the populations we have been conducting a capture mark recapture study on both populations. Female larger sexual size dimorphism exists in both populations. In addition, snout vent length is significantly greater on Cayo Grande than Cayo Menor for both sexes. On Cayo Menor growth rates decrease exponentially with increased body size for both sexes, with growth decreasing at a faster rate in males. Growth rates vary across years, with greater growth rates seen in those years with greater resource availability. Sex ratio of the population is not significantly different from 1:1. Growth rates and asymptotic size of boas in the Cayos Cochinos are likely regulated by local resource availability. Understanding this relationship will allow managers to make better decisions for conservation and management of the populations.

0185 Poster Session III, Sunday 10 July 2011; SSAR POSTER AWARD

Melissa Moody¹, Rory Telemeco², Jason Kolbe³, Daniel Warner²

¹Pennsylvania State University, University Park, PA, USA, ²Iowa State University, Ames, IA, USA, ³Harvard University, Cambridge, MA, USA

Egg Environments have Large Effects on Embryonic Development, but have Minimal Consequences for Fitness-Related Phenotypes in a Lizard (*Anolis sagrei*)

Plastic responses of embryos to developmental environments shape phenotypes in ways that impact fitness. The mechanisms by which developmental conditions affect offspring phenotypes vary substantially among taxa and they are poorly understood in most systems. In this study, we evaluate the effects of thermal and hydric conditions on patterns of egg water uptake, embryonic development, and yolk metabolism in embryos of the lizard *Anolis sagrei* to gain insights into how these factors shape morphological variation in hatchlings. Our 3x2 experimental design (3 thermal and 2 hydric conditions) revealed that developmental temperature had strong effects on rates of development and yolk metabolism, but the impacts of moisture were minimal. The effects of incubation temperature on offspring morphology differed from that of moisture. The interactive effect of incubation temperature and moisture on offspring body size

depended on egg size; large eggs generally produced heavy offspring, but this pattern was reversed under dry and warm incubation conditions. Increased water uptake by eggs under relatively wet conditions resulted in larger hatchlings with less internalized residual yolk than hatchlings from dry-incubated eggs. Despite these phenotypic effects, however, the relatively small differences among treatments may have minimal fitness consequences. These results demonstrate that embryos of *A. sagrei* can tolerate a broad range of environmental conditions without substantial impacts on critical morphological traits. Such tolerances may facilitate the successful colonization and establishment of organisms into novel environments.

0745 Poster Session III, Sunday 10 July 2011

Brad Moon

University of Louisiana at Lafayette, LA, USA

The Relationship between Oxygen Consumption and Respiratory Water Loss in Rattlesnakes

Rattlesnakes increase their oxygen consumption to support the energetic demand of rattling. The ventilation associated with oxygen consumption causes some respiratory water loss. In this study, we tested the relationship between rates of oxygen consumption and respiratory water loss using a mass flow meter to measure air flow rates, a water vapor analyzer to measure respiratory water loss, and an oxygen analyzer to measure oxygen consumption at rest and during 15-min bouts of rattling in 10 western diamond-backed rattlesnakes (*Crotalus atrox*). To determine rates of oxygen consumption, we measured the air flow rates and the difference in oxygen concentration between incurrent and excurrent air, and for rattling we subtracted the resting rate from the rattling rate of oxygen consumption. To determine rates of water loss, we measured air flow rates and excurrent water vapor density, and subtracted the water vapor density of the incurrent air. Resting incurs low levels of oxygen consumption (averaging 0.0009 mL/g snake/min) and respiratory water loss (averaging approximately 0.25 mg/g snake/hr). Rattling incurs about four times more oxygen consumption and two to five times more water loss. Coupled with infrequent and brief use of rattling, these relatively low levels of oxygen consumption and water loss probably do not cause any significant energetic or osmoregulatory stress in the snakes.

0241 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

John Moriarty

Ramsey County Parks, Maplewood, MN, USA

Commercial Turtle Harvesting on the Upper Mississippi River

Historic and current commercial turtle harvesting regulations for Minnesota, Wisconsin, Iowa, and Illinois will be reviewed. Harvest rates related to recent changes in Minnesota turtle harvesting laws will be detailed. This will include renewal restrictions, allowable species, season changes, and size limits.

0300 Poster Session II, Saturday 9 July 2011

Matthew Most, Lauren Grande, Terry Grande

Loyola University of Chicago, Chicago, IL, USA

Spatial Ecology of the Eastern Garter Snake, *Thamnophis sirtalis*, in Relationship to Hibernacula

The Eastern Garter Snake (*Thamnophis sirtalis*) is a common, widely distributed North American snake species, and holds a fundamental ecological niche within wetland habitats. However, in spite of *Thamnophis sirtalis*' environmental value and unrivaled adaptability, many threats, such as habitat loss, stand to destroy this species. This study was designed to investigate the *Thamnophis sirtalis* population of Lake Forest, Illinois' Open Lands with an emphasis on the movement and dispersion of individuals in relationship to utilized hibernacula. Spatial ecology holds many important implications for the understanding of a species' fitness and can often reveal other aspects of a species' ecology. By incorporating passive sampling (Gibbons and Semlitsch) and mark-recapture techniques data including: a population estimate, snout-vent length (cm), weight (g), density, habitat category, and predator/prey density were monitored by the location of capture(s) input into a Global Information Systems (GIS) program, ArcView. GIS data, provided by Lake County, IL, was used to gain distance and area measurements of habitat categories (i.e. Agriculture, Wetlands, etc.) from recapture points of *Thamnophis sirtalis*. With the incorporation of the DS1923 Data Logger (iButton ThermoChron; Dallas Semiconductor, Dallas, Tex.), repeated measures ANOVAs were employed to test whether temperature and humidity variables had an effect on the weight (g), Snout-Vent Length (cm), and/or density during temporal sampling. Our results suggest that there is a complex relationship between population structure, snout-vent length, temperature, humidity, and habitat type with utilized hibernacula within our PIT tagged sample (N=150), that is likely the result of microhabitat selection.

0118 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

Philip Motta¹, Maria Laura Habegger², Amy Lang³, Robert Hueter⁴

¹University of South Florida, Tampa, FL, USA, ²University of South Florida, Tampa, FL, USA, ³University of Alabama, Tuscaloosa, AL, USA, ⁴Mote Marine Laboratory, Sarasota, FL, USA

Placoid Scale Morphology, Erection and Function in the Shortfin Mako *Isurus oxyrinchus*

The shortfin mako *Isurus oxyrinchus* is perhaps the fastest swimming shark and exhibits a suite of physiological and morphological adaptations for sustained and rapid swimming. We investigated the functional morphology of the placoid scales from 16 regions on the body to investigate putative scale erection leading to drag reduction and compared this to the scales of a slower swimming blacktip shark *Carcharhinus limbatus*. Scanning electron microscopy, histological staining, and manipulation of scales overlying pressurized skin revealed regions on the flank with extremely small (0.18 mm crown length) and flexible scales that can be manually erected to 50 degrees in mako sharks. The lateral flank scales had significantly greater erection angles (mean = $44^{\circ} \pm 1.44$ SE) than both the dorsal (mean = $25.8^{\circ} \pm 0.78$ SE) and ventral regions (mean = $25.1^{\circ} \pm 1.9$ SE). Highly flexible scales were also found at the trailing edge of the pectoral fins. The scales on the trailing edge of the pectoral had the highest erection angles compared to the leading edge and the central region of the fin. Conversely, blacktip scales were larger (0.32 mm) and less flexible. Scale flexibility appears to be related to the length of the scale crown and base, the shape of the base, and anchoring to the dermis. These flexible scales on the flank and pectoral fin occur in regions most prone to flow separation and reversal, and scale erection most likely occurs passively at these regions of flow reversal resulting in a reduction of form drag.

0532 HERPETOLOGISTS' LEAGUE GRADUATE STUDENT AWARD, Minneapolis Ballroom E, Thursday 7 July 2011

Krista Mougey, Gad Perry

Texas Tech University, Lubbock, TX, USA

Radio Transmitter Mass: Impacts on Home Range, Daily Displacement, and Nesting Movement in Texas Horned Lizards

One of the assumptions that influences the validity of radio telemetry studies is the idea that neither the radio tag nor its method of attachment causes appreciable negative impacts to the marked organism. Traditionally, scientists have used a set of guidelines known as the "percent rules" to determine the maximum acceptable mass of radio transmitter that can be applied to an individual without violating this assumption. For reptiles, this is usually 10% of the individual's body mass. However, this rule is a relatively arbitrary figure with questionable origins. During 2008 and 2009, I radio

tracked 74 Texas horned lizards (carrying encumbrance masses constituting between 3.5 and 22.3% of their average body masses) to evaluate the efficacy of this traditional transmitter-to-body mass tolerance limit. I focused on the impacts of instrumentation to the field movement parameters of daily displacement rate, nesting movement distance, and seasonal home range area. Mass of instrumentation was significantly correlated to a decrease in both displacement rates ($F_{1,26} = 4.208$; $p = 0.05$) and nesting movement distances ($F_{1,9} = 9.875$; $p = 0.009$). However, the predictive value of treatment mass was non-significant ($F_{1,27} = 2.316$; $p = 0.140$) in relation to seasonal home range area. Hindrances to normal movement patterns may have fitness consequences. The results of my studies indicate that the standard "percent rules" commonly applied to radio telemetry technology may well induce serious bias into a broad range of studies, placing some of the commonly accepted insights derived from radio telemetry in doubt.

0534 Poster Session III, Sunday 10 July 2011

Krista Mougey, Gad Perry

Texas Tech University, Lubbock, TX, USA

Radio Transmitter Mass: Impacts on Endurance in Texas Horned Lizards and Bearded Dragons

Locomotor performance in laboratory studies has been causally linked to fitness in natural field settings for a variety of species and, therefore, has received extensive attention for its potential ecological implications. I examined the impacts of radio transmitter mass on the stamina of bearded dragons and Texas horned lizards in laboratory settings. Individuals of both species were assigned treatments that accounted for between 0 and 25% of their body masses and were induced to run to exhaustion on a small motorized treadmill. The endurance running times recorded for the bearded dragons ranged from 54 to 256 seconds, and I determined that treatment mass, SVL, and brood were all significantly correlated with stamina times ($F_{1,43} = 138.643$; $p < 0.0001$; $F_{1,43} = 4.519$; $p < 0.0001$; and $F_{2,43} = 4.317$; $p = 0.020$ respectively). In the tests of adult and sub-adult horned lizards, stamina times ranged from 143 seconds (just under 2.5 minutes) to 884 seconds (nearly 15 minutes). Treatment mass ($F_{1,16} = 27.326$; $p < 0.0001$), sex ($F_{1,16} = 9.601$; $p = 0.007$), and age ($F_{1,16} = 8.700$; $p = 0.009$) all had significant predictive value within the model. Treatment masses of 5%, 10%, and 20% produced endurance times that were 14%, 27%, and 46% reductions from the average endurance times of the control horned lizards. Similar trends were seen within the bearded dragons, indicating that the mass of instrumentation from radio telemetry research could have large impacts on the locomotor performance of marked individuals.

0543 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

Anna Moyer¹, Barney Luttbeg¹

¹Oklahoma State University, Stillwater, OK, USA

The Effects of Short Term and Long Term Exposure to Elevated Cadmium Levels on Predator Avoidance Behavior in Southern Leopard Frog (*Rana sphenocephala*) Tadpoles

The effects of heavy metals on amphibian behavior are poorly understood. We hypothesize that cadmium (Cd) in the water column inhibits olfaction in tadpoles. Tadpoles detect predators by smelling chemical alarm cues that are released when predators prey on nearby conspecifics. We tested how Cd levels in the water altered the predator avoidance behaviors of southern leopard frog (*Rana sphenocephala*) tadpoles. We exposed tadpoles to various concentrations of Cd and alarm cues created from feeding dragonfly (*Anax sp.*) nymphs. This determined if sub-lethal levels of Cd in the water prevents tadpoles from detecting these cues. To test if tadpole populations have adapted to Cd contamination, these tests were also conducted on tadpoles collected from ponds with a history of elevated Cd. These results were compared to tests conducted on tadpoles from an environment without Cd. *Rana sphenocephala* tadpoles decrease activity when they detect predators. The higher levels of Cd reduced the activity of tadpoles even before alarm cues were added. With this initial change of behavior accounted for, adding alarm cues decreased tadpole activity of the tadpoles tested in the lower levels of Cd, and increased it in tadpoles that were tested in the higher concentrations of Cd. At high Cd concentrations tadpoles were unable to detect the alarm cues and continued to actively swim.

0284 Poster Session I, Friday 8 July 2011

Joshua Moyer

Millersville University, Millersville, PA, USA

Sex Pheromones in Elasmobranchs: A Preliminary Investigation using *Mustelus canis* and *Carcharhinus plumbeus*

This study is a preliminary investigation of the use of sex pheromones by elasmobranch fishes through examinations of olfactory receptor cell morphology in the smooth dogfish shark, *Mustelus canis*, and the behaviors exhibited by captive sandbar sharks, *Carcharhinus plumbeus*, at the Adventure Aquarium in Camden, NJ. Using scanning electron microscopy, it was determined that the morphology and distribution of a microvillous receptor cell type present on the olfactory epithelium of *M. canis* matches descriptions of a cell type of unknown function found in the literature. Overall organ and cellular morphology does not preclude the use of sex pheromones by elasmobranchs. Although no reproductive behavior was observed in the captive population of *C. plumbeus*, statistical analysis revealed a significant difference between the sexes in paired swimming patterns. These results indicate that males of a captive

population of *C. plumbeus* distinguish the sex of conspecifics when not actively breeding. Together, these findings strengthen the argument in favor of more research in the field of pheromones and their role in elasmobranch biology.

0495 Poster Session II, Saturday 9 July 2011

Peter Muelleman, Chad Montgomery

Truman State University, Kirksville, MO, USA

Ecology of a Snake Community in Northwestern Missouri

Much of the landscape in Northern Missouri has been converted to agricultural fields, leaving relatively few places where natural snake communities can be found. One such community was located on a small piece of unused, protected property of a commercial pig farm in Daveiss County, MO. A three year (2008-2010) survey was conducted to determine the richness of the snake community on the site. A total of 205 individuals, representing eight species, were captured, processed, and marked. *Lampropeltis triangulum* (n = 65) was the most abundant species, followed by *Crotalus horridus* (n = 61), *Diadophis punctatus* (n = 38), *Nerodia sipedon* (n = 16), *Coluber constrictor* (n = 7), *Thamnophis sirtalis* (n = 7), *Pantherophis obsoletus* (n = 6), and *Carphophis vermis* (n = 5), respectively. Recaptures were rare until the last year of the survey and only occurred in the three most abundant species. These data indicate the importance of maintaining suitable snake habitat on privately owned land in agriculturally dominated regions.

0394 AES GRUBER AWARD, Session I, Minneapolis Ballroom G, Friday 8 July 2011

Christopher Mull¹, Kara Yopak², Nicholas Dulvy¹

¹*Simon Fraser University, Burnaby, BC, Canada*, ²*University of California San Diego, La Jolla, CA, USA*

Does More Maternal Investment Lead to Larger Brains? Evolutionary Relationships Between Reproductive Mode and Brain Size in Chondrichthyans

Chondrichthyans have the most diverse array of reproductive strategies of any vertebrate group, ranging from egg-laying to live-bearing with placental matrotrophy. Matrotrophy is defined as additional maternal provisioning beyond the yolk to the developing neonate; in chondrichthyans, this occurs through a range of mechanisms including uterine milk, oophagy, uterine cannibalism, and placentotrophy. Chondrichthyans also exhibit a wide range of relative brain sizes and patterns of brain organization. Brains are energetically expensive to produce and maintain, and represent a major energetic constraint during early life in vertebrates. In mammals, more direct maternal-fetal placental connections have been associated with larger brains. We test for

a relationship between reproductive mode and relative brain size across 85 species from 6 major orders of chondrichthyans using several phylogenetic comparative analyses. Maximum body size had a significant influence on relative brain size, with the largest-bodied species (body mass > 100 kg) having smaller relative brains, across all analyses. Ordinary least squares (OLS) and reduced major axis (RMA) regression of body mass versus brain mass suggest that increased maternal investment results in larger relative brain size. Our findings were supported by a regression method that incorporates the evolutionary relatedness of species. This study suggests there may be a link between reproductive investment and relative brain size in chondrichthyans, but a more definitive test requires a better resolved phylogeny and a more nuanced categorization of the level of maternal investment in chondrichthyans.

**0148 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Thomas Munroe

National Systematics Laboratory, NMFS/NEFSC, Smithsonian Institution, Washington, DC, USA

**Systematic Revision of the Flatfish Genus *Peltorhamphus* Günther, 1862
(Pleuronectiformes: Rhombosoleidae), with Description of a New Species**

The rhombosoleid genus *Peltorhamphus* Günther was thought to contain only three species, *P. novaezeelandiae* Günther, *P. latus* James, and *P. tenuis* James, that are widespread in shallow, continental shelf waters of New Zealand, and also at nearby Chatham Islands and Norfolk Island. The only systematic revision of *Peltorhamphus* (in 1972) developed a key to assist in identifying specimens. During on-going studies updating taxonomic information for *Peltorhamphus*, problems were encountered when attempting to identify specimens, especially juveniles. Examination of 1106 specimens of *Peltorhamphus*, representing 203 lots, revealed that 81 of 203 lots (40%) contained misidentified specimens (including lots with paratypes). In addition to three previously-described species, a fourth species, with a much more limited geographic range than the others, was also discovered. Discovery of this undescribed species, most often misidentified as juvenile *P. novaezeelandiae* or as adult and juvenile *P. latus*, in addition to the large number of other misidentified specimens in collections required taxonomic re-evaluation and redescription of all species in the genus, and an appraisal of characters used to differentiate them. Some characters traditionally used to differentiate species continue to be useful, whereas, others were found to overlap too much to be useful in separating the species. Novel characters related to scales, gillrakers and pigmentation were also discovered during this study that further facilitate species identifications of *Peltorhamphus*. Re-assessment of the number of valid species of *Peltorhamphus* provides better understanding of species diversity within this genus as well as that of the flatfish assemblage residing in New Zealand waters.

0413 Herp Physiology, Minneapolis Ballroom E, Saturday 9 July 2011

Christopher Murray

Southeastern Louisiana University, Hammond, LA, USA

Salinity and Alligator Egg Shape Variation: A Geometric Morphometric Analysis

The harvest and incubation of American alligator eggs is an important component to the commercial alligator harvest industry in the southeastern United States. As a result, various methodologies have been used to monitor alligator populations including abundance counts, stress quantification, and nesting surveys. Past studies have dismissed the importance of egg shape in crocodylians, Squamates, and turtles and deemed egg shape in birds and other amniotes as similar, in relation to functionality. The complexity of crocodylian eggs has been examined and both turtle and Squamate eggs have recently been regarded as physiologically more intricate than bird eggs. This study takes an eco-physiological approach to monitor alligator populations from freshwater and low salinity environments. In addition, we introduce a fractional semilandmark shape template method to quantify egg shape within a geometric morphometric framework. This approach is beneficial because it allows for the quantification of shape for curved structures, such as eggs, which lack homologous landmarks. The results from this study suggest that alligator egg shape is correlated with varying salinity levels, such that variation in alligator egg shape at low salinities changes in gradient-like fashion while salinities high enough to be deemed stressful result in reversion back to a low salinity egg shape or desiccation.

0107 Herp Conservation, Minneapolis Ballroom E, Saturday 9 July 2011

David Mushet¹, Ned Euliss, Jr.¹, Craig Stockwell²

¹*U.S. Geological Survey, Jamestown, ND, USA*, ²*North Dakota State University, Fargo, ND, USA*

The Effects of USDA Conservation Programs on Northern Leopard Frog Habitat Suitability in North Dakota

The western population of the northern leopard frog (*Lithobates pipiens*) is currently being considered for listing as threatened under the federal Endangered Species Act. One threat of concern is the declining availability of suitable habitat. Changes in habitat suitability resulting from landscape alterations associated with modern agricultural production and related conservation programs can significantly alter occurrence of leopard frogs on the prairie landscape. To evaluate how northern leopard frog habitat suitability varies in response to land-use change, we conducted night-time amphibian call surveys within a 260 km² study plot in central Stutsman County, North Dakota. We then mapped areas of suitable habitat using ecological niche factor analyses and measurements of environmental variables obtained from various GIS, remote sensing, and climate data sources. Leopard frog habitat suitability varied markedly between the

eastern and western portions of our study area. While significant areas of grasslands and wetlands in the western portion of our study area provided an abundance of suitable habitat for northern leopard frogs, suitable habitat in the eastern portion was limited to areas maintained by U.S. Department of Agriculture conservation programs (e.g., Conservation Reserve Program, Wetlands Reserve Program). Our study highlights the importance of such conservation programs in providing habitat for the northern leopard frog in areas on intensive agricultural activity.

0145 Herp Ecology, Symphony I & II, Sunday 10 July 2011

Henry Mushinsky, Earl McCoy

University of South Florida, Tampa, FL, USA

The Value of Enclosures When Studying Cryptic Species

We study the Florida Sand Skink (FSS) (*Plestiodon reynoldsi*), a threatened fossorial lizard found only on the Lake Wales Ridge of central Florida. Because it rarely comes above ground and has a body mass of less than 3 gm it is a challenge to study. To estimate population size in response to periodic fires we installed 12 20m X 20m enclosures in plots of land with three distinct burn histories (1-6, 7-19, 20-40 year intervals between fire) to use a simulated removal trapping method to estimate FSS densities in relation to fire periodicity. To monitor responses to burning and movement patterns each captured FSS was given an individual mark and a tip of the tail was removed for genetic analysis. To establish relationships among environmental variables and FSS densities we quantified the microhabitats within each of the 36 enclosures. To monitor the success of a translocation effort we placed more than 500 FSS into 24 enclosures at another site further north in Florida and followed them for three years to establish rates of survival and reproduction. To improve our ability to judge changes in population sizes, we installed eight cover boards (0.6 X 0.6m) within the enclosures to establish a relationship between the number of "hits" under a cover board to the number of FSS in an enclosure. The results of these efforts will be discussed.

0359 Poster Session III, Sunday 10 July 2011

Steven Mussmann¹, Marlis Douglas¹, Michael Douglas¹

¹University of Illinois, Champaign, IL, USA, ²University of Illinois, Champaign, IL, USA, ³University of Arkansas, Fayetteville, AR, USA

Molecular Determination of Parentage in Bowfin (*Amia calva*)

Refined methods for assessing genetic relatedness in vertebrates have greatly improved our perspectives on parentage, parental care, and mating systems. Use of microsatellite markers (msats) has been particularly influential in this regard by allowing for a more accurate determination of parent-offspring relationships, thereby giving new insights

into multiple paternity, sib-sib competition, and offspring survival. This study evaluates 10 msats as a means of determining parentage in the Bowfin (*Amia calva*), a basal Actinopterygian fish that provides an elevated level of parental care, particularly given its high fecundity. Bayesian and Maximum Likelihood methods were used to reconstruct family groups and to quantify parental genotypes. These analyses provided a baseline for evaluating male-mediated Bowfin parental care in the context of genetic relatedness, in that some broods appeared to be sired by multiple males. Results promote an understanding of the Bowfin mating system in particular, and contribute broadly to categorizing the evolution of male parental care in fishes.

0237 Legler Turtle Symposium, Symphony III, Monday 11 July 2011

Erin Myers

University of Houston, Houston, TX, USA

A Phylogenetic Assessment of Morphological Evolution within a Radiation of Turtles

Morphological and species diversification are often linked in species radiations. However, it is not often clear whether morphological diversification contributed to speciation, or whether it occurred as a by-product of other speciation processes. I addressed this question using a species and morphologically rich turtle radiation, the map turtles (*Graptemys*), characterized by unique facial colorations. To assess the role that color pattern variation has played in the diversification of this genus, this project sought to determine the evolutionary relationships among the species within the map turtles and to subsequently assess patterns of morphological evolution across the phylogeny. Map turtles formed a monophyletic group with two major clades. However, species-level resolution was limited, consistent with rapid speciation within the genus. I found parsimonious evolution of four major morphological patterns across the genus and less parsimonious evolution within morphological groups. This pattern suggests possible early sexual selection on these facial coloration traits during the formation of the major species clades and then subsequent stochastic morphological evolution.

0047 Poster Session I, Friday 8 July 2011

Jawad Nazir, Marisa Spengler, Rachel E. Marschang

University of Hohenheim, Stuttgart, Germany

Persistence of Amphibian and Reptilian Ranaviruses in Ponds

The present study was conducted to compare the persistence of amphibian and reptilian ranaviruses in the pond habitat. Four viruses were included in the study: two amphibian ranaviruses (FV 3, the type species of the genus *Ranavirus*, and an isolate from a *Pelophylax kl. esculentus*) and two ranaviruses of reptile origin (from a *Testudo hermanni*

and from a *Uroplatus fimbriatus*). A sandwich germ carrier technique was used to study the persistence of these viruses in sterile and unsterile pond water (PW) and soil obtained from the bank of a pond. For each virus, virus loaded carriers were placed in each of the three substrates and incubated at 20 and 4 °C and titrated at regular intervals. Serial data were analyzed by linear regression model to calculate T-90 values. Resistance of the viruses to drying was also studied. All four viruses were resistant to drying. At 20 °C, T-90 values of the viruses were 22-31 days in sterile PW, 22-34 days in unsterile PW, and 13-22 days in soil while at 4 °C the values were 102-182 days, 58-72 days, and 30-48 days. At lower temperatures, viral persistence was highest in the sterile PW followed by the unsterile PW and the lowest in the soil. There were no significant differences in the survival times between the amphibian and reptilian viruses. The results of the present study suggest that ranaviruses can survive for long periods of time in pond habitats at low temperatures.

**0488 Fish Evolution, Phylogeny, & Systematics, Minneapolis Ballroom F,
Monday 11 July 2011**

Thomas Near

Yale University, New Haven, CT, USA

Molecular Inferred Phylogeny of Darters (Teleostei: Percidae).

The phylogenetic relationships of darters were investigated using a dataset comprising DNA sequences sampled from mtDNA and nuclear encoded genes. The taxon sampling included 245 of the 248 recognized darter species. External fossil calibrations, external molecular evolutionary rates, and relaxed clock models were used to investigate divergence times. Comparisons among gene trees indicated that more than 12% of all extant darter species carry a mtDNA genome of heterospecific origin. The phylogenies inferred from analyses that ignore mtDNA haplotypes of heterospecific origin indicate *Nothonotus* is not nested in *Etheostoma* and these trees provide phylogenetic resolution for the enigmatic *Etheostoma cinereum*. The divergence time analyses resulted in age estimates for the darter radiation at approximately 35-40 million years ago. The well-resolved phylogeny was used to develop a rank-free classification for darters.

0155 AES Ecology, Minneapolis Ballroom F, Saturday 9 July 2011

Brandi Neifert¹, Alton Dooley¹

¹Roanoke College, Salem, VA, USA, ²Virginia Museum of Natural History, Martinsville, VA, USA

A Comparison of Tooth Breakage Rates in Miocene Carcharhinid Sharks from the Carmel Church Quarry, Caroline County, VA

Excavation of marine sediments of the middle Miocene Calvert Formation at the Carmel Church Quarry has resulted in the collection of thousands of shark and ray teeth. Genera of teeth commonly found include *Hemipristis*, *Carcharhinus*, and *Galeocerdo*, among others. Unlike most large collections of shark teeth, the Carmel Church specimens were all collected *in situ* from a single bed with a maximum thickness of less than 1 m. While the majority of teeth from Carmel Church represent clearly reworked specimens, a substantial portion show no evidence of reworking and provide a sample that may represent the local population of sharks over a relatively short period of time. Multiple shark taxa with similar tooth morphologies and body sizes may have coexisted through niche partitioning. This could have been achieved through behavioral variations such as temporal segregation (diurnal or nocturnal habits, or seasonal movements) or through variations in dietary preferences. In order to test for evidence of variation in dietary preferences, tooth breakage frequency and height-thickness ratios were examined in three shark genera that are broadly similar to each other in size and tooth morphology – *Hemipristis*, *Galeocerdo* and *Carcharhinus*. Preliminary results show *Carcharhinus* with a low frequency of breakage at the apex of the tooth. Further results pending.

0479 Turtle Ecology & Morphology, Minneapolis Ballroom E, Saturday 9 July 2011

Jennifer Neuwald, Nicole Valenzuela

Iowa State University, Ames, IA, USA

The Lesser Known Challenge of Climate Change: Thermal Variance and Sex-Reversal in Vertebrates with Temperature-Dependent Sex Determination

Climate change is expected to disrupt biological systems. Particularly susceptible are species with temperature-dependent sex determination (TSD), which includes many reptiles and some fish. While the potentially devastating effect of rising mean temperatures on sex ratios in TSD species such as turtles is appreciated, the consequences of increased thermal variance predicted to accompany climate change remain obscure. Surprisingly, no study has tested if the effect of thermal variance around high-temperatures (which are particularly relevant given climate change predictions) has the same or opposite effects as around lower temperatures. Here we show that sex ratios of the painted turtle (*Chrysemys picta*) were reversed as experimental fluctuations increased around low and high unisexual mean-temperatures.

Unexpectedly, the developmental and sexual responses around female-producing temperatures were decoupled in a more complex manner than around male-producing values. Tests using naturally-fluctuating thermal conditions are also discussed. Our novel observations are not fully explained by existing ecological models of development and sex determination, and provide strong evidence that thermal fluctuations are critical for shaping the biological outcomes of climate change.

0666 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Kyle Newton¹, James Wraith¹, Kathryn Dickson¹

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Potential Benefits of Visceral Endothermy in the Shortfin Mako Shark, *Isurus oxyrinchus*

Lamnid sharks, including the shortfin mako (*Isurus oxyrinchus*), maintain digestive tract temperatures elevated above ambient water temperature (visceral endothermy). These sharks have evolved a vascular counter-current heat exchanger, the suprahepatic *rete*, which conserves metabolic heat produced by digestion and assimilation. It has been hypothesized that visceral endothermy results in higher food-processing rates in lamnid sharks. We tested the hypothesis that visceral endothermy results in higher digestive enzyme activities in lamnid sharks, by comparing the shortfin mako shark, *Isurus oxyrinchus*, to two sharks that cannot elevate visceral temperatures, the thresher, *Alopias vulpinus*, and the blue, *Prionace glauca*. Sharks were collected by longline, and stomach tissue samples were frozen in liquid nitrogen and stored at -80°C until assays were performed. Specific activities of the protease pepsin (units g⁻¹) were measured spectrophotometrically at physiological temperatures. Pepsin activity in *I. oxyrinchus* (mean ± SD: 26.0 ± 18.9 U g⁻¹ at 25C, N = 16) was significantly greater than in both *A. vulpinus* (4.3 ± 2.8 U g⁻¹ at 15C, N = 6) and *P. glauca* (15.5 ± 8.3 units g⁻¹ at 15C, N = 16). These data support the hypothesis that maintaining a higher digestive enzyme activity was a selective advantage leading to the evolution of visceral endothermy in lamnid sharks. We plan to collect additional specimens of *A. vulpinus* and also measure pancreatic trypsin and lipase activities in all three species.

0325 Poster Session II, Saturday 9 July 2011

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Evolutionary and Biogeographic Relationships Among Species of the *Anolis humilis* Complex

The biogeographic relationships among *Anolis* lizards are still unresolved, and very little has been investigated regarding mainland anoles of the Norops clade. The prevailing hypothesis is that an ancestral Norops member traveled overwater from the Caribbean and landed somewhere in the vicinity of Mexico. Subsequently, the ancestor rapidly speciated and descendants dispersed southwards and eventually invaded South America. This hypothesis has never been specifically tested, nor other alternatives explored. As part of a larger project to investigate the biogeography of the Norops clade, here we present results regarding the biogeographic relationships of the *Anolis humilis* complex. Using molecular data, we investigated (1) the monophyly of the *A. humilis* species group, (2) support for some debated species within the group, and (3) tested the proposed north to south pattern for this group. We find no support for the monophyly of the *A. humilis* species group, and support for some debated species but not others (*A. marsupialis* and *A. humilis/quagglus*). The biogeographic pattern that emerges is contrary to the expected pattern and appears to go from south to north, although data collection was not quite complete at the time of this writing. Completed results will be presented at the meetings.

0261 Snake Morphology, Symphony I & II, Saturday 9 July 2011

Philip Nicodemo, Bruce C. Jayne

University of Cincinnati, Cincinnati, OH, USA

Longitudinal Variation in the Axial Muscles of Snakes

In snakes, as in other vertebrates, both the axial muscles and axial skeleton have a segmented organization. However, many of the axial muscles of snakes are notable for having individual segments that often span several vertebrae. Consequently, muscles that extend anteriorly have a constraint on their length as their origins are located closer to the skull. However, this and other aspects of longitudinal variation in axial muscle morphology are poorly documented either within or between species of snakes. Thus, we compared patterns of segmentation and morphology of the anterior trunk (< 50% SVL) spinalis muscle (SP) in several phylogenetically and morphologically distinct species of snakes. We found a variety of mechanisms for reducing segmental length, some of which varied among taxa. In both Henophidians and Caenophidians, anterior decreases in total segmental length of the SP resulted primarily from reducing the length of tendon rather than contractile tissue. At mid-body, the more anterior segment within

an adjacent pair both arises and inserts one vertebra anterior to the locations of the neighboring segment, whereas in the neck region of some Caenophidians, the more anterior segment within an adjacent pair may arise from a location as many as five vertebrae anterior to the origin of the neighboring segment but the anterior sites of muscle attachment differ by only a single vertebra. *Ahaetulla prasina* had an unusual mechanism of reducing segmental length, in which the anterior tendons of several adjacent SP muscles fused to insert on a single vertebra.

0408 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Mark Nielsen

University of Utah, Salt Lake City, UT, USA

Comparative Analysis of Aquatic and Terrestrial Walking Morphologies within the Order Testudines

The functional and mechanical determinants of the structure of the posterior appendage are analyzed and compared in terrestrial walking chelonians and aquatic walking chelonians. The order Testudines is unusual in having some species that are adapted for walking on land and others that are specialized for a similar gait on a submerged substrate in an aquatic environment. In the terrestrial environment the vertical force of gravity is the primary loading factor the animal must overcome during locomotion. In the water the buoyant nature of water reduces gravitational loading and the water column imposes resistance to movement in the horizontal plane. Models based on engineering principles predict the optimal morphologies for the pelvic apparatus and posterior appendage of turtles specialized for walking gaits in these two contrasting environments. The models are tested with a morphometric analysis of the skeletal and muscular systems in a representative terrestrial walker, *Xerobates agassizi*, and a representative bottom walker, *Chelydra serpentina*. Analyses support the adaptive nature of evolution; that is, different environmental constraints lead to morphologies that optimize functions for the environmental conditions.

0103 AES GRUBER AWARD, Session II, Minneapolis Ballroom G, Saturday 9 July 2011

Andrew Nosal, Daniel Cartamil, Nicholas Wegner, Jeffrey Graham

Scripps Institution of Oceanography, University of California - San Diego, La Jolla, CA, USA

Aggregation Behavior of the Leopard Shark (*Triakis semifasciata*) Associated with the Head of La Jolla Submarine Canyon, San Diego County, California

We investigated the demographics and movement patterns of leopard sharks (*Triakis semifasciata*), which aggregate by the hundreds near the head of La Jolla Submarine

Canyon (LJSC) from spring to autumn. The function of this behavior remains unclear. Sampling to date (n=124) indicates these sharks are mature (111-159 cm TL) and mostly female (96.7%). To quantify the fine-scale movement patterns and long-term presence-absence of leopard sharks at LJSC, sharks were manually tracked (n=8) for uninterrupted periods of 24-48 h or surgically implanted with coded transmitters (n=12) and passively monitored by an acoustic receiver array (July 2009-present). Detection patterns varied among individuals, however some displayed marked synchrony. For example, 2 sharks returned to LJSC within 1.5 h of each other after absences of 218 and 306 days, respectively. Sharks also exhibited strong site fidelity, with some individuals detected at LJSC for >70 consecutive days. Manually tracked sharks occupied significantly greater depths at night (mean \pm SD night: 4.52 \pm 8.45 m, day: 1.71 \pm 1.62 m), occasionally exceeding 50 m during roundtrip offshore excursions. Detection data also reflect these nocturnal departures. Leopard sharks may be attracted to the canyon head due to locally calm waters caused by bathymetric wave refraction and proximity to an abundant supply of market squid (*Loligo opalescens*), which spawn in the canyon and are the primary dietary component of these sharks.

0668 Poster Session I, Friday 8 July 2011

Schyler Nunziata, Stephen Richter, Stacey Lance

Eastern Kentucky University, Richmond, KY, USA

Influence of Within- and Among-stream Movements on Population Structure of Two-lined Salamanders

Destruction and degradation of habitat is considered one of the leading causes of the worldwide amphibian decline. Amphibians that require both aquatic and terrestrial habitat in their life-cycle are sensitive to the loss of either. By understanding how amphibians utilize the landscape, land planning can be established to maintain healthy populations. Most research looking at spatial dynamics of amphibian populations has focused on pond-breeding amphibians, with less focus on stream-breeding amphibians, which have very different spatial ecologies. Stream salamanders, e.g. the southern two-lined salamander (*Eurycea cirrigera*), can disperse either along the stream channel or over land. However, previous studies have failed to quantify these dispersal patterns or establish population boundaries for the species. Population connectivity is critical in maintaining dispersal and corresponding gene flow in amphibian populations, as well as in decreasing local extinction risk and allowing for recolonization after local extinction events. *Eurycea cirrigera* is considered a terrestrial stream salamander, but understanding of its spatial ecology is lacking. We used 12 microsatellite loci to investigate (1) the population boundaries of *E. cirrigera* along stream channels and (2) dispersal patterns both within the stream and across land. To investigate these patterns we performed whole-stream salamander surveys in two forested stream systems that flow into the Kentucky River in the Bluegrass Region of Kentucky. Results of this study provide data on the aquatic and terrestrial spatial ecology of *E. cirrigera* and have

application to land-use planning in and around streams aiming to maintain viable amphibian populations.

0682 Fish Physiology, Minneapolis Ballroom G, Monday 11 July 2011

Lois O'Boyle, Wayne Bennett Jr.

University of West Florida, Pensacola, FL, USA

Evaluating Thermal Ecology of Dusky Pipefish, *Syngnathus floridae*, and Gulf Pipefish, *Syngnathus scovelli*

Little is known about the thermal tolerance of pipefishes that, across their latitudinal range, regularly experience large seasonal and diel shifts in water temperature. In this study, chronic thermal acclimation ranges determined acclimation temperatures for dusky (*Syngnathus floridae*) and gulf pipefish (*Syngnathus scovelli*) inhabiting seagrass beds in the Gulf of Mexico. Critical thermal methodology (CTM) was employed to estimate upper and lower thermal limits for each species as well as construct a thermal tolerance polygon demonstrating each species' thermal niche. Daily water temperatures were collected and used to identify specific variation encountered by pipefish in this study. Chronic thermal ranges were significantly different ($p < 0.0001$) and provided acclimation temperatures of 11-33°C for gulf and 12-32°C for dusky pipefish. Critical thermal maxima and minima were significantly correlated with acclimation temperature ($p < 0.0001$ in both species) and accounted for 93-98% of the variability in CTM. Gulf pipefish had both the highest CTmaxima, 39.6°C, and the lowest CTminima, 3.2°C. Polygons calculated for dusky and gulf pipefish had total areas of 617°C² and 736°C², respectively. Gulf pipefish possess significantly larger intrinsic and total tolerance area compared to dusky pipefish, which may indicate disparate use of seagrass habitats. Both species utilize well developed mechanisms for thermal tolerance as well as behavioral adaptations when temperatures fluctuate. Continued patterns of sea surface warming could impact local pipefish populations and challenge them to seek new habitats.

0132 Poster Session I, Friday 8 July 2011

Christopher O'Bryan, Chad Brooks, A. Floyd Scott

Austin Peay State University, Clarksville, TN, USA

Presence of Ranavirus in Syntopic Amphibian Larvae in West Tennessee, USA

Ranaviruses have been linked to pervasive die-offs in amphibian populations throughout the Americas, Europe, Asia, and Australia. Studies have found ranaviruses throughout the Southeast United States; however, no research has identified this pathogen in West Tennessee. It has been shown that anthropogenic induced stress is a pivotal cause of amphibian susceptibility to disease and this could exacerbate ranavirus infected amphibian mortalities. Poor water quality from cattle-access (an anthropogenic

stressor) has been suggested to be linked with ranavirus infection. This study describes the presence of Frog Virus 3, an aggressively pathogenic strain of ranavirus, at cattle-access and non-access ponds from select sites in West Tennessee. Frog tissues tested were shown to contain ranavirus DNA and to be prolific in the ponds examined. These data support the notion that Frog Virus 3 could be more widespread than previously known and point to the need for developing management and conservation techniques to reduce ranavirus-derived amphibian declines.

0660 Poster Session I, Friday 8 July 2011

Katherine M. O'Donnell¹, Frank R. Thompson III², Raymond D. Semlitsch¹

¹University of Missouri, Columbia, MO, USA, ²U.S.D.A. Forest Service, North Central Forest Experiment Station, Columbia, MO, USA

Does Fire Alter Salamander Housing Options?: Potential Effects of Fire on Terrestrial Salamander Microhabitat Use

Prescribed fire and timber harvest are human-caused disturbances that can have substantial effects on forest ecosystems. Terrestrial salamanders may play an integral role in nutrient cycling and forest productivity, but might be negatively affected by disturbances that alter their microhabitat. Therefore, we investigated the effects of prescribed fire and timber harvest on terrestrial salamanders. The study occurred in the Sinkin Experimental Forest, located within the Mark Twain National Forest in the Ozark Highlands region of southeastern Missouri. The site consists of mature, fully-stocked oak-hickory stands. Twenty 5-hectare experimental plots will be burned or shelterwood-harvested in 2011-2012. We sampled two locations within each of the 20 sampling plots in the spring and fall of 2010. We conducted 3 x 3 meter area-constrained searches of natural cover objects and leaf litter, and measured (SVL) and recorded the capture location of all salamanders (*Plethodon serratus*, *Plethodon albagula*). We recorded 1025 captures of *P. serratus* and 18 of *P. albagula*. We found most salamanders (75%) within the leaf litter; the remaining 25% were found under natural cover objects (logs, rocks, etc.). Salamander density was positively correlated with recent rainfall events. We did not find any significant pre-treatment differences between groups. Our results suggest that including leaf litter in area-constrained searches for terrestrial salamanders allows for a more complete understanding of their distribution among microhabitats. This sampling technique will allow us to detect changes in cover object use following prescribed fire and timber harvest and reveal the role of leaf litter loss in population persistence.

**0773 Herp Genomics, Morphology & Development, Symphony I & II, Monday
11 July 2011**

Eric O'Neill, David Weisrock

University of Kentucky, Lexington, KY, USA

Population Genomics of the North American Tiger Salamander Radiation

The genetic delimitation of recently diverged species and the reconstruction of their underlying phylogeny is likely to require an assessment of the population genetic and genealogical histories of numerous independent nuclear loci. Next generation sequencing technology provides novel opportunities for gathering genome-scale sequence data in natural populations. In this talk we will present the preliminary results of a first attempt to use the next generation methods to sequence, in parallel, ~9,000 barcoded PCR amplicons across the range of the tiger salamander species complex, a widely distributed North American clade containing many endangered and imperiled species, and likely more cryptic and undiscovered species lineages. Prior to sequencing, we screened over 250 EST loci for positive PCR from a test pool of representative individuals. From this set of loci we identified 95 that amplified across all individuals. We used standard PCR methods to amplify all 95 loci from 94 individual samples representing most of the currently described species and subspecies of the tiger salamander (*Ambystoma tigrinum*) complex. PCR amplicons from each individual were then uniquely barcoded and pooled for 454 next generation sequencing. Our preliminary work has produced over 400,000 sequence reads and a recently-completed bioinformatic pipeline to process these data into analyzable data matrices. Preliminary population structure and phylogenetic analyses indicate that these data contain considerable information about the evolutionary history of the *A. tigrinum* complex, and that these techniques are likely to become extremely useful for the rapid and large-scale sequencing and genotyping of populations for systematic research.

0687 Fish Behavior, Minneapolis Ballroom F, Sunday 10 July 2011

Ronald G. Oldfield¹, Rayna M. Harris², Dean Hendrickson², Hans A. Hofmann²

¹Case Western Reserve University, Cleveland, OH, USA, ²The University of Texas at Austin, Austin, TX, USA

Expression of Arginine Vasotocin and V1a Receptor in the Brain is Higher in a Polygamous Fish Species than in a Closely Related Monogamous Species

The nonapeptide arginine vasopressin (AVP; including its non-mammalian homolog arginine vasotocin, AVT), and its receptor V1a, regulate social behavior across vertebrates. In monogamous prairie voles, the AVP pathway is necessary for pair-bond formation, specifically by stimulating affiliative behavior toward the mate and aggression toward non-mates. Recently we used a receptor antagonist to find that during pair bond formation a nonapeptide pathway stimulated aggression toward competitors and affiliation toward a potential mate in the monogamous convict cichlid,

Amatitlania nigrofasciata. In the current study, we use qPCR to compare AVT and V1a gene expression in the brains of free-living reproductively active males of two closely related North American cichlid species, one of which is monogamous (*Herichthys cyanoguttatus*) and another that is polygamous/haremic (*H. minckleyi*). We found that expression of AVT and V1a are elevated in the polygamous species. This pattern appears opposite to the pattern observed in voles, but it can be explained by male *H. minckleyi* defending larger territories and pair-bonding with more females than *H. cyanoguttatus*. This study indicates that the expression of AVP/AVT is not a universal switch that 'turns on' monogamous behavior, which is consistent with other recent studies that have found cases of monogamy that are not associated with up-regulation of the AVP/V1a system. Instead, this study highlights the fact that there are many forms of monogamous and polygamous mating systems, and that the brain mechanisms that underlie each form are tied to the particular patterns of social behavior performed in a particular population.

0585 Herp Ecotoxicology, Minneapolis Ballroom E, Monday 11 July 2011

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¹NRRI - University of Minnesota Duluth, Duluth, MN, USA, ²EPA Mid-Continent Ecology Division, Duluth, MN, USA

Development, Size, and Gonadal Endpoints Differ in Two Native Frog Species Exposed to Atrazine and Accelerated Pond-drying

The herbicide atrazine (2-chloro-4-ethylamino-6-isopropyl-amino-s-triazine) is one of the most widely used pesticides in the U.S. and has been shown to reduce amphibian size and health at metamorphosis and alter gonadal function, presumably through endocrine disruption. Climate change directly impacts amphibian populations through habitat loss, and could alter development through accelerated drying of their habitats, but may also have indirect impacts through interactions with pesticides and other stressors. We evaluated the effect of environmentally relevant atrazine concentrations (0.1, 20, 200 µg/L) and interactions with pond-drying rate (normal and accelerated drawdown) on metamorphic size, development, and gonadal anomalies in two native frog species grown in outdoor mesocosms: northern leopard frog (*Rana pipiens*) and wood frog (*Rana sylvatica*). Exposure to atrazine slightly reduced survival in both species. Exposure to 200 µg/L atrazine was significantly associated with increased mortality during metamorphosis (Gosner stage 42-46) in *R. sylvatica*. This highest atrazine concentration also significantly altered development. In *R. sylvatica*, initiation and completion of metamorphosis was delayed and metamorphic size was reduced. In *R. pipiens*, significantly fewer tadpoles initiated and completed metamorphosis; however development time and metamorphic size did not differ in those that reached metamorphosis. Drawdown rate did not independently affect growth or development, but in *R. sylvatica* interacted with atrazine concentration to alter metamorphic size. Testicular oocytes (TOs) were found in both species, with no relationship between atrazine concentration and proportion of individuals with TOs. By altering amphibian

growth and development, atrazine may contribute to amphibian declines through reduced survival and reproductive capabilities.

0676 Fish Ecology II, Minneapolis Ballroom G, Monday 11 July 2011

Lance Olsen, Todd Crail, Jonathan Bossenbroek

University of Toledo, Toledo, OH, USA

Quantifying the Habitat Utilization of Darters in the Central Great Lakes Region

Darters are a group of North American fishes that includes both common species that live in many rivers and several species that are considered imperiled. The goal of this research is to quantify habitat utilization patterns of riffle-dwelling *Etheostoma* darters in the Central Great Lakes Region. The specific objectives of this study are (1) to determine if darters are partitioning riffles, and if so, what environmental variables being partitioned, and (2) determine if darters partition the environmental variables in the same manner across the landscape. To address these objectives, we sampled seven riffles in six rivers in Ohio (Grand River, Ashtabula River, and Conneaut Creek) and Michigan (Chippewa River, Mill Creek, and the River Raisin). In each riffle, between 25 & 100 samples were collected using a kick-seining method. Each darter was measured and identified to species. Local habitat variables including depth, flow, and percent substrate composition were measured after each seine sample. A GIS was used to compile data from our local study and paired with additional locality data from agency and academic site databases across Ohio and Michigan. This allowed us to analyze patterns of use at the regional scale such as river size, slope, drainage accumulation and bedrock type/age. The four *Etheostoma* species observed in our surveys were: *E. blennioides*, *E. nigrum*, *E. caeruleum*, and *E. flabellare*. Results suggest a relationship between darter species and the habitat variables, with each species exhibiting preferential habitat selection in the presence of congeners.

0205 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

Sarah A. Orlofske, Robert C. Jadin, Amanda V. Johnson, Pieter T.J. Johnson

University of Colorado at Boulder, Boulder, CO, USA

Dispersal Barriers and Phylogeographic Patterns of the Pacific Chorus Frogs (Hylidae: *Pseudacris regilla*)

Pacific chorus frogs (*Pseudacris regilla*) are a species complex that spans the west coast of North America from British Columbia, Canada, to Baja California, Mexico. Historically, across this range, the species was considered to include up to seven subspecies. More recently, the complex has been divided into 3 distinct species: *P. regilla*, *P. pacifica*, and *P. hypochondriaca*. However, previous studies lacked sampling at species boundaries for *P.*

pacifica and *P. regilla*. Therefore, additional sampling is needed to delimit possible contact zones and to investigate barriers to dispersal and historical biogeography. During the summer of 2010, we obtained tissues of *P. regilla* from 48 sites across California, Oregon, Washington, and Montana. We conducted a molecular phylogenetic analysis of the *P. regilla* complex throughout the range, including new sampling across previously identified lineage breaks and species range limits of several co-distributed taxa. We used 12S-16S and cyt b mitochondrial gene fragments in order to compare our phylogeny of the *P. regilla* complex to other species in the genus *Pseudacris* and to incorporate divergence dating methods. Our analysis filled in several distributional gaps in sampling from previous studies, allowing us to better distinguish species boundaries. We found that populations from western Montana and Idaho belong to the species *P. regilla*, and that these populations result from recently dispersing *P. regilla* from the southwest, rather than from *P. pacifica* populations directly to the west. This study contributes to a better understanding of dispersal barriers for amphibians and phylogeographic patterns across the Pacific Coast.

0712 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

Clint Otto, Gary Roloff

Michigan State University, East Lansing, MI, USA

Coarse Woody Debris Surveys Reveal Sampling Disturbance Effects and Seasonal Occupancy Differences of Red-backed Salamanders

Coarse Woody Debris (CWD) surveys are a standard, but potentially invasive technique for sampling terrestrial salamanders. We used dynamic occupancy models to investigate two sources of potential bias in CWD transect surveys for red-backed salamanders (*Plethodon cinereus*): 1) seasonal differences in occupancy estimates, presumably due to salamanders emigrating from natural cover objects later in the summer and 2) repeated CWD survey disturbances being associated with local turnover of salamanders within and between primary sampling periods. Initial occupancy estimates of red-backed salamanders were higher for transects initially surveyed in May ($\psi_{\text{May}} = 0.59$; 95% CI: 0.43 – 0.73) than those initially surveyed in June ($\psi_{\text{June}} = 0.52$; 0.40 – 0.64), or July ($\psi_{\text{July}} = 0.42$; 0.27 – 0.60); however 95% CIs overlapped. Between each primary sampling period, the probability that an occupied site went locally extinct was 0.16 (95% CI; 0.07 – 0.31). The beta parameter for our sampling disturbance covariate overlapped zero ($\beta_{\text{Disturbance}} = -0.04$; -0.10 – 0.02), suggesting repeated CWD surveys did not decrease salamander occupancy across primary periods. Within each primary period, however, we observed evidence of a disturbance effect on salamander detectability during the second sampling event, presumably due to temporary salamander emigration ($p_{1\text{st}} = 0.31$; 0.23 – 0.41, $p_{2\text{nd}} = 0.22$; 0.16 – 0.29). We provide multiple solutions, within design- and model-based frameworks, for minimizing bias associated with seasonal changes in occupancy and repeated sampling disturbances.

0355 Poster Session III, Sunday 10 July 2011

Patrick Owen, Christopher Brown

University of Cincinnati, Cincinnati, OH, USA

Relative Response Levels to Visual and Acoustic Stimuli in Territorial Male Green Frogs, *Lithobates (Rana) clamitans*

Acoustic information (the calls of neighbors and intruders) seems to be of primary importance in advertisement and territorial defense, at least in most North American frogs. It is becoming increasingly clear that many species of frogs also use visual information to mediate encounters. The green frog, *Lithobates (Rana) clamitans*, is a species that has been well studied in terms of how territorial males acoustically respond to the calls of other males. However, males of this species also exhibit behaviors that add a visual dimension to their advertisement and aggressive displays. This study refines a previous series of experiments on the close-range territorial encounters of green frogs by adding an acoustic-only stimulus, allowing the determination of relative response levels to visual and acoustic stimuli. We demonstrate that visual stimuli could be important in territorial signaling under ambient light conditions at night. Supporting previous work, the present study indicates that responses directed at visual stimuli are relatively stronger than responses directed at acoustic stimuli, but that acoustic stimuli are more likely to trigger an aggressive response.

0411 Fish Ecology I, Symphony I & II, Friday 8 July 2011; ASIH STOYE ECOLOGY & ETHOLOGY AWARD

Hannah Owens

University of Kansas, Lawrence, KS, USA

Climate Change and the Distributions of Atlantic Fishes: A Correlative Ecological Niche Modeling Approach

Commercially fished species with distributions in the North Atlantic Ocean, such as Atlantic cod (*Gadus morhua*), play key roles not only within their ecosystems, but also as important economic resources. Climate models suggest that the North Atlantic is likely to see dramatic climate changes in coming decades. First indications of shifts in geographic distributions of cods and other fishes have already been observed in the North Atlantic, including northward shifts of some populations and precipitous declines in others. It is hypothesized that these range shifts may alter not only community composition, but also the availability of these species as resources within the current fisheries management framework. Correlative algorithms (GARP and Maxent) were used to generate ecological niche models for multiple species with distributions in the North Atlantic Ocean, including Atlantic cod, Atlantic halibut (*Hippoglossus hippoglossus*), Atlantic herring (*Clupea harengus*), and haddock (*Melanogrammus*

aeglefinus). These models were projected into several future climate change scenarios to investigate possible effects of climate change on species' ranges and fish community composition. This information has the potential to inform strategies for future fisheries management regarding necessary adaptations to changing climates.

0713 Amphibian Evolution, Minneapolis Ballroom E, Sunday 10 July 2011

Diego Páez-Moscoso, Juan Manuel Guayasamin

Pontificia Universidad Católica del Ecuador, Quito, Pichincha, Ecuador

Diversity and Speciation Patterns in the Andean Genus *Osornophryne* (Anura: Bufonidae)

Using the Andean toad genus *Osornophryne* as a study taxon, we address the following questions: (1) How many evolutionary species are within *Osornophryne*? (2) Are molecular and morphological datasets congruent when delimiting species? (3) Which morphological traits are the most variable among species? (4) Is speciation driven by ecological or non-ecological processes? and (5) What biogeographic model better explains the observed speciation pattern? To evaluate species limits, we performed molecular analyzes (2 mitochondrial and 2 nuclear genes), morphometric analyses (12 variables; 183 individuals), and niche comparison (14 ecological variables; 28 unique localities). The inferred phylogeny is mostly congruent with the morphological data, supporting the reality of most of the recognized species in *Osornophryne*; however, the genetic analysis reveals the presence of an undescribed taxon. The most morphological divergent characteristics are limbs and head, traits that might be associated with the habits of the species (terrestrial or arboreal). In relation to patterns of speciation, evidence suggests that there are no major ecological differences in closely related species; nevertheless, different ecological requirements were found in the two main *Osornophryne* clades (forest species and paramo species). We conclude that the most consistent model of diversification in *Osornophryne* is an allopatric model without ecological change, but the first event of cladogenesis seems to have been accompanied by an ecological shift.

0203 Poster Session I, Friday 8 July 2011; AES CARRIER AWARD

Erin (Misty) Paig-Tran, Adam Summers

U. of Washington, Seattle, WA, USA

Doing it Their Way: Exploring the Filter Morphology and Filtration Mechanisms in Mobulidae

Filter feeding has evolved independently four separate times in three lineages of cartilaginous fishes (Lamiformes: *Megachasma* and *Cetorhinus*, Orectolobiformes: *Rhincodon*, and Mobulidae: *Manta* and *Mobula*). Each lineage has morphologically distinct filtering structures and presumably very different mechanisms for removing food particles from the water. Recent work has posited engulfment (Nakaya et al. 2007) and cross flow filtration (Motta et al. 2010) as dominant modes in mega mouth shark and whale shark, respectively. The structure of *Manta* and *Mobula* filtering pads are quite different and we suppose a different mechanism may be in use. In the rays, the filter pads are chevron shaped structures composed of many rows of filtering lobes located on both anterior and posterior edges of the gill filaments, facing toward the incoming flow of water and also toward the posterior buccal cavity. We used scanning electron microscopy to examine the filtering pads of *Manta birostris*, *Mobula tarapacana*, and *Mobula thurstoni* and have found evidence that the surfaces of the lobes are covered with a blanket of cilia, which likely serve as a surface for capturing and transporting particles by hydrosol filtration. Using histology, we identified mucus secreting cells on the distal edge of the epithelium, presumably to provide a sticky coating for capturing food particles and for transferring to the esophagus. Finally, we identified the presence of denticles along the leading edge of the lobes which may serve a protective layer by intercepting large, fast-moving particles.

0133 Poster Session III, Sunday 10 July 2011

Daniel J. Paluh, Christopher A. Sheil

John Carroll University, University Heights, OH, USA

Anatomy of the Fully Formed Chondrocranium of *Emydura subglobosa* (Chelidae), 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, *Emydura subglobosa* (Chelidae). Formation and ossification of skeletal elements has been studied in this species (Werneburg et al., 2009); however, a detailed description of this pleurodiran

turtle has not been presented. We compare the chondrocranium of this species 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.

0474 Legler Turtle Symposium, Symphony III, Sunday 10 July 2011

Michael Pappas¹, Justin Congdon¹, Bruce Brecke¹

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Tactics of Nesting and Patterns of Hatchling Orientation in 8 species of Backwater Wetland and River Turtles during Nest Dispersal in an Upper Mississippi River Floodplain

The Weaver Bottoms and adjacent Weaver Dunes of the Upper Mississippi River supports one of the most diverse chelonian communities in the northern U.S. representing 8 species of turtles (*Apalone spp.*, *Chelydra*, *Chrysemys*, *Graptemys spp.*, and *Emydoidea*). We examined the orientation problems presented to naïve hatchlings during initial dispersal from experimental nests in large (~ 90 m diameter) circular arenas in natural nesting habitat near Weaver Bottoms. Hatchlings' of Blanding's turtles oriented toward far dark horizons and Map turtles toward near dark horizons; whereas, hatchling Snapping, Painted, and Softshell turtles primarily orient and disperse toward near open and highly illuminated horizons. Orientation by naïve hatchlings was almost always non-random and primarily based on visual cues. We found no evidence that geotaxis, olfaction or humidity were important environmental cues during initial dispersal of hatchlings. Naïve hatchlings in some situations were unexpectedly influenced by the time of day during dispersal. We examined among species patterns for evidence that nest site selection by females and orientation and dispersal of hatchlings are co-evolved. Selection of nest sites by females and orientation cues presented to dispersing hatchlings seeking recruitment habitats may be compromised by the current and historic alteration of the nesting dunes (agriculture, silviculture, fire suppression) and river habitats (dams, channel maintenance, sedimentation, wind fetch and recreational use).

0412 Conservation & Management, Minneapolis Ballroom G, Sunday 10 July 2011

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Does it Fit? Choice of Growth Model can Bias Vulnerability Estimates in Sharks

Growth is an intrinsic ability of living organisms, and is of particular importance in marine systems where an individual's size can increase numerous orders of magnitude during their lifetime, and determines the niche they occupy in the ecosystem. Quantifying growth rates allows the calculation of parameters which are important in demographic modelling and for assessing the vulnerability of a species to extinction. In elasmobranchs, the von Bertalanffy growth function (VBGF) is commonly used as it provides biologically meaningful parameters, such as asymptotic size (L_{∞}) and growth rate (k). A variant of the VBGF has been recommended for use in elasmobranchs; fixing the size at age-0 (L_0) to an empirical estimate of size at birth. Using simulation modelling we demonstrate that this does not improve model fit but in fact biases growth parameters, resulting in the underestimation of vulnerability. Incorporating variability in L_0 also biases results. The assumption that the L_0 parameter from the VBGF is equal to actual size at birth is erroneous, with the former usually being ~15% lower than the latter; an analogous difference between asymptotic size and observed maximum length. The limitations of certain growth functions need to be taken into account as well as the difference between model parameters and life history traits in order to accurately predict demography and vulnerability of a species.

0016 Fish Ecology, Diversity & Conservation, Minneapolis Ballroom F, Sunday 10 July 2011

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Discovery and Description of an Endemic Freshwater Fish Biota in Southeastern Sulawesi, Indonesia

The ricefish *Oryzias woworae* (Belontiiformes: Adrianichthyidae) was discovered on Muna Island, Sulawesi Tenggara (Southeastern Sulawesi), in 2007 and described in 2010. Prior to 2007, scientific collection of freshwater fishes in Sulawesi was limited largely to Sulawesi Selatan (Southern Sulawesi) and Sulawesi Tengah (Central Sulawesi). The discovery was notable for several reasons: ricefishes had not been reported previously

from the geologically distinct Sulawesi Tenggara; the new species was abundant; and, it was distinguished by a distinctive blue and red color pattern in both sexes. It prompted a joint field trip by US and Indonesian ichthyologists to Sulawesi Tenggara, June 2010, to collect freshwater and coastal fishes. Comparative morphology and molecular sequence data were used to recognize species-level taxa. We report at least five *Oryzias* from Sulawesi Tenggara: 1) *O. woworae*; 2) a golden species compared to *O. woworae*, 3) a short-bodied species compared to *O. woworae*, 4) *O. celebensis*, and 5) a species compared to *O. javanicus*. The species do not form a monophyletic group; following a monographic revision of ricefishes, they represent at least two ricefish lineages. Other endemic fishes in the biota include species of the halfbeak *Nomorhamphus* and the gobiid *Mugilogobius*. Continued exploration throughout Sulawesi is needed to confirm the natural distribution of known species and identify and describe new species. Endemic species are ideal icons to draw attention to the endemic freshwater fish fauna of Sulawesi and encourage its conservation and its pivotal role in understanding the history of the biota of the Indo-Australian Archipelago.

0778 Herp Genomics, Morphology & Development, Symphony I & II, Monday 11 July 2011

Scott L. Parker¹, Martha Patricia Ramírez-Pinilla², Joanna Biazik^{3,4}, Christopher R. Murphy³, Michael B. Thompson⁴

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Influence of the progesterone receptor antagonist mifepristone on uterine blood vessel development and epithelial surface morphology in viviparous Australian skinks

Structural and functional changes to the uterus associated with maintenance of pregnancy are controlled primarily by steroid hormones such as progesterone. We tested the hypothesis that progesterone regulates uterine surface morphology and blood vessel development during pregnancy in the viviparous skinks, *Pseudemoia entrecasteauxii* and *Niveoscincus coventryi*, by treating females with the progesterone receptor antagonist mifepristone at different stages of pregnancy. Mifepristone treatment resulted in altered uterine epithelial cell surface morphology and high embryo mortality in pregnant females of *P. entrecasteauxii* with recently ovulated embryos, but did not affect females at mid and late stages of pregnancy. Females treated with mifepristone at very early stages of pregnancy exhibited increased cellular blebbing and presence of wide gaps between epithelial cells. In *P. entrecasteauxii*, mifepristone may prevent successful embryo attachment in early pregnancy through its effects on uterine

epithelial cells but may have little effect on pregnancy once maternal-embryo interaction is established. In contrast, there was no apparent effect of mifepristone treatment on uterine surface morphology or blood vessel proliferation in pregnant females of *N. coventryi* at any stage of pregnancy. Both species exhibited distinct regionalization of uterine ridges and in the shape of uterine epithelial cells which may relate to the function of both chorioallantoic and yolk sac placentae during gestation. Differences in progesterone receptor amino acid sequence in *P. entrecasteauxii* and *N. coventryi* may account for the differences in response to mifepristone treatment observed between the two species.

0038 Poster Session II, Saturday 9 July 2011

James Paterson¹, Brad Steinberg², Jacqueline Litzgus¹

¹Laurentian University, Sudbury, ON, Canada, ²Algonquin Park, Whitney, ON, Canada

Not Just Any Old Pile of Dirt: Evaluating the Use of Artificial Nesting Mounds for Turtles

The viability of a turtle population is largely dependent on the survivorship of reproducing females. However, road mortality that occurs as females move to terrestrial nesting sites is decimating many freshwater turtle populations via direct mortality and lowered recruitment. One possible solution is to install artificial nesting mounds that may increase recruitment and decrease the risk of mortality for gravid females by enticing them to nest closer to aquatic habitats. Before the widespread implementation of this conservation tool, incubation conditions and nest success at artificial nesting mounds should be compared to natural nests. We installed four artificial nesting mounds in Algonquin Provincial Park, ON, and transplanted clutches of Painted Turtle (*Chrysemys picta*) and Snapping Turtle (*Chelydra serpentina*) eggs from natural nests to these mounds. Hatching success was significantly higher in nests transplanted to artificial mounds than in natural nests for Snapping Turtles, despite no differences in heat units, moisture, or canopy cover between treatment groups. Painted Turtle clutches had very high hatching success and both treatment groups experienced similar hatching success and incubation conditions. Hatchlings of both species emerging from artificial nesting mounds had similar body conditions and deformity rates compared to hatchlings from natural nests. High hatching success, low deformity rates, and healthy hatchlings emerging from artificial nesting mounds suggest promise for the use of these sites as conservation tools. However, low rates of mound use by females at our study site suggest that future studies should identify spatial attributes to increase encounters with artificial nesting mounds.

0039 SSAR SEIBERT ECOLOGY AWARD, Conrad B & C, Friday 8 July 2011

James Paterson¹, Brad Steinberg², Jacqueline Litzgus¹

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Generally Specialized or Especially General? Habitat selection by Snapping Turtles (*Chelydra serpentina*)

Central to our understanding of animal ecology is habitat use and resource selection. By comparing habitat use to availability, preferences for specific habitats may become evident, and this information is important for creating management plans for species at risk. While most studies of habitat selection have focused on specialists, very few have considered selection in species that are generalists. We tested for habitat selection in a supposed generalist, the Snapping Turtle (*Chelydra serpentina*) in Algonquin Provincial Park, Ontario. Radio telemetry was used to follow adult turtles (n = 22) during 2009 and 2010. We tested for habitat selection at two spatial scales during the active season (selection of a home range from the population range, and selection of habitat from within the home range) by comparing random points to turtle home ranges and individual locations. Although turtle home ranges were significantly closer to several wetland types than random points, there was no difference in preference among aquatic habitats. We compared habitat composition in individual home ranges to the composition of the population range to test for individual specialization in habitat selection. Over half of the individuals showed evidence of specialization on different habitats, and this causes the population to be portrayed as a habitat generalist. Although capable of living in a wide range of aquatic habitats, certain characteristics such as nesting sites and hibernacula may represent limiting resources in populations. These findings have implications for the evolution of resource generalists in freshwater communities and the conservation of this species.

0554 Poster Session I, Friday 8 July 2011

Crystal D. Paulson, Robert J. Visalli, Mark A. Jordan

Indiana University - Purdue University, Fort Wayne, IN, USA

Mexican Axolotls (*Ambystoma mexicanum*) Appear to be Resistant to *Ambystoma tigrinum* Virus

Disease outbreaks are linked to declines in amphibians. Among the best characterized examples of this phenomenon is the infection of wild tiger salamanders (*Ambystoma tigrinum* spp.) by the ranaviral pathogen *Ambystoma tigrinum* virus (ATV). Relatively little is understood of how tiger salamanders mount an immunological response to infection. The goal of this study was to test the effects of ATV infection on laboratory reared Mexican Axolotls (*A. mexicanum*), a close relative of the tiger salamander that is a likely candidate for the development of an infection model in ambystomatids. Four groups of 20 axolotl larvae each were infected with increasing doses of virus ranging from 10¹ to 10⁴ plaque forming units, and compared to a control group with no exposure

over a 40 day period. Before and after the experiment, all larvae were measured and weighed. Whole body tissues were collected to screen individuals for infection using PCR to detect viral DNA. We surprisingly found a high survival rate across viral titers. Of the 23 axolotls that tested positive for the virus, 15 survived the experimental period. Larvae from infected groups grew less in length but more in mass, relative to those not exposed to the virus. The data suggests that axolotls can be infected with ATV and demonstrate sub-lethal responses to infection, but may also clear the infection and survive with persistent infection more often than wild congeners.

0603 Fish Ecology I, Symphony I & II, Friday 8 July 2011

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¹University of Arkansas at Pine Bluff, Pine Bluff, AR, USA, ²Arkansas Game and Fish Commission, Little Rock, AR, USA

Applicability of the Flood-Pulse paradigm to largemouth bass *Micropterus salmoides* in the highly regulated Arkansas River

Modern-day large river systems are frequently characterized by regulated flows, leveed floodplains, and potential temperature-flow asynchronies. Thus, expected relationships between fishes and hydrology as hypothesized under the Flood-Pulse Concept may be weak or non-existent. Relationships between river hydrology and fish growth have not been widely studied, with the few studies done produce mixed results. Using the Arkansas River, Arkansas as a study area, annual growth increments were generated via backcalculated length at age data from largemouth bass collected during 2004, 2005, and 2010 (n=2,192). Between these sampling intervals, the Arkansas River experienced three consecutive years (2007-2009) with long durations of elevated flows. When examining age-1 through age-6 cohorts from 2004 and 2005 (n=1,715), largemouth bass growth increments were positively correlated with growth years (March through February) containing longer durations of lower flows (<15,000 ft³/s). Conversely, largemouth bass growth increments were negatively correlated with growth years containing sustained periods of higher flows (>50,000 ft³/s). Two-way ANOVA analyses containing backcalculated age and growth year classification (i.e., high, medium, and low flows) as main effects also suggested significant (P<0.05) hydrologic effects on growth. Significant (P<0.05) interaction between backcalculated age and growth year classifications further suggested that flow affected growth differently across ages, with more pronounced effects observed with age 1-3 cohorts. Results presented here suggest high-flow events that are typically beneficial to largemouth bass populations in large river-floodplain systems may be dampened or non-existent in more highly regulated, impounded river systems such as the Arkansas River.

0731 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

Joseph Pechmann¹, Jeremy Hyman¹, Robert Warren², Kenneth Kozak³, R. Haven Wiley⁴

¹Western Carolina University, Cullowhee, NC, USA, ²Yale University, New Haven, CT, USA, ³University of Minnesota, Saint Paul, MN, USA, ⁴University of North Carolina, Chapel Hill, NC, USA

Trends in a *Plethodon* Hybrid Zone Along an Elevational Gradient in the Southern Appalachians from 1976-2010

We and Nelson Hairston, Sr. studied a hybrid zone between *Plethodon shermani*, a high-elevation species, and *P. teyahalee*, a low-elevation species, in the Nantahala Mountains of NC from 1976-2010. *Plethodon shermani* is characterized by red legs, *P. teyahalee* by white spots, and hybrids by intermediate phenotypes. We scored the amount of red and the amount of white spotting separately on a scale of 0-3 for approximately 20 *Plethodon* along an altitudinal gradient at 686, 777, 869, 960, and 1052 m annually during September. Subtracting the white score from the red score provided a phenotype index. The average amount of white spotting relative to red legs increased at the highest elevation whereas the reverse occurred at the lowest elevation over time, indicating expansion of the hybrid zone. Generalized least squares with autoregressive error identified significant relationships between the phenotype index and the cool season North Atlantic Oscillation index (NAO). There was a significant positive relationship with no lag at low elevations and a significant negative relationship with a 2-3 year lag at high elevations. At low elevations, more red/less white was found in years with warm wet winters; the lack of lag suggests this signal reflects different activity patterns of different phenotypes. At high elevations there was more white/less red 2-3 years after warm wet winters; the lag likely indicates a population shift. These observations suggest that the expansion of the hybrid zone is influenced by climatic changes.

0485 AES Behavior & Ecology, Minneapolis Ballroom G, Thursday 7 July 2011

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Depth and Temperature Preferences of Arctic Skate (*Amblyraja hyperborea*) and Greenland Halibut (*Reinhardtius hippoglossoides*) in a Deep Water Arctic Marine Ecosystem

Animal movement plays a key role in determining the spatial, demographic and genetic structure of populations, and ultimately underpins species management. Quantifying movements can reveal behavioral patterns that provide insight into habitat preferences and responses of animals to environmental or human-induced changes. Given concerns about climate changes and exploitation of arctic marine resources, it is critical to expand

our knowledge of the movements of largely unstudied deep-water arctic fishes. To address this knowledge-gap, we employed satellite telemetry in two arctic marine species, Arctic Skate (*Amblyraja hyperborea*) and Greenland Halibut (*Reinhardtius hippoglossoides*) in Cumberland Sound, Nunavut, Canada. MiniPAT tags were attached to fish for 70, 100 and 300 days and recorded depth and temperature at 150, 300 and 600 second intervals, respectively. Data obtained between August and November 2010 (70 and 100 day deployments) showed the mean water temperature encountered was 2.1 ± 0.007 °C for skates and 2.4 ± 0.001 °C for halibut. In general, skates showed higher vertical activity levels and traversed a larger depth range (400-1400 m) than halibut (800-1400 m). Skates moved repeatedly across the Sound between deep and shallow waters. Halibut remained in deep water pockets for the entire period and mean distance traveled between tagging and pop-off locations (11.5 ± 4.6 km) was shorter than in skate (30.1 km). Depth and temperature profiles provide evidence for overlapping habitats but also suggest differences in activity levels and behavioral patterns in these two species. These data will contribute to regional species-specific management plans.

0195 Invasive Species, Symphony I & II, Sunday 10 July 2011

Gad Perry¹, Robert Powell², Robert Henderson³, Michael Farmer¹, Michel Breuil⁴, Arthur Echternacht⁵, Gerard van Buurt⁶, Christina Romagosa⁷

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Introduced Amphibians and Reptiles in the Greater Caribbean: Patterns and Conservation Implications

Non-native species, including amphibians and reptiles, are often second only to habitat destruction and alteration as a cause of extirpations and extinctions. We documented the arrival and establishment of alien herpetofauna in the greater Caribbean region. These include 130 species (25 amphibians and 105 reptiles) responsible for 364 individual introductions, of which 70.3% resulted in populations established for at least a short period, often in urban settings. The impact of those 256 established populations ranges from minimal to severe. Intentional introductions for pest control and food are factors in some (primarily historical) instances, but the primary pathways for introductions today are inadvertent. Nearly all are associated with either the pet trade or stowaways in cargo and ornamental plants. We review the surprisingly large numbers of documented individuals exported from the Caribbean into the United States (US) and from the US to the Caribbean. The extent of such trade and the rates of non-native arrivals continue to increase, and both are related to indices of regional economic activity. Because prevention is far better - and more economical - than eradication of an established alien, we recommend increased scrutiny of transported goods and animals to and from the islands. An integrated policy response is clearly necessary to address this regional issue. Although the region is highly fragmented, we urge an increased regional cooperation for

fighting invasive species in general and invasive herpetofauna in particular. Precedents for such cooperation include the Caribbean Community and Common Market and the Caribbean Cooperation in Health initiative.

0722 Poster Session II, Saturday 9 July 2011; SSAR POSTER AWARD

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Oviposition and Tadpole-rearing Site Selection of a Phytotelm-breeding Frog, *Anomaloglossus beebei*

For many organisms, selection of suitable breeding habitat is essential for successful reproduction. Species that care for offspring at separate breeding sites during different developmental stages have the added task of selecting different sites for offspring with unique requirements for survival and growth. Such a situation occurs with the phytotelm-breeding frog, *Anomaloglossus beebei*, where tadpole-rearing sites are spatially separated from oviposition sites. We investigated abiotic and biotic factors at both types of sites to (i) examine the impact these factors have on hatching success at oviposition sites and (ii) to compare these factors between oviposition and tadpole-rearing sites. We visited 60 oviposition and 29 tadpole-rearing sites in May -July 2009 in Kaieteur National Park, Guyana. During daily visits we documented the presence of predators, egg survival and hatching rates as well as water temperature, water volume, dissolved oxygen, bromeliad size, leaf height, and leaf angle. Results showed that dissolved oxygen concentrations and the presence of predators were related to hatching success at oviposition sites. Specifically, egg clutches with one or more hatched larva were found in phytotelm with higher dissolved oxygen concentrations, while egg clutches in phytotelm containing predators were more likely to have one or more eggs depredated. Further, tadpole-rearing sites were more often found in phytotelm with greater water volumes and in leaves at greater angles (i.e., closer to the center of the bromeliad) compared to oviposition sites. We discuss how these findings relate to the specific requirements of eggs and tadpoles.

0094 Ranavirus Symposium, Minneapolis Ballroom F, Friday 8 July 2011

Angela Picco¹

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Amphibian Commerce and the Threat of Pathogen Pollution

The global trade of amphibians has the potential to spread diseases into new areas and contribute to amphibian die-offs and declines around the world - a phenomenon known

as pathogen pollution. Amphibians are widely traded as pets, food, bait, and for biomedical and research purposes. Recent studies show that ranaviruses, a group of ectothermic vertebrate pathogens, affect a variety of hosts and are common in the global amphibian trade. Studies in North America indicate that pathogen pollution is likely occurring with the translocation of larval tiger salamanders (*Ambystoma tigrinum*) used in the fishing bait industry and the sale of market bullfrogs (*Rana catesbeiana*) for human consumption. Further, strains from bait shops and ranaculture facilities may be more pathogenic than wild strains. What we do not know is the likelihood that ranaviruses are transmitted from trade to amphibians in the wild, how trade is responsible for the spread of diseases into new areas, what effects released pathogens may have on native populations, how pathogen pollution contributes to amphibian declines around the world, and what the most effective approaches are for curbing the spread of ranaviral disease into new areas. Future research on these topics is needed to help address this risk of pathogen pollution to native amphibians and to formulate intervention strategies.

0563 Herp Reproductive Biology, Symphony I & II, Saturday 9 July 2011

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Secondary Sex Ratios in Six Snake Species

Sex ratios at birth or hatching in snake populations are often assumed to be 1:1 in agreement with Fisherian Theory. This hypothesis has rarely been tested in snake populations and recent theoretical efforts indicate that individual females may deviate from sex ratio equality due to a diversity of factors, including selective pressures associated with maternal condition, differential pre-partum mortality, and parthenogenesis. We evaluated secondary sex ratios (SSRs) in two viperids (*Sistrurus catenatus* and *S. miliarius*) and four natricine colubrids (*Nerodia rhombifer*, *Thamnophis proximus*, *T. radix* and *T. sirtalis*). We captured 274 gravid females that produced 2443 living offspring. Population-level SSRs in our focal species did not differ significantly from 1:1. In addition, variation in individual litter SSRs conformed to expectations generated by the binomial distribution with an even sex ratio. In our study, each species showed individual variation in SSRs. However, the majority of variation in litter SSRs was not explained by variation in the maternal characteristics we examined. The three exceptions were a very strong negative association between mean offspring mass and litter SSR in *T. radix* ($r^2=0.96$), a strong positive association between mean offspring mass and litter sex ratio in *T. proximus* ($r^2=0.40$), and a strong positive association between maternal condition and litter SSR in *T. proximus* ($r^2=0.40$). Whether or not these relationships have functional or adaptive significance warrants further study. The significance of our results within the conceptual framework of vertebrate sex allocation will be discussed.

0200 Fish Evolution, Minneapolis Ballroom F, Saturday 9 July 2011

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Evolutionary Diversification of Shape Disparity in New World Silversides (Atherinopsidae)

Investigating patterns of morphological diversity can offer important insight into an organism's evolutionary history. Silverside fishes (Tribe Menidiini) have diversified in numerous lakes on the Central Mexican Plateau and in many ways, display similar patterns of diversification as have other aquatic taxa. *Chirostoma* is the most ecologically and morphologically diverse group in the tribe. Previously we showed the group displays replicated patterns of generalist to specialist mode of trophic evolution among inland lakes in Central Mexico. This replicated pattern and large degree of morphological variation, allow for the investigation of morphological disparity, the variability in shape or form, among the lakes, genera, and clades of silverside. We took a comparative approach to examine disparity within the Tribe Menidiini by incorporating geometric morphometrics, a fossil-calibrated multilocus phylogeny, and diversification analyses to make several phylogenetic and ecological comparisons. Lake Chapala silversides were found to possess the largest degree of disparity in shape compared to all other groups and lakes. Silversides from Lake Patzcuaro were the second most disparate group, followed by other genera, *Menidia*, and *Poblana*, respectively. The results suggest that morphological disparity is greatest in freshwater species in the Central Mexican Lakes and may be the result of niche expansion into the depauperate lakes of the region.

0194 Poster Session III, Sunday 10 July 2011

Maribel Piñon¹, Jessica Maciel¹, David Zaragoza³, Aaron Reedy³, Andrew Durso², Timothy Mitchell¹, Daniel Warner¹, Fredric Janzen¹

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Microhabitat Use by Hognose Snakes with Respect to Vegetation and Temperature within a Sand Prairie Landscape

Most animals have very specific resource requirements. For reptiles, these requirements often involve suitable microhabitats for efficient thermoregulation, but many studies that quantify habitat use tend to focus at much larger scales (i.e., geographic range and landscape). To better understand how reptiles use their habitat, researchers must measure microhabitat selection at a finer resolution. To address this issue, we studied microhabitat use by western hognose snakes (*Heterodon nasicus*) in a sand prairie in northwest Illinois. At our study site, we established four 30x30 meter plots, subdivided into 2x2 meter quadrats. Each quadrat was thoroughly searched for *H. nasicus* twice

daily for a 10-day period in summer and a 2-day period in fall. Detailed thermal measurements were taken throughout each plot, and cloacal temperatures were taken for each snake immediately after capture. At this fine resolution, patterns of habitat use varied with time of day and showed strong associations with the plant *Tephrosia virginiana*. Many snakes were captured in leaf litter under this plant, presumably because of the relatively constant thermal conditions in this specific micro-environment. Body temperatures of individual snakes were also associated with microhabitat use. Due to seasonal changes in the abundance of *T. virginiana* at our site, it is likely that *H. nasicus* shifts habitat use during other times of the year. Given the threatened status of *H. nasicus* in Illinois, information on fine-scale microhabitat use will be useful for conservation efforts.

0607 Poster Session III, Sunday 10 July 2011

Shannon Pittman, Grant Connette, Raymond Semlitsch

University of Missouri-Columbia, Columbia, MO, USA

Identifying Optimal Natal Dispersal Behavior of Spotted Salamanders (*Ambystoma maculatum*) in Modified Landscapes Using Individual-based Modeling

Empirical work has shown that juvenile pond-breeding salamanders exhibit considerable variation in natal dispersal behaviors such as speed of movement, path linearity, and settlement propensity. Habitat alteration and landscape change may alter the benefits associated with different dispersal strategies. Using individual-based simulation techniques, we built a movement model of initial natal dispersal in juvenile salamanders using empirical data from spotted salamanders to parameterize movement tendencies. We investigated the consequences of behavioral decisions in differing habitat modification scenarios by altering size of buffer zones, distance to forest habitat, and microhabitat density. We found that some movement strategies were optimal under different habitat modification scenarios. We discuss the implications of our simulations for pond breeding salamander population persistence in modified landscape and the usefulness of this modeling approach for determining conservation strategies.

0604 Herp Behavior, Symphony I & II, Monday 11 July 2011

Shannon Pittman, Raymond Semlitsch

University of Missouri-Columbia, Columbia, MO, USA

Fine-scale Movement Behavior of Recently-metamorphosed Spotted Salamanders (*Ambystoma maculatum*)

Pond breeding amphibian populations are highly susceptible to changes in habitat quality, but little is known regarding the individual behaviors affecting population-level

processes. Natal dispersal is an important but extremely risky stage in the life of recently-metamorphosed amphibians; behaviors at this life stage have a substantial impact on future survival. We investigated fine-scale movement decisions of recently-metamorphosed spotted salamanders released in a harsh grassland environment different distances from a forest edge. We combined powder-tracking with drift fence mark-recapture to investigate both short and long-term movement decisions following release. Individuals were released in grassland habitat 5, 10, 20, and 35 meters from a forest edge. Drift fences were placed along the forest edge. We released a total of 388 salamanders the summer of 2010 and recaptured 107 in the forest fences. We found significant initial orientation toward forest of individuals released 5 and 10 meters from the forest ($p=0.0054$ and 0.038), and random orientation at 20 and 35 meters, indicating either a small perceptual range or decreasing motivation to move towards forest with distance. However, orientation even at 5 and 10 meters was highly variable (mean vector length=0.181, 0.138). Juveniles in this study generally moved straight and with a low tendency to respond to habitat even at close distances, potentially reflecting a motivation to move quickly away from the natal wetland rather than attraction to forest. We discuss the potential consequences of the observed behavior to juvenile salamanders dispersing into modified habitat.

0370 Herp Biogeography & Phylogeography, Minneapolis Ballroom E, Sunday 10 July 2011

John Placyk¹, Ben Fitzpatrick², Gary Casper⁴, Randall Small², Graham Reynolds², Daniel Noble³, Ronald Brooks³, Gordon Burghardt²

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Historical Perspective Suggests the Hybrid Zone between Two Snakes of Conservation Concern is an Important Natural Interaction

Distinguishing between hybrid zones formed by secondary contact vs. parapatric divergence-with-gene-flow is an important challenge for understanding geographic isolation and local adaptation in the origin of species. A similar challenge, distinguishing between natural hybrid zones vs. those formed as a consequence of recent human activities, is important for conservation. Recent work has demonstrated the existence of a hybrid zone between the plains gartersnake (*Thamnophis radix*) and Butler's gartersnake (*T. butleri*), raising questions about the history and conservation of genetically admixed populations. Both taxa are of conservation concern, and it is not clear whether to regard hybridization as a threat or a natural interaction. Here we use phylogeographic and population genetic methods to assess the timescales of divergence and hybridization. We assayed AFLPs and mtDNA sequences from *T. radix*, *T. butleri*, and the closely related short-headed gartersnake (*T. brachystoma*) throughout their ranges. We find shallow mtDNA divergence and high levels of variation in the contact

zone, patterns inconsistent with a hypothesis of long-term divergence followed by recent contact. It is not possible to distinguish true divergence-with-gene-flow from a secondary contact zone at equilibrium between gene flow and selection, but we infer that the hybrid zone is a long-standing, natural interaction. The distinctiveness of these taxa is likely maintained by ecological differences, and the hybrid zone might be an important reservoir of genetic variation.

0643 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

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Population Genetics of the Spinetail Devil Ray (*Mobula japonica*) in the Pacific Ocean

Rays of in the genus *Mobula* (Mobulidae), like other elasmobranchs of the open ocean, are subject to high mortality from bycatch and targeted fisheries. In light of the extremely low fecundity and type of life history of these species, it is clear that continued high levels of (by)catch will be detrimental. However, development of a realistic management program is difficult given the paucity of data on mobulids. Population genetic data can provide important information for their conservation by helping to define conservation units on the basis of genetic populations. Here we focus on *Mobula japonica*, a circum-tropical pelagic species, which is one of the more common rays in the Pacific Ocean. Using twelve variable microsatellite loci and two mitochondrial genes (CO1 and ND5) we surveyed genetic structure across the Pacific Ocean. Samples were collected from six locations spanning the Pacific Ocean basin. Conventional F_{ST} analyses revealed no significant population structure for either mitochondrial or microsatellite data. The apparent absence of population structure in *Mobula japonica* provides a compelling argument for development of broad international approaches for management and conservation of this charismatic species.

0466 AES Physiology & Genetics, Minneapolis Ballroom G, Friday 8 July 2011

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***Squalus acanthias* Swims Using its Vertebral Column as a Spring**

In bony fishes, dynamically bending vertebral columns operate as springs, storing and returning elastic energy, which is hypothesized to be stored mainly in the pressurized intervertebral joints. Also, we assume joints undergo more strain than the stiffer,

mineralized vertebrae. The underlying assumption that vertebrae are stiffer than joints has been challenged in cartilaginous fishes. We demonstrated that both joints and centra strain during bending in *ex vivo* segments of *Squalus acanthias* vertebral column. To determine if significant centra strain occurs in life, we measured *in vivo* vertebral column strains in five *S. acanthias* during a variety of behaviors. As predicted, both centra and joints strained during volitional and manual dynamic bending, with the greatest strains (6% strain in the centrum and 10% strain in the segment) occurring during turning. Centrum strain was similar during volitional swimming and manual undulation (3% strain), but strain was greater in the vertebral segment during manual undulation (5% strain). Thus, it appears that the entire vertebral column of sharks, both joints and centra, is mechanically engaged as a dynamic spring during locomotion. NSF IOS-0922605 supported this work.

0379 Fish Biogeography & Phylogeography, Symphony III, Saturday 9 July 2011

David Portnoy, John Gold

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Evidence of a Surprisingly Recent Vicariant Event in a Geologically Active Suture-Zone in the Gulf of Mexico.

Suture-zones are areas of contact for biotic assemblages where hybridization between related taxa is common. Formation of these zones is thought to involve single vicariant events that affect a broad variety of taxa, followed by divergence and then secondary contact. Such a suture-zone appears to be present in the northeastern Gulf of Mexico where at least 14 clades of fishes and invertebrates meet, with hybridization occurring between a number of taxa. Hypothesized vicariant events in the literature for this region all occur >100,000 years ago. Analysis of molecular data for lane snapper, *Lutjanus synagris*, revealed two divergent assemblages on either side of this zone. Coalescent simulations indicate that these assemblages began diverging ~3,600 to 21,000 years ago. This suggests that processes at the end of Wisconsin glaciation created a previously unrecognized barrier for this and possibly other marine species. These results also suggest that the Gulf suture-zones may be characterized by complex a geological/environmental history featuring multiple vicariant events.

0249 Invasive Species, Symphony I & II, Sunday 10 July 2011

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Community Ecology of Invasions: Direct and Indirect Effects of Aquatic Invaders from Multiple Trophic Levels

With many ecosystems now supporting multiple nonnative species from different trophic levels, principles from community ecology offer a promising context to understand the net effects of invaders. Here, we combined wetland surveys with a mesocosm experiment to examine the individual and combined effects of nonnative predators (western mosquitofish, *Gambusia affinis*) and nonnative grazers (bullfrog larvae, *Lithobates catesbeianus*) on aquatic communities. Among 139 wetlands, nonnative fish correlated negatively with native amphibian richness, bullfrogs correlated negatively with presence of endangered California red-legged frogs (*Rana draytonii*), whereas neither invader influenced western toad presence (*Anaxyrus boreas*). In mesocosms, invasive fish dramatically reduced the abundance of zooplankton and palatable amphibian larvae (*Pseudacris regilla* and *Taricha torosa*), leading to increases in phytoplankton and nutrient concentrations (through loss of zooplankton), and rapid growth of unpalatable toad larvae (through competitive release). Bullfrogs reduced the growth of native anurans but had no effect on survival. Despite strong effects on natives, invaders did not negatively influence one another and their combined effects were additive. Our results highlight how the net effects of multiple nonnative species depend on the trophic level of each invader, the form and magnitude of invader interactions, and the traits of native community members.

0358 SSAR SEIBERT CONSERVATION AWARD, Session I, Minneapolis Ballroom F, Thursday 7 July 2011

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Modeling the Effects of Urbanization on Salamander Abundances using a Before-After Control-Impact Design

Urbanization represents a threat to amphibian populations, especially stream-dwelling salamanders. Although previous studies on urbanization effects on amphibians have been conducted, there is an need to follow populations over longer time periods, account for imperfect detection, and determine the response time to urbanization. Consequently, we used a before-after control-impact (BACI) study design to estimate changes in abundances of larval and adult salamanders in urbanizing streams. From 2005 to 2009, we used standard sampling techniques to obtain a count of salamanders in 13 streams that underwent urbanization of catchment after the first year of sampling.

Simultaneously, we counted salamanders in 17 streams that experienced no disturbance within stream catchments. We used Royle's binomial mixture model to estimate annual mean abundances and individual detection probabilities, and Bayesian inference was used to estimate population parameters for each stage and species. Although mean abundance estimates varied among years in control and urbanized streams, we found that both larval and adult salamander abundances decreased in urbanizing streams, with two-lined salamanders (*Eurycea cirrigera*) being more sensitive than dusky salamanders (*Desmognathus fuscus*). Despite the variance in abundance estimates, we found that abundances were significantly less at urban sites only one or two years after urbanization than at control sites, suggesting a rapid, population-level response to urbanization. Our study highlights the use of the BACI design to study how urbanization affects populations. We emphasize that inferences regarding urbanization effects on populations are more difficult without comparing abundances to control sites, especially for species in which populations fluctuate.

0354 Poster Session I, Friday 8 July 2011; SSAR POSTER AWARD

Steven Price², Evan Eskew¹, Kristen Cecala¹, Robert Browne², Michael Dorcas¹

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Estimating Survival of a Streamside Salamander: Importance of Temporary Emigration, Capture Response and Urban Development

Estimating survival for highly secretive aquatic animals, such as stream salamanders, presents numerous challenges. Salamanders often spend a considerable time under rocks, or in other refugia where they are difficult for capture. The need to quantify vital rates for salamanders is considerable; they are threatened by a wide range of land-use stressors, especially urban development. In this study, we used 34 months of continuous field samples collected at an urbanized and nonurban stream and robust design mark-recapture analysis to evaluate the importance of capture response, temporary emigration, and urban development on survival estimates of the salamander *Desmognathus fuscus*. We constructed a set of a priori candidate models incorporating combinations of time- and location-varying capture and recapture probabilities, capture responses, temporary emigration, and survival estimates and ranked models using Akaike's Information Criterion. We found strong support for month-specific capture probabilities, recapture probabilities, and temporary emigration and a negative behavioral response to capture in the majority of months. We found no support for variation in capture probabilities, recapture probabilities, and temporary emigration between locations; however we found that location strongly influenced survival estimates. Specifically, survival estimates were significantly higher at the nonurban site than at the urban site. Our results emphasize the importance of estimating capture probabilities, recapture probabilities, capture response, and temporary emigration when evaluating survival in highly secretive aquatic animals. Failure to account for these

population parameters will likely yield biased estimates of survival in amphibian populations.

0320 AES Reproduction & Morphology, Minneapolis Ballroom G, Saturday 9 July 2011

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Utilization of Steroid Hormones Extracted from the Skeletal Muscle Tissue of the Little Skate (*Raja erinacea*) and the Spiny Dogfish (*Squalus acanthias*) to Determine Reproductive Status

Currently, circulating levels of plasma steroid hormones have been used as a non-lethal method to determine reproductive maturity and reproductive cycles in elasmobranchs. However, this method can prove problematic to perform on large and/or endangered species, due to difficulties involved with specimen handling. These constraints make it imperative for new techniques to be developed. Previous work conducted on other vertebrates has shown that hormones can be successfully extracted from muscle tissue. The process of collecting muscle samples is quick, minimally invasive, and may be conducted without removing the animal from the water, facilitating its use on larger, and/or endangered species of elasmobranchs. The focus of this presentation will be the development of a valid method for extracting steroid hormones from the skeletal muscle tissue of the oviparous little skate (*Raja erinacea*) and the aplacental viviparous spiny dogfish (*Squalus acanthias*). For each species 80 females are currently being collected from the Gulf of Maine and will consist of 20 immature individuals, to act as control replicates, 20 maturing individuals, 20 mid-gestation individuals, and 20 near parturition individuals. Sample collections of spiny dogfish and little skates began in October 2010, and the remaining samples will be collected this spring. To verify the use of this tissue for reproductive analysis, steroid hormone levels extracted from skeletal muscle will be compared to the concentrations and patterns of those same steroid hormones extracted from plasma, via radioimmunoassay.

0472 Fish Genetics & Morphology, Symphony III, Thursday 7 July 2011

Kevin Purcell, Craig Stockwell

North Dakota State University, Fargo, ND, USA

Evaluation of the Introduction History and Genetic Diversity of a Serially Introduced Fish Population in New Zealand

The reconstruction of invasion routes for invasive species is crucial to the management and evolutionary study of invasive species. The western mosquitofish, *Gambusia affinis*,

has been widely introduced from its native range in the southeastern United States for its putative abilities as a vector control agent. Here we evaluate the introduction history of *G. affinis*, to the north island of New Zealand. We use molecular markers to verify the published historical record of this invasion, and to evaluate the genetic diversity among populations following its serial introduction to New Zealand. We found strong support for the published introduction history, indicating that populations in New Zealand are descended from populations from central Texas. The introduced populations show significant losses of allelic richness ($A_R = 4.55-7.77$) compared to the parental populations ($A_R = 11.44-12.33$). By contrast, heterozygosity did not differ between parental and introduced populations. We also found evidence that the genetic divergence among introduced population in New Zealand ($F_{ST} = 0.0843$) is greater than that of their native source populations ($F_{ST} = 0.002 - 0.009$). It seems that the bottleneck and founder effects of serial introductions in these populations have reduced allelic richness but have had little impact on overall genetic diversity. Understanding the relationship between the introductions and founding populations as well as the impact of serial introduction events will help to manage the introduction of invasives and assist us in understanding the differential success of some populations.

0505 Phylogeography Gulf-Atlantic Symposium, Friday 8 July 2011

Joseph Quattro

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Genetic and Morphological Divergence in Lake Waccamaw Endemic Fishes

Lake Waccamaw, a bay lake located on the Atlantic coastal plain in North Carolina, USA, is an interesting and appropriate system for investigating the role of environmental versus evolutionary influences on morphological diversity. Lake Waccamaw has relatively clear water and high pH and supports a diverse fish community comprised of approximately 42 species. The lake is presumed to be of recent origin, perhaps no more than 15,000 - 32,000 years ago. Despite a recent origin, the lake is unique in having a suite of endemic species, including four species of fishes that form the focus of this talk (*Etheostoma perlongum*, *Fundulus waccamensis*, *Menidia extensa* and an undescribed species of madtom). We discuss similarities and differences in the evolutionary history of these species from three perspectives: phylogeographic, phylogenetic and morphological.