

**1030 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, Salon D, Thursday 7 July 2016**

Kristen Dahl<sup>1</sup>, William Patterson III<sup>1</sup>, Richard Snyder<sup>2</sup>

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**Experimental assessment of lionfish removals to mitigate reef fish community shifts on northern Gulf of Mexico artificial reefs**

Substantial declines in reef fishes were observed on northern Gulf of Mexico reefs between 2009-10 and 2011-12, a time period that brackets the appearance of invasive lionfish. However, a confounding factor during these declines was the Deepwater Horizon Oil Spill (DWH). The extent to which the DWH versus lionfish contributed to initial reef fish declines is unclear, but taxa that experienced the greatest declines are the preferred prey of lionfish in other systems. Targeted lionfish removals have been demonstrated to mitigate or reverse negative impacts on native fishes elsewhere. Therefore, we conducted a two-year experiment to examine the effectiveness and ecological benefits of lionfish removals at artificial reefs (n=27) off northwest Florida, where lionfish densities reached the highest recorded in the western Atlantic by 2013. All lionfish were removed via spearfishing from 17 reefs in December 2013, nine of which were periodically re-cleared of lionfish through May 2015. Remaining sites served as uncleared controls. Both juvenile and adult lionfish quickly recruited to cleared reefs, with lionfish reaching pre-clearance densities in less than a year on reefs cleared once. Removal treatment significantly affected reef fish community structure, but removal effort was insufficient to achieve substantial gains for most taxa, and declines in several taxa were observed throughout the study regardless of treatment. It is unclear whether chronic effects of the DWH or regionally high lionfish densities were more important factors in explaining trends in community structure, but removals had few positive impacts overall on native reef fish communities in this study.

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**0943 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Hollis Dahn, Alejandra Osorio, Jason Strickland, Christopher Parkinson

*University of Central Florida, Orlando, FL, USA*

**Comparative Phylogeography of *Arizona elegans* and *Rhinocheilus lecontei*: Two Perspectives on North American Desert Biogeography**

Post-glacial population expansion and associated secondary contact are common features of North American phylogeography. Cases of incipient speciation such as these are considered especially informative in studying the process of speciation. In these cases, divergent populations have begun to accumulate disparate genetic and

phenotypic traits, and may either fail or continue to speciate at secondary contact. The dynamic geography of North America's arid regions presents an ideal landscape for comparative study of these effects. Separating the two major deserts to the east and west is a combination of high-elevation features known as the Continental Divide. This has shown to be a boundary for eastern and western lineages in many desert taxa. Here we conduct comparative, multi-locus analyses of the historical biogeography and evolutionary histories of lineages within two colubrid snake species, *Arizona elegans* and *Rhinocheilus lecontei*, selected for their relative similarity in ecology as well as range, and for their close phylogenetic relationship. We recovered intraspecific phylogenies of each species as well as divergence time estimates and historical demographics. Our results indicate disparity between the two species in the intensity of population divergences, biogeographical histories of lineages, and levels of introgression between lineages. Major eastern and western clades are recovered in both species with varying levels of substructure. *Rhinocheilus lecontei* presents comparatively larger secondary contact between eastern and western lineages. The apparently differing responses of these organisms to one landscape merits further investigation through an ecological lens.

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## **0522 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kacey Dananay, Michael Benard

Case Western Reserve University, Cleveland, OH, USA

### **Artificial Light at Night: Tests for Direct and Indirect Effects on American Toad Growth, Development and Behavior**

Artificial Light at Night (ALAN) impacts over 20% of the earth's surface, disrupting ecological interactions and individual physiology. We tested whether ALAN affected American toads through either direct impacts on individual toads or by altering the toads' ecological community. We conducted a two-phase experiment using outdoor mesocosms and indoor terraria. In the first phase, we raised toad larvae using a 2x2x2 factorial design manipulating the presence and absence of ALAN, opportunity for colonization (presence or absence of lids to control insect colonization) and the presence or absence of toads. We measured treatment effects on toad traits (growth, development, survival) and ecological community traits (algal growth, invertebrate abundance). The primary effect of ALAN in the first phase was to cause earlier metamorphosis and reduced variability in metamorphosis. We did not detect indirect effects of ALAN on toads mediated through changes in invertebrate colonization. In the second phase, we moved metamorphosing toads into laboratory terraria where they were separated into two post-metamorphic photoperiod treatments: ALAN or natural. In the second phase of the experiment, ALAN during the juvenile stage increased juvenile toad activity but reduced juvenile toad growth. Additionally, toads that experienced ALAN as larvae had reduced growth after metamorphosis, even when they were no longer exposed to ALAN. These results suggest ALAN has important direct effects on amphibians. Expanding our experiment to post-metamorphic life-stages not only revealed a carry-

over effect but also suggested that short-term exposure to ALAN can increase activity and reduce growth.

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**0444 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Kaylan Dance<sup>1</sup>, Jay Rooker<sup>1</sup>, Brooke Shipley<sup>2</sup>, David Wells<sup>1</sup>

<sup>1</sup>Texas A&M University, Galveston, Texas, USA, <sup>2</sup>Coastal Fisheries- Artificial Reef Program, Texas Parks and Wildlife Department, Austin, Texas, USA

**Feeding Ecology of Fishes at Artificial Reefs in the Northwest Gulf of Mexico**

Two heavily exploited species in the Gulf of Mexico (GOM), Red Snapper *Lutjanus campechanus* and Gray Triggerfish *Balistes capriscus*, were used as model species to compare the feeding ecology of a demersal (Red Snapper n=184) and midwater (Gray Triggerfish n=70) predator at near shore (16-30 km) artificial reefs (ARs). Objectives were to compare dietary shifts of both species across different reef types (pyramids, concrete culverts, and quarry rocks) and estimate contribution rates of particulate organic matter (POM) and benthic microalgae (BMA) to each model species. Samples of model species were collected via vertical longline and trap surveys during 2014 and 2015. Epaxial muscle tissue was used to obtain species-specific stable isotope ratios of carbon ( $\delta^{13}\text{C}$ ), nitrogen ( $\delta^{15}\text{N}$ ), and sulfur ( $\delta^{34}\text{S}$ ), and paired with gut content analyses. Differences in  $\delta^{13}\text{C}$  and  $\delta^{34}\text{S}$  of Red Snapper ( $\delta^{13}\text{C}$  mean = -17.70,  $\delta^{34}\text{S}$  mean = 18.70) and Gray triggerfish ( $\delta^{13}\text{C}$  mean = 18.76,  $\delta^{34}\text{S}$  mean = 20.32) were significant (ANCOVA,  $p < 0.05$ ). Gut contents between species were also significantly different (ANOSIM,  $p < .05$ ), with invertebrate fauna (bivalves, echinoderms, and gastropods) in the diets of Gray Triggerfish, and fish in the diets of Red Snapper contributing most to the dissimilarity (using SIMPER analysis) in gut contents. This study illustrates differences in stable isotope ratios and gut contents between species and discusses them across reef types, as well as the estimated contribution of POM and BMA to both model species.

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**0359 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Jon Davenport<sup>1</sup>, Blake Hossack<sup>2</sup>, LeeAnn Fishback<sup>3</sup>

<sup>1</sup>Southeast Missouri State University, Cape Girardeau, MO, USA, <sup>2</sup>United States Geological Survey, Missoula, MT, USA, <sup>3</sup>Churchill Northern Studies Centre, Churchill, MB, Canada

**Additive impacts of experimental climate change increase risk to an ectotherm at the Arctic's edge**

Ectotherms are particularly susceptible to environmental change (e.g., warming and wetland drying). Several studies in temperate environments have examined the adaptive capacity of organisms to greater understand the potential repercussions of

warming and associated accelerated drying for freshwater ecosystems. However, few experiments have examined these impacts in Arctic or Subarctic freshwater ecosystems, where the climate is changing most rapidly. To evaluate the capacity of a widespread ectotherm to anticipated environmental changes, we conducted a mesocosm experiment with the wood frog (*Rana sylvatica*) in the Subarctic. Three warming treatments were fully crossed with three drying treatments to simulate a range of predicted changes in wetland environments. We measured survival, growth rate, and size at metamorphosis. We predicted wetland warming and drying would act synergistically, with water temperature partially compensating for some of the negative effects of accelerated drying. Across all drying regimes, a 1°C increase in water temperature increased the odds of survival by 1.79, and tadpoles in 52-day and 64-day hydroperiod tanks were 4.1–4.3 times more likely to survive to metamorphosis than tadpoles in 45-day tanks. For individuals who survived to metamorphosis, there was only a weak negative effect of temperature on size. Our results reveal that one of the dominant herbivores in Subarctic wetlands, wood frog tadpoles, are capable of increasing their developmental rates in response to increased temperature and accelerated drying, but only in an additive manner. The strong negative effects of drying on frog survival suggest that drastic alterations may be occurring in Subarctic wetland communities.

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## **0167 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Donald Davesne, Matt Friedman

*Department of Earth Sciences, University of Oxford, Oxford, UK*

### **A History of Sea Serpents: Reassessing the Early Fossil Record of Lampridiformes (Teleostei: Acanthomorpha)**

Lampridiformes is a morphologically distinctive group of marine pelagic acanthomorph teleosts, including iconic species such as the homeothermic opah (*Lampris guttatus*) and the giant elongated oarfish (*Regalecus glesne*). A relatively high number of Lampridiformes relatives are known in the fossil record, as early as the Late Cretaceous (~95 million years). However, the phylogenetic position of most of these fossil taxa is poorly constrained. In order to better understand the early evolution of Lampridiformes, we reviewed several Palaeogene fossil taxa within the most recent phylogenetic frameworks. For example, *Whitehippus* (Early Eocene of England) is redescribed with CT-scan data. In contrast with previous interpretations that included it within Ephippidae (spadefishes), we show that this taxon is one of the oldest anatomically modern Lampridiformes. On the other hand, the very strange *Bajaichthys* from the Middle Eocene of Italy, while described as an elongated lampridiform (Taeniosomi), probably does not belong to this group. Finally, we present a preliminary phylogenetic analysis of Lampridiformes including Palaeogene taxa alongside modern diversity. The deep-bodied, so-called "veliferoid" or "bathysome" fossil taxa are placed at varying positions in the tree, helping to break down the sequence of acquisition of modern lampridiform's characters states.

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## 0247 Fish Systematics II, Salon F-H, Saturday 9 July 2016

Donald Davesne<sup>1</sup>, Cyril Gallut<sup>2</sup>, Olga Otero<sup>3</sup>

<sup>1</sup>*Department of Earth Sciences, University of Oxford, Oxford, UK*, <sup>2</sup>*ISyEB, Université Pierre et Marie Curie/Muséum national d'Histoire naturelle, Paris, France*, <sup>3</sup>*IPHEP, Université de Poitiers, Poitiers, France*

### **Towards a Consensus for Deep Intrarelationships of Acanthomorph Teleosts**

Since the 2000s, numerous large-scale molecular phylogenies have restructured the spiny-rayed teleost (Acanthomorpha) evolutionary tree and challenged previous hypotheses, mainly based on anatomy. However, major uncertainties remain, imputable to the various topologies obtained by different molecular studies. This is particularly true for the first dichotomies of the acanthomorph tree. To address these uncertainties, we performed two sets of analyses: - analyses of a morphological dataset including extant and Upper Cretaceous fossil representatives of every major acanthomorph clade; - analyses of molecular datasets, including nuclear and mitochondrial markers, with a similar taxonomic coverage. The separate analyses of these datasets show how different lines of evidence converge towards a consensual acanthomorph tree. Acanthomorph monophyly is recovered by morphological data, individual nuclear gene partitions and also by the mitogenome, but with low support values. A clade including Polymixiiformes (beardfishes), Percopsiformes (trout-perches), Gadiformes (cods and allies), Zeiformes (dorids) and *Stylephorus* (tube-eye) is always recovered with high support, but the precise position of Polymixiiformes and *Stylephorus* is variable from one dataset to another. The inclusion of Ophidiiformes (cusk-eels and allies) and Batrachoidiformes (toadfishes) in a clade with Beryciformes (soldierfishes and allies) is also always recovered. Finally, Lampridiformes (oarfish and allies) are always recovered as sister-group to other acanthomorphs, but with a weak support.

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**1061 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday  
10 July 2016**

Solomon David<sup>1</sup>, Scott Hansen<sup>4</sup>, Peter McIntyre<sup>3</sup>, Andrew Rypel<sup>4</sup>, Charles Madenjian<sup>2</sup>, Eric Larson<sup>5</sup>, Olivia King<sup>7</sup>, Bryan Frenette<sup>6</sup>, Wendy Stott<sup>2</sup>

<sup>1</sup>John G. Shedd Aquarium, Chicago, IL, USA, <sup>2</sup>U.S. Geological Survey Great Lakes Science Center, Ann Arbor, MI, USA, <sup>3</sup>University of Wisconsin-Madison, Madison, WI, USA, <sup>4</sup>Wisconsin Department of Natural Resources, Madison, WI, USA, <sup>5</sup>University of Illinois Urbana-Champaign, Champaign, IL, USA, <sup>6</sup>Kansas State University, Manhattan, KS, USA, <sup>7</sup>North Central College, Naperville, IL, USA

**Call It a Comeback: Reemergence and Restoration of Great Lakes Coregonid Fishes**

Coregonid fishes serve important ecological and economic roles throughout the Laurentian Great Lakes, both presently and historically. The Lake Whitefish (*Coregonus clupeaformis*) constitutes the largest commercial fishery in Lake Michigan. The Cisco (*Coregonus artedii*) was once the largest commercial fishery on multiple Great Lakes before crashing due to a combination of overfishing, habitat loss, and invasive species in the mid 20th century. River spawning migrations of Lake Whitefish greatly declined in the early 20th century due to habitat loss, but have reemerged in the past decade in northern Lake Michigan. The primary drivers for reemergence of these migrations are currently unknown; additionally, little is known regarding the ecology of these river-spawning populations. To investigate potential differences among migratory and non-migratory populations of Lake Whitefish, we compared stable isotope signatures ( $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ ), age and growth (otoliths), gill rakers, and morphometrics of three river- and two nearshore-spawning Lake Whitefish populations in Lake Michigan from 2012-2014. Results indicated river-spawning Lake Whitefish were significantly different in morphology and stable isotope signatures from nearshore-spawning Lake Whitefish in northern Lake Michigan, whereas differences in gill rakers were less distinct. These results will help identify migratory and non-migratory Lake Whitefish populations during non-spawning season sampling and harvest, as well as informing restoration efforts for Cisco and other coregonid fishes throughout the Great Lakes region.

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**0025 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Lindsay Davidson, Nicholas Dulvy

*Simon Fraser University, Burnaby, Canada*

**Global Marine Protected Areas for Avoiding Extinctions**

Target 11 of the Convention on Biological Diversity (CBD) outlines that 10% of global coastal oceans should be designated as a Marine Protected Areas (MPA) by 2020. This area goal has driven rapid gains in global MPA coverage but it remains unclear whether threatened species are being protected. We find the area-grabbing approach of MPA designations will fail to avert extinctions of sharks, rays, and chimaeras (Class Chondrichthyes). We find that only 10 of the 99 most vulnerable and irreplaceable chondrichthyans meet the minimum protection target of 10% of their range within a MPA and only one (*Squalus raoulensis*) is found in a Marine Reserve - those areas that are no-take and strictly protected. However, to protect chondrichthyans the solution is simple. Using a unique dataset we identify twelve countries that harbour over half of the world's vulnerable and irreplaceable chondrichthyans, as well as three-quarters of wide-ranging threatened species within an area of less than 1% of the world's ice-free oceans. These countries have much room for conservation and management action in terms of (i) adequate Shark-Plans, (ii) shark finning regulations, (iii) conserving migratory sharks and rays, (iv) commitments to eliminating Illegal Unreported and Unregulated fishing. Looking forward, an additional 3.5% of the global ice-free EEZ area would protect 50% of the global distribution of the 99 threatened endemics - well below the 10% target. Our analysis lays the foundation for marine biodiversity conservation goals beyond 2020.

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**0032 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Drew Davis<sup>1</sup>, Cameron Siler<sup>2</sup>, Jacob Kerby<sup>1</sup>

<sup>1</sup>*Department of Biology, University of South Dakota, Vermillion, SD, USA,*

<sup>2</sup>*Department of Biology, University of Oklahoma, Norman, OK, USA*

**Co-infection of *Batrachochytrium dendrobatidis* and Ranavirus in Amphibians from Northern Luzon, Philippines**

Amphibians are one of the most threatened groups of organisms on earth, with reports suggesting that one-third of the world's species are at risk of extinction. Although factors contributing to this biodiversity crisis include habitat loss, a major concern has been the emergence of infectious diseases, particularly *Batrachochytrium dendrobatidis* (*Bd*) and ranaviruses, which are known to cause large amphibian die-offs. At the core of mitigating negative effects these pathogens have on amphibian populations is a need for a comprehensive understanding of their distribution and of what amphibian species are particularly susceptible to infection. While there has been increasing interest in

understanding the distribution of these pathogens in tropical Southeast Asia, there are still large regions with limited information on the distribution of these pathogens. Here, we sampled both skin swabs and tissue (liver) samples from multiple species of anurans from Aurora Province, Luzon Island, Philippines for infection by both *Bd* and ranavirus. We report on pathogen prevalence and infection intensity as well as comment on conservation priorities in this region.

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## **0526 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Mark Davis<sup>1</sup>, Michael Dreslik<sup>1</sup>, Sarah Baker<sup>1</sup>, Chris Phillips<sup>1</sup>, Charles Smith<sup>2</sup>, Roger Repp<sup>3</sup>, Gordon Schuett<sup>4</sup>

<sup>1</sup>Illinois Natural History Survey, Champaign, IL, USA, <sup>2</sup>Wofford College, Spartanburg, SC, USA, <sup>3</sup>National Optical Astronomy Observatory, Tucson, AZ, USA, <sup>4</sup>Georgia State University, Atlanta, GA, USA

### **A Comparative Assessment of Pitviper Life Histories Using Robust Quantification**

Biodiversity in the Anthropocene faces unprecedented challenges that may differentially impinge upon life stages of species. As such, quantifying life histories and assessing their elasticities and sensitivities can yield key insights into the endangerment process itself, while also informing adaptive management strategies. However, data to populate such models are hard won, particularly given the relatively long life spans of pitvipers, their often cryptic and semi-fossorial nature, and the periodicity and term of modern funding cycles. And yet the advent of the Endangered Species Act paved the way for long-term mark-and-recapture (MR) studies of imperiled pitvipers (e.g. Eastern Massasauga, *Sistrurus catenatus*; New Mexico Ridge-Nosed Rattlesnake, *Crotalus willardi obscurus*). These and studies of other pitviper species provide the fodder for a comparative assessment. Here we accessed long-term (>5 years) MR datasets for pitvipers and estimated fecundity and stage-specific survival rates. We constructed Leftkovich matrices for each species and conducted Eigenanalyses to yield asymptotic population growth ( $\lambda$ ), stable stage distributions, and matrix element elasticities and sensitivities. Similarities and differences between pitviper species were then identified. The results of our analyses 1) underscore the importance of long-term datasets to parameterize population models, 2) identifies commonalities and disparities in pitviper life histories, 3) inform targeted adaptive management strategies aimed at promoting sensitive stage classes, and 4) yield a key step in developing population viability analyses for imperiled pitviper species.

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## **0589 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Matthew Davis

*St. Cloud State University, St. Cloud, MN, USA*

### **Evolutionary Relationships and Patterns of Diversification among the Lizardfishes and their Allies (Teleostei: Aulopiformes)**

This study focuses on the morphologically diverse and species-rich (~250 species) lineage of lizardfishes (Aulopiformes), which are found in marine habitats worldwide. Aulopiform fishes inhabit marine environments ranging from coral reefs to the deep sea, and possess adaptations (e.g., bioluminescent organs, predatory innovations, hermaphroditism) that may have impacted their diversification. For this study, the patterns and processes of diversification among aulopiform fishes are investigated. A densely sampled, multi locus, and temporal phylogenetic hypothesis of aulopiform evolutionary relationships is used to inform lineage diversification and character evolution (e.g., depth partitioning, bioluminescence, reproductive strategy) across the lizardfishes radiation.

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## **0524 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Matthew Davis, Toby Daly-Engel

*University of West Florida, Pensacola, FL, USA*

### **Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*) Rangewide Genetic Stock Structure**

The Atlantic Sharpnose shark (*Rhizoprionodon terraenovae*) is a small coastal species associated with the subtropical and tropical waters of the Gulf of Mexico (GoM) and northwest Atlantic. The members of the genus *Rhizoprionodon* are often utilized by small-scale fisheries as an important resource, and *R. terraenovae* alone represents 46% of annual artisanal elasmobranch catches in the southern GoM. Despite the species' commonality in both artisanal and commercial fisheries, relatively little is known regarding its reproductive behavior, range limits, and movement patterns. We seek to characterize the fine-scale genetic connectivity of this species through statistical comparison of DNA sequences from both the mitochondrial and nuclear genome, including >650 base pairs of the control region and 10-12 microsatellite loci cross-amplified from congener species. To date we have accumulated over 500 *R. terraenovae* tissue samples from 10 sites throughout its range from Rhode Island to Belize, and collections are ongoing. With these data we delineate the patterns of gene flow, philopatry, and dispersal in *R. terraenovae*, information that will enable managers and conservationists to better protect and manage this species in the future.

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**0479 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016**

Julie L Day<sup>1</sup>, Ron Barnes<sup>2</sup>, Darrick Weissenfluh<sup>1</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, Klamath Falls, OR, USA, <sup>2</sup>Gone Fishing, Klamath Falls, OR, USA

**From Manuscript to Management: Development of a New Assisted Rearing Program for Endangered Klamath Suckers (Catostomidae)**

Decades of inadequately abated natural and anthropogenic threats coupled with competing and often controversial water needs have resulted in the compromised status and endangered listing of numerous freshwater fishes, many of which are now artificially propagated in hatcheries. However, low survival of hatchery-reared fish is a commonly reported problem for many programs, particularly those being implemented in systems with substantial non-native predator populations. Extensive sampling for shortnose (*Chasmistes brevirostris*) and Lost River sucker (*Deltistes luxatus*) in the Klamath River Basin have failed to detect any new adult recruitment for at least two decades, elevating concern that senescence of the population will result in the demise of the species and prompting an investigation into propagation. Balancing the risks of interfering with natural ecological and evolutionary processes for the good of the species requires a substantial investment in recognizing synergies within the existing knowledge base prior to moving forward with program design. As such, we are developing a new assisted rearing program designed to address the need to minimize human intervention in the rearing process and alleviate risks associated with domestication. Wild-spawned fish are collected in relatively low numbers as larvae or young juveniles and reared in a series of earthen ponds that are operated as semi-natural mesocosms, and success to date has been promising. Here we present an overview of how key concepts identified in academic literature are incorporated into management actions associated with this program, and an update on initial collection and husbandry activities which commenced in November 2015.

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**0692 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Juan D. Daza<sup>1</sup>, Virginia Abdala<sup>4</sup>, Aaron M. Bauer<sup>3</sup>

<sup>1</sup>Sam Houston State University, Huntsville, Texas, USA, <sup>2</sup>Marquette University, Milwaukee, Wisconsin, USA, <sup>3</sup>Villanova University, Villanova, Pennsylvania, USA, <sup>4</sup>Instituto Miguel Lillo, Universidad Nacional de Tucumán, San Miguel de Tucumán, Tucumán, Argentina

**Synapomorphies and symplesiomorphies in geckos from the southern cone of South America: *Garthia* and *Homonota* (Squamata: Gekkota: Phyllodactylidae) revisited**

The genus *Homonota* from southern South America comprises ten species of broad-headed geckos, which reach the austral limit for the Gekkota. Historically,

morphological data have supported the monophyly of a clade including *Homonota* and the Chilean genus *Garthia*, with the latter possibly embedded within the former. On the other hand, recent molecular evidence indicates that these two genera are in separate clades, and that *Homonota* is more closely related to the leaf toad geckos of the genus *Phyllodactylus*. Here we analyze a combined analysis of 659 morphological characters and eight nuclear loci in an analysis that includes *Garthia*, *Homonota*, *Phyllodactylus*, and other phyllodactylid geckos. Our results indicate that *Homonota* and *Garthia* are nearly indistinguishable on morphological grounds and share a vast majority of characters both externally and internally. The result of these analyses suggests many morphological states in *Garthia* and *Homonota* are symplesiomorphic in reference to the differentiation of the American leaf-toed geckos.

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### **0703 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Juan D. Daza<sup>1</sup>, Raynie Leard<sup>1</sup>, Aaron M. Bauer<sup>2</sup>, Emma Sherratt<sup>3</sup>

<sup>1</sup>Sam Houston State University, Huntsville, Texas, USA, <sup>2</sup>Villanova University, Villanova, Pennsylvania, USA, <sup>3</sup>University of New England, Armidale, New South Wales, Australia

#### **The Amber Gecko *Sphaerodactylus dommeli*: One Species or Two?**

The amber gecko *Sphaerodactylus dommeli* from Hispaniola was described in 1984 based on two specimens. These geckos date back to the late Early Miocene or early Middle Miocene, 15 to 20 ma. Since their discovery, there have been some claims that they are anoles and not geckos. Based on High-resolution x-ray computed tomography (HRXCT) data, we confirm that the two specimens are in fact geckos. In order to ascertain that these amber geckos are one or two species, we examined intraspecific size variation using a postnatal series of the Puerto Rican gecko species *Sphaerodactylus townsendi* including hatchlings and skeletally mature specimens. Cleared-and stained preparations and digital x-rays from *S. townsendi* specimens were measured digitally. Based on linear measurements we were able to determine that skeletally-mature specimens are about 2.4 times larger than the hatchlings. We demonstrated that the holotype of *S. dommeli* is 2.4 times larger than the paratype, suggesting they correspond to adult and hatchling stages, respectively. However morphological differences not attributable to observed ontogenetic changes in *S. townsendi* indicates that *S. dommeli* is represented by specimens from two distinct species; the paratype has a proportionally longer shorter snout, a well-developed lateral process of the postorbitofrontal, and pointed posteromedial laminae of the parietal, rather than rounded as in the holotype. Based on the new evidence, we conclude that the paratype of *S. dommeli* needs to be described as a separate species, adding to the large number of Dominican amber species that remain to be formally characterized.

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**0386 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Simon Dedman<sup>1</sup>, Rick Officer<sup>1</sup>, Deirdre Brophy<sup>1</sup>, Maurice Clarke<sup>2</sup>, Dave Reid<sup>2</sup>

<sup>1</sup>*Galway-Mayo Institute of Technology, Galway, Ireland*, <sup>2</sup>*Marine Institute, Galway, Ireland*

**Gbm.auto - a Decision Support Tool automating Boosted Regression Tree modelling of data-poor species abundance using environmental and human inputs, mapping essential habitats, and designing MSY-based MPAs considering stakeholder priorities**

The gbm.auto R package suite automates and greatly simplifies delta log-normal Boosted Regression Tree spatial modelling, removing the high technical barrier that prevents many potential users from reaping the benefits of this powerful statistical modelling technique. The package and its documentation allow users with very little experience of R to generate maps of predicted abundance, representativeness maps for those abundance maps, bar plots of the relative influence of explanatory variables, dot and line plots of the relationships between explanatory variables and response variables, databases of the processed model objects, and a report explaining all the steps taken within the model. This process can be used to map essential habitats such as nursery grounds and spawning areas, to produce areas of key conservation importance for multiple species. Escapement biomass - the percentage of the stock which must be retained each year to conserve it - is then combined with the predicted abundance maps to create a Decision Support Tool that generates location and size options for MPAs to protect the target stocks, based on stakeholder priorities, especially the minimisation of fishing effort displacement. In bridging the gap between advanced statistical mathematics and conservation science/management/policy, these tools can allow improved spatial abundance predictions, and therefore better management and better conservation. This poster demonstrates how the package is used and the outputs it produces.

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**0264 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Simon Dedman<sup>1</sup>, Rick Officer<sup>1</sup>, Deirdre Brophy<sup>1</sup>, Maurice Clarke<sup>2</sup>, Dave Reid<sup>0</sup>

<sup>1</sup>*Galway-Mayo Institute of Technology, Galway, Ireland*, <sup>2</sup>*Marine Institute, Galway, Ireland*

**A flexible decision support tool for Maximum Sustainable Yield-based MPA design**

Novel, spatial approaches have been called for to manage elasmobranchs, but existing techniques struggle to model abundance hotspots and essential habitats of data-poor stocks. When proposed MPA's are presented as definitive and singular solutions this can entrench an antagonistic relationship between fisherman and managers/scientists. We have used survey data and discarding records to develop Fmsy (fishing CPUE equating

to Maximum Sustainable Yield) and Bpa (precautionary minimum total biomass to support a species) proxies for these populations, allowing us to estimate the proportion of population biomass that must be conserved annually to meet PA or MSY thresholds, i.e. escapement. We have then applied Boosted Regression Tree modelling of survey catch and environmental factors such as depth, substrate and flow, to map skate and ray abundance hotspots. The outputs are combined with international fishing effort data (VMS) and fed into a custom-built Decision Support Tool (DST), to identify the location and size of candidate MPAs that could protect the escapement PA biomass while minimizing the displacement of fishing effort. The DST allows fishermen, managers and scientists to use spatial management, underpinned by fisheries science, to explore MPAs which incorporate different and often conflicting priorities. The entirety of this work has been integrated into a simple R package which takes surveyed CPUE and environmental data and produces CPUE hotspot maps for a whole study area, including for sensitive subsets such as nursery areas, and an MPA-generating DST incorporating stakeholder priorities.

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## **0922 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Brian Deis, Kathleen Cole

*University of Hawaii at Manoa, Honolulu, HI, USA*

### **Reproductive Behavior and Bi-directional Sex Change in a Cryptobenthic Reef Fish, *Eviota epiphanes* in Hawaii**

*Eviota epiphanes*, a small (2cm TL), cryptobenthic species of goby (Family Gobiidae) has been documented as the most abundant fish on near shore reefs in Hawai'i. *Eviota epiphanes* (Family: Gobiidae) is a reef fish native to the Hawaiian Islands, and has been hypothesized to be a bi-directional hermaphrodite (i.e., able to alternate between sperm and ova production) (Cole 2010). In addition, elements of the courting behavior displayed by species in this genus are hypothesized to be phylogenetically informative (Sunobe 1998). Individuals were collected around Oahu and observed in aquaria in pairs of two ova-producing individuals, two sperm-producing individuals, and one ova-producing individual and one sperm-producing individual. Behavioral observations and, when appropriate, the associated presence of eggs, were recorded daily. From these data behaviors associated with reproduction in *E. epiphanes* were characterized and quantified, in order to test hypotheses proposed by Cole (2010) and Sunobe (1998). The results of this study demonstrated for the first time bi-directional sex change in *E. epiphanes*, and found courting behavior to be inconsistent with what is hypothesized as representative for the assigned *Eviota* clade in Sunobe (1998) to which *E. epiphanes* has been assigned (Karnella and Lachner 1980). In addition, significant differences were found in the frequency of certain behaviors between different pair types. This research is the first in-depth look into the social and reproductive behavior of *E. epiphanes* and, as such, will contribute to the growing literature on the biology of both serially hermaphroditic and cryptobenthic reef fishes.

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## 0836 General Herpetology, Balconies L & M, Sunday 10 July 2016

Jennifer Deitloff<sup>1</sup>, Jacob Fetterman<sup>1</sup>, Todd Pierson<sup>2</sup>

<sup>1</sup>Lock Haven University, Lock Haven, PA, USA, <sup>2</sup>University of Tennessee Knoxville, Knoxville, TN, USA

### **Variation in mating tactics of *Eurycea wilderae*: Does morphology correlate with mating strategy used by males?**

Amphibians exhibit a wide variety of mating systems and characteristics, including variation in tactics used to find or acquire mates. Specifically, species within the *Eurycea bislineata* complex exhibit a continuum of male morphologies and diverse habitat associations. During this study we examined behavior of *Eurycea wilderae*, focusing on differences in behavior between the two different male morphologies common in this species. One form possesses long cirri and a slender head (cirriferous), and the other form has a larger, robust head (robust morph or previously described as Morph A in *E. wilderae*). Based on previous studies of *Eurycea* mating strategies, we tested three hypotheses: (1) Morph A males would display mate guarding behaviors, but males with the cirriferous morph would not; (2) neither morph would exhibit territoriality; and (3) the cirriferous morph would be able to detect, and would prefer areas containing, female pheromones. We did not find any support for the hypothesis about mate guarding: neither morph exhibited aggression towards males in the presence of females and, as expected, neither morph showed territoriality behaviors. We did determine that males likely detect and show a preference for areas that contain female pheromones; however, the male morphology types did not show a significant difference in this ability. This study demonstrates that the relationship previously described between male morphology and mate strategy in other *Eurycea* species does not hold true for all the species within this complex. We hope to continue to explore the differences in mating strategies within *Eurycea* in the future.

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## 0801 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016

Caitlin Dempsey, Kimberly Richard, Lance Olson, Michelle Norden, Robert Hancoc

Metropolitan State University of Denver, Denver, CO, USA

### **Who's out there: Integration of stationary point counts and conservation photography to assess reef fish biodiversity**

In the face of declining coral reefs due to human impacts, periodic assessments of "reef health" have been implemented. Conventional scientific methods include standardized fish counts executed in defined areas on randomly selected reefs by trained SCUBA divers. These counts rely predominantly on *in situ* identifications of fishes by the divers

with adjunct photography being performed for unknown fishes. Examined in this study was the utilization of underwater photography and fish counts with intentions to enhance representation of the biodiversity in demersal reef fishes. We coupled stationary point count surveys in designated 10 M cylinders with free roaming photography to compare measurable indices of biodiversity between openly fished areas, and ecologically similar no-take preserve areas within the Florida Keys National Marine Sanctuary. The availability of high quality digital photography and videography conjoined with high capacity memory storage enabled a visual census to be catalogued in a greater capacity than past methods allowed. Preliminary results indicate differences in biodiversity between openly fished and the preserved reefs.

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## **0169 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

John Denton

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

### **Diversification patterns in myctophiform fishes suggest a positive response to a range of oceanic perturbations**

Although the deep-sea environment is the largest ecosystem on the planet, little is known about how its species may respond to environmental changes over evolutionary timescales. Fishes in the order Myctophiformes (lanternfishes, blackchins) exhibit a worldwide distribution, extreme biomass abundance, and intermediate trophic position, making them a useful proxy for overall biotic response in the midwater environment. I analyze myctophiform diversification rates using a time-calibrated phylogeny, comprising 138 of the approximately 254 species in the order, and accounting for node calibration density uncertainty, and show that myctophiform fishes exhibit a continuously increasing diversification rate, in contrast with the patterns of decreasing or constant diversification through time inferred for other widespread clades. The increasing diversification rate in myctophiform fishes is accompanied by three major rate shift locations, with temporal patterns broadly coinciding with large-scale ocean acidification, anoxia, and cooling events responsible for thermohaline disruption and the establishment of deepwater circulation. These results suggest that diversification in myctophiform fishes may be positively responsive to a wide range of changes in oceanic climatic conditions.

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**0377 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C,  
Friday 8 July 2016**

Robert Denton<sup>1</sup>, Kyle McElroy<sup>2</sup>, Laura Bankers<sup>2</sup>, Joel Sharbrough<sup>2</sup>, Maurine Neiman<sup>2</sup>, Lisle Gibbs<sup>1</sup>

<sup>1</sup>Ohio State University, Columbus, Ohio, USA, <sup>2</sup>University of Iowa, Iowa City, Iowa, USA

**Quantifying Genome Theft and Characterizing Gene Expression Patterns in Unisexual *Ambystoma* Salamanders**

Unisexual *Ambystoma* salamanders are an all-female vertebrate lineage with the potential to add and replace genomes from males of sexual *Ambystoma* salamander species. The result of this reproductive mode is a staggering diversity of genome compositions within unisexual salamanders: from triploid to pentaploid with genomes potentially representing five different species. While many unisexual animal lineages are considered "evolutionary weeds", this unisexual lineage is currently the oldest recognized in vertebrates (~5 mya) and unisexuals are abundant across a large area of eastern North America. We present two separate genetic analyses that potentially address the evolutionary success of unisexuals. First, we directly quantified the gene flow from two sexual species (*A. jeffersonianum* and *A. laterale*) into the unisexual lineage using species-specific microsatellites and model-based analyses. Second, we compared relative gene expression across the subgenomes of a triploid unisexual individual with three different parental genomes (*A. laterale*, *A. texanum*, and *A. tigrinum*). We used a competitive transcript mapping technique to show that expression is balanced across the unisexual's haploid genomes and the majority of genes that are differentially expressed are dominated by the *A. tigrinum* genome. This work presents one of strongest pieces of evidence for the "theft" of sperm in the unisexual genome and provides a new direction in understanding how sexual genomes behave after being captured into the unisexual lineage.

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**1010 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Brian Devlin, Tiffany Doan, Kevin Greene

University of Central Florida, Orlando, Florida, USA

**Differential Rates of Malarial Infection by *Plasmodium floridense* between two *Anolis* species in Central Florida**

Central Florida is home to two species of *Anolis* lizards. *Anolis carolinensis* is native to the southeastern United States, whereas *Anolis sagrei* is an invasive species native to the islands of the Caribbean. *Plasmodium floridense* is a saurian malaria parasite known to infect both of these species, but the prevalence of infection by *P. floridense* of these two lizard species had never been examined in Central Florida. We hypothesized that *A.*



*sagrei* would suffer a higher infection rate than *A. carolinensis* because the native species has coexisted with the parasite much longer, potentially evolving some resistance to infection. We captured lizards by either slip noose or by hand, and the third toe on the right rear leg was clipped for marking and for a blood sample. We measured parasite prevalence between these two species in multiple sites of Central Florida over 3 months in 2016. Presence and prevalence were based on examination of fixed and stained blood smears for 3 minutes under a microscope. The invasive *A. sagrei* was found to have a higher rate of *P. floridense* infection than *A. carolinensis*. Although the reason for differences in infection rate between the two species is not known, higher infection rates in *A. sagrei* may be related to their high population density. Further study could indicate patterns of distribution of *P. floridense* in the southeastern United States.

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**1119 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D,  
Friday 8 July 2016**

Jayna L. DeVore, Michael Crossland, Richard Shine

*University of Sydney, NSW, Australia*

**Invasion and Evolving Plasticity: Influences of Disparate Predator  
Communities and Shifting Parental Investment on Cane Toad Plastic  
Responses**

As exotic invasive species colonize new habitats they frequently encounter novel predator communities and shifts in competitive pressures. Plastic responses allow for rapid adaptation to unpredictable environments, thereby frequently enhancing performance, but the optimal plastic response might change as new habitats are colonized. Additionally, the severity of the costs incurred as a consequence of these responses may differ depending on their nature or the condition of the individual in question. We used common gardens in Australia and Hawaii to investigate the nature and cost of plastic responses to predation by dragonfly larvae and food limitation in cane toad tadpoles from a variety of established populations and the Australian invasion front. In Australia, where the majority of predators find cane toads unpalatable, we found evidence of chemical plasticity in response to predator cues, whereas Hawaiian populations responded to predators through behavioral modifications. We also found that the costs of predator-induced plasticity were highest at the Australian invasion front and correlated with egg size, such that reductions in embryo volume along the invasion front drove reduced survival in predator-exposed treatments. This appears to be a consequence of shifting parental investment along advancing front, in which parents are investing in larger numbers of lower quality offspring to maximize population growth in newly colonized environments. The divergent trajectories in the evolution of these responses since toad introduction in the 1930s exemplify how quickly plastic responses to environmental cues can be modified, and has implications for both toads and their predators as the invasion advances.

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## 0733 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016

Alyse DeVries, Paul Bartelt

*Waldorf College, Forest City, IA, USA*

### **Response of Eastern Tiger Salamanders to Restored Wetlands on an Agricultural Landscape in North Central Iowa: Preliminary Results**

Wetland drainage has predictable effects on amphibian populations; but, how soon after restoration will amphibians colonize wetlands? How do they use the intervening row-crop matrix to find these "islands" of wetlands? Over 150 years of agriculture has reduced prairie pothole wetlands in north Iowa to a fraction of its former expanse, but substantial amounts of wetlands have been restored over the last 20 years. We measured occupancy and colonization patterns of Eastern Tiger Salamanders (a species of conservation concern in Iowa) among recently restored wetlands in Winnebago County, IA. In 2014, we used visual encounter surveys and unbaited minnow traps to estimate occupancy in 45 ponds among 19 restored wetlands, including 14 ponds among 5 wetlands that were restored in 2013. Each pond was surveyed at least twice. In 2015, we used radio-telemetry, GPS, and a GIS to begin mapping movement and habitat use patterns of 12 salamanders. Combining results from both visual and trapping surveys, naïve estimates of salamander occupancy was 60% (27/45) of all ponds and 67.7% (21/31) of older ponds (2-20 years old). Occupancy models ( $\psi$ ) showed that salamanders occupied 74+/-21% of all ponds and 90+/-26% of older ponds. Salamanders traveled an average daily distance of 12.4+/-8.2 m; they moved a total of 286.3+/-168.2 m for the season. Five (perhaps seven) salamanders were eaten by predators; one was killed by agricultural equipment. This year we are repeating telemetry with another 25 salamanders and collecting tissue samples for genetic analysis across a larger portion of the landscape.

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## 0445 Fish Systematics II, Salon F-H, Saturday 9 July 2016

Casey Dillman<sup>1</sup>, Richard Vari<sup>1</sup>, Brian Sidlauskas<sup>2</sup>

*<sup>1</sup>Smithsonian Institution, National Museum of Natural History, Washington, D.C., USA, <sup>2</sup>Oregon State University, Corvallis, OR, USA*

### **A Complete Morphological Supermatrix for the Superfamily Anostomoidea (Teleostei: Characiformes). What can it tell us about history?**

The freshwater superfamily Anostomoidea is endemic to the Neotropical realm, and is very diverse with nearly 300 species unequally assigned to 27 genera in four families. Decades of synthetic studies at the familial and generic levels have resulted in numerous monographs, and, more germane to the present study, a vast number of morphological character-state descriptions for various focal ingroup. From these publications 463 anatomical characters were culled and compiled. Each character was scored for 222 terminals via direct specimen examination. The resultant supermatrix was then examined in two distinct ways. The first used the full matrix to reconstruct hypotheses

of relationships using non-parametric and parametric approaches. The second saw the supermatrix subdivided into character-complex matrices and then analyzed to build a phylogenetic hypothesis of relationships. Each of these was subsequently used in the construction of an MRP supertree for comparison with hypotheses obtained with the full supermatrix.

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**0199 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Erin Dillon, Aaron O'Dea

*Smithsonian Tropical Research Institute, Panama City, Panama*

**Dermal Denticles as a Tool to Reveal Pre-exploitation Shark Communities**

What were shark communities like before humans? Ecological surveys and historical records demonstrate significant declines in shark populations, yet pre-exploitation baselines are nonexistent. Fossil dermal denticles may offer insight into pre-human shark communities. Denticles are well-preserved in reef sediments, but their identification represents a major challenge. To address this problem, we built a large reference collection from museum and local collections comprising 215 denticles from 37 species within 16 elasmobranch families. Morphometric analysis revealed that denticle morphology is loosely tied to taxonomy, making species-level identification almost impossible. We found, however, that denticle traits are strongly correlated with life habit and feeding mode. Quantitative measurements of traits also corroborated existing qualitative functional groupings and refined the boundaries between them. For example, fast, predatory sharks possess thin, ridged 'drag reduction' denticles, whereas demersal sharks are characterized by thick 'abrasion strength' denticles. In a proof of concept, we extracted 254 denticles from a 7,000-year-old fossil reef and 602 denticles from comparable modern reefs in Bocas del Toro, Panama and classified them using the reference collection. Denticle assemblages in Holocene and modern sediments corresponded well with families documented in the region. We found a significant decrease in the relative abundance of 'drag reduction' denticles and an increase in 'abrasion strength' denticles over the last ~7,000 years. Denticles in modern sediments can therefore supplement survey data given the rarity of sharks, and denticles in the recent fossil record may shed light on shifts in shark community composition over time.

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**0431 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Pavel Dimens, David Portnoy

*Texas A&M University - Corpus Christi, Corpus Christi, TX, USA*

**Population structure of a migratory small coastal shark, the blacknose shark *Carcharhinus acronotus*, across cryptic barriers to gene flow**

For marine species existing along seemingly continuous habitat, identifying regional groups poses challenges because the ability to define a priori hypotheses with respect to population structure is limited. Further, in highly vagile species like the blacknose shark (*Carcharhinus acronotus*), individuals from independent populations may co-occur seasonally on feeding grounds. A recent study using microsatellite markers identified as many as five distinct populations spread across an area from South Carolina, USA to Campeche Banks, Mexico and the Bahamas but found ambiguity in the Florida Keys, an area that spans the divide between the U.S. Atlantic and eastern Gulf of Mexico populations, as well as their management units. This project used next-generation sequencing to identify single nucleotide polymorphisms (SNPs) across thousands of loci to distinguish between four possible scenarios of population structure and gene flow in the region: 1) the Keys are a zone of admixture between Atlantic and eastern Gulf of Mexico populations, 2) individuals from both populations are seasonally present in the Keys but there is no gene flow, 3) the Keys are a unique genetic unit, separate from Atlantic and Gulf of Mexico populations, 4) previous microsatellite markers were insufficient to resolve structure for the Keys and individuals there group distinctly with either Atlantic or Gulf populations.

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**0274 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Kyle Dineen, Brook Fluker

*Arkansas State University, Jonesboro, AR, USA*

**Genetic Structure and Diversity of Disjunct Populations of Rainbow Darters (*Etheostoma caeruleum*) and Southern Redbelly Dace (*Chrosomus erythrogaster*) Throughout the Mississippi Corridor**

Conservation-based studies of North America's rich freshwater fish fauna have primarily focused on species with naturally small distributions or species with distributions recently fragmented by anthropogenic factors. However, our grasp of how migration and genetic diversity are affected by recent, natural isolation in common or widespread freshwater fishes is still limited. *Etheostoma caeruleum* and *Chrosomus erythrogaster* are excellent subjects for studying the impacts of recent, natural genetic isolation because of their widespread and overlapping distributions, high abundance, and replicated patterns of naturally disjunct populations on their range margins. Of particular interest are potentially isolated populations of both species on Crowley's Ridge in Arkansas and the Bluff Hills in Mississippi. Both regions are relatively recent

geological formations that would have been colonized by these species within the last 10,000 years. In this study, we analyze microsatellite DNA loci from both species, with emphasis on the tributaries of the lower Mississippi river, to evaluate genetic diversity and connectivity among populations on Crowley's Ridge, the Bluff Hills, and larger core populations. We also use DNA sequence data to test hypotheses about the pattern and timing of colonization of Crowley's Ridge and the Bluff Hills. Results of this study will provide valuable information about the biogeographic and demographic history and conservation status of disjunct populations of *E. caeruleum* and *C. erythrogaster* from Crowley's Ridge and the Bluff Hills.

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## **1045 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Vladimir Dinets

*University of Tennessee, Knoxville, Tennessee, USA*

### **Cooperative hunting in reptiles: an overview**

The majority of extinct and extant reptiles are predators, but until a few years ago it was thought that they virtually all of them are exclusively solitary hunters, and observations to the contrary were ignored or left unpublished as aberrational. Now it is becoming clear that non-solitary hunting is used by numerous reptiles and might not be uncommon. I present an overview of what is known about group hunting, cooperative and even coordinated hunting in reptiles, including some yet unpublished data.

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## **1085 General Herpetology, Balconies L & M, Sunday 10 July 2016**

José Pedro do Amaral<sup>1</sup>, Duaa Mureb<sup>2</sup>

<sup>1</sup>*The University of Cincinnati Clermont College, Batavia, Ohio, USA*, <sup>2</sup>*The University of Cincinnati, Cincinnati, Ohio, USA*

### **Patterns of movement during wall lizard thermoregulation**

Temperature is the most pervasive physiological factor that affects the way organisms work. Ectotherms such as wall lizards *Podarcis muralis* depend mainly on the physiological and behaviorally controlled exchange of heat with the environment to regulate their body temperature. Consequently, ectotherm thermoregulation is associated with movement. We tested the relationship between movement patterns and concomitant body temperature during wall lizards' thermoregulation. To do so, we tested the hypothesis that wall lizards move in a thermal gradient as a function of a predetermined set of selected (preferred) body temperatures. General models of computer-generated lizard movement patterns were used to test our hypothesis. We failed to reject the null hypotheses associated with the movement models, thus no movement pattern models adequately explained wall lizard movement. However, some

models were better at approaching lizard movement. Albeit not perfect matches, these movement models show a promising degree of approximation to real lizard movement behavior.

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**0804 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Devon Donahue, Amanda Cramer, Mariangeles Arce, Mark Sabaj

*The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

**Test of Variable Morphospecies in Neotropical Swamp Eels (*Synbranchidae*: *Synbranchus*) using Nucleotide Sequence Data**

*Synbranchidae* is a family of eel-shaped fishes with a remarkably disjunct distribution in tropical and subtropical freshwaters of the New and Old Worlds. Only three species of *Synbranchus* are currently treated as valid in South America: *S. lampreia*, *S. madeirae* and *S. marmoratus*. Collections of *Synbranchus* were recently made in the lower Xingu River Basin, Brazil, by the iXingu Project (NSF DEB-1257813). From those specimens, at least five distinct morphotypes were recognized on the basis of external morphology (e.g., head shape and color pattern). One morphotype represents an undescribed miniature species. Three small specimens were collected via trawling in the mouth of a tributary to the lower Xingu. One specimen measuring 65 mm TL bears several large eggs and is evidently a mature female. Preliminary analysis of molecular sequence data (16s) supports the recognition of some morphotypes as distinct monophyletic lineages. A more complete molecular analysis (including *cytb* and *rag1*) will test the utility of external morphology for identifying and diagnosing species of *Synbranchus*.

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**0338 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Terry Donaldson

*University of Guam Marine Laboratory, Mangilao, Guam, USA*

**Lek-like Mating Systems in Reef Fish Spawning Aggregations: What's Going on Here?**

A number of reef fishes form aggregations for the purpose of courtship and spawning. There are two major types of spawning aggregation, transient and resident. Transient spawning aggregations are formed by species that migrate periodically from relatively distant home ranges to specific sites where they persist for days or weeks during a spawning cycle before returning home. Resident spawning aggregations often form daily, depending upon time of day or tidal state, and participants are drawn to a common site from relatively nearby territories or home ranges. There, they court and spawn over a matter of hours before returning to their place of origin. A number of spawning aggregation characteristics resemble those seen in leks. Lekking or lek-like behavior has been defined as a temporary aggregation of sexually active males for

reproduction. Characteristic of the formation of leks and lekking behavior include reproductive synchrony, the presence of a lekking ground, sufficient mobility to allow travel to that lekking ground, little or no feeding while on the lekking ground, and little or no parental care. Other characteristics include reduced aggression but increased displays between males, dominance relationships (with dominant males occupying central positions within the lekking site), sexual dimorphism, male displays towards females within the lekking site, and selection by females of centrally-located males for spawning. These characteristics are consistent with observations of mating behavior in transient aggregations of some groupers (Epinephelidae) and triggerfishes (Balistidae), and in resident aggregating species of wrasses and parrotfishes (Labridae), and lizardfishes (Synodontidae) from the western Pacific.

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**0980 NIA II, Galerie 3, Sunday 10 July 2016**

Carlos DoNascimento

*Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia*

**Disentangling the Systematics of the Neotropical Catfish Genus  
*Trichomycterus* (Siluriformes, Trichomycteridae)**

The catfish genus *Trichomycterus* comprises 164 valid species that constitute more than half the taxonomic diversity of Trichomycteridae. However, authors broadly agree on the non-monophyletic status of the genus, and until recently even that of the whole subfamily Trichomycterinae. Except for a single unpublished PhD dissertation, comprehensive attempts to resolve the phylogenetic relationships of the genus or of the subfamily have not been made. This is mainly due to the complex taxonomic history of *Trichomycterus*, with several poorly known old nominal species, a broad geographic distribution in Central and South America in both sides of the Andes, and an important number of new names continuously being added in the recent years. This background imposes some restrictions, mainly in the form of approaches restricted to a determined geographic region (at the basin scale). Here, we present the previous results of the analysis of the taxonomic diversity of *Trichomycterus* in northern South America (Colombia and Venezuela), providing data on the homoplastic nature of the purported synapomorphies of Trichomycterinae, recognition of smaller monophyletic subsets, and the rampantly non-monophyly of *Trichomycterus*, in the context of an extensive phylogenetic analysis of Trichomycteridae based on morphology.

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**0012 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Maureen A. Donnelly

*Florida International University, Miami, FL, USA*

**ASIH through the Secretary's Prism - 100 years of work laying a foundation for the next 100 years**

I will use the SUMMARY OF MEETINGS as published in *Copeia* and other historical sources to describe how our society has functioned during the first 100 years from the viewpoint of the Office of the Secretary. Some of the most notable members of the ASIH have served as Secretary (J.T. Nichols, E.R. Dunn, C.L. Hubbs, M.G. Netting, E.C. Raney, A.B. Grobman, R. Conant, J.A. Peters, R. Highton, B.B. Collette, C.R. Gilbert, B.R. Burr, D. Hendrickson, R.K. Johnson as well as myself as the most recent Secretary). I will describe how I became the Secretary following the tragic and untimely death of Robert K. Johnson in 2000, and some of the highlights of my years of service with 15 different presidents. As the first woman to serve in the Office of the Secretary I hope to inspire members of other underrepresented groups to take on active roles in the governance of the oldest society in North America that celebrates the conservation and scientific study of fishes, amphibians, and reptiles.

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**0996 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Sean Doody

*Southeastern Louisiana University, Hammond, Louisiana, USA*

**Challenges and Future Directions of Social Behavior Research in Reptiles**

Social behavior in animals evolves to solve problems that are impossible or more difficult for individuals to resolve alone; yet the evolution of social behaviors creates new problems, and species and groups that are more solitary certainly have persisted over geological time. We have recently argued against a dichotomy of social behavior in vertebrates, instead calling for the recognition of diverse social behaviors among and within groups. The social repertoires of more secretive animals like reptiles, however, often defy description, resulting in knowledge gaps so numerous that comparative analysis is futile. This problem is exacerbated by the bias towards studying endotherms, and by the more general trend away from the study of natural history. Fortunately, a relatively small but motivated group of researchers remain interested in social behavior in reptiles, from quite different perspectives and research directions. This somewhat eclectic group has recently uncovered remarkable reptilian social behaviors, illuminating our ignorance for both the diversity of social behavior in reptiles and their role for understanding the evolution of social behavior in vertebrates. I will use a few examples to illustrate, including the recent discovery of communal nesting in large conspicuous lizards.



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**0122 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Mareike Dornhege, Anne McDonald

*Sophia University, Tokyo, Japan*

**Shifts in Shark Community Assemblage in the North Pacific Indicated by the Japanese Longline Fishery**

Japan's oldest shark longline fishery dates back to the 18th century. According to the FAO, until the 1940s, Japan registered the highest elasmobranch landings worldwide and is currently the 9<sup>th</sup> largest shark fishery worldwide. The national longline fishery for sharks is concentrated in the port of Kesennuma in Northern Japan and since the collapse of the Pacific tuna fishery in 2003, blue shark and billfish are the main target species. The goal of this study is to present an analysis of this fishery and its effects on the ecosystem through an integrated approach. Three methods have been employed: 1) analysis of historical documents from libraries, museums and fisheries cooperatives on the historical use and fisheries of shark, with a focus on determining peaks in fisheries and most landed species over the past centuries; 2) interviews with fishermen, vessel owners, shark product processors and other stakeholders to identify any shifts in species landed over the past 60 years; and 3) analysis of landing and market data that recorded elasmobranchs to the species or family level over the past 20 years to calculate CPUEs and biodiversity indices. Results indicate that historically, a wide variety of sharks were used and preferred depending on the product created while today, only three species account for more than 95% of the landings and most products. Both fishermen and processors report steep declines in *Squalus acanthias* and the genus *Charcharinus* compared to the three dominant species, a trend which is confirmed by the CPUE and biodiversity analysis.

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**0803 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Kaitlin K Doucette<sup>1</sup>, Stephanie Mounaud<sup>2</sup>, William Neirman<sup>2</sup>, Andrew N Evans<sup>1</sup>

<sup>1</sup>*Department of Coastal Sciences, The University of Southern Mississippi, Ocean Springs, MS 39564, USA,* <sup>2</sup>*J. Craig Venter Institute, Rockville, MD 20850, USA*

**The Elasmobranch Microbiome: Changing Our Understanding of Vertebrate-Microbe Relationships**

Communities of bacteria in digestive systems play a critical role in host physiology; however, the existence of non-pathogenic bacteria in other healthy tissues is unusual. Previous studies suggested that elasmobranch fishes, unique in numerous aspects of physiology, possess endogenous bacteria in tissues that are sterile in other vertebrates such as kidney, liver and blood. Surprisingly, this phenomenon has not been explored since initial publications in the late 1980s, which employed culture-based approaches to

microbial characterization. Using modern methods (16S rRNA gene sequencing via the Illumina MiSEQ platform), we identified a diverse array of bacteria present in intestinal, hepatic and renal tissues of *Dasyatis sabina* (Atlantic stingray) and *Rhizoprionodon terraenovae* (Atlantic sharpnose shark) from the Gulf of Mexico. Using this preliminary data, we hope to elucidate the costs and benefits of symbiont bacteria to elasmobranch hosts. The results of this study suggest an unprecedented relationship between microbes and vertebrate hosts and raise compelling questions about the importance of resident bacteria to elasmobranch physiology, as well as the possible implications of differences in microbial diversity across individuals.

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### **0919 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Alistair Dove<sup>1</sup>, Harry Webb<sup>1</sup>, Rafael De la Parra-Venegas<sup>3</sup>, Christian Schreiber<sup>1</sup>, Jeffrey Reid<sup>1</sup>, Simon Pierce<sup>5</sup>, Robert Hueter<sup>4</sup>, Katie Hindle<sup>2</sup>, LeeAnn Henry<sup>2</sup>, Annalea Beard<sup>2</sup>, Ross Leo<sup>2</sup>, Elizabeth Clingham<sup>2</sup>

<sup>1</sup>Georgia Aquarium, Atlanta, Georgia, USA, <sup>2</sup>St Helena Government, Jamestown, St Helena, UK, <sup>3</sup>Ch'ooj Ajauil AC, Cancun, Quintana Roo, Mexico, <sup>4</sup>Mote Marine Laboratory, Sarasota, Florida, USA, <sup>5</sup>Marine Megafauna Foundation, Tofo, Mozambique

#### **St Helena Island provides important habitat for whale sharks**

Studies of whale sharks in recent years have focused on near-coastal aggregations, but this approach does not tell the whole demographic story because these events are typically dominated by immature males. Remote oceanic islands have been hypothesized to be the site of mating or pupping in whale sharks, which are activities affiliated by definition with adults. One such island is St Helena in the South Atlantic, which was recently discovered to play host to a seasonally predictable population of adult whale sharks. Two collaborative expeditions have been conducted in 2015 and 2016 to document whale shark abundance and population composition, to characterize behavior and habitat use around the island, and to determine regional scale movement patterns using satellite telemetry. The whale shark population observed at St Helena consisted of an approximately equal mix of mature males and females that were larger than the sub-adults seen in most coastal aggregation sites, but smaller than the large female animals seen regularly in the Galapagos. Two eyewitness accounts of mating behavior have been recorded at St Helena, but this behavior was not directly observed during the expeditions. Preliminary PAT telemetry data are showing a pattern of extraordinary deep diving in the vicinity of the island. A single useful track from the 2015 expedition suggests that St Helena whale sharks are connected to the west coast of Africa. We propose a regional movement pattern with animals feeding in coastal upwelling zones, and travelling to remote oceanic islands to fulfill aspects of the reproductive cycle.

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## 0638 Fish Genetics, Salon D, Sunday 10 July 2016

Thomas Dowling<sup>1</sup>, Paul Marsh<sup>2</sup>, Robert Clarkson<sup>3</sup>

<sup>1</sup>Wayne State University, Detroit, MI, USA, <sup>2</sup>Marsh&Associates, Tempe, AZ, USA,

<sup>3</sup>Bureau of Reclamation, Glendale, AZ, USA

### **Molecular markers identify segregation of two species of chubs (genus *Gila*) in an Arizona stream**

Two species of cyprinid fish, *Gila robusta* and *G. nigra*, were once common to rivers and headwater streams of the Gila River drainage of the southwestern US, but are now being considered for listing. These taxa have been difficult to discriminate with morphology and also show high levels of genetic divergence among local populations but not species. Here we report on a study of these species from Fossil Creek, a spring-fed tributary of the Verde River that was managed extensively for hydropower generation beginning in the early 20<sup>th</sup> century. Projects were implemented in 2004-2005 to decommission the power facility and return full flows following construction of an artificial fish barrier near the terminus, chemical renovation upstream to remove non-native fishes, and subsequent repatriation of the native fish community. We examined genetic consequences of these management activities on the two chubs by comparing patterns of microsatellite and mtDNA variation from a temporal longitudinal series of post-project samples collected from above and below an enhanced barrier falls. Our data demonstrate that *G. robusta* has become more common downstream of the falls over time, with *G. nigra* becoming rare; however, *G. nigra* is able to persist upstream of the barrier in the absence of *G. robusta*. Results are consistent with specific status for *Gila robusta* and *G. nigra*, and have specific implications for the conservation and management of these forms.

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## 0389 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016

Danielle H. Drabek, Antony M. Dean, Sharon A. Jansa

University of Minnesota, Twin Cities, MN, USA

### **Convergent evolution of venom targeted nicotinic acetylcholine receptors in mammals that survive venomous snake bites**

Honey badgers (*Mellivora capensis*) prey upon and survive bites from venomous snakes (Family: Elapidae), but the molecular basis of their venom resistance is unknown. The muscular nicotinic cholinergic receptor (nAChR), targeted by snake alpha-neurotoxins, has evolved in some venom-resistant mammals to no longer bind these toxins. Through phylogenetic analysis of mammalian nAChR sequences, we show that honey badgers, hedgehogs, and pigs have independently acquired functionally equivalent amino acid replacements in the toxin-binding site of this receptor. These convergent amino acid changes impede toxin binding by introducing a positively charged amino acid in place of an uncharged aromatic residue. In venom-resistant mongooses, different

replacements at these same sites are glycosylated, which is thought to disrupt binding through steric effects. Thus, it appears that resistance to snake venom alpha-neurotoxin has evolved at least four times among mammals through two distinct biochemical mechanisms operating at the same sites on the same receptor. This is the first comparative work demonstrating convergent adaptive response to snake venom in mammals, and suggests that snake venom evolution may be significantly impacted by a potential coevolutionary relationship with resistant mammalian predators.

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**0901 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY,  
Salon A-C, Thursday 7 July 2016**

Mary Draghetti, Ken Oliveira

*University of Massachusetts Dartmouth, Dartmouth, MA, USA*

**The Effect of Cortisol on Growth and Body Composition of the American Eel,  
*Anguilla rostrata***

The American eel, *Anguilla rostrata*, is a catadromous species found in nearly every freshwater and coastal system along the western Atlantic. Immigrating elvers (YOY) must accumulate enough energy stores in order to maximize growth and survival during year one. Energy stores are critical to first year survival, particularly in areas of high stress. Stress, such as crowding, signals the release of cortisol from the ACTH-axis causing metabolic and physiological changes in teleost fishes. In order to determine the effect of cortisol on growth and body composition of the American eel, immigrating glass eels were collected from a coastal river in Massachusetts and fed diets containing varying doses of cortisol and dexamethasone in an attempt to mimic the stress response. Conversely, some eels were fed diets with varying levels of RU-486, metyrapone, and a mix of the two cortisol antagonists. These treatments were used to examine growth and body composition of “unstressed” fish by blocking cortisol receptors and/or preventing cortisol synthesis. Bimonthly samples were examined for total length (mm), weight (g) and proximate body composition (% water, lipid, ash, and protein). Long-term exposure to cortisol in the first year of the eel's freshwater life history appears to negatively affect growth, resulting in decreased protein and lipid accumulation. Treatment with cortisol antagonists showed no significant effect on growth or body composition. Our results indicate that high stress environments, resulting in high cortisol secretion, may result in decreased growth and survival in the early freshwater life stage of American eels.

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## **0145 Snake Ecology, Galerie 3, Sunday 10 July 2016**

Michael Dreslik<sup>1</sup>, John Crawford<sup>2</sup>, Sarah Baker<sup>1</sup>, William Peterman<sup>3</sup>, Christopher Phillips<sup>1</sup>

<sup>1</sup>Illinois Natural History Survey, Champaign/Urbana, Illinois, USA, <sup>2</sup>National Great Rivers Research and Education Center, East Alton, Illinois, USA, <sup>3</sup>Ohio State University, Columbus, Ohio, USA

### **Factors Affecting the Detection Probability and Capture Yield of an Imperiled Species**

Reptiles are in decline worldwide and despite their ecological importance, insufficient data exist to accurately assess many species at the population and landscape levels. Therefore estimating occupancy or abundance of imperiled species is a critical conservation concern. Certain taxa, such as snakes, can exhibit cryptic behaviors and occur at low densities, further hampering population assessments. To accurately evaluate snake populations it is important to understand and account for behavioral patterns influencing detectability, e.g. spring emergence for snakes. Since 1999, we have been monitoring an eastern massasauga *Sistrurus catenatus* population at Carlyle Lake, Illinois to provide a complete view of the species' ecology. We conducted annual visual encounter surveys during spring emergence periods in occupied and potential habitat. Our objectives for this study were to determine what factors affect detection probability and capture-yield of eastern massasaugas with the goal of maximizing both. Of 27 detection models examined, the best model included the size of habitat patch searched, start time, starting air temperature, mean three-day maximum air temperature, starting humidity, mean search effort, and solar radiation. Of the 26 capture yield models examined, the best model included the size of habitat patch searched, starting humidity, mean search effort, and solar radiation. Together, these models can be applied to design survey protocols maximizing detection and capture yield of individuals throughout the species' range.

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## **0710 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Rachel Dreyer, Kim Bassos-Hull, Krystan Wilkinson, Breanna DeGroot

*Mote Marine Laboratory, Sarasota, FL, USA*

### **When the Shark Bites and the Remora Sucks: Incidence of Injury on Spotted Eagle Rays (*Aetobatus narinari*) and Lesser Devil Rays (*Mobula hypostoma*)**

The spotted eagle ray, *Aetobatus narinari*, and the lesser devil ray, *Mobula hypostoma*, have been the subjects of capture-tag-release studies off southwest Florida from 2009-2015. We analyzed data and photographs of *A. narinari* (2009 - 2015, n=518) and *M. hypostoma* (2013 - 2015, n=97) to determine incidence of injury inflicted by shark predators, other species such as remoras and marine mammals, and human activity. While predation was not actively observed by researchers, shark bite wounds and scars were documented in both *A. narinari* (n=45) and *M. hypostoma* (n=26). Remoras attach to the

smooth, mucous-coated skin of rays and attachment sites are recognized by the pattern created by the remora's modified dorsal fin. Many *A. narinari* (n=390) and *M. hypostoma* (n=68) displayed recent wounds or healed scars from remora attachment. Of these animals, 23 and 12, respectively, had open wounds with bloody and/or reddened tissue. Recaptured *A. narinari* with remora scars on the first capture (n=25) displayed rapid healing, including one individual that displayed no remora attachment sites after 225 days at liberty. No *M. hypostoma* individuals were recaptured during this study; however, one individual held at our facility for 21 days showed near-complete healing from a shark bite wound observed at capture. Injuries inflicted by anthropogenic sources including boat scars, fishing line entanglement, and fishing hook embedment were observed on *A. narinari* (n=15) and *M. hypostoma* (n=3). This study confirms that *A. narinari* and *M. hypostoma* displayed significant healing abilities after non-fatal injuries.

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## **0625 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Stephen Drozda, Jessica Hultberg, John Steffen

*Pennsylvania State University Erie, The Behrend College, Erie, Pennsylvania, USA*

### **Effects of Carotenoid Access and Food Intake on Blood Reactive Oxygen Species Levels in Painted Turtles**

Animals use carotenoid-based color patches because they represent visual signals that cannot be faked. Carotenoids are known to have multiple physiological benefits in animals. One benefit carotenoids have shown is their ability to scavenge free-radicals (i.e., Reactive Oxygen Species, or ROS). The purpose of this research was to determine if dietary carotenoid levels would influence the level of reactive oxygen species in the blood of *Chrysemys picta* (painted turtles). Turtles were randomly split into four groups and placed on a feeding regimen for 7 weeks: normal food amount with added carotenoids, reduced food amount with added carotenoids, normal food amount with no carotenoids, and reduced food amount with no carotenoids. Before and after the feeding regimen, flow cytometry was performed on the blood of each turtle to determine their ROS levels. Results showed that the reduced food group maintained their weight, and the normal food group gained weight. Carotenoids did not affect ROS levels, but the weight maintenance group had higher ROS levels than the weight gain group. These results imply that carotenoid color patches are not used to communicate information about ROS levels. Future research should investigate why weight-maintaining animals have increased ROS levels compared to weight gaining animals.

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## 0288 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016

J. Marcus Drymon<sup>1</sup>, John Froeschke<sup>2</sup>, Andrea Kroetz<sup>3</sup>, John Mareska<sup>4</sup>, Sean Powers<sup>1</sup>

<sup>1</sup>University of South Alabama, Dauphin Island, AL, USA, <sup>2</sup>Gulf of Mexico Fishery Management Council, Tampa, FL, USA, <sup>3</sup>NOAA Fisheries, Panama City, FL, USA, <sup>4</sup>Alabama Department of Conservation and Natural Resources, Marine Resources Division, Dauphin Island, AL, USA

### **Sex-specific seasonal changes in community dynamics of a northern Gulf of Mexico coastal shark assemblage**

Abiotic factors are known to influence the distribution of marine organisms; however, the relative importance of abiotic drivers is often species and sex-specific. Understanding how species respond to changes in abiotic conditions is critical for successful conservation and management plans, and in light of future climate change. To investigate species and sex-specific seasonal changes in the community dynamics of coastal shark assemblage, we analyzed catch data from two concurrent bottom longline surveys. A combination of multivariate (PERMANOVA) and univariate (boosted regression trees) approaches was used to examine differences in the assemblage as a function of season and depth, and further explore the factors influencing the sex-specific probability of capture. From February 2011 through May 2013, 126 bottom longline sets were conducted, resulting in the capture of 1844 individuals across 19 elasmobranch taxa. Multivariate analysis revealed a community structured by season and depth. Boosted regression trees further revealed species and sex-specific differences in the factors driving species' distributions. For females, depth had the highest relative influence on the distribution of Atlantic sharpnose (*Rhizoprionodon terraenovae*), blacknose (*Carcharhinus acronotus*), and bull sharks (*C. leucas*), whereas bottom temperature and longitude had a larger relative influence on the distribution of male Atlantic sharpnose and blacktip sharks (*C. limbatus*). These results support the counterintuitive notion that despite having relatively small size at birth, Atlantic sharpnose and blacknose sharks may be using open waters for parturition. Our findings underscore the importance of quantifying species-specific abiotic drivers of shark distribution, particularly in light of impending climate change.

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## 0456 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016

Mason DuBois, Tanner Shea, Natalie Claunch, Rob Brewster, Emily Taylor  
California Polytechnic State University, San Luis Obispo, CA, USA

### **Testing the Oxygen Limitation Hypothesis in two *Sceloporus* Lizards**

The critical thermal maximum (CTMax) is a useful tool for researchers studying thermal ecology in ectotherms. While it is relatively well studied across various taxa, the physiological mechanisms driving this measurement of thermal tolerance are poorly

understood. We tested the oxygen limitation hypothesis, which states that organisms reach the CTMax when their metabolic demand for oxygen surpasses their cardiovascular system's ability to deliver it, in two lizard species, *Sceloporus occidentalis* and *S. graciosus*. We sampled 95 lizards across four altitudes in the Sequoia National Forest, treating them with either normoxic (21% oxygen) or hypoxic (6% oxygen) air while heating them to observe how their CTMax responded to oxygen availability. The change in altitude resulted in lizards being treated with one of eight different partial pressures of oxygen ( $P_{O_2}$ ). We found that lizards treated with lower  $P_{O_2}$  had a significantly lower CTMax than lizards treated with higher  $P_{O_2}$ . We also found intriguing evidence for the existence of a threshold  $P_{O_2}$ , with a rapid decline in thermal tolerance when the  $P_{O_2}$  falls below this value. At low  $P_{O_2}$ , there was a strong relationship between oxygen and the CTMax, suggesting that the CTMax is very sensitive to oxygen availability and providing strong support for the oxygen limitation hypothesis. These results have implications for climate change-driven alterations of species ranges: if oxygen is a limiting factor in the thermal tolerance of ectotherms, it may affect their ability to compensate for climate change by migrating into higher altitudes, where oxygen levels are low.

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**0661 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Drew Duckett<sup>1</sup>, Greg Skomal<sup>2</sup>, Adam Leache<sup>3</sup>, Gavin Naylor<sup>1</sup>

<sup>1</sup>College of Charleston, Charleston, SC, USA, <sup>2</sup>Massachusetts Department of Fish and Game, Boston, MA, USA, <sup>3</sup>University of Washington, Seattle, WA, USA

**Contrasting mitochondrial and nuclear signals in Great White Sharks, *Carcharodon carcharias***

Understanding population structure is important for species management and protection. However, the accuracy of population inferences is often limited by both the number of samples obtained and the information-content of the molecular markers employed. Consequently, despite its popularity, global population structure in the great white shark, *Carcharodon carcharias*, remains poorly understood. Previous studies contrasting mitochondrial sequence and microsatellites in white sharks have indicated limited nuclear differentiation and possible sex-biased dispersal. Nonetheless, a poor understanding of nuclear patterns make the species appealing for the employment of a large nuclear dataset. The present study examines *C. carcharias* population structure and the possibility of male-mediated dispersal using whole mitochondrial genomes and ~350 nuclear loci obtained from hybridization sequence capture. The hypothesis of female philopatry is tested through multiple analyses, and alternative explanations are explored to reconcile signal discrepancies among markers.

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## 0115 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016

Nicholas Dulvy<sup>1</sup>, Will Stein<sup>1</sup>, Chris Mull<sup>1</sup>, Tyler Kuhn<sup>2</sup>, Neil Aschliman<sup>3</sup>, Lindsay Davidson<sup>1</sup>, Jeff Joy<sup>4</sup>, Gordon Smith<sup>1</sup>, Arne Moers<sup>1</sup>

<sup>1</sup>Simon Fraser University, Vancouver, Canada, <sup>2</sup>Yukon Beringia Interpretive Centre, Whitehorse, Canada, <sup>3</sup>St Ambrose University, Iowa, USA, <sup>4</sup>C Centre of Excellence HIV/AIDS, Vancouver, Canada

### Using trees to save sharks and rays

Inevitably, greatest conservation attention is given to the most charismatic or distinctive species while others equally deserving get left behind. How do we ensure that the less-charismatic underworld of chondrichthyans is prioritised for conservation action in an objective manner? We take advantage of recent advances in phylogenetic methods for combining genetic and taxonomic information to produce taxon-complete phylogenies to rank all 1192 chondrichthyan species by their evolutionary distinctiveness. First, we recovered a molecular phylogeny of 624 species based on 13 mitochondrial and 2 nuclear loci from GenBank and Barcode of Life. Second, this time-calibrated tree was infilled with the remaining species for which there were no molecular data based on their known taxonomic affinities. We generated a distribution of 10,000 fully resolved, taxon-complete phylogenies. We describe the depths, habitats, and geographic locations with the greatest and least amount of evolutionary distinctiveness. We combined Evolutionary Distinctiveness information with known and inferred Global Endangerment scores to identify EDGE species and locations that embody the highest conservation priorities to mitigate the loss of chondrichthyans' unique evolutionary history.

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## 0977 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016

Brian Durkin<sup>1</sup>, Kaite Anderson<sup>1</sup>, Teal Richards-Dimitrie<sup>2</sup>, Richard Seigel<sup>1</sup>

<sup>1</sup>Towson University, Towson, Maryland, USA, <sup>2</sup>Humboldt State University Sponsored Programs Foundation, Arcata, California, USA

### Impacts of the Depredation of Northern Map Turtle (*Graptemys geographica*) Nests in a Fragmented and Altered Habitat

Habitat alteration negatively impacts turtle populations and important spatial resources including nesting habitat. In eastern Maryland, the Susquehanna River is divided by the Conowingo Hydroelectric Dam, fragmenting and altering the habitat of the state-endangered Northern Map Turtle (*Graptemys geographica*). Nesting habitat below the dam is altered through the erosion of sandy beaches, leaving largely suboptimal habitat. We studied the nesting ecology of Map Turtles from 2009-2015 to understand how these habitat changes impact nest success. Nesting was studied in three distinct habitats, a forested area along the river called Octoraro Beach, on the in-river Wood Island, and in the urbanized town of Port Deposit. Nesting intensity varied between sites and years.

Wood Island and Octoraro Beach had the highest number of nests (37-111 nests per year) and Port Deposit had the fewest (4-8 per year). Nests at Octoraro Beach and Wood Island were subject to high rates of depredation, approaching 100% in some years, while only one nest was predated in Port Deposit. In 2012-2014, woody vegetation and brush was cleared at Octoraro Beach in an attempt to open and enhance the nesting habitat. In 2012 and 2013 nest depredation was low, 44% and 66% respectively, and Map Turtles were observed utilizing the cleared habitat. Depredation rates returned to 100% in 2014 when clearing of vegetation was not as extensive. In 2016, the effect of habitat manipulation on nest depredation rates will be experimentally tested at the Octoraro Beach site in order to determine its effectiveness as a management strategy.

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### **1043 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Julia Earl<sup>1</sup>, Luke Pauley<sup>2</sup>, Raymond Semlitsch<sup>2</sup>

<sup>1</sup>Oklahoma State University, Stillwater, OK, USA, <sup>2</sup>University of Missouri, Columbia, MO, USA

#### **Frogs as Fertilizer? Effects of Metamorph Amphibians on Plant Growth**

Ponds can produce large amounts of amphibian biomass. Juvenile amphibians disperse away from their natal wetlands, creating a subsidy to the surrounding terrestrial ecosystem. However, it is unclear how this amphibian subsidy affects the terrestrial ecosystem. Metamorph amphibians are important prey for a variety of terrestrial consumers, but many metamorphs die of desiccation in drier years, potentially providing nutrients for decomposers and plants. We were interested in whether plants could benefit from nutrients exported from ponds by metamorph amphibians. We examined this by adding dead metamorph toads (*Anaxyrus americanus*) labeled with N<sup>15</sup> to two species of native Missouri plants and tomatoes grown in pots in a greenhouse. We examined the growth of plants under three densities of dead toads with and without added fertilizer. Further, we tested plant tissue for stable isotopes to see if plants incorporated nitrogen from the toads into their tissues. We found that all three species of plant had higher nitrogen isotopic ratios when grown with dead toads, indicating that the plants incorporated toad nitrogen into their tissues. Tomato plants had higher growth rates with realistic densities of dead metamorphs when compared with no metamorphs. Tomato plants also incorporated higher amounts of nitrogen from toad metamorphs in their fruit under low soil nutrients than with commercial fertilizers present. Our results indicate that plants near ponds could benefit from the export of nutrients from ponds by amphibian metamorphs. These subsidies will likely have the largest effects in terrestrial systems with low soil nutrients.

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## 1044 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016

Julia Earl<sup>1</sup>, Raymond Semlitsch<sup>2</sup>

<sup>1</sup>Oklahoma State University, Stillwater, OK, USA, <sup>2</sup>University of Missouri, Columbia, MO, USA

### High Variability in Metamorph Leg Length and Relationships to Resource Level

Amphibians exhibit high levels of phenotypic plasticity in time and size at metamorphosis in response to a variety of different environmental characteristics. Environmental characteristics can also induce changes in morphology. Previous work shows that intraspecific competition can alter the length of metamorph legs relative to their body size, though the differences among treatment often are small. Here, we show that relative leg length (leg length/body length) can be quite variable, as seen in four different species: *Hyla versicolor*, *Lithobates sylvaticus*, *Lithobates sphenoccephalus*, and *Anaxyrus americanus* under experimental conditions. We measured relative leg length for metamorphs from aquatic mesocosm studies examining the effects of resource type and quality in the form of plant litter input. In most cases, treatments with lower resources (either no plant litter or plant litter with very low nutrient content, such as white pine) resulted in metamorphs with shorter legs relative to body length than treatments with higher resources. This effect of resource level on leg length suggests individual fitness consequences for metamorphs that spent their larval period in lower resource environments, such as closed canopy ponds with low quality leaf litter input. Shorter relative leg length was often highly correlated with body length and mass, but not time to metamorphosis. Metamorphs with shorter leg length often have reduced jumping performance. The correlation between relative leg length and body size may be one contributing mechanism to the general relationship between size at metamorphosis and fitness.

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## 0791 Fish Conservation, Galerie 3, Sunday 10 July 2016

David Edds<sup>1</sup>, David Gillette<sup>2</sup>, Bibhuti Jha<sup>3</sup>, Bhogendra Mishra<sup>4</sup>

<sup>1</sup>Emporia State University, Emporia, Kansas, USA, <sup>2</sup>University of North Carolina Asheville, Asheville, North Carolina, USA, <sup>3</sup>Kathmandu University, Dhulikhel, Nepal, <sup>4</sup>Asian Institute of Technology, Pathumthani, Thailand

### Assessing fish community change in Nepal

In 2015-16, we are re-sampling fish assemblages at 40 sites in Nepal's Gandaki River basin that we sampled in 1984-86 and 1996 using standardized methodology. Preliminary analysis suggests a decline in fish species richness and absolute abundance. Our long-term dataset will allow us to compare the fish community across decades of human population growth, infrastructure development, and climate change in Nepal. Recent data indicate that warming is occurring faster in the Himalayas than in the rest of the world, with greatest increases at high altitudes; increasing temperatures coupled

with faster glacier melt and decreasing precipitation likely will impact river discharge and the ecology of Himalayan fishes. The Gandaki is well suited for study of the impacts of increasing temperatures on riverine fish communities, given its extraordinary altitudinal gradient from headwaters on the Tibetan Plateau downstream to subtropical Gangetic Plains. We are examining historical and contemporary data to assess fish species loss or range shifts, and will determine whether any range shifts have kept pace with stream isotherm shifts over time. Our study should help us understand the response of Nepal's stream fishes to climate change, and aid policy makers and resource managers in conservation planning for Himalayan river ecosystems.

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### **0826 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Robert Edman<sup>1</sup>, Gorka Sancho<sup>1</sup>, Bryan Frazier<sup>2</sup>, Wally Buble<sup>2</sup>, John Kucklick<sup>3</sup>

<sup>1</sup>College of Charleston, Charleston, SC, USA, <sup>2</sup>South Carolina Department of Natural Resources, Charleston, SC, USA, <sup>3</sup>National Institute of Standards and Technology, Charleston, SC, USA

### **Movement Patterns and Trophic Ecology of Tiger Sharks (*Galeocerdo cuvier*) Caught off the Southeast Coast of the United States**

Exploitation of sharks has markedly increased in the past three decades, and this exploitation, coupled with degradation of essential habitats, can contribute to declining species abundance. Understanding the movement patterns and diet composition of sharks is central to creating and enacting appropriate management actions to preserve these animals and their habitats. The present study seeks to analyze the movement patterns and diet of Tiger Sharks caught in coastal waters of the southeast United States utilizing passive acoustic telemetry, satellite telemetry, and stable isotope analysis. Results show Tiger Sharks tagged in South Carolina during spring months move extensively in coastal and shelf waters. These movement patterns appear to differ from Tiger Sharks tagged in the Bahamas and Bermuda, which move primarily through shelf and offshore waters. Results of Tiger Sharks tagged during autumn months indicate that these sharks may overwinter in offshore waters and in the Bahamas. Stable isotope analyses on multiple tissue types (blood, muscle, skin, and plasma) from captured Tiger Sharks confirm that smaller Tiger Sharks occupy a lower trophic level, and that this species undergoes an ontogenetic diet shift. Results of a Bayesian mixing model will be used to determine the proportions of different prey items in the diet of Tiger Sharks caught in South Carolina. Satellite and acoustic tracking of tagged sharks is ongoing, and the third year of tagging and collecting samples from Tiger Sharks is currently underway.

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## 0958 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016

Danielle Edwards<sup>1</sup>, Luciano Avila<sup>2</sup>, Lorena Martinez<sup>2</sup>, Jack Sites<sup>3</sup>, Mariana Morando<sup>2</sup>

<sup>1</sup>University of California, Merced, Merced, CA, USA, <sup>2</sup>Centro Nacional Patagónico – Consejo Nacional de Investigaciones Científicas Técnicas, Puerto Madryn, Chubut, Argentina, <sup>3</sup>Brigham Young University, Provo UT, USA

### **Evolution of niche and ecomorphological traits in a phylogenetic context in lizards of the *Liolaemus bibroni* complex (Squamata: Liolaemini)**

The South American lizard genus *Liolaemus* is one of the most ecologically diverse terrestrial vertebrate radiations on the planet. Given this ecological breadth, hypotheses abound regarding the evolutionary mechanisms by which species diversity in *Liolaemus* arises, including body size diversification driven by ecophysiological mechanisms and the evolution of viviparity. Unlike most putatively adaptive radiations – studies of sparsely sampled higher level phylogenies have failed to find an evolutionary relationship between ecomorphological and ecological niche evolution. By using a completely sampled phylogeny of the *L. bibronii* complex, a group representing the ecological diversity of all *Liolaemus* and including 23 described and candidate species, we used comparative phylogenetic analyses to look at 1) how niche and ecomorphological traits have evolved through time (i.e., using disparity-through-time analyses), and 2) whether or not ecomorphological trait evolution is correlated with niche evolution (phylogenetic correlation). The morphological disparity analyses showed clear evidence of increasing diversification (greater than null disparity) towards the present in ecomorphology and vegetative niche, with correlated evolution of these traits including multivariate axes describing variation in body shape and size. Unlike previous studies we find no relationships between body size and ALM – a composite variable explaining the change in temperature associated with latitude and elevation. Our results are both congruent with (i.e., diversification in body size) and contrary to (i.e., correlated evolution of body size and shape with vegetation) to studies at higher phylogenetic scales and with less complete sampling.

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## 0440 Poster Session I, Acadia/Bissonet, Friday 8 July 2016

Ariel N. Egan<sup>1</sup>, Toby S. Daly-Engel<sup>1</sup>, J. Marcus Drymon<sup>2</sup>

<sup>1</sup>University of West Florida, Pensacola, FL, USA, <sup>2</sup>University of South Alabama, Mobile, AL, USA

### **Multiple Paternity of the Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)**

The Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) is an abundant, small coastal shark found in temperate and tropical waters of the western Atlantic and Gulf of Mexico, where it is an important part of both artisanal and commercial elasmobranch fisheries. Life history characteristics in this species are generally established, but the

occurrence of multiple mating by females (polyandry) as a reproductive strategy remains undocumented. Studies indicate that polyandry is common among sharks, but to date no small coastal sharks have been studied. For this study, muscle tissue samples from 20 *R. terraenovae* broods were collected off the coast of Alabama. DNA will be extracted from all samples and microsatellite markers applied for parentage analysis. With these data, we aim to discern the occurrence and frequency of multiple mating in *R. terraenovae* over several reproductive seasons to examine how this trait varies over time. The results and information from this study may provide additional information about genetic diversity of the *R. terraenovae* population in the Gulf of Mexico. Different reproductive strategies can influence genetic diversity and fitness, and are therefore of interest for conservation management. If multiple paternity proves to be common in *R. terraenovae*, potential population-level consequences of exploitation by fisheries may need to be assessed to understand how fisheries affect the genetic diversity of this species.

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#### **0408 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jacob Egge, Ashley Farre, Christian McConnell, Heidi Schutz

*Pacific Lutheran University, Tacoma, WA, USA*

#### **Cryptic Speciation in the Brown Madtom, *Noturus phaeus***

The Brown Madtom, *Noturus phaeus*, is an ictalurid catfish distributed across a series of drainages in the Mississippi embayment spanning western Tennessee, western Mississippi, and Louisiana, USA. Previous phylogeographic analyses of populations sampled from across the range using DNA sequence data from the mitochondrial gene cytochrome *b* (*cytb*) recovered two deeply divergent haplotype lineages congruent with two geographic regions. One lineage was comprised of individuals from the Obion and Forked Deer drainages in western Tennessee, and the other lineage contained individuals from across all other populations. To test the hypothesis that these two lineages represented two cryptic species, we sequenced 59 individuals sampled from across the range for two additional nuclear loci (recombination activating gene 2, *rag2* and early growth response 2b, *egr2b*). Morphological variation among populations was examined using over 110 museum specimens photographed from multiple angles, landmarked at 33 anatomical reference points, and analyzed using geometric morphometric techniques. Results of the phylogenetic analyses recovered two deeply divergent lineages, consistent with those recovered previously using *cytb* data. These lineages were consistently recovered with high support when each gene was analyzed separately, but also in analyses including both the mitochondrial and nuclear genes. Analyses of morphometric data, however, failed to recover any significant morphological differentiation between the lineages. These data are consistent with the presence of two morphologically cryptic phylogenetic species within *Noturus phaeus*, one corresponding with populations in the Obion and Forked Deer drainages, and another comprised of all other populations.

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**0048 Herp Conservation & Ecology, Galerie 2, Sunday 10 July 2016**

Tomoharu Eguchi, Scott Benson, David Foley, Karin Forney

*National Marine Fisheries Service, La Jolla, CA, USA*

**Predicting Overlap Between Drift Gillnet Fishing and Leatherback Turtle Habitat in the California Current Ecosystem**

Concern over bycatch of protected species has become a key factor in shaping fisheries management decisions. In 2001, the National Marine Fisheries Service established an annual closure of a large mesh drift gillnet fishery (DGN) targeting swordfish from northern Oregon to central California between August 15 and November 15 due to concerns of bycatch of endangered leatherback turtles (the Pacific Leatherback Conservation Area; PLCA). The spatio-temporal constraints of the PLCA were developed to encompass nearly all previously observed bycatches in the fishery. The PLCA has been effective at reducing bycatch of leatherback turtles. In this study, we examine whether the timing of the current PLCA closure is optimal for leatherback turtle conservation by developing statistical models of leatherback turtle presence inside the PLCA based on environmental variables. We also examine finer-scale spatiotemporal patterns of potential overlap between the fishery and leatherback turtle foraging habitat using Maxent and Random Forests applied to logbook data and leatherback turtle telemetry data. Our results suggest that the current static closure period is the shortest and most effective for protecting the turtles while allowing fishing during low bycatch-risk periods. We also found that it is possible to predict foraging habitat of leatherback turtles and fishing effort using environmental variables. Identification of spatial and temporal hotspots of potential overlap between fishing effort and leatherback turtle distribution can form a basis for dynamic management approaches that limit fishing in high bycatch risk areas while permitting fishing in areas where overlap is unlikely to occur.

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**0200 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Samantha Ehnert, Jim Gelsleichter

*University of North Florida, Jacksonville, FL, USA*

**Mercury Accumulation and Effects in the Brain of Atlantic Sharpnose Sharks (*Rhizoprionodon terraenovae*)**

Sharks often bioaccumulate mercury (Hg) in muscle to levels that threaten human health. However, few published studies have examined if the high Hg levels seen in shark muscle also occur in the shark brain, or if Hg accumulation affects shark neurophysiology. Therefore, this study examined if shark brains accumulate significant levels of Hg, if Hg accumulation occurs in certain subcomponent of the brain, and if Hg accumulation is associated with effects on the shark nervous system, with special focus

on the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*). Sharks were collected along the southeast U.S. coast. Muscle and brain Hg concentrations were determined using a Direct Mercury Analyzer. Correlations between brain Hg concentrations and levels of known biomarkers of Hg-induced neurological effects (e.g., levels of a protein biomarker of glial cell damage, S100b, and markers of oxidative stress) in shark cerebrospinal fluid (CSF) were examined. Brain Hg levels were correlated with muscle Hg levels, but were significantly lower and did not exceed most known thresholds for neurological effects, suggesting limited potential for such responses. Data on CSF biomarker levels support this premise, because they were not correlated with brain Hg levels. Higher Hg levels were measured in the forebrain of shark in comparison with the hindbrain, but levels in both were below threshold levels for effects. This study is the most extensive analysis of Hg in a single shark species, spanning most of its Atlantic range. It is also the first to examine neurological effects of Hg exposure in these animals.

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#### **0400 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Jean Elbers<sup>1</sup>, Mary Brown<sup>2</sup>, Sabrina Taylor<sup>1</sup>

<sup>1</sup>*School of Renewable Natural Resources, Louisiana State University and AgCenter, Baton Rouge, LA, USA,* <sup>2</sup>*Department of Infectious Diseases and Pathology, College of Veterinary Medicine, University of Florida, Gainesville, FL, USA*

#### **Tortoise immunomes shed light on genetic variation underlying infectious disease**

Immune response genes control the immune system's response to pathogens and because changes in these genes can alter disease susceptibility, they are likely to be influenced by selection. Populations of threatened species generally possess low levels of genetic variation, and genetically depauperate hosts may be at greater risk of infectious disease contributing to extirpations. To better understand the genetic basis of infectious disease susceptibility in a species of conservation concern, we sequenced the immune response genes (i.e., immunomes) from 16 free-ranging gopher tortoises *Gopherus polyphemus* from 3 Florida populations (CF, FC, and OLD) with (n=10) or without (n=6) clinical symptoms and that produced antibodies against one of causal agents for an infectious upper respiratory tract disease (URTD). We found several synonymous and non-synonymous SNPs and indels associated with URTD phenotypes. Genetic diversity was lowest in CF followed by OLD and FC. Population differentiation and admixture were as expected based on geographic proximity of populations. There were two SNPs putatively under selection according to  $F_{ST}$  outlier tests, and there were 35 genes that deviated from neutrality according to Tajima's  $D$ . These results demonstrate that immunome sequencing of individuals with symptomatic and asymptomatic phenotypes from several populations can be conducive to better understanding the genetic basis of infectious disease by elucidating what genetic variation is associated with disease susceptibility. Immunome sequencing can also provide valuable information on levels of population genetic diversity, how populations



are genetically differentiated, and what genetic variation may be under selection or deviating from neutrality.

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**0297 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Igbal Elhassan

*University of Bahri, Khartoum, Sudan*

**The Occurrence of the Green Sawfish (*Pristis zijsron*) along the Sudanese Red Sea with Observations on Some Reproductive Parameters**

The aim of the study is to identify the species of sawfish in the Sudanese Red Sea and to assess its current status. Collection of data has been carried out since 2001 by the author. Data from fieldwork was compiled for the period 2001 to 2016, and during Oct 2015 to March 2016 data have been collected from bottom trawling in the southern Sudanese Red Sea Coast. Data have also been collected since 2011 through standard questioner and interviews with fishermen along the Sudanese Red Coast (Age 15 to 90). Identification of 21 rostra of adult sawfish (from 1978 to 2016), two adult sawfishes and juvenile sawfish were *Pristis zijsron*. The result of the questioners and the interviews showed that the sawfish were abundant along all the coastal lagoons (mersas) of the Sudanese Red Sea coast until the 1980s. Larger sizes of sawfish were from the north coast (about 6 m) while the maximum size recorded from the South coast was 375 cm. Current nursery areas of *P. zijsron* along the Sudanese Red seacoast were identified. Based on few specimens (four females) and reports from the fishers, birth dates are from early January to late April. The size of pregnant females ranges from 350 to 375 cm. The maximum numbers of the pups encountered were 8 while the minimum number of pups encountered were 6. Fishers reported 2. Size at birth ranges from 80 to 84 cm. The project is continuing.

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**0931 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Diego Elias, Kimberly Foster, Elyse Parker, Kyle R. Piller

*Southeastern Louisiana University, Hammond, Louisiana, USA*

**Re-evaluation of the Biogeographic history of *Pseudoxiphophorus* (Poeciliidae)**

Poeciliidae is a family of live bearing fishes belonging to the order Cyprinodontiformes. The sub-family Poeciliinae, is comprised of 276 valid species, occurring from eastern United States to northeastern Argentina and the Caribbean, representing one of the most dominant groups of North and Middle American freshwater fishes. The genus *Pseudoxiphophorus* contains eight species and occurs from northern Nicaragua through the northern portion of Mexico. Recent molecular work indicated that cryptic diversity may exist within *Pseudoxiphophorus* and also suggested three major geological events

that have shaped the biogeographic history of *Pseudoxiphophorus* in North and Middle America, the activity in the Trans-Mexican volcanic belt, the Polochic-Motagua fault and the appearance of the Isthmus of Tehuantepec. The objective of this work was to test if these geological events are congruent with divergence time estimates for the species within *Pseudoxiphophorus*. A time calibrated phylogeny was constructed using molecular markers and several fossil calibrations, and a biogeographic inference of ancestral areas for the species in the genus *Pseudoxiphophorus* was made. Our data sheds light into the evolutionary history of the genus *Pseudoxiphophorus*, and the complex history of freshwater fishes in Middle America.

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**0404 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H,  
Thursday 7 July 2016**

Diego Elias, Kyle Piller

*Southeastern Louisiana University, Hammond, Louisiana, USA*

**Digging through the trash: A phylogenetic examination of the Threadfin Shad,  
*Dorosoma petenense* (Günther 1867)**

The genus *Dorosoma* (Clupeidae) is comprised of five recognized species: *Dorosoma cepedianum*, *D. smithi*, *D. anale*, *D. chavesi*, and *D. petenense*. The Threadfin Shad, *Dorosoma petenense*, is the most widespread species of the genus possessing a Nearctic to Neotropical distribution. However, the species is not continually distributed across its range, as a distributional break occurs within the Neo-volcanic Plateau in east central Mexico in a region known as Punta del Morro. The taxonomic status of *D. petenense* has been problematic, and others have recognized variation throughout its range. Furthermore there has not been a comprehensive systematic review of the species or the entire genus. The objectives of this study were to investigate the phylogenetic relationships of the species in the genus *Dorosoma*, and to conduct a phylogeographic analysis of *D. petenense* throughout its distributional range using multiple mtDNA and nDNA markers. The results from our multi-locus analysis of the species relationships provide the first taxon complete phylogeny for *Dorosoma*. Our phylogeographic analysis suggests that *D. petenense* does not represent a single lineage, and previously synonymized species might be taxonomically valid. This work sheds light into the evolutionary history of the ichthyofauna in North and Middle America, and provides insights into the events that may have played a role in shaping the diversity of freshwater fishes in the region.

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## **0847 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Duncan Elkins<sup>1</sup>, Anna George<sup>2</sup>, Sarah Hazzard<sup>2</sup>, Bernie Kuhajda<sup>2</sup>, Seth Wenger<sup>1</sup>

<sup>1</sup>University of Georgia, Athens, GA, USA, <sup>2</sup>Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA

### **Who follows the fish? Patterns in the fishes, mussels, and crayfishes of the Southeast**

The southeastern United States is a global hotspot of temperate biodiversity for freshwater fishes and supports over 90% of the U.S. total species of mussels and nearly half of the global total for crayfish species. These species are also both highly endemic and, increasingly, imperiled; over the last two decades, the number of imperiled freshwater fish species in the Southeast has risen 125%. As part of a project funded by the National Fish and Wildlife Foundation to develop a multi-species conservation plan, we compiled native range maps for 592 species of freshwater fishes using museum records, corrected for recent taxonomic changes. Such plans are frequently hampered by data gaps and differing scales of data availability for the focal taxa, and this project is no exception – sampling data for fish were much more readily available. Previous biogeographic analyses, in drainages within and adjacent to our study area, demonstrate that the patterns of species richness for mussels tend to track fishes closely, likely due to the role of fish hosts in the mussels' life history. However, the concordance between patterns of fish and crayfish is less well studied. To test the hypothesis that fish may be used as a surrogate for other aquatic taxa, we attempt to characterize the scale and pattern of correlation between fish, mussel, and crayfish species presence, endemism, and imperilment at the sub-basin and basin scale.

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## **0627 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, Salon A-C, Thursday 7 July 2016**

Laura Ellis<sup>1</sup>, Walt Golet<sup>2</sup>, James Sulikowski<sup>1</sup>

<sup>1</sup>University of New England, Biddeford, ME, USA, <sup>2</sup>University of Maine, Orono, ME, USA

### **Utilizing Steroid Hormones Within the Skeletal Muscle Tissue to Determine Sex-specific Ratios of Atlantic Bluefin Tuna (*Thunnus thynnus*) in the Gulf of Maine**

The Atlantic bluefin tuna (*Thunnus thynnus*) is prized among recreational and commercial fishermen, which has led to the overexploitation of this species. To properly manage any fishery, routine biological sampling is required. This data is traditionally obtained through the gross examination of bodily tissues. However, the majority of bluefin tuna are eviscerated at sea. Thus individuals are landed lacking their gonads making sexual identification problematic and necessitating the development of an alternative technique for assessing reproductive biology. Previous studies suggest quantifying sex hormones and their metabolites within skeletal muscle tissue is a

reliable means for determining reproductive characteristics of various fish species. Building off this premise, radioimmunoassay was used to quantify estradiol (E<sub>2</sub>) and testosterone (T) concentrations from the muscle tissue of 22 females (FL:195+35cm; 119+71kg) and 29 males (FL:212+27cm; 130+47kg) landed in the New England bluefin tuna fishery between June-December from 2014. These results suggest female E<sub>2</sub> concentrations are higher (969+160pg/g) compared to males (770+94pg/g), while male T levels (1617+241pg/g) are higher than females (753+126pg/g). Based on these results, the levels of reproductive hormone in skeletal muscle tissue are currently being used to evaluate the sex and possible seasonal cyclical reproduction of individuals (>100") landed in the New England fishery. These preliminary results will be presented at this years meeting.

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**0888 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Iain Emmons, Erika Nowak

*Northern Arizona University, Flagstaff, Arizona, USA*

**Winter Habitat Use and Behavior of the Northern Mexican Gartersnake (*Thamnophis eques megalops*) in North-central Arizona**

The Northern Mexican Gartersnake (*Thamnophis eques megalops*) is a wetland and riparian obligate and federally threatened species that has experienced range-wide population declines in the United States. Habitat loss is considered one of the leading threats to survival, yet descriptions of ecological requirements are limited to relatively few studies. Our objectives for this radiotelemetry study were to identify winter behavior and retreat site use for Northern Mexican Gartersnakes in north-central Arizona. We located 22 winter retreat den sites for 21 snakes, and documented ingress, egress, and duration of winter inactivity for nine individuals with internal, temperature-sensitive radio transmitters from 2012-2015. Snakes used burrows and cavities associated with a variety of habitat types located 0.5-156 m from the nearest water source. We documented winter surface activity by multiple snakes, including basking and changing den sites mid-season, the first known records of communal denning for the species, and approximately 3-5 months duration of winter inactivity between late October and mid-March. Our findings have direct implications for Northern Mexican Gartersnake management and recovery efforts, and build on previous winter habitat and behavior records for snakes in seasonally mild climates.

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**0845 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Alison Enchelmaier, Neil Hammerschlag

*University of Miami, Miami, FL, USA*

**Fish Diversity and Abundance in a Restored Mangrove Habitat**

Restoration and monitoring are important conservation tools to ensure the recovery and maintenance of human impacted habitats. Bill Baggs Cape Florida State Park, located in Miami, has been impacted by urban development and hurricanes, leading to the removal of much of the park's native habitat, including mangrove forest. While restoration efforts have been implemented, data on fish abundance and diversity in this critical habitat are lacking. We used BRUVs (baited remote underwater video) to examine the effectiveness of restoration efforts in the man-made mangrove pools in Bill Baggs Park. We then evaluated catch differences between BRUVs and seine net sampling to examine the viability of comparing historical data from previous studies. We observed several species utilizing the pools year-round, including barracuda and grey snapper. We discuss our results as they relate to the efficacy of small-scale restoration efforts in human-dominated ecosystems in subtropical regions.

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**0179 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Nicole Enright, Gavin Naylor

*College of Charleston, Charleston, South Carolina, USA*

**A Vicariance Model for Biogeography and Speciation in Elasmobranchs using Molecular Clocks**

Understanding rates of molecular evolution and dates of divergence in different species can provide useful insights into phenomena such as adaptation and speciation, and may allow one to make inferences about population structure and biogeography. Barriers such as the Isthmus of Panama and the Suez Canal are relatively new vicariant barriers separating two bodies of water inhabited by elasmobranchs, where no gene flow can occur between the separated populations. Such structures provide opportunities to calibrate rates of molecular evolution across a diversity of marine taxa and to explore the influence of different life history parameters on estimated rates of molecular evolution. Elasmobranchs are well suited for such studies as they exhibit both a wide range of life history attributes and include several taxa whose populations have been separated by such vicariant events. In this study, rates of molecular evolution are contrasted for mitochondrial markers across a suite of elasmobranch sister taxa found on either side of vicariant barriers. Patterns of molecular evolution are examined for potential influence of different life history parameters including but not limited to ovipary versus vivipary, generation time, and effective population size.

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**0300 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

James Erdmann

*Southeastern Louisiana University, Hammond, Louisiana, USA*

**This little piggy gets roast beef: the significance of toe movements during amphibian feeding**

Toe vibrations associated with feeding have been observed in several amphibian groups. Hypotheses for the purpose behind this behavior range from neurological disorder to active prey luring. I will test predictions of this poorly understood phenomenon with feeding trials and predator/prey movement and position tracking, using the Gulf Coast Toad (*Incilius nebulifer*) as the study predator and woodlice (*Amadillidium nasatum*) as the prey. Observations will be repeated on a soil and artificial paper substrate to test for the influence of stimulus transfer medium. The resulting video and feeding rate data will be analyzed using regression analysis and analysis of covariance.

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**0504 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Julia Ersan<sup>1</sup>, Brian Halstead<sup>1</sup>, Erica Wildy<sup>2</sup>, Mike Casazza<sup>1</sup>, Glenn Wylie<sup>0</sup>

<sup>1</sup>*US Geological Survey, Dixon, CA, USA*, <sup>2</sup>*California State University, East Bay, Hayward, CA, USA*

**Giant Gartersnakes (*Thamnophis gigas*) Selectively Forage on Native Anurans, Despite High Abundance of Introduced Prey**

The introduction of exotic species can alter trophic dynamics of native species. Threatened giant gartersnakes (*Thamnophis gigas*) forage on a prey community that is comprised almost entirely of exotic species. We examined prey selection of giant gartersnakes by analyzing trap by-catch and regurgitated gut contents of snakes in four basins in the Sacramento Valley of California to determine whether these snakes actively select their prey or if they are simply consuming what is abundant. Although non-native anuran and fish species dominate the available prey community, giant gartersnakes most strongly selected native Sierran treefrogs (*Pseudacris sierra*) metamorphs. If all prey types were equally available, giant gartersnakes would have selected Sierran treefrogs with a probability of 0.596 [0.0254 - 0.855]. Giant gartersnakes also were more likely to select introduced American bullfrog (*Lithobates catesbeianus*) adults over all tested introduced fishes. Managing prey communities to increase native amphibian abundance within the giant gartersnake's range might benefit populations of this rare snake.

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**0226 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Paula Escudero<sup>1</sup>, Derek Tucker<sup>2</sup>, Luciano Avila<sup>1</sup>, Jack Sites<sup>2</sup>, Mariana Morando<sup>1</sup>  
<sup>1</sup>IPEEC-CENPAT-CONICET, Puerto Madryn, Chubut, Argentina, <sup>2</sup>Brigham Young University, Provo, Utah, USA

**Genetic Structure of a Population of *Liolaemus xanthoviridis* Inferred from Microsatellite Markers**

Microsatellites are useful markers for addressing questions on an ecological time scale given that they are relative neutral to natural selection and show high levels of variability. No studies use these molecular markers to answer ecological questions in the widespread and species-rich lizard genus *Liolaemus*, and here we use these markers to estimate the population structure and paternity of several clutches of eggs within a population of *L. xanthoviridis*. The study took place in Bahía Isla Escondida, Chubut (Argentina), during four spring-summer seasons (2012 to 2015). We marked and sexed all individuals captured, and transported gravid females to our laboratory. Digits of marked lizards were used for molecular work, and we amplified 8 microsatellite loci to characterized genetic diversity, paternity, and population structure. Our results showed that genetic diversity higher than in other species of lizards, the paternity analysis revealed absence of multiple paternity and that over the entire sampling area there is only one population of *L. xanthoviridis*. High genetic diversity is important given the restricted geographic distribution of this species, and the absence of multiple paternity suggests that it has a relatively large effective population size.

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**0138 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Evan Eskew, Michael Miller, Janet Foley, Brian Todd

University of California, Davis, Davis, CA, USA

**Comparative Transcriptomics of Two Amphibian Host Species Exposed to the Emerging Fungal Pathogen *Batrachochytrium dendrobatidis***

The emerging disease chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), has devastated amphibian populations globally. However, *Bd* infection has highly variable impacts on different host species. The mechanisms underlying differential host susceptibility to *Bd* are poorly understood, yet this understanding is critical to conserving species imperiled by disease. To characterize amphibian host responses to *Bd* infection, we conducted an experimental exposure trial with a disease-susceptible species, the wood frog (*Lithobates sylvaticus*), and a disease-resistant species, the American bullfrog (*L. catesbeianus*), followed by a comparative transcriptomic analysis using RNA-sequencing to examine gene expression changes associated with pathogen exposure. The two host species were each exposed to two different isolates of *Bd*: Section Line Lake (SL) *Bd*, which has a high virulence phenotype, and Carter Meadow (CM) *Bd*, which has lower virulence. Wood frogs exposed to SL *Bd* suffered significantly greater mortality than wood frogs exposed to CM *Bd* or sham

controls, whereas there were no differences in American bullfrog survival attributable to *Bd* exposure. Our transcriptomic analysis revealed a greater number of sequencing reads mapping to *Bd* in wood frog samples, consistent with their greater *Bd* infection loads compared with American bullfrogs. Both host species showed greater numbers of genes differentially expressed in response to the highly virulent *Bd* compared with the lower virulence isolate. Overall, however, American bullfrogs had much less gene expression change in response to exposure than wood frogs, suggesting American bullfrogs may tolerate *Bd* infection through alternative morphological mechanisms, such as a thickened epidermis.

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### **1103 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Robert Espinoza<sup>1</sup>, Gregory Pauly<sup>2</sup>, Jeanne Robertson<sup>1</sup>

<sup>1</sup>California State University, Northridge, Northridge, California, USA, <sup>2</sup>Natural History Museum of Los Angeles County, Los Angeles, California, USA

#### **Coming to America I: The Invasion History of the Mediterranean House Gecko (*Hemidactylus turcicus*) in the USA**

Documenting the invasion history of an introduced species is the first step toward predicting its invasive potential and ecological impacts. Mediterranean House Geckos (MHGs; *Hemidactylus turcicus*) first appeared in the New World ~100 yr ago in Key West, Florida. Populations are now established from the northeastern US to Chile although their distribution is very patchy over most of this range. Because of their limited innate dispersal abilities and close association with humans, the modes of dispersal are a combination of localized movements (e.g., among houses within a neighborhood) and human-aided jump dispersal (purposefully or unintentionally) over longer distances. To assess which modes of dispersal were likely more prevalent, we assembled locality data from the literature, museum records, and citizen scientists to document the invasion history and current distribution of MHGs in the US. Despite their relatively recent colonization, MHGs have become established in >400 counties across 23 states. We found that although colonization generally followed an out-of-southern-Florida pattern of dispersal to the north and west, there were many instances of jump dispersal as well. The rate of dispersal has also increased dramatically over time, likely because of the concomitant increase in vehicles, human relocations, and commercial shipping. Although these patterns indicate the geographic spread of this species over time, they do not reveal which populations are more likely to disperse or be moved and in what directions. Resolution of these questions will require genomic studies to reveal the fine-scale movements of MHGs into and across the US.

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**0176 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Kory Evans<sup>1</sup>, Brandon Waltz<sup>1</sup>, Prosanta Chakrabarty<sup>2</sup>, James Albert<sup>1</sup>, Victor Tagliacollo<sup>1</sup>

<sup>1</sup>University of Louisiana at Lafayette, Lafayette, Louisiana, USA, <sup>2</sup>Louisiana State University, Baton Rouge, USA

**Modularity begets brachycephaly: Repeated patterns of neurocranial evolution in Neotropical electric fishes.**

The Neo-Darwinian view of adaptation by natural selection assumes that phenotypic variation is produced randomly with respect to function. However, developmental pathways are often buffered against the effects of mutations such that small changes in the timing of gene expression may generate non-random, functionally viable phenotypes. Here we explore the role of heterochrony in the production of ontogenetic variation and phylogenetic diversity in the neurocrania of Neotropical electric fishes (Gymnotiformes: Teleostei). We assess patterns of shape changes during growth and among adults of different species using landmark-based geometric morphometrics in an explicitly phylogenetic framework. We find the brachycephalic to dolichocephalic axis of neurocranial variance, broadly observed across many vertebrate groups, represents the largest component of shape variance (PC1) in development and evolution. We also find shape changes in the face and braincase regions are more integrated during growth in some taxa, and more modular in others, thereby suggesting tradeoffs in the developmental coordination of these two skull regions. These results suggest that neurocranial evolution in gymnotiform electric fishes is constrained by common genetic and developmental pathways present in all vertebrates, and that this biased production of variation has constrained the evolution of neurocranial morphology along lines of least developmental resistance.

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**0545 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Daniel Fahy, Richard Spieler, William Hamlett

Nova Southeastern University, Halmos College of Natural Sciences and Oceanography, Guy Harvey Oceanographic Center, Dania Beach, Florida, USA

**Synchrony of Male and Female Reproductive Parameters during the Biannual Reproductive Cycle of the Yellow Stingray, *Urobatis jamaicensis* (Myliobatiformes: Urotrygonidae)**

A definitive, biannual reproductive cycle with mature females capable of producing two broods annually was documented for the yellow stingray (*Urobatis jamaicensis*) in southeast Florida. Pregnant females were collected during all months throughout the year, but exhibited two discretely overlapping periods of reproduction. The first cycle extended from January to August and the second cycle from July to February. Male and

female stingrays each demonstrated mutual synchrony with consistent bimodal patterns measured for nearly all reproductive parameters. Combining data from individuals on: follicle development, ovulation, embryonic growth, and parturition identified the periodicities of the repetitive female cycles with ovulation and parturition coinciding from January through April (Feb-Mar peak), and July through October (Aug-Sep peak). Sequential patterns of follicle development, with concurrent vitellogenesis and limited reproductive intervals, enabled females to breed immediately following or shortly after parturition of the previous cycle. Gestational periods overlapped during the transition between consecutive cycles (Jan-Feb & Jul-Aug). Thus these periods often displayed the simultaneous occurrence of either term stage females completing the previous cycle, or post-ovulatory females at the onset of the subsequent cycle. Gestation rates of *ca.* 5 months were estimated from the timing between peak ovulation, and observations of both postpartum females and free swimming neonates. Bimodal patterns of spermatogenesis and male sperm storage maintained appropriate levels of synchrony between male and female biannual cycles. Additional support of a biannual cycle was provided by significant differences between fecundity and lateralization of uterine function during each reproductive cycle.

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### **1008 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Luara Falcão<sup>1</sup>, Matthew McDavitt<sup>2</sup>, Vicente Faria<sup>3</sup>

*<sup>1</sup>Programa de Pós-graduação em Ciências Marinhas Tropicais, Instituto de Ciências do Mar - Labomar, Universidade Federal do Ceará, Fortaleza, Brazil, <sup>2</sup>National Legal Research Group Inc., Charlottesville, VA, USA, <sup>3</sup>Departamento de Ciências Biológicas, Universidade Federal do Ceará, Fortaleza, Brazil*

#### **International online trade of sawfish rostra**

The sawfish are rays that belong to the family Pristidae. All five sawfish species are listed in Appendix I of CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora. International trade of species included in this appendix is prohibited, either whole animals or parts of them, with the exception of trade authorized by CITES for scientific purposes. Despite the risk of extinction and the urgent need for conservation, the sawfish is still a target for capture and trade. This trade consists mainly of isolated fins and rostra, which have great cultural value beyond their intrinsic commercial value. The present study aimed to monitor the online international sawfish trade. The data were obtained by searches on *Google Images* using key words about sawfish trade. The search was conducted between March 2015 and January 2016 with a frequency of 3 to 4 times per week. The following data were recorded for each offer of a sawfish specimen: (1) photo, (2) species, (3) URL, (4) price, (5) seller's country, (6) delivery country, (7) size of rostra, (8) estimated rostra age (antique or recently collected), (9) product availability (whether it was already sold or not). A total of 403 isolated sawfish rostra available for trade were recorded. The result of this research is presented in the context of illegal sawfish trade as well as to highlight the need for monitoring of the online trade of such species.

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**0838 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Bryan Falk<sup>1</sup>, Amy Yackel Adams<sup>2</sup>, Robert Reed<sup>2</sup>

<sup>1</sup>*U.S. Geological Survey, Homestead, FL, USA*, <sup>2</sup>*U.S. Geological Survey, Fort Collins, CO, USA*

**How can we use activity patterns to improve the management of invasive reptiles?**

A major obstacle in the research and management of invasive reptiles is the long search time necessary to find individual animals. Long search times may be reduced if the conditions when the animals are active (and likely to be encountered) are well understood. Furthermore, land managers planning rapid-response actions for newly invasive species may want to use information about activity patterns from closely related taxa to inform their searches. Using a large dataset of 2607 observations of 19 snake species in the Florida Everglades, we: 1) identify the covariates of activity for invasive Burmese pythons, and 2) evaluate whether covariates of activity are most similar among closely related species. Our results show how knowledge of activity patterns can improve invasive-reptile management by increasing search efficiency and informing rapid-response decisions.

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**0097 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Vincent Farallo<sup>1</sup>, Rebecca Wier<sup>2</sup>, Donald Miles<sup>1</sup>

<sup>1</sup>*Ohio University, Athens, OH, USA*, <sup>2</sup>*John Carroll University, University Heights, OH, USA*

**Will behavioral compensation buffer species loss in a warming climate?**

Identifying suitable thermal environments for a species is critical, because body temperature influences a myriad of physiological processes. Climate warming is projected to alter the thermal quality of habitats across the planet and the ability for ectothermic organisms to persist in contemporary habitats. One potential response to climate warming is to follow shifting habitats through dispersal. However, species with limited dispersal capacities must adapt to changing conditions or face extinction. Alternatively, species may use behavioral compensation to modulate the influence of environmental variation on physiological processes (Bogert effect). Plethodontid salamanders are lungless and breathe through their skin, resulting in high sensitivity to temperature and moisture. Most species have limited home ranges and low dispersal capacities, which makes them ideal to study behavioral compensation and how it may promote or constrain species persistence in altered thermal niches. In this study we tested the Bogert effect by determining whether several species of plethodontid salamanders select divergent microhabitats in different portions of their range to

maintain similar thermal and hydric conditions. We used agar model salamanders and Thermochron iButtons to assess water loss rates and temperatures at various microhabitat types. We also conducted over 120 area constraint surveys to quantify what microhabitats salamanders were using and when they were being used. Specifically, we addressed two questions; 1) Do thermal and hydric conditions differ for microhabitats at different elevations and/or times?, and 2) Will salamanders utilize different microhabitats at different elevations and/or times?

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### **0999 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Vicente Faria<sup>1</sup>, João Eduardo Freitas<sup>2</sup>, Bruno Macena<sup>3</sup>, Andrey Castro<sup>4</sup>, Pedro Afonso<sup>5</sup>, Jorge Miguel Fontes<sup>5</sup>, Simon Thorrold<sup>6</sup>, Patricia Bordallo<sup>7</sup>, Fábio Hazin<sup>8</sup>, Tito Lotufo<sup>9</sup>

<sup>1</sup>*Departamento de Ciências Biológicas, Universidade Federal do Ceará, Fortaleza, Brazil,* <sup>2</sup>*Programa de Pós-graduação em Ciências Marinhas Tropicais, Instituto de Ciências do Mar - Labomar, Universidade Federal do Ceará, Fortaleza, Brazil,* <sup>3</sup>*Programa de Pós-graduação em Oceanografia, Departamento de Oceanografia, Universidade Federal de Pernambuco, Recife, Brazil,* <sup>4</sup>*Departamento de Ciências Naturais, Universidade Federal de São João del Rei, São João del Rei, Brazil,* <sup>5</sup>*MARE – Marine and Environmental Sciences Centre, University of the Azores, Azores, Portugal,* <sup>6</sup>*Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA, USA,* <sup>7</sup>*Embrapa Agroindústria Tropical, Fortaleza, Brazil,* <sup>8</sup>*Departamento de Pesca e Aquicultura, Universidade Federal Rural de Pernambuco, Recife, Brazil,* <sup>9</sup>*Instituto Oceanográfico, Universidade de São Paulo, São Paulo, Brazil*

### **Population genetic structure of the whale shark, *Rhincodon typus*, in the Atlantic Ocean**

Currently, there is no consensus about whale shark population genetic structure at a global scale. Proposed models based on the mitochondrial DNA control region and microsatellites include (a) a single circumtropical population with low geographic differentiation (mainly between Atlantic and Indian Oceans), and (b) two populations that rarely mix: Atlantic and Indo-Pacific. In both cases, genetic data about the whale shark in the Atlantic has been obtained from specimens sampled in the Gulf of Mexico/Caribbean. The goal of this study was to further describe the population genetics of whale sharks by sequencing the mitochondrial DNA control region (1,344 to 1,388 base pairs) from specimens sampled along previously unsampled Atlantic areas including the following regions and localities: southwest (Ceará, Bahia, and Santa Catarina, in the Brazilian coast; n=3), central (Saint Peter and Saint Paul Archipelago; n=4), and northwest (Azores Archipelago; n=3). We will present a network to describe the relationships among Atlantic whale shark mtDNA haplotypes. The Atlantic network will also be presented in a global context based on publicly available DNA sequences. Further analysis of the dataset will include an analysis of molecular variance to assess whale shark population genetic structure between Atlantic, Indian, and Pacific Oceans.

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**0870 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Stacy Farina

*Harvard University, Cambridge, MA, USA*

**Virtual fish gills: Computational modeling of gills to examine hydrodynamic trade-offs in fishes from diverse habitats**

When compared with air, water is a poor respiratory fluid, with a high viscosity and low dissolved oxygen concentration. Therefore, fluid dynamics potentially play a large role in natural selection of respiratory morphology of fishes that rely on aquatic respiration. While the mechanism of aquatic ventilation in ray-finned fishes is relatively conserved, there is a tremendous diversity in the morphology of this system, particularly regarding the microstructures of the gill tissues. Fish gill tissue consists of long filaments (primary lamellae), which are covered with small folds of tissue (secondary lamellae) that are the main site of gas exchange. These secondary lamellae vary considerably in shape, size, and spacing among species. In this study, I quantify hydrodynamic trade-offs of secondary lamellae morphology in species representing six ecological categories: open-ocean pelagic, benthic-pelagic, deep sea, benthic, pelagic freshwater, and diel vertically migrators. Using a 3D computational model of the secondary lamellae that I have developed in COMSOL Multiphysics, I model the hydrodynamics of the gills of each species based on measurements from scanning electron microscopy. By measuring flow rate through and around the secondary lamellae over a range of differential pressures, I examine the ecological trade-off between the volume of fluid in contact with the surface of the secondary lamellae and the ability of water to pass through the gills.

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**0298 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Jillian Farkas, Drew Davis, Brianna Henry, Jeff Wesner, Jacob Kerby

*University of South Dakota, Vermillion, South Dakota, USA*

**The Effect of Agricultural Runoff on Fish Habitat in the Prairie Pothole Region**

Agricultural tile drains expose wetlands to a suite of pesticides and other agrochemicals. Exposure to these contaminants affects wildlife either directly through toxicity, or indirectly by degrading habitat quality. Wetland habitat quality was measured using the South Dakota Wetland Rapid Assessment Protocol that included variables that estimate both abiotic (e.g., size of wetland, average buffer width, extent of damage caused by agricultural drainage) and biotic factors (e.g., interspersed emergent to submergent vegetation, algal mat coverage) affecting wetland quality. Fish abundance and diversity were sampled via fish traps and seining. Using fish blood smears, we examined the extent of genotoxicity occurring within the individual by quantifying the number of

micronuclei within erythrocytes, a bioindicator signifying that stress occurred during cell division. We examined how habitat quality and fish abundance, diversity, and genotoxicity varied among 18 wetlands receiving three levels of agricultural tile drain input (reference, surface runoff, and tile drain effluent). Results indicated that tile drain wetlands have significantly lower habitat quality than reference sites. Preliminary data indicate that fish abundance and diversity did not differ among treatments, but clear differences among sites were observed for vegetation. Tile sites had significantly increased levels of floating algae and reduced amounts of submergent vegetation. Genotoxicity data is currently being analyzed, and data obtained from ongoing work should provide further information on how agricultural runoff potentially impacts native fish populations.

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## **0810 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Terence Farrell<sup>1</sup>, Sarah Smiley-Walters<sup>2</sup>, Diane McColl<sup>1</sup>

<sup>1</sup>Stetson University, DeLand, FL, USA, <sup>2</sup>The Ohio State University, Columbus, OH, USA

### **Pigmy rattlesnake (*Sistrurus miliarius*) foraging behavior in trials with skinks (*Scincella lateralis*) and centipedes (*Scolopendra viridis*)**

Predators often evolve specialized behaviors to feed on dangerous prey. In vipers, many snakes prey on centipedes but this behavior has only been anecdotally studied. We ran laboratory foraging trials using 29 field captured pigmy rattlesnakes and one of two prey: giant centipedes (*Scolopendra viridis*) or little brown skinks (*Scincella lateralis*). Our goal was to determine how prey type influenced foraging behaviors. In skink trials, pigmy rattlesnakes were significantly more likely to form foraging coils or crater into the substrate than in centipede trials where active pursuit of prey was significantly more frequent. Centipedes were struck in significantly more trials than skinks and centipedes were also struck from significantly closer distances. Strike latency was significantly lower for centipedes than skinks. The location on the prey's body where the strike was directed did not differ in skink and centipede trials. The mean time from the strike to last locomotion of the prey and from strike to prey ingestion were both significantly longer for centipedes. Pigmy rattlesnakes exhibited several behaviors in centipede trials, including head elevation when approaching prey and prey throwing, that were never observed in skink trials. The differences observed in the behavioral trials were related to both snake and prey traits, including centipede resistance to rattlesnake venom. The plasticity observed in prestrike, strike, and poststrike foraging behaviors indicate pigmy rattlesnakes are effective predators on centipedes. The ecological and evolutionary implications of centipede consumption in vipers merits increased attention given its widespread occurrence and behavioral sophistication.

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**0102 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Thomas Farrugia, Andrew Seitz

*University of Alaska Fairbanks, Fairbanks, AK, USA*

**Developing the First Stock Assessment for Skates in Alaska: What Harvest Level is Sustainable?**

Skates are in growing demand worldwide, specifically in European and Asian markets. Big (*Beringraja binoculata*) and longnose (*Raja rhina*) skates are the most commonly landed skates in Alaska and currently, these species are landed as non-target catch, partly because of a lack of information and formal stock assessments. Because skates are long-lived, slow-growing and late-maturing, they are vulnerable to overfishing, and management is unlikely to allow additional skate landings until skate populations are shown to be capable of sustaining increased harvest pressures. Recently, more species-specific information on these skates has made it possible to develop full stock assessments. Through cooperation with the National Marine Fisheries Service (NMFS), we developed the first stock assessment for big skates in Alaska, using Stock Synthesis (SS3), a powerful software package flexible enough to handle data-poor assessments. This single-sex model divides the fishery into longline and trawl fleets, and incorporates two survey data sets. The model shows that the big skate population in the Gulf of Alaska has declined since 2004, and suggests that the initial depletion of the stock has not yet pushed the population to the biomass at maximum sustainable yield. It is unlikely that skate landings could be substantially increased without jeopardizing the sustainability of the stock. A parallel model for longnose skates will also be developed and these models will be shared with NMFS, and used to evaluate the feasibility of expanding harvest opportunities and prosecuting directed fisheries for skates in Alaska.

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**0941 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Jeremy Feinberg, Joanna Burger

*Rutgers University, New Brunswick, NJ, USA*

**Anuran disease surveillance: Examining tadpoles raised *in situ* within an extinction area**

Frog declines, extirpations, and extinctions have occurred with increasing frequency around the world over the past several decades. Many such events have been linked to amphibian diseases. To explore what involvement, if any, disease might have had in one recent frog disappearance from the New York City metropolitan region, we conducted a disease-surveillance experiment using an *in situ* transplant design. We raised tadpoles of two regional leopard-frog species, *Rana* (= *Lithobates*) *kauffeldi* and *R. sphenocéphala*, within enclosures deployed across historical wetlands and watersheds in an extinction zone on eastern Long Island. This work was repeated over three years and four separate

trials, and we found evidence of three deadly frog diseases in our tadpoles: chytrid fungus (*Batrachochytrium dendrobatidis*), ranavirus, and a recently identified Perkinsia-like protist. We did not find all diseases at all sites, but each study site had tadpoles infected with at least one disease. In most cases, within-site results were fairly similar over repeated trials, revealing the somewhat unique disease signature of each individual wetland.

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## **0997 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

**Chris Feldman**<sup>1</sup>, Andrew Durso<sup>2</sup>, Charles Hanifin<sup>3</sup>, Michael Pfrender<sup>4</sup>, Peter Ducey<sup>5</sup>, Amber Stokes<sup>6</sup>, Kenneth Barnett<sup>7</sup>, Edmund Brodie, III<sup>8</sup>, Edmund Brodie, Jr<sup>2</sup>

<sup>1</sup>University of Nevada-Reno, Reno, NV, USA, <sup>2</sup>Utah State University, Logan, UT, USA, <sup>3</sup>Utah State University, Uintah Basin, Vernal, UT, USA, <sup>4</sup>University of Notre Dame, Notre Dame, IN, USA, <sup>5</sup>State University of New York-Cortland, Cortland, NY, USA, <sup>6</sup>California State University Bakersfield, Bakersfield, CA, USA, <sup>7</sup>65 Meadow Rue Place, Ballston Spa, NY, USA, <sup>8</sup>University of Virginia, Charlottesville, VA, USA

### **Is there more than one way to skin a newt? Convergent toxin resistance in snakes is not due to a common genetic mechanism**

Convergent evolution of tetrodotoxin (TTX) resistance, at both the phenotypic and genetic levels, characterizes coevolutionary arms races between amphibians and their snake predators around the world, and reveals remarkable predictability in the process of adaptation. Here we examine the repeatability of the evolution of TTX-resistance in an undescribed predator-prey relationship between TTX-bearing Eastern Newts (*Notophthalmus viridescens*) and Eastern Hog-nosed Snakes (*Heterodon platirhinos*). We found that local newts contain levels of TTX dangerous enough to dissuade most predators, and that Eastern Hog-nosed Snakes within newt range are highly resistant to TTX. In fact, these populations of Eastern Hog-nosed Snakes are so resistant to TTX that the potential for current reciprocal selection might be limited. Unlike all other cases of TTX resistance in vertebrates, *H. platirhinos* lacks the adaptive amino acid substitutions in the skeletal muscle sodium channel (Na<sub>v</sub>1.4) that reduce TTX-binding, suggesting that physiological resistance in Eastern Hog-nosed Snakes is conferred by an alternate genetic mechanism. Thus, phenotypic convergence in this case is not due to parallel molecular evolution, indicating that there may be more than one way for this adaptation to arise, even among closely related species.

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**0626 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Martín Femenías<sup>3</sup>, Luciano J. Avila<sup>1</sup>, Jack W. Sites, Jr.<sup>2</sup>, Mariana Morando<sup>1</sup>

<sup>1</sup>IPEEC-CONICET, Puerto Madryn, Argentina, <sup>2</sup>Brigham Young University, Provo, Utah, USA, <sup>3</sup>Universidad Nacional de la Patagonia San Juan Bosco, Puerto Madryn, Argentina

**On the southernmost leiosaurid lizards: phylogeographic and evolutionary patterns of *Leiosaurus belli*, *Diplolaemus bibronii* and *Diplolaemus darwini* based on the mitochondrial cytochrome b gene**

The Leiosaurae species *Leiosaurus belli*, *Diplolaemus bibronii* and *Diplolaemus darwini* are endemic to southern South America and are distributed over diverse habitats in the ecoregions of Monte and Patagonian Steppe. We sampled 124 localities representing all the distributional range of these species, and for 187 individuals we sequenced the mitochondrial gene cyt-b. We analyzed phylogeographic patterns in the light of historical Miocene-to-Pleistocene events of Patagonia. For *Leiosaurus belli* we inferred 3 allopatric haploclades with uncorrected genetic distances higher than 3%, suggesting that they may be different species. These divergences may have been related to the formation of the Negro, Neuquén and Limay rivers as they have been proposed as gene flow barriers for other lizard species. The northernmost populations show signs of recent expansion. *Diplolaemus darwini* and *D. bibronii* have a southern Patagonia distribution and the latter shows signs of recent population expansion with no apparent role for the Deseado river on their genetic structure. The results of this study, coupled with those of other lizard species from this area, may be useful to define conservation strategies. We suggest a taxonomic review of *Leiosaurus belli*, including more molecular markers and integrating morphological, ecological and behavioral data.

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**0084 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
HERPETOLOGY**

Christina Feng, Michael Dreslik

*Illinois Natural History Survey, Champaign, IL, USA*

**Sex Differentiation in the Growth of Spotted Turtles (*Clemmys guttata*)**

Understanding an organism's growth pattern is essential for informing a species' ecology, life history, and demography. For many chelonians, size correlates strongly with development and can be used to estimate the age at sexual maturity. We investigated organismal growth in an Illinois population of Spotted Turtles using long-term mark-recapture data collected from 1988-2015. We compiled the growth histories of 134 individuals with captures spanning 1-27 years for the size measurements of carapace length (CL) and plastron length (PL). We conducted a nonlinear regression analysis to determine what growth functions best fit the data and then expanded the best-fit function to account for sex. For both CL and PL, the data best fit the Weibull growth function. When reparametrizing the function for sex, the top model parameters included

sex-specific asymptotic size ( $A$ ), growth rate ( $k$ ), and slope of growth ( $m$ ) parameters. For CL, there were an additional three competitive models that included the null model. For the top model, females had a slightly larger asymptotic adult CL (112.42mm) and PL (103.05mm) than did males (106.99mm and 92.30mm, respectively). This difference in PL is likely due to the necessity of tail articulation in males associated with copulation. Because growth differs among sexes, we calculated an ontogenetic SDI, which demonstrates a slight dimorphism ( $0.90 < SDI \leq 1.10$ ) for CL and PL. We estimate the minimum age at sexual maturity for females to be 9.7-10.4 years based on minimum measurements (CL = 91.5mm, PL = 83mm) of gravid females captured during the study.

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## **0510 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Christina Feng<sup>1</sup>, Dave Mauger<sup>2</sup>, Jason Ross<sup>1</sup>, Michael Dreslik<sup>1</sup>

<sup>1</sup>Illinois Natural History Survey, Champaign, Illinois, USA, <sup>2</sup>Forest Preserve District of Will County (retired), Lockport, Illinois, USA

### **A Long-Term Demographic Analysis of Spotted Turtles (*Clemmys guttata*) in Illinois**

Chelonians represent one of the most threatened vertebrate taxa, but the absence of adequate life history and demographic information hinders effective conservation efforts for most species. For freshwater turtles, collecting life history and demographic data is difficult due to their longevity, secretive nature, ontogenetic shifts, and relative inaccessibility. The semi-aquatic Spotted Turtle (*Clemmys guttata*) is listed as an endangered species in Illinois, and only two populations remain extant within the state. Since 1988, one of the populations has been the subject of a mark-recapture study to examine its long-term population dynamics. We compiled capture histories for 258 individual turtles (198 included in the analysis) and used Program RMark to compare 17 live-encounter Cormack-Jolly-Seber models using AICc rankings. These models represented all combinations of and interactions between the variables sex, time, and age. The top-ranked model included a constant survival probability and cohort-dependent recapture probabilities across survey years. We incorporated age as a time-dependent covariate and computed age-specific survival rates for 0 (hatchling) to 21 years. We calculated female fecundity rates from captures and radiographs of gravid females and combined these with female survival rates to construct a deterministic life table and Leslie matrix. Our results indicate survival rates and recapture probabilities vary substantially by age but have been relatively stable between years for the duration of this study.

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**0246 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Allyson Fenwick<sup>1</sup>, Christopher Parkinson<sup>2</sup>

<sup>1</sup>University of Central Oklahoma, Edmond, OK, USA, <sup>2</sup>University of Central Florida, Orlando, FL, USA

**Taxon-dense Phylogeny of Crotalinae Using Combined Morphological and Multigene Analysis**

Pitvipers are not only of medical interest but also excellent model organisms for evolutionary and ecological questions. The group can be even more useful with a phylogeny including a maximal number of species. Although several studies have thoroughly sampled species relationships of genera or related groups of genera, the most comprehensive study to date included 126 of 231 currently-described species. One challenge is that DNA or specially-preserved tissues may not be available for newly described species or for those known from few specimens, but images or formalin-fixed specimens are often available for these taxa. This study combines morphological data for over 90% of species with multigene mitochondrial data for approximately 75% and a nuclear locus for 40%. We evaluate the placement of limited-data morphology-only taxa (approximately 98% incomplete in a matrix of over 4500 characters) and the effect of combining these independent datasets. We investigate pitviper intergeneric relationships, which have been historically difficult to resolve due to short internal branches. We discuss species- and genus-level relationships which have not been reported or have been controversial in prior work.

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**0161 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Jennifer Fernandez<sup>1</sup>, Leigh Anne Harden<sup>2</sup>, Brock Struecker<sup>1</sup>, Joseph Milanovich<sup>1</sup>

<sup>1</sup>Loyola University Chicago, Chicago, IL, USA, <sup>2</sup>Benedictine University, Lisle, IL, USA

**Seasonal Blood Chemistry of Ornate Box Turtles in Restored Prairies of North-central Illinois**

The development and conversion of native prairies, primarily to agricultural land, has left only 3% of original native prairie habitat in the United States. In Illinois, *T. ornata* was recently listed as threatened and little remains known about the overall health of *T. ornata* populations in the smaller, restored/remnant prairies in north-central Illinois. We investigated the physiological health status of two *T. ornata* populations across one year using radiotelemetry, temperature data loggers, and blood tissue collection. Turtles from two populations in Will and Grundy Counties, Illinois were followed one to three times per week from April 2015 - April 2016. Once per month between April to September 2015 we secured each turtle to take a blood sample (<0.25 ml) from the subcarapacial vein. A blood chemistry panel measuring concentrations of Na<sup>+</sup>, Cl<sup>-</sup>, K<sup>+</sup>, Ca<sup>2+</sup>, glucose,

hematocrit, urea, hemoglobin, and creatinine was immediately performed on whole blood using an i-STAT point-of-care (POC) handheld blood analyzer and an i-STAT CHEM8+ cartridge. Whole blood was also used to create three blood smears per turtle to investigate blood cell morphology and parasites using a standard light microscope under 1000x (oil). Our results indicate seasonal variation in several blood chemistry metrics across both sites, driven by variation during spring months. Furthermore, our data did not show any measurable variation in blood cell morphology and no parasites were identified. An assessment of *T. ornata* populations, specifically data regarding the blood chemistry, is much needed to further establish specific conservation targets for this threatened species.

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### **0594 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Luciana C Ferreira<sup>1</sup>, Michele Thums<sup>2</sup>, Andre Afonso<sup>5</sup>, Adam Barnett<sup>3</sup>, Richard Fitzpatrick<sup>3</sup>, Neil Hammerschlag<sup>4</sup>, Fabio Hazin<sup>5</sup>, Michael Heithaus<sup>6</sup>, Rory McAuley<sup>7</sup>, Jessica Meeuwig<sup>9</sup>, Mahmood Shivji<sup>10</sup>, John Stevens<sup>8</sup>, Ben Radford<sup>2</sup>, Mark Meekan<sup>2</sup>

<sup>1</sup>University of Western Australia/Australian Institute of Marine Science, Perth, WA, Australia, <sup>2</sup>Australian Institute of Marine Science, Perth, WA, Australia, <sup>3</sup>James Cook University, Cairns, QLD, Australia, <sup>4</sup>University of Miami, Miami, FL, USA, <sup>5</sup>Universidade Federal Rural de Pernambuco, Recife, PE, Brazil, <sup>6</sup>Florida International University, Miami, FL, USA, <sup>7</sup>Department of Fisheries, Government of Western Australia, Perth, WA, Australia, <sup>8</sup>CSIRO Marine and Atmospheric Research, Hobart, TAS, Australia, <sup>9</sup>University of Western Australia, Perth, WA, Australia, <sup>10</sup>Nova Southeastern University, Fort Lauderdale, FL, USA

### **Global Patterns in the Movements and Habitat Use of tiger sharks**

The expense and difficulties of capturing and tagging large apex predators such as tiger sharks means that most studies report movement and habitat use data for only a few individuals. This hampers our understanding of the ecological and environmental drivers of movement at both stock and population scales. To address this issue, we pooled data among tracking studies to create a database of tracks of 104 tiger sharks that were tagged in the Indian (Ningaloo Reef, Australia), the Pacific (Great Barrier Reef and Hawaii), and the Atlantic (Recife, Fernando de Noronha Brazil, Florida and Bahamas) Oceans. Monthly utilization distributions were calculated for each track using the Biased Random Bridge kernel method. Tracks were divided into periods of migration and residency and the migration section was analysed separately with a Step Selection Function. This method generates random steps around each location based on the real distribution of angles and steps as a way to estimate resource selection by comparing observed habitat used with available structures. We then modelled the resulting dataset with a binomial distribution using generalized additive mixed models with a range of environmental variables (SST, bathymetry, currents). Utilization distributions were also used as a response variable to identify the major drivers of movement and habitat use

for the species. We only found weak trends in migratory movements, suggesting high plasticity in spatial ecology of tiger sharks a trait that might be important in the success of the species as a top order predator in tropical oceans worldwide.

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### **0349 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Karen Field, Karen Maruska

*Louisiana State University, Baton Rouge, LA, USA*

#### **Context-dependent chemical signaling and social behaviors in reproductively-receptive female cichlids**

Across vertebrates chemoreception provides crucial information about survival and reproduction. In several fish species, chemosensory signaling is crucial for social communication, and female-released compounds can elicit physiological and behavioral responses in males. These socially-relevant female-released compounds can be passively emitted through the skin and gills, or actively released through urine. It was previously shown that males of the highly social African cichlid, *Astatotilapia burtoni*, alter urination behaviors depending on social context, but whether females have evolved a similar chemosensory signaling mechanism is unknown. We tested the hypothesis that gravid (reproductively-receptive) females actively alter urination rate and social behavior in a context-dependent manner. Using an innocuous dye to visualize urine pulses, we exposed dye-injected gravid females to five conditions: dominant male, gravid female, brooding (non-receptive) female, juvenile fish, and no fish, and quantified urine release and social behaviors. We found that gravid females alter urination rates in a context-dependent manner with increased urination in both reproductive (dominant male exposure) and aggressive (brooding female exposure) settings, and that aggressive behaviors differ in the presence of females of different reproductive states. Further, urination rate and aggressive displays were positively correlated. This suggests that *A. burtoni* females have a similar chemosensory signaling mechanism to that of males, conveying reproductive status or body condition to males and to other females. Coupled with previous studies, these data demonstrate how intra- and inter-sexual social behaviors, including chemosensory signaling, are used by both sexes in varying contexts within a single species, shedding light on social communication in vertebrates.

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## 0262 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016

Andrew Fields<sup>1</sup>, Kevin Feldheim<sup>2</sup>, Gregg Poulakis<sup>3</sup>, Rachel Scharer<sup>3</sup>, Demian Chapman<sup>1</sup>

<sup>1</sup>*Stony Brook University, Stony Brook, NY, USA*, <sup>2</sup>*The Field Museum, Chicago, IL, USA*, <sup>3</sup>*Florida Fish and Wildlife Conservation Commission, Port Charlotte, FL, USA*

### **Insights on Smalltooth Sawfish, *Pristis pectinata*, Biology and Life History from Over a Decade of Genetic Sampling**

Florida populations of smalltooth sawfish (*Pristis pectinata*) have declined up to 99% over the past several decades. Despite this, these populations are relatively robust genetically, exhibiting high levels of allelic richness and heterozygosity at microsatellite loci. Using this suite of microsatellite markers, we examined the mating system and potential reproductive philopatry at two sites in Florida: the Caloosahatchee River and the Peace River. Preliminary results have shown a biennial reproductive cycle and interannual site fidelity of mature females to these sites. Additionally, we describe the first documented cases of parthenogenesis in a normally sexually reproducing wild vertebrate. These results will be instrumental in guiding the recovery planning process for this species.

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## 0796 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016

Andrew Fields<sup>1</sup>, Gunter Fisher<sup>2</sup>, Stanley Shea<sup>3</sup>, Huarong Zhang<sup>3</sup>, Debra Abercrombie<sup>4</sup>, Kevin Feldheim<sup>5</sup>, Elizabeth Babcock<sup>6</sup>, Demian Chapman<sup>1</sup>

<sup>1</sup>*Stony Brook University, Stony Brook, NY, USA*, <sup>2</sup>*Kadoorie Farm and Botanic Garden, Tai Po, Hong Kong*, <sup>3</sup>*BLOOM association, Central, Hong Kong*, <sup>4</sup>*Abercrombie and Fish, Port Jefferson Station, NY, USA*, <sup>5</sup>*Pritzker Laboratory for Molecular Systematics and Evolution, The Field Museum, Chicago, IL, USA*, <sup>6</sup>*Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL, USA*

### **Species composition of the global shark fin trade assessed by a genetics-based survey of the retail market**

Fisheries supplying the demand for the Cantonese delicacy shark fin soup are a major driver in the depletion of shark populations all over the world, prompting strong public support for new investments to address this global environmental problem.

Understanding the species composition of the global dried shark fin trade will be an essential component of emerging efforts to improve the sustainability of these fisheries. We estimate the contemporary species composition of the fin trade by genetically surveying randomly collected samples (N=4,800) from the retail market of the Hong Kong Special Administrative Region (SAR), one of the world's largest shark fin trading and consumption centers. We estimate that at least 81-99 species of sharks, rays and chimeras occur in the fin trade yet the trade has become very focused on a small subset

of the sharks. The blue shark (*Prionace glauca*), a productive epipelagic species, has become the foundation of the trade (40.73-57.56%) as the importance of certain less prolific species has declined. The supplies of many of the other commonly traded species are likely to decline in the future due to overfishing and increasing regulation, while one third of all of the traded species are assessed by the International Union for the Conservation of Nature (IUCN) to be at high risk of extinction.

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**0222 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Derek Filipek<sup>1</sup>, Ginny Adams<sup>1</sup>, Donald Shepard<sup>2</sup>

<sup>1</sup>University of Central Arkansas, Conway, Arkansas, USA, <sup>2</sup>University of Louisiana Monroe, Monroe, Louisiana, USA

**Phylogeography and Historical Demography of the Queensnake, *Regina septemvittata***

The eastern United States has a complex physiography characterized by large river systems, extensive mountain ranges, and historical glacial cycles. These geographical features have significantly impacted distributions and evolutionary patterns of species within the region. The Queensnake, *Regina septemvittata*, is a semi-aquatic snake with a mostly contiguous distribution throughout the eastern United States and a disjunct population in Arkansas. To determine how this species has been affected by geographical factors, we sequenced the mitochondrial cytochrome *b* gene for *R. septemvittata* from throughout their distribution and inferred phylogeographic relationships, divergence times, and historical changes in population size. Using model-based phylogenetic methods, we inferred four geographically distinct lineages: an Arkansas lineage, an east-central lineage, a Gulf Coast lineage, and an Atlantic Coast lineage. Divergence times estimated using BEAST indicated that *R. septemvittata* originated in the Middle Miocene and the most recent common ancestor of all *R. septemvittata* was during the Late Pliocene. Divergence of Atlantic and Gulf coast lineages occurred during the Early Pleistocene whereas the Arkansas lineage diverged from the east-central lineage more recently during the Late Pleistocene. Historical demographical analyses indicated that population sizes of Arkansas, Gulf Coast, and Atlantic Coast lineages have been relatively stable. In contrast, the east-central lineage showed a stable population size until ~20,000 years ago when it displayed a marked increase, likely due to northward range expansion following glacial retreat after the Last Glacial Maximum. Our results underscore the importance of geography in generating and maintaining biodiversity patterns in the eastern United States.

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**0225 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Derek Filipek<sup>1</sup>, Ginny Adams<sup>1</sup>, Donald Shepard<sup>2</sup>

<sup>1</sup>University of Central Arkansas, Conway, Arkansas, USA, <sup>2</sup>University of Louisiana Monroe, Monroe, Louisiana, USA

**The Role of the Ecological Niche in Lineage Diversification of Queensnakes, *Regina septemvittata***

The reduction in gene flow that facilitates population divergence and speciation can be due to 'hard' barriers such as rivers and mountains or 'soft' barriers such as variation in environmental conditions. Hard barriers are typically obvious physical features of the landscape that impact a large number of species similarly whereas soft barriers are more difficult to detect and may be species-specific. Ecological niche modeling is often used to characterize and compare the niches of different species or populations. These methods also provide a means to determine whether divergence is associated with soft barriers to gene flow and to examine patterns of niche evolution. We used freshwater environmental data layers to generate ecological niche models (ENMs) in Maxent for the four geographically distinct evolutionary lineages within the Queensnake, *Regina septemvittata*. We used ENMTools to determine if geographic boundaries between lineages were associated with abrupt environmental changes as would be predicted by the presence of a soft barrier to gene flow. We also used ENMTools to test whether niche conservatism or niche divergence has played the more prominent role in promoting and maintaining lineage divergence. ENMs showed that the region separating the disjunct Arkansas population from populations east of the Mississippi River has low suitability. Geographic boundaries between lineages varied in their degree of environmental change with some supporting the presence of a soft barrier; the existence of hard barriers was also evident. Environmental niches differed among lineages, indicating niche divergence has played the prominent role in lineage divergence.

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**0133 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Brittany Finucci<sup>1</sup>, Carlos Bustamante<sup>2</sup>, Emma Jones<sup>3</sup>, Matthew Dunn<sup>1</sup>

<sup>1</sup>Victoria University of Wellington, Wellington, New Zealand, <sup>2</sup>Molecular Fisheries Laboratory, University of Queensland, Brisbane, Australia, <sup>3</sup>National Institute of Water and Atmospheric Research (NIWA), Auckland, New Zealand

**Specialized Diet of the Deep-sea Elasmobranch, the prickly dogfish (*Oxynotus bruniensis*)**

Specialist diets have been identified amongst elasmobranch, although the degree of specialization can be subjected to individual specialists, competition, and fluctuations in spatial and temporal prey abundance and availability. Several examples of chondrichthyans playing a large role in diet of other chondrichthyans have been previously documented, although few are known from the deep-sea, and have included



large bodied species. The prickly dogfish *Oxynotus bruniensis* is a small (<75 cm), little known deep-sea elasmobranch distributed on the outer continental and upper slope of southern Australia and New Zealand. Specimens (n = 53) were collected from research trawls surveys and fisheries observers from around New Zealand at depths from 400 to 1300 m. Stomach contents were dissected and prey items were identified to the lowest possible taxon. Findings included longnose chimaera *Harriotta raleighana* embryos and vitellus from unknown origin. The mitochondrial genes *cox1* and *nadh2* were sequenced from 24 samples of homogenized stomach content (including vitellus and egg cases). DNA sequences reveals that *O. bruniensis* preys exclusively on the egg cases of oviparous chondrichthyans, including Pacific spookfish *Rhinochimaera pacifica* and brown chimaera *Chimaera carophila*. These findings are the first evidence of a wild shark relying solely on egg cases from other chondrichthyans as a food source. In addition to its low reproductive output and high distribution overlap with fishing efforts, the reliance on a specialized diet may make *O. bruniensis* a particular vulnerable species to overfishing.

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## **0107 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Brittany Finucci<sup>1</sup>, Matthew Dunn<sup>1</sup>, Emma Jones<sup>2</sup>

<sup>1</sup>Victoria University of Wellington, Wellington, New Zealand, <sup>2</sup>National Institute of Water and Atmospheric Research (NIWA), Auckland, New Zealand

### **Aggregative Behaviour and Social Structure in Deep-sea Chondrichthyans**

A wide range of Chondrichthyans are known to form aggregations, associations or groupings. The motivation for these interactions have been attributed to foraging, reproduction, energy conservation, and social preference. Due to the highly mobile nature of sharks, in addition to the difficulty of following individuals in the open sea, most research on social interactions or associations has been limited to temperate, inshore species, with some degree of site fidelity. However, some of the earliest insights into the structure of shark groupings were gained from analysing commercial trawl catches. We evaluate the occurrence of social grouping in a range of common and infrequently caught deep-sea chondrichthyans (6 holocephalans, 10 elasmobranchs), including the estimation of companion preferences across sex and size classes, using a large data set from fisheries-independent research trawl surveys. Only a few species were found to engage in aggregative behaviour, and those that did had companion preferences that varied with sex, and fish density. Group composition changed with depth and density, and for some species, aggregations were repeatedly found in discreet locations. Most often, aggregations consisted largely of juveniles, and mature females were the least likely to form aggregations. However, this pattern was not true of all species. The existence and nature of aggregations will influence species relative vulnerability to fishing.

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**0435 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
ICHTHYOLOGY**

Taylor Fisher, Lesley Kim, Kory Evans, James Albert

*University of Louisiana at Lafayette, Lafayette, Louisiana, USA*

**Relationship Between Diet and Snout Morphology in Apterodontid Electric  
Fishes (Gymnotiformes) from the Amazon Basin**

Apterodontid electric fishes in deep river channels of the Amazon and Orinoco Basins are species rich and exhibit pronounced differences in the morphology of the snout and oral jaws. However, the diet of these species is poorly known. We compared morphological and ecological variables using  $\delta^{15}\text{N}$  stable isotope, gut content, geometric morphometric, and habitat data for six species; *Compsaraia samueli* (n=20), *Porotergus gimbeli* (n=17), *Sternarchella orthos* (n=20), *Sternarchogiton nattereri* (n=20), *Sternarchorhamphus muelleri* (n=10), and *Sternarchorhynchus chaoi* (n=10), all collected using trawls at 5 - 10 m along river margins at Santarém (Eastern Amazon) and Iquitos (Western Amazon).  $\delta^{15}\text{N}$  values from epaxial muscle were used to estimate diet integrated over weeks, and gut content analysis to estimate diet at a single time point. PC1 of head shape was not correlated with average  $\delta^{15}\text{N}$  values, indicating that species with long and short snouts have a similar average trophic position (3.5 +/- 0.8). Species with short snouts have a greater range of variances in average trophic position (SD = 0.1-0.8) compared to species with long snouts (SD = 0.34-0.38). Species with short snouts had the least (*S. orthos*) and most (*P. gimbeli*) variable  $\delta^{15}\text{N}$  values. These results suggest that apterodontids collected in the same habitats consume similar prey items, although perhaps in different proportions, and that species with short snouts have both the least and most specialized diets. These results do not indicate trophic partitioning among species of the deep channel apterodontid ichthyofauna.

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**1107 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Robert Fisher<sup>1</sup>, Peter Harlow<sup>2</sup>, Ramesh Chand<sup>3</sup>, Jone Niukula<sup>4</sup>, Joeli Vadada<sup>4</sup>, Baravi Thaman<sup>4</sup>, Elenoa Seniloli<sup>5</sup>, Tuverea Tuamoto<sup>5</sup>, Sia Rasalato<sup>6</sup>, Tui Yanuya<sup>4</sup>, Stesha Pasachnik<sup>7</sup>, Kim Lovich<sup>7</sup>, Nunia Thomas-Moko<sup>5</sup>

<sup>1</sup>U.S. Geological Survey, San Diego, California, USA, <sup>2</sup>Taronga Zoo, Mosman, NSW, Australia, <sup>3</sup>Kula Eco Park, Sigatoka, Fiji, <sup>4</sup>National Trust of Fiji Islands, Suva, Fiji, <sup>5</sup>NatureFiji-Mareqeti Viti, Suva, Fiji, <sup>6</sup>Birdlife Pacific, Suva, Fiji, <sup>7</sup>San Diego Zoo Global, San Diego, California, USA

**Community-Based Recovery of the Monuriki Island Crested Iguana  
(*Brachylophus cf. vitiensis*) in Fiji**

The Fijian Crested Iguanas (*Brachylophus cf. vitiensis*) are a critically endangered species restricted to a few small islands in the dry forest zone of Fiji. This dry forest habitat is also critically endangered and restricted to a few isolated patches on disparate islands. The population of iguanas on Monuriki Island (40.4 hectares) represents a putative new

species and is the third largest population of the Crested Iguanas that remains. Since its first documentation in the early 1980's it has been a well known location that local resorts have harvested iguanas from for display. In the late 1990's the first efforts to conserve and restore this island were discussed but it took until the development of the Crested Iguana Recovery Plan in 2008 that conservation was implemented. Since 2008, goats and rats have been removed from the island, and 10 pairs of iguanas were brought into captivity in Fiji for captive breeding. In 2015 the first 32 captive-bred iguanas were released back on the island. Twenty-six of these were radio-tracked for the short term to determine their fate, and 18 were found after 56 days indicating excellent short term survival. In February of 2016 Tropical Cyclone Winston passed through Fiji with a peak intensity of ten-minute sustained winds of 230 km/hr and removed most or all of the canopy leaves from trees on Monuriki Island. Results of the March/April island surveys which will document longer term survival will be presented and the success of the community based efforts will be discussed.

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## **0751 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Lee Fitzgerald<sup>1</sup>, Wade Ryberg<sup>2</sup>

<sup>1</sup>*Biodiversity Research and Teaching Collections, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas, USA*, <sup>2</sup>*Institute of Renewable Natural Resources, Texas A&M University, College Station, Texas, USA*

### **Conservation Scaling: Confronting the mismatch between ecological knowledge and conservation strategies**

A central question in conservation is “What allows a species to persist and conversely, what causes it to disappear?” The ecological answer depends on factors such as species’ life history and sensitivity to landscape change. The relative importance of these processes varies with scale. The conservation answer depends on the match between ecological scaling and conservation scaling: the extent to which conservation measures are effective at multiple scales. Most conservation strategies, for example sustainable use, ecotourism, stopping illegal wildlife trade, and protecting endangered species are confronted with challenges related to scaling and mismatch. Our research on an endemic habitat specialist, the Dunes Sagebrush Lizard (*Sceloporus arenicolus*), lends insight to challenges of conservation scaling. Ecological studies reveal how population dynamics in these lizards scales from neighborhoods of interacting individuals up to the distribution of the species across its range. Moreover, the configuration of irreplaceable dune landforms are directly linked to population vital rates, neighborhood vitality, and population persistence. Fragmentation from oil and gas development in the Mescalero-Monahans Dunes disrupts both the geomorphologic processes that maintain dunes and the diffusion-dispersal dynamics that connect lizard neighborhoods. The extent of conservation measures in conservation agreements does not match the dynamics of ecological scaling in this system and may not confront the higher-level problem of fragmentation that drives species disappearance. The mismatch between conservation scaling and ecological scaling is a pervasive challenge to biodiversity conservation.

Conservation scientists might benefit from embracing realities of conservation scaling, and planning for the scaling limits of conservation interventions.

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### **0858 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Cristín Keelin Fitzpatrick<sup>1</sup>, Andrea Bernard<sup>1</sup>, Filip Osaer<sup>2</sup>, Krupskaya Narváez<sup>2</sup>, Mahmood Shivji<sup>1</sup>

<sup>1</sup>Save Our Seas Shark Research Center and Guy Harvey Research Institute, Nova Southeastern University, Dania Beach, Florida, USA, <sup>2</sup>ElasmoCan, Las Palmas de Gran Canaria, Spain

#### **A Genetic Exploration in a Last Refuge: The Common Angelshark (*Squatina squatina*) in the Canary Islands**

The common angelshark (*Squatina squatina*) has been extirpated from nearly the entirety of its historical eastern North Atlantic and Mediterranean range and is listed as 'Critically Endangered' by the IUCN Red List of Threatened Species. Currently, only a single known remnant population of any abundance exists, occurring within the waters surrounding the Canary Islands. Nothing is known about the genetic population dynamics of this species. To assess the common angelshark's genetic connectivity and diversity, tissue samples (n = 509) were collected between 2009-2016 from three separate islands within the archipelago: Gran Canaria and Tenerife - which are separated by a deep ocean channel (~3000 m) which potentially serves as a barrier to dispersal for this benthic species, and Lanzarote. To date, DNA sequences have been obtained from four mitochondrial loci [control region (CR) (n = 233), Cytochrome c oxidase subunit 1 (COI) (n = 16), NADH dehydrogenase subunit 4 (ND4) (n = 28), and NADH dehydrogenase subunit 2 (ND2) (n = 4)] revealing exceptionally low genetic diversity across all regions, as identical haplotypes were found in nearly all analyzed individuals. Additionally, next-generation sequencing has been used to develop a species-specific library for novel microsatellites and preliminary screening of each of 18 markers has shown these loci to be monomorphic across 16 individuals. Further screening of additional loci (mitochondrial and microsatellite) and individuals is ongoing. Such potentially low levels of genetic diversity may have far reaching implications for the persistence of this species and ultimately underscore the common angelsharks' highly vulnerable state.

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**0643 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday  
7 July 2016**

Virginia Fleer, Chet Rakocinski

*University of Southern Mississippi- Gulf Coast Research Laboratory, Ocean Springs,  
MS, USA*

**Cryptic fish assemblages vary between artificial and historic oyster reefs in the  
Mississippi Sound**

Various natural and anthropogenic driven stresses on oyster reefs in the Mississippi Sound have recently led to extensive reef restoration efforts within this region. Reef restoration is primarily directed toward the overall goal of enhancing the production of commercially and recreationally important oysters and fishes, and secondarily toward the provision of other ecological services, including filtration, nutrient regeneration, and shoreline protection. However, functional assessments of restoration success are typically lacking. Through multifarious trophic connections within the oyster reef food web, resident cryptic fishes represent a critical element of proper oyster reef function. This study examines variation in cryptic fish assemblages between a historic reef and among three restored artificial reef sites in the MS Sound over four months in summer/fall 2014. Artificial reefs varied in terms of substrate (limestone/concrete and oyster shell), depth, water flow, and distance from shore. Sampling trays were deployed at reefs and retrieved every five weeks to examine spatio-temporal variation in cryptic fishes and invertebrates. Cryptic fish assemblages varied significantly seasonally ( $P = 0.015$ ; PERMANOVA); and a temporal shift in assemblage structure at the historic reef occurred one month prior to that at the artificial reefs. The temporal shifts were further illustrated and elucidated by multidimensional scaling (MDS) and similarity percentages (SIMPER). This study is instrumental to understanding and elucidating the dynamics of cryptic fish species assemblages as indicators of proper ecological function between historic and artificial reefs in the Mississippi Sound.

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**0387 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
ICHTHYOLOGY**

Michelle Fleming, Ginny Adams, Reid Adams

*University of Central Arkansas, Conway, Arkansas, USA*

**Historic Changes in Centrarchidae Assemblage Patterns in the Saline River,  
Arkansas**

Links between land use change and persistence and stability of fish assemblages are not well understood and require long-term data sets. Data from fish faunal surveys conducted in 1971 and 1982 in the Saline River system, located in the Ouachita River basin of south central Arkansas, by students from University of Louisiana at Monroe were available to begin studying changes in fish assemblages and relationships with land use. Centrarchid assemblage patterns and historic land use were studied at 20 sites

sampled in both periods. Centrarchid species richness and total abundance generally increased from 1971 (13 species; 1,216) to 1982 (17 species; 2,528). *Lepomis megalotis* (75% and 63%) and *Lepomis macrochirus* (17% and 15%) had highest relative abundances during both collection periods, respectively. Mean similarity of centrarchid assemblages among time periods was low (Jaccard's: 0.33) and ranged from 0 to 0.75 across the 20 sites. *Lepomis cyanellus* and *Lepomis miniatus* increased in frequency of occurrence across sites by 35% in the upper Saline River from 1971 to 1982. Similarly, *Lepomis macrochirus* increased by 15%, *Lepomis gulosus* 20%, and *Micropterus salmoides* 25%. There was no significant correlation between land use and sunfish assemblage similarity (all  $r < -0.02$ ;  $p > 0.05$ ). However, there was an apparent upstream shift of lowland, pool-adapted species across the upper Saline River study sites. Moving forward, we will use historical (1971,1982) and more recent data to evaluate changes in land use and centrarchid assemblage patterns in the Saline River.

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## 0525 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016

Daniela Flores<sup>1</sup>, Jaymie Reneker<sup>2</sup>, Daniel Warner<sup>3</sup>, Fredric Janzen<sup>1</sup>

<sup>1</sup>Iowa State University, Ames, IA, USA, <sup>2</sup>University of North Carolina Wilmington, Wilmington, NC, USA, <sup>3</sup>Auburn University, Auburn, AL, USA

### **Intrasexual size variation in *Chrysemys picta* as a potential indicator of reproductive strategies**

Sexual dimorphism is observed in a wide variety of taxa, presumably stemming from sexual selection. Sexual size dimorphism in the painted turtle (*Chrysemys picta*) extends to intrasexual size variation, most notably in females. In this and many other oviparous species, parental care is limited to maternal effects in terms of egg size, yolk hormones, and nest microenvironment. Maternal nest-site choice is especially critical in species like *C. picta* that have temperature-dependent sex determination, in which incubation temperature permanently dictates the sex of the offspring. This two-part experiment combined field observation with a laboratory incubation study of *C. picta* to examine morphological indicators of a female's nesting behavior and measures of reproductive output. Nesting females in the field were characterized as flat, domed, or average based on carapace measurements. A measure of the thermal environment (i.e., vegetation cover) was quantified for each nest site and offspring sex ratios were obtained after egg incubation at the pivotal temperature of sex determination (i.e., 28°C). In the field study, more domed females exhibited a weak tendency to nest in sunnier sites. Egg incubation in the lab, however, did not detect any association between a female's shape and the sex of her offspring, implying that female *C. picta* do not have an intrinsic ability to alter their offspring sex ratio. These findings highlight a unique example of a morphology-behavior relationship in vertebrates.

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## 1083 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016

Brook Fluker

*Arkansas State University, Jonesboro, AR, USA*

### **Identifying Phylogeographic Breaks in Darters Across the Gulf Coastal Plain of the Southeastern United States**

One of the most prominent phylogeographic breaks among Gulf Coastal Plain species in the southeastern United States is the division between populations east and west of the Mississippi River (i.e., the Mississippi River discontinuity). Recent phylogeographic studies of darters distributed in this region have revealed unique patterns of diversification, yet concordant phylogeographic breaks have not yet been well identified. This study used mitochondrial and nuclear DNA sequence data from several Gulf Coastal Plain darter species including *Etheostoma chlorosoma*, *E. gracile*, and *E. parvipinne* to evaluate concordance of the east-west Mississippi phylogeographic break, and to gain a better understanding of factors that shape genetic structure in darters across the Gulf Coastal Plain. Preliminary analyses revealed that only one of the three species (*E. parvipinne*) exhibits a clean phylogeographic break east and west of the Mississippi River. For *E. gracile*, specimens from the Colorado River exhibit pre-Pleistocene (approx. 4 mya) divergence from all other populations, and more recent Pleistocene divergence was identified between two well-supported groups subdivided by the Mississippi Alluvial Plain in Arkansas. Preliminary analyses of *E. chlorosoma* recovered two well-supported clades roughly situated east and west of the Mississippi. However, individuals from the Sabine River were recovered in the “eastern” clade, indicating a need for additional sampling of *E. chlorosoma* to understand the complexity of this phylogeographic pattern. Ongoing work with additional nuclear DNA markers and increased sampling will be incorporated into this framework to further explore phylogeographic breaks among darters in the Gulf Coastal Plain.

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## 0405 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016

Brian Folt

*Auburn University, Auburn, Alabama, USA*

### **Trees as Templates for the Abundance of Tropical Herpetofauna: A Test of the Guyer Hypothesis**

Carbon input into terrestrial systems varies in space and time, in part due to the leaf-drop phenology and spatial distribution of tree species. In lowland wet Neotropical forests, deciduous canopy tree species differ in leaf-drop phenology: the majority of species shed leaves during the dry season, but this event occurs in the wet season for others. Because litter-drop events provides the trophic base for decomposing microorganisms, their arthropod consumers, and arthropod predators, Guyer (1988) hypothesized that leaf-drop phenology of tree species regulates the population and

community dynamics of terrestrial amphibians and reptiles; this hypothesis predicts that species with different leaf-drop phenology should support different abundance cycles of species through the year. Alternatively, mixture of leaf litter due to physical processes could diminish the effect of individual trees. In this study, I sought to test this hypothesis at La Selva, Costa Rica in two ways: 1) by monitoring the abundance of leaf litter, terrestrial arthropods, and herpetofauna beneath replicate plots of two tree species (*Dipteryx panamensis*, *Castilla elastica*) with distinct patterns of leaf drop, and 2) by manipulating the abundance of litter beneath *C. elastica*. Models describing demography (birth, death, immigration, emigration) and abundance of herpetofauna will be used to evaluate the Guyer (1988) hypothesis. If the results are consistent with the predictions, tree species may serve as templates for the terrestrial ecology of wet forest ecosystems.

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**0391 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Brian Folt<sup>1</sup>, John Jensen<sup>2</sup>, Amber Teare<sup>3</sup>, David Rostal<sup>3</sup>

<sup>1</sup>Auburn University, Auburn, Alabama, USA, <sup>2</sup>Georgia Dept. of Natural Resources, Forsyth, Georgia, USA, <sup>3</sup>Georgia Southern University, Statesboro, Georgia, USA

**Establishing Reference Demography for Conservation: A Case Study of *Macrochelys temminckii* in Spring Creek, Georgia**

The conservation of large, long-lived turtle species is challenging because populations are sensitive to changes in adult survival and are difficult to sample. *Macrochelys temminckii* (Alligator Snapping Turtle) is a large freshwater turtle for which commercial harvest reduced populations through the species' range. Given declines and limited demographic knowledge for *Macrochelys*, we conducted a mark-recapture study of *M. temminckii* from 1997-2013 in Spring Creek, Georgia. We made 166 captures of 75 individuals using hoop-net traps. Observed and estimated population structure described an even adult sex ratio and adults more abundant than juveniles. Survival was higher for males (0.98) and females (0.95) than juveniles (0.86). We used the empirical demographic parameters described here to build an updated population model for *M. temminckii*. The model described population growth as consistent with a growing population ( $\lambda = 1.013$ ), and population viability analysis found the population to grow over the next 50 yr in 93% of simulations. Application of the model to two western populations was consistent with a declining population in Oklahoma ( $\lambda = 0.563$ ), at imminent risk of extirpation, but also revealed that a historically-harvested population in Arkansas may be in decline as well ( $\lambda = 0.978$ ). This is the first study to document a stable and viable population of *Macrochelys*. We suggest that the demographic parameters described at Spring Creek are the best approximation of reference conditions for *Macrochelys* to date. The study provides a framework applicable for other large, long-lived, endangered turtle species for which demographic data are unavailable.

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## 0727 General Ichthyology II, Balconies J & K, Sunday 10 July 2016

João Pedro Fontenelle<sup>1</sup>, William Crampton<sup>2</sup>, Nathan Lovejoy<sup>1</sup>

<sup>1</sup>University of Toronto Scarborough, Ontario, Canada, <sup>2</sup>University of Central Florida, Florida, USA

### **Does Water Color Matter? Phylogeny and Phylogeography of the Genus *Steatogenys* (Boulenger, 1898) (Gymnotiformes: Hypopomidae)**

The rivers of the Amazon divide into high-conductivity systems (comprising sediment-rich white waters) flowing out of Andean erosion zones, and low-conductivity systems, comprising black water systems (high in humic acid and low in sediments) draining lowland Cenozoic formations and clear water systems (with intermediate sediment composition) draining Paleozoic formations. Waters with different conductivities are likely to affect the electric communication and navigation systems of weakly electric gymnotiform fishes. To investigate the evolutionary influences of water-type on electric fishes, we use the genus *Steatogenys* (Boulenger, 1898) as a model system. The species *S. elegans* and *S. duidae* are widely distributed across the Amazon and occur in the three main water types, while *S. ocellatus* is restricted to central upper Amazon black water rivers. We generated a phylogeny for the three valid species of *Steatogenys* using both mitochondrial and nuclear genes and evaluated the phylogeography of *S. duidae* and *S. elegans*. Our analyses confirm reciprocal monophyly for each recognized species of *Steatogenys*, and indicate two as-of-yet undescribed lineages within *S. elegans*. Our results indicate that the undescribed lineages within *S. elegans* are sympatric over broad spatial scales, but one lineage is associated with black and clear water, while the other is associated with white water habitats. This suggests that conductivity may play a role in lineage diversification of electric fishes.

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## 0829 Herp Ecology, Salon F-H, Sunday 10 July 2016

Clifford Fontenot

Southeastern Louisiana University, Hammond, LA, USA

### **The Influence of Hurricanes on Local Snake Abundance and Road Mortality: 11 Years of Data From a Southeastern Louisiana Wetland Assemblage**

Long term studies are critical for understanding ecosystem function, and response to environmental change. Roads through ecosystems represent a transect through habitat, and can provide convenient access for sampling taxa, but can also result in mortality of animals crossing the road. Routine observations of high snake road mortality led me to question how populations could sustain such high chronic mortality. To address this, weekly night road surveys were conducted for 11 years (2003-2014) along a 37 km segment of Highway 51 in southeastern Louisiana, a land bridge between two major lakes, through marsh, and swamp. Peak abundance of snakes (14 species) occurred following weather induced flood events that submerged most of adjacent habitat, causing snakes to seek higher ground associated with the land bridge. However,

abundance remained high after well after the water level returned to normal, and declined gradually over the next three years to pre-flood numbers. This surge in local abundance increased occurrence on the road, and likelihood of being killed. There were significant differences among species in occurrence on the road, as well as condition (dead vs alive), which may be due to abundance, detectability, behavior, or other aspects of their ecology and natural history.

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## **0267 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Kassandra Ford<sup>1</sup>, Samba Diallo<sup>2</sup>, Frank Pezold<sup>1</sup>

<sup>1</sup>Texas A&M University Corpus Christi, Corpus Christi, Texas, USA, <sup>2</sup>Centre National des Sciences Halieutiques de Boussoura, Conakry, Guinea

### **A new online reference to the freshwater and estuarine fishes of Guinea West Africa**

A research collaboration was initiated in 2001 with the Direction Nationale de Recherche Scientifique et Technique (CNRST) from Conakry, Guinea, to develop zoological research and reference resources for Guinean researchers and students. Funding was obtained from US National Science Foundation and the Critical Ecosystem Partnership Fund (CEPF) to launch five field collections for freshwater and estuarine fishes in Guinea over the one year period May 2002 to June 2003. Collections from May 2002 were centered on the Parc National du Haut Niger near Faranah, Guinea. In January 2003 collections were made in the freshwaters of the Fouta Djallon highlands and in several estuaries. Collections resumed in the Fouta Djallon in March and April, and additional estuarine collections were conducted in April. In May 2003 collections extended to southern Guinea. The 278 collections produced 51,099 specimens representing 286 species in 89 genera and 49 families. An online reference map with localities, dropdown species lists, and photographs of representative specimens is being developed to complement a research collection established at CNRST.

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## **0995 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Sonja Fordham

*Shark Advocates International, Washington, DC, USA*

### **Saving Sawfish: Progress and Priorities for Preventing Extinction and Promoting Recovery**

The exceptionally high extinction risk for the world's sawfishes (family Pristidae), after decades of going largely unnoticed, has in recent years received significant attention. While resulting actions include the strongest possible commitments under global wildlife agreements, basic safeguards remain urgently needed in many key regions

where sawfish are highly endangered. In 2013, the last of the sawfish species was listed under Appendix I of the Convention on International Trade in Endangered Species (CITES), thereby essentially banning commercial, international trade in all sawfishes and their parts. Additional sawfish conservation needs were explored and prioritized during the development of the 2014 International Union for Conservation of Nature (IUCN) Global Sawfish Conservation Strategy. All five sawfish species were listed on Appendix I and II of the Convention on Migratory Species (CMS) later in 2014, bringing obligations for strict national protection and commitments to collaborate on regional conservation. In 2016, the sawfishes were also added to the scope of the CMS Memorandum of Understanding for Migratory Sharks, an agreement that is, on one hand, voluntary without mechanisms to ensure compliance, and, on the other, unique in the world with great promise for benefits. These advances, as well as the relatively effective US Recovery Plan for Smalltooth Sawfish (*Pristis pectinata*) under the Endangered Species Act, have sparked increased opportunities for researching and safeguarding sawfish in previously under-studied regions, including several developing countries. Implementation of these initiatives will be reviewed. Recommendations for priority next steps to prevent sawfish extinction and promote recovery will be offered.

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**0197 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H,  
Thursday 7 July 2016**

Kimberly Foster, Kyle Piller

*Southeastern Louisiana University, Hammond, LA, USA*

**Morphology of trophotaeniae within the subfamily Goodeinae (Goodeidae:  
Cyprinodontiformes)**

The Goodeinae are a viviparous group of freshwater fishes (Cyprinodontiforms: Goodeidae) found in the Mesa Central of Mexico. The group contains 17 genera and 38 extant species. The embryos of every species in the subfamily are characterized by epithelial processes termed 'trophotaeniae' that extend from the perianal lip into the ovarian lumen. Trophotaenial tissue is the site of nutrient uptake and gas exchange in larval goodeids, and attributed to a massive increase in embryonic dry weight. Historically, these structures have been used, in part, as a diagnostic character for goodeid taxonomy. Trophotaenial tissue has been examined for morphological descriptive purposes but only for a few species, and four general types have been recognized. This presentation will utilize gross examination, along with high resolution scanning electron microscopy to evaluate surface characteristics of the trophotaeniae. Our study included nearly all of the species in the subfamily, making it the most comprehensive study to date. Larval specimens were extracted from females using one ventral incision from below the pelvic fin to the dorso-ventral axis. The trophotaeniae were then run through a series of graded ethanol washes, critically point dried, mounted, and sputter coated. Various trophotaenial features were quantified and analyzed in a phylogenetic comparative framework to examine the evolution of this historically important taxonomic character.

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**0717 NIA II, Galerie 3, Sunday 10 July 2016**

Benjamin Frable<sup>1</sup>, Bruno Melo<sup>2</sup>, Claudio Oliveira<sup>2</sup>, Brian Sidlauskas<sup>1</sup>

<sup>1</sup>*Oregon State University, Corvallis, Oregon, USA*, <sup>2</sup>*Universidade Estadual Paulista, Botucatu, São Paulo, Brazil*

**Paleoecological influence and the historical biogeography of the Neotropical fish family Prochilodontidae (Ostariophysi:Characiformes)**

Members of characiform family Prochilodontidae are some of the most abundant fish by biomass in South America. This group is characterized by low morphological diversity, large size and extensive migratory behaviors. Prochilodontid species are generally restricted to single basins with very little population structure within basins owing to their mass-schooling migratory life histories. Additionally, large body sizes and strong swimming ability allow them to overcome the small barriers, which often isolate populations of smaller fishes. Therefore, prochilodontid speciation and modern distributions most likely reflect historic environmental changes. As such, we use this widespread family to investigate the influence of large-scale paleoecological events, such as the rise of the Andean Eastern Cordilleras, and geographic barriers on diversification of Neotropical fishes. We present the first time-calibrated molecular phylogeny for Prochilodontidae and compare diversification events with known paleoecological events. Additionally, we use biogeographic model testing on hypotheses of diversification and origination. Our results indicate an ancient origin of the family with species differentiation mostly following the formation of the modern Amazon. The rise of the Eastern Cordillera is upheld as a significant impermeable barrier to dispersal. However, we find evidence of more recent exchange between the Magdalena and Maracaibo and over the Vaupes arch. The rapid and recent diversification of *Prochilodus* in eastern Brazil is likely the result of expansion from Amazon tributaries after the formation of the modern basin. Study of this widespread group provides a robust means for understanding how landscape evolution influenced the riot of modern diversity in the Neotropics.

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**0285 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Austin Francis, Jr., Jay Hodgson, Aaron Schrey

*Armstrong State University, Savannah, GA, USA*

**An Introductory Biology Laboratory on Form and Function Using Hammerhead Sharks**

As part of an effort to improve student understanding and retention of evolution, a new introductory biology laboratory has been developed to illustrate how differences in form may result in differences in function. To accomplish this, students are asked to calculate drag force for different geometric shapes (with a known coefficient of drag) and

generate hypotheses about how each shape will perform when moving through a fluid. Students are then provided with 3D printed versions of these geometric shapes for performance testing. With the width and mass standardized for all shapes, students determine the sinking rate (cm/s) for each shape as it descends in a fluid filled, 16 cm diameter, 120 cm tall cylindrical testing chamber. Each shape is tested three times and the average velocity used to evaluate performance (with shorter times reflecting reduced drag). These results are then used by students to generate hypotheses about how different hammerhead shark cephalofoils may be expected to perform. Computed tomography (CT) scans of three species of hammerhead shark (*Sphyrna tudes*, *Sphyrna mokarran*, and *Eusphyrna blochii*) and one conical-shaped shark species (*Rhizoprionodon terraenovae*) were used to print 3D models of shark heads for performance testing. To test student derived hypotheses, the experimental design for geometric shapes was replicated with the average sinking velocity determined for each shark head. Initial results indicate greater student engagement in the lab, student comprehension of the basic principles of evolution, and motivation to learn more.

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#### **0451 Fish Genetics, Salon D, Sunday 10 July 2016**

Michael Franklin, Chris Chabot, Larry Allen

*California State University Northridge, Northridge, CA, USA*

#### **A Baseline Investigation into the Population Structure of White Seabass, *Atractoscion nobilis*, in California and Mexican Waters Using Microsatellite DNA Analysis**

The white seabass, *Atractoscion nobilis*, is a commercially important member of the Sciaenidae that has experienced historic exploitation by fisheries off the coast of southern California. For the present study, we sought to determine the levels of population connectivity among localities distributed throughout the species' range using nuclear microsatellite markers. Data from the present study have revealed distinct genetic breaks between the Southern California Bight, Pacific Baja California, and the Peninsula of Baja California.

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#### **0541 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Ryan Freedman<sup>1</sup>, Chris Caldow<sup>2</sup>, Jenn Caselle<sup>1</sup>

<sup>1</sup>*University of California Santa Barbara, Santa Barbara, CA, USA*, <sup>2</sup>*NOAA Channel Islands National Marine Sanctuary, Santa Barbara, CA, USA*

#### **Tropicalization and Community Change in the Transition Zone: A Case Study for Fish in the Channel Islands National Marine Sanctuary**

Marine environment transition zones are at the confluence of warm and cold water bodies and are typically associated with high biodiversity due to the mixing of species

with different thermal associations. In the face of climate change, these transition zones may undergo changes in environmental parameters that in turn will alter local ecological communities. California's northern Channel Islands are an example of a transition zone that is at the boundary of the California Current and the California Countercurrent. PISCO has been conducting subtidal fish surveys around the Channel Islands since 1999 as a monitoring program implemented to long-term community change and anthropogenic influences. In an attempt to understand the effects of shifting climate on this transition zone, we classified species in the PISCO surveys as having tropical or temperate affinities and assessed changes in their abundance and biomass over time. We compared the shifts in the fish community to a suite of environmental parameters including Pacific Decadal Oscillation, North Pacific Gyre Oscillation, sea surface temperature, wind stress, kelp biomass, wave period, and wave height. Moving forward, we hope to use the environmental associations to give conservation managers a sense of the impacts of changing climate on ecosystem condition around the islands.

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## **0152 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016**

Bryan Frenette, Michael Tobler, Keith Gido

*Kansas State University, Manhattan, KS, USA*

### **Physiological Constraints on the Distribution and Abundance of Two Prairie Stream Fishes in Relation to Thermal Regime**

Data collected over a 20-year period through the Long Term Ecological Research (LTER) program shows spatial and temporal variability in the distribution and abundance of fish species within Kings Creek on the Konza Prairie Biological Station. Variability in groundwater inputs in this system results in heterogeneous thermal regimes among reaches. Our research focuses on whether differences in thermal regimes influence the abundance and distribution of two herbivorous minnows (*Campostoma anomalum* and *Chrosomus erythrogaster*) within Kings Creek. We measured thermal maxima (CTMax) to test for inter- and intraspecific differences in physiological response to temperature. Analyses from a laboratory acclimation experiment found a significant effect of acclimation temperature on CTMax (two-way ANOVA,  $F_{3,66} = 456.7$ ,  $P < 0.001$ ), but no significant difference in CTMax between species (two-way ANOVA,  $F_{1,66} = 3.401$ ,  $P = 0.07$ ). Furthermore, field assays of CTMax collected during late 2015 and early 2016 show a similar trend, with no significant difference in CTMax between species (two-way ANOVA,  $F_{1,54} = 0.00$ ,  $P = 0.99$ ), while CTMax differed within species seasonally (two-way ANOVA,  $F_{2,54} = 289.5$ ,  $P < 0.001$ ). Results suggest these species have similar abilities to acclimate to variable thermal regimes. However, additional physiological data (e.g., metabolic rate and activity) are needed to verify these species performance under different thermal regimes.

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## **0221 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Jennifer Frey, Ali Leggett

*Mississippi Department of Marine Resources, Biloxi, MS, USA*

### **The Mississippi Department of Marine Resources Coastal Preserves Program: Biological Inventory and Monitoring**

The Mississippi Department of Marine Resources (MDMR) Coastal Preserves Program which was developed in 1992 by authority of the Wetlands Protection Act. The Coastal Preserves Programs objective is to acquire, protect, and manage sensitive coastal wetland habitats along the Mississippi Gulf Coast, therefore ensuring the ecological health of Mississippi's coastal wetland ecosystems. The State currently has title to approximately 33,000 acres of the designated 72,000 acres of crucial coastal wetland habitat within Mississippi's 20 coastal preserve sites (<http://www.dmr.ms.gov/index.php/wildlife-a-plants/coastal-preserves>). Since the Programs' inception management activities have centered on restoring the preserves to their 'natural' state through the use of invasive species control, burn management and replanting of native species. To further aid in these efforts staff has been conducting a biological inventory of preserve lands beginning with one preserve in each coastal county and conducting multi-seasonal trapping to give a baseline of herpetological species and aid in guiding management for the area. The areas include Ansley which is part of the Hancock County Marshes, Bells Ferry which is part of the Wolf River Watershed in Harrison County and Twelve Oaks which is part of Old Fort Bayou in Jackson County. Multiple survey methods have been implemented and will conclude in 2017. To date we have accounted for 102 species and 44 Herpetological species after 3 seasons of trapping monthly.

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## **0328 SSAR SEIBERT ECOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Kelley A. Fritz, Lucas J. Kirschman, Matt R. Whiles

*Southern Illinois University, Carbondale, IL, USA*

### **Influence of Amphibians on Energy and Nutrient Fluxes across Aquatic-Terrestrial Boundaries of Temporary Ponds**

Energy and nutrient subsidies across aquatic-terrestrial boundaries are recognized in systems ranging from oceanic islands to freshwater wetlands. Such subsidies are important for recipient habitats and can alter consumer distribution and increase consumer growth, abundance, and biomass. Temporary ponds can be closely linked to surrounding forests via forest-to-pond and pond-to-forest subsidies, including amphibian egg deposition and metamorph emergence. We intensively sampled amphibian assemblages in eight temporary ponds in Southern Illinois to quantify nutrient flows associated with egg deposition and metamorph emergence for ten species breeding in the ponds. We analyzed nitrogen (N), carbon (C), and phosphorous (P)

content of egg masses and recently emerged metamorphs of each species. Percent N in eggs ranged from  $9.3 \pm 0.4$  to  $11.1 \pm 0.2$ , %C from  $47.3 \pm 0.9$  to  $52.6 \pm 0.2$ , and %P from  $0.03 \pm 0.01$  to  $0.07 \pm 0.03$ . We used these estimates to produce total amphibian nutrient budgets for each pond and species. Understanding the roles of amphibians in linking habitats is increasingly important in light of ongoing extirpations and population declines.

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## **0856 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Bridgette Froeschke<sup>1</sup>, John Froeschke<sup>2</sup>

<sup>1</sup>The University of Tampa, Tampa, FL, USA, <sup>2</sup>Gulf of Mexico Fishery Management Council, Tampa, FL, USA

### **Habitat and Environmental Influences on the Distribution Patterns of Atlantic Croaker (*Micropogonias undulates*) and Spot (*Leiostomus xanthurus*) in the Aransas-Bay Complex in Texas, USA**

Declining populations of fishery species underscore the importance of defining critical habitats. The goal of this study was to use an ecosystem-based approach to incorporate environmental changes into fisheries management plans for two scianenidae species. Specifically, this study developed predictive species habitat models that delineated critical nursery habitat for juvenile Atlantic croaker (*Micropogonias undulates*) and spot (*Leiostomus xanthurus*). These models were used to determine mechanisms of habitat selection within the Aransas Bay Complex. Species habitat models predicting the occurrence for both species were identified using Boosted Regression Trees (BRT) consisting of ten predictors: habitat type, dry weight of sediments, depth (m), dissolved oxygen (mg O<sub>2</sub>/L), temperature (°C), turbidity (cm), salinity, pH, distance to inlet, and month. The species habitat model for juvenile Atlantic croaker indicated that they were not associated with any particular habitat type, but were associated primarily with low temperatures (< 20°C), and depths greater than 2m. The model for juvenile spot indicated that they were associated with distance to the inlet, low percent dry weight of sediment (<25 percent), and low temperatures (<25°C). Our models indicate that EFH within the Aransas Bay Complex occur among all habitat types along the eastern side of Aransas Bay, and the north corner of Copano Bay. These findings provide a valuable new tool for fisheries managers to aid sustainable management of Atlantic croaker and spot in the Mission-Aransas Reserve ecosystem and provide crucial information needed to prioritize areas for habitat conservation and management in the Gulf of Mexico.

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## 0886 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016

Bridgette Froeschke, Leslie Jones, Brian Garman

*The University of Tampa, Tampa, Florida, USA*

### **The Influence of Gear Type, Environmental, Spatial, and Temporal Parameters on Distribution Patterns of Sheepshead (*Archosargus probatocephalus*) in Tampa Bay, Florida from 1996 to 2014**

Long-term, fisheries-independent bag seine surveys and otter trawls conducted in Tampa Bay, Florida, USA from 1996-2014 were used to develop a spatio-temporal species-environmental model for sheepshead, *Archosargus probatocephalus*. Relationships between environmental predictors and sheepshead distribution were investigated using boosted regression trees (BRT). Results showed good model performance and suggested that, in relation to environmental factors, sheepshead distribution was most closely linked to gear type, month and year of collection, and salinity. Overall, probability of occurrence increased when using a 183m center-bag seine, and collections conducted during June, July and August. When examining the relationship of environmental factors on the occurrence of sheepshead for each gear separately (targeting different size classes), high salinities (>20 ppt) was the most influential environmental parameter for adult sheepshead, and temperature (below 10°C and above 25°C) was the most influential environmental parameter for juveniles. By interpolating the environmental predictors, monthly maps of the probability of capture were produced using ordinary kriging. Spatial patterns were also evident. The development of spatially explicit models allows for prioritization and conservation of areas in a region that has great potential for human disturbance and climate change impacts.

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## 0699 Poster Session I, Acadia/Bissonet, Friday 8 July 2016

Joseph Aaron Frumkin, Kenshu Shimada

*Depaul University, Chicago IL, USA*

### **Morphological Differences in Placoid Scales among the Three Extant Species of Thresher Sharks (Lamniformes: Alopiidae) and Their Functional Implications**

The thresher sharks (Alopiidae) are a group of lamniform sharks consisting of three extant species: *Alopias pelagicus* (pelagic thresher), *A. superciliosus* (bigeye thresher), and *A. vulpinus* (common thresher). They are characterized by a highly elongate caudal fin that is as long as the rest of the body, and at least *A. pelagicus* and *A. vulpinus* are documented to use their caudal fin to hunt for small fish prey by stunning them. On the other hand, the hunting behavior of *A. superciliosus* has not been observed in the wild, but it has been suggested that the species must be a faster swimmer relative to *A. pelagicus* and *A. vulpinus* based on the skeletal architecture of their caudal fins. We test this hypothesis by comparing placoid scale morphologies among the three species. Samples were taken from preserved museum specimens on their lateral side of the body

above the pectoral fin immediately anterior to the first dorsal fin. Our preliminary study shows that all three species possess keeled scales consistent with most pelagic sharks. The average inter-keel distance is smaller for *A. superciliosus* (49.9  $\mu\text{m}$ ) compared to *A. pelagicus* (52.7  $\mu\text{m}$ ) and *A. vulpinus* (52.5  $\mu\text{m}$ ). The smaller inter-keel value in *A. superciliosus* suggests that the placoid scales of the species are better suited to reduce surface drag for faster swimming relative to scales of *A. pelagicus* and *A. vulpinus*. Therefore, our scale-based data support the hypothesis that *A. superciliosus* must be a faster swimming shark than *A. pelagicus* and *A. vulpinus*.

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**0698 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Michael Fulbright, David Penning

*University of Louisiana at Lafayette, Lafayette, LA, USA*

**Going Out on a Limb: Striking Constraints on a Semi-arboreal Ratsnake**

Aside from fleeing predators, snakes use defensive strikes to evade capture. Ratsnakes are semi-arboreal snakes that must dispel predators in both terrestrial and arboreal environments. However these differences in habitat choice may lead to differences in performance, which has remained untested until now. We measured defensive terrestrial and arboreal strikes to determine if snakes (N = 17) modulate their strike performance relative to the habitat they occupy. Maximum velocity, strike duration, and strike distance were significantly higher in terrestrial strikes compared to perched strikes ( $p < 0.01$  for all). Performance of snakes in arboreal habitats is likely confounded by the need to use a portion of the posterior part of the body to maintain contact with limbs and prevent falling.

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**0711 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Lauren Fuller, Glenn Parsons

*University of Mississippi, Oxford, MS, USA*

**Sedation as a Means to Reduce Capture Stress of Sharks**

Capture stress is a significant problem in fisheries biology and may lead to reduced survivorship of bycaptured species. In some fisheries, sedation may be useful for capture stress reduction. In this study, we provide preliminary data regarding the effect of iso-eugenol (clove oil) sedation on the stress response of sharks via measurement of lactate and respiration rate. Sharks caught by hook-and-line (*Rhizoprionodon terraenovae*, *Carcharhinus isodon*, and *Carcharhinus limbatus*) were placed into a sealed respiration chamber in-situ containing iso-eugenol (treatment) or seawater (control) from which dissolved oxygen was continuously monitored to determine the respiration rate. Blood

samples were taken at 0, 10, 20 and 30 minute intervals and later analyzed for lactate. The results indicate that treatment has a significant effect on overall respiration rate in *R. terraenovae*. There is no significant difference in shark lactate levels between treatments, but the proposed sample size has not yet been achieved. These preliminary results suggest that iso-eugenol sedation may be useful for stress reduction in bycaptured sharks, thereby increasing survivorship after release.

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## **0742 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Andrew Furness<sup>1</sup>, David Reznick<sup>2</sup>, John Avise<sup>1</sup>

<sup>1</sup>University of California, Irvine, Irvine, CA, USA, <sup>2</sup>University of California, Riverside, Riverside, CA, USA

### **Ecological, evolutionary, and human-mediated determinants of Poeciliid species richness on Caribbean islands**

The theory of island biogeography provides a predictive framework relating species richness to island size and distance from the mainland, but the theory as originally formulated does not necessarily scale to large islands and continental landmasses that are capable of generating species through *in situ* speciation (rather than entirely by colonization). Here we apply biogeographic principles to a taxonomic group that has undergone a radiation on Caribbean islands: live-bearing fishes of the family Poeciliidae. We show that species richness on small islands results entirely from colonization and increases modestly with island area, whereas on larger islands species richness increases dramatically as a function of area due primarily to *in situ* speciation. This non-linear scaling pattern of species richness with island size is accommodated by a two-stage regression that incorporates these underlying ecological and evolutionary effects. Poeciliid fishes have been introduced widely, both as a byproduct of their popularity in the aquarium hobby and as a means of mosquito control. We show that such establishments have occurred disproportionately on islands depauperate in native species. We also show that the inclusion of species introduced by humans lessens the contribution of *in situ* speciation to total species richness, thereby strengthening and linearizing the species-area relationship.

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**1026 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H,  
Thursday 7 July 2016**

Brittany Furtado, Jessie Green, Loren Stearman, Ginny Adams, Reid Adams

*University of Central Arkansas, Conway, AR, USA*

**Investigating the Effect of Unconventional Natural Gas Development on Fish Population Size Structure**

The demand for natural gas has increased exponentially over the last 15 years and growth of unconventional natural gas development (UNGD) on the Fayetteville shale has occurred at a rate of 300-900 wells/year. Previous work, using Index of Biotic Integrity (IBI) metrics, has shown decreases in the relative abundance of fishes considered sensitive, based on specific reproductive and feeding requirements, and increases in the relative abundance of tolerant fishes with increasing UNGD. However, preliminary analysis of population structure indicated species we have grouped together, based on shared life history characteristics, do not necessarily exhibit the same relationship with UNGD. Analysis of length-frequency histograms for abundant species indicated fishes we have classified as sensitive (e.g. *Etheostoma spectabile* and *Etheostoma whipplei*), had an absence of young-of-year at High treatment sites in every year except for 2014. Interestingly, *Notropis boops*, a species traditionally considered sensitive due to its intolerance to sedimentation, displayed trends in size-frequency distribution that indicated greater evenness at High treatment sites. Furthermore, elucidation of robust relationships between fish population structure and UNGD has been difficult due to covarying landscape effects including percent pasture and hydrologic variability. To investigate the relative influence of UNGD on fish population structure we implemented an IT multiple regression approach with a priori selected predictor variables representing UNGD, hydrology, and land use with response variables representing size-related population structure. Initial results will be presented and their contribution to our understanding of the influence of UNGD on fish population structure will be discussed.

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**0960 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Sandra P. Galeano, Kyle E. Harms

*Louisiana State University, Baton Rouge, LA, USA*

**Assembly Patterns of Leaf-litter Anurans on Neotropical Land-bridge Islands: Species Co-occurrence and The Role of Morphological Traits**

Species patterns traditionally have been used to identify the underlying mechanisms of community assembly. However, the study of co-occurrence patterns in animal communities has been limited, taking mostly a species identity approach and rarely considering intraspecific differences in traits other than body size. We examined co-occurrence patterns in the assembly of leaf-litter anurans at local and regional scales in

the Bocas del Toro Archipelago, Panama. We combined species and trait-based approaches using body size and coloration - a trait associated with aggressive behavior in the territorial *Oophaga pumilio*. We tested for non-random patterns of species co-occurrence and body size in anuran assemblages and asked whether those patterns varied once the distribution of highly conspicuous, more aggressive vs. less conspicuous, less aggressive frogs of *O. pumilio* was considered. We found random patterns of co-occurrence at local and regional scales for the entire assemblage. However, segregated patterns emerged at the regional scale for sub-matrices of islands with highly conspicuous morphs of *O. pumilio*. These results suggest that species composition of leaf-litter anuran communities in land-bridge archipelagos are mainly structured by random processes at local scales, whereas both random and deterministic processes influence their structure at the regional scale. Furthermore, because we did not find evidence of habitat effects on islands where highly conspicuous morphs exclusively occurred, our results also support the idea that species interactions underlie the segregated patterns. Our findings highlight the utility of considering morphological traits that associate with behavioral traits in the study of ecological assembly of animal communities.

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#### **0487 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Bannon Gallaher, Steven Beaupre

*University of Arkansas, Fayetteville, Arkansas, USA*

#### **Factors That Affect Home Range Size in the Timber Rattlesnake, *Crotalus horridus horridus***

As a result of higher energetic cost stemming from body size, a larger animal must acquire more energy than a smaller individual of the same species would to meet energetic requirements. In systems where food sources are ephemeral, meeting a higher energetic demand requires a larger search radius for prey. The main goal of this paper is to examine the relationship between body size and home range area in Timber Rattlesnakes (*Crotalus horridus horridus*). Data used from this analysis came from an ongoing, 20 year study at McIlroy Wildlife Management Area, Madison Co., Arkansas. Timber Rattlesnakes *Crotalus horridus horridus* were tracked every three days using radio telemetry during the active season (March through October). From 1996 to 2015 a total of 140 individuals were tracked for approximately 10,000 records. Home range estimates were calculated using the Minimum Convex Polygon method in ArcMAP. In addition to body size the following variables were examined for their effect on home range area: sex, age, body condition index, landscape disturbances, and supplemental feeding. The results of this study will allow for more accurate individual based modeling and improve the use of Timber Rattlesnakes *Crotalus horridus horridus* as an indicator species.

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## **0651 Fish Conservation, Galerie 3, Sunday 10 July 2016**

Grantly Galland, Anthony Rogers, Amanda Nickson

*The Pew Charitable Trusts, Washington, DC, USA*

### **A first global value of commercial tuna fisheries**

Commercial fisheries are estimated to be worth billions of dollars each year, but a lack of understanding of the true economic value of marine fisheries places the stability of the populations and the sustainability of their value at risk, particularly when these long term benefits are traded for short term economic gains. Commercial tuna fisheries are an important source of wealth and employment in places where fishing and processing is concentrated. To date, however, few studies have attempted to place a dollar value on this sector, at the global level. The seven most commercially important tunas are among some of the most economically valuable fishes on the planet. Canned tuna products provide millions of kilograms of inexpensive protein to markets around the world, while high-quality tuna steaks and sashimi provide a small amount of expensive protein to affluent markets in Asia, Europe, and North America. Here, we present a detailed estimate of the global value of tuna fisheries targeting Skipjack, Albacore, Bigeye, Yellowfin, Atlantic Bluefin, Pacific Bluefin, and Southern Bluefin tunas. The final estimated values demonstrate the importance of tuna fisheries as a major sector in commercial seafood production. Values are presented by species, gear type, ocean basin, and product stream, and estimates are provided for both dock value (based on prices paid to fishermen) and end value (based on prices paid by the ultimate consumer). Finally, we frame these values in a wider, management context and highlight regions and stocks where improved fisheries management could promote economic growth.

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## **0680 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Tony Gamble<sup>1</sup>, Martin Cohn<sup>2</sup>, David Zarkower<sup>3</sup>

<sup>1</sup>*Marquette University, Milwaukee, WI, USA*, <sup>2</sup>*University of Florida, Gainesville, FL, USA*, <sup>3</sup>*University of Minnesota, Minneapolis, MN, USA*

### **Sex-specific genetic markers and sex chromosomes in the Little Skate (*Leucoraja erinacea*)**

The Little Skate (*Leucoraja erinacea*) is an emerging model in the study of developmental biology and human disease. The ability to accurately sex individuals is vital to this research, particularly as it relates to gonadal development and other sex differences. Adults and advanced embryos can be sexed via examination of sexually dimorphic traits such as presence of claspers on male pelvic fins or differentiated gonads. However, early embryos cannot be morphologically sexed and there is no molecular test to differentiate males from females prior to sex determination. PCR sex tests have proven invaluable in other vertebrate model organisms such as mouse and chicken and a skate molecular sex test would aid the study of sexually dimorphic traits in early development. We

developed a PCR-based assay to sex *L. erinacea* using data from restriction site associated DNA sequencing, or RAD-seq. RAD-seq sequences restriction-digested DNA and can generate tens of thousands of molecular markers for analysis. We identified and validated three male-specific genetic markers by comparing RAD-seq data from ten male and nine female *L. erinacea*. These markers can identify the genetic sex of *L. erinacea* at all developmental stages and will significantly enhance developmental studies of this emerging vertebrate model. Furthermore, male-specific markers confirm an XY sex chromosome system in *L. erinacea*. We will discuss the implications of *L. erinacea* sex chromosomes on elasmobranch sex chromosome evolution and identify opportunities for further study.

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**0254 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Marissa Ganzfried, Brian Waldron, Matt Lee, Carl D. Anthony, Cari-Ann Hickerson

*John Carroll University, University Heights, OH, USA*

**Differential Foraging and Repeatability of Behavior Between Two Color Morphs of *Plethodon cinereus* Following Simulated Predation**

Behavioral repeatability greatly affects the capacity of an individual to respond to varying environments. When a behavior has high repeatability across time or across contexts, it is termed a behavioral syndrome (sometimes referred to as animal personality). However, not all behaviors exhibit the same level of repeatability and few studies have examined repeatability in amphibians. We examined the repeatability of foraging behavior in the Eastern Red-backed Salamander (*Plethodon cinereus*) before and after a simulated predation event. We tested several hypotheses: 1) Foraging behavior would be repeatable and consistent with previous studies; 2) Simulated predation would have a negative effect on foraging, increasing latency to feed and decreasing the proportion of prey items eaten in a given time period; and 3) Because striped color morphs of *P. cinereus* are more aggressive, striped individuals would exhibit more "bold" behavior and resume foraging sooner. We found that the predation treatment negatively affected foraging behavior in both morphs, and that simulated predation resulted in an increase in the repeatability of foraging behavior. Morphs did not significantly differ in latency to feed or proportion of prey eaten in either treatment. Our results suggest that within-individual foraging behavior in *P. cinereus* is generally not repeatable, but individuals' responses to predation are consistent over time. This distinction further illustrates the need to carefully define the behavior to be tested and experimental methodology in studying behavioral repeatability or behavioral syndromes.

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**0984 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016**

Eric Garcia, Giacomo Bernardi

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

**Genomic Analysis of Disjunct Marine Fish Populations of the Northeastern Pacific and Sea of Cortez**

Disjunct populations are formed after a physical barrier separates the populations of a species, which then has the potential to remain the same species or diverge depending on how effectively the barrier impedes gene flow. Disjunct populations provide an excellent opportunity to study the evolutionary processes of allopatric speciation. The sargo, *Anisotremis davidsoni* (Haemulidae), and the longjaw mudsnapper, *Gillichthys mirabilis* (Gobiidae), have disjunct distributions with populations on the Pacific coast of California and Baja California and isolated populations in the upper half of the Sea of Cortez. These disjunct populations have been suggested to be at the initial phases of allopatric speciation. This project utilizes restriction site associated DNA (RADSeq) to produce a highly confident connectivity analysis of populations sampled across the Pacific and Sea of Cortez ranges of these species. The goals of this project are to (1) characterize the genomic structure of these populations and assess divergence levels across the Baja California peninsula, (2) determine the connectivity within each region and (3) explore the molecular signatures of incipient allopatric speciation. This study sheds light into the processes in the speciation continuum in these species and provides a deeper understanding of how populations are connected and how biodiversity might be shaped in these regions.

**CANCELLED**

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**0365 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Donnell Gasbarrini<sup>1</sup>, David Lesbarrères<sup>1</sup>, Anna Sheppard<sup>2</sup>, Ed Morris<sup>2</sup>, Jacqueline Litzgus<sup>1</sup>

<sup>1</sup>*Laurentian University, Sudbury, Ontario, Canada*, <sup>2</sup>*Ontario Parks, Sudbury, Ontario, Canada*

**An Investigation into the Cause of a Mass Mortality Event of Blanding's turtles (*Emydoidea blandingii*) in Misery Bay Provincial Park, Ontario, Canada**

Mass mortality events (MMEs) can remove up to 90% of individuals in a population, which is especially damaging to persistence of long-lived species with low capacity to recover. While MMEs are being documented with increased frequency, a limited understanding of the causes and consequences of MMEs remains. Our study aims to determine the causes of a MME of Blanding's turtles (*Emydoidea blandingii*), a threatened species, in a relatively pristine habitat at Misery Bay Provincial Park (MBPP), Ontario, Canada. The typical anthropogenic threats to turtles are minor or virtually absent in the MBPP setting, and yet 53 Blanding's turtles were found dead without obvious cause in



2013. Potential causes of death under consideration include predation in the active season and failed overwintering through either metabolic/respiratory acidosis, freezing, or winter predation. Telemetry and mark-recapture studies were used to monitor live animals, to look for clues to the cause of death, and to monitor overwintering habitat. Motion-sensor activated trail cameras were paired with a Blanding's turtle decoy, as a novel strategy to identify predators within the park. Potential predators identified include otter, mink, coyote, and raccoon. No significant differences in temperature and dissolved oxygen content of water were found between known overwintering sites and sites near where turtle carcasses were found. Based on evidence collected to date, predation seems a likely cause of death. The results of our study will be informative for the conservation of this population, and for the management of future MMEs.

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**0368 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Donnell Gasbarrini<sup>1</sup>, David Lesbarrères<sup>1</sup>, Anna Sheppard<sup>2</sup>, Ed Morris<sup>2</sup>, Jacqueline Litzgus<sup>1</sup>

<sup>1</sup>Laurentian University, Sudbury, Ontario, Canada, <sup>2</sup>Ontario Parks, Sudbury, Ontario, Canada

**Examining Long Term Consequences of a Mass Mortality Event in the Long-Lived Species, *Emydoidea blandingii***

Little information pertaining to long-term effects of MMEs exists in the primary literature, especially in relation to long-lived species with limited capacity for natural recovery, such as chelonians. Such information can inform management plans to aid in ensuring the persistence of these populations into the future. A MME of Blanding's turtles (*Emydoidea blandingii*) in Misery Bay Provincial Park (MBPP) on Manitoulin Island, Ontario, Canada, was first reported and has been under investigation since 2013. With a sum of 53 dead ( $n_{\text{adult}}=44$ ,  $n_{\text{subadult}}=6$ ,  $n_{\text{juvenile}}=2$ ,  $n_{\text{unkown}}=1$ ) and 63 live ( $n_{\text{adult}}=46$ ,  $n_{\text{subadult}}=5$ ,  $n_{\text{juvenile}}=12$ ) Blanding's turtles found, this event appears to have removed nearly half of the breeding population. Given the life history of Blanding's turtles, whose population persistence relies on adult survivorship, and as age at first reproduction is 14 years for males and 18-22 years for females, and average clutch size is 10.2 eggs/clutch, we hypothesized that the population at MBPP will continue to decline if unaided. Population viability analyses will be conducted on the MBPP Blanding's turtle population in an effort to determine the most efficient conservation and recovery strategies for this population. It is of the utmost importance to be aware of the natural and human-associated threats to species at risk, such as chelonians, and the long-term effects that these threats will have on population, and ultimately species' persistence, both locally and globally. The information gained through our study will inform recommendations of appropriate conservation strategies for this population, and will aid in the management of future MMEs elsewhere.

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**0044 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday  
7 July 2016**

John Gatto, Joel Trexler

*Florida International University, Miami, Florida, USA*

**Endurance Tests Explain Recolonization Patterns Following Hydrological  
Disturbance**

Inundation of floodplain ecosystems creates aquatic habitats and pulses in primary production. Immigration to newly inundated habitats is well documented, but the mechanisms that influence a species' ability to colonize successfully are poorly understood. Recent studies focus on the behavioral changes and directionality of fish movement caused by changing hydrology. However, recolonization may be limited by physiological, not behavioral, phenomena. We focus on how intraspecific differences in the critical swimming speed (UCRIT) can explain recolonization patterns following a dry-down. Twenty juveniles and 20 adult of varying lengths were tested independently for six coexisting species in the Florida Everglades. Individuals were placed in a Blazka-style swim chamber and allowed to acclimate at a low flow velocity (1-3 BLS) for 30 minutes. Following acclimation, the flow velocity was increased 2 cm/s every 5 minutes until the fish could no longer maintain station in the tunnel. We then compared the rank order of estimated UCRIT to the observed recolonization patterns over the past 17 years in the Florida Everglades. Spatial-temporal patterns of recolonization were consistent for each species, with some species taking several years to recover pre-drought densities following disturbance. Early colonizing species were associated with higher estimates of UCRIT (high endurance); whereas, late colonizing species had lower estimates (low endurance). Intraspecific variation in swimming ability was best explained by differences in body size. This study demonstrates that the critical swimming speed not only describes an individual's ability to maintain station at certain flow velocities, but acts as a metric of dispersal potential.

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**0482 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10  
July 2016**

Aaron Geheber

*University of Oklahoma, Norman, OK, USA*

**Incorporating Phylogenetic Relatedness Measures in Long-term Fish  
Community Studies: What can Temporal Patterns of Evolutionary Similarity  
Tell us?**

Long-term studies of freshwater fish communities are invaluable and provide basic understanding of structural dynamics across time. Many studies have quantified stream fish community structure (i.e., based on species richness and abundance) across generous time scales; however, influences of mechanisms that might explain temporal dynamics are often difficult to discern. Mechanisms including competition, habitat

filtering, predator-prey interactions, and dispersal limitation may influence community structure and should be assessed to gain a greater understanding of long-term structural dynamics. By incorporating measures of phylogenetic relatedness among co-occurring species, it is possible to bring these processes to light. Because recently diverged taxa often retain similar ecological traits, patterns of evolutionary relatedness and patterns of ecological characteristics among community members may provide a useful link for identifying structuring mechanisms. For example, phylogenetic clustering among species may be the result of habitat filtering (i.e., closely related species have similar ecological requirements), whereas phylogenetic overdispersion may be the result of competitive exclusion (i.e., limiting similarity among close relatives). I demonstrate the utility of this phylogenetic approach for gaining a greater understanding of fish community dynamics using examples from Southeastern U.S. stream systems. Moreover, I discuss the requirements of, and visions for, this approach in relation to time, spatial scale, ecological traits, and system specificity.

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**0286 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Daniel Geldof, Nicholas Gidmark

*University of Washington, Seattle, WA, USA*

**Heterochrony in two sculpins of the genus *Psychrolutes*: growth outpaces skeletal development in an apex predator among ichthyoplankton**

In fishes, development is a plastic process, even among closely-related, sympatric taxa. Selective pressure manifests itself through morphological divergences in early life. Of particular interest in the present study is heterochrony: alterations in developmental rates of change. Examinations of skeletal development in the Soft Sculpin, *Psychrolutes sigalutes* and Tadpole Sculpin, *Psychrolutes paradoxus* revealed marked developmental differences between species. While *P. paradoxus* quickly develops an adult skeleton and settles in adult habitat, *P. sigalutes* undergoes a remarkably protracted transformation (the transition from larval to juvenile characters) over a period of three to four months. It reaches sizes in excess of 40 mm (75% of adult size) before settling. While the earliest phases of life focus on the development of feeding elements and a transition from larval/anguilliform locomotion to caudal/subcarangiform propulsion, the two species diverge quickly in postflexion development. With the exception of feeding elements, the skeleton of *P. sigalutes* remains largely incomplete to sizes beyond 25 mm in length. By shunting resources typically dedicated to skeletal growth towards the development of mass alone, *P. sigalutes* quickly grows larger than any cohabitant zooplankton. Hiding by the day and hunting by night, *P. sigalutes* relies on its mass and inertia to chase down smaller prey hampered by the viscosity of water. The seasonality of *P. sigalutes* gives it ample time to grow before the majority of larval fishes hatch. *Psychrolutes sigalutes* may be a specialized ichthyoplankton predator, responsible for the earlier settlement times of cohabitant larvae.

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## 0426 Poster Session I, Acadia/Bissonet, Friday 8 July 2016

Jim Gelsleichter, Morgan Eason

*University of North Florida, Jacksonville, FL, USA*

### **Localization of progesterone receptors in reproductive organs of female bonnetheads (*Sphyrna tiburo*)**

Previous studies on sharks have examined plasma concentrations of the gonadal steroids estradiol (E2), testosterone (T), and progesterone (P4) in elasmobranchs, and have provided strong evidence for their involvement in regulating various stages of reproduction. P4 in particular has been shown to be elevated during two specific periods of female reproduction in some sharks, ovulation and early gestation. However, while logical roles for P4 during these stages have been presented, virtually no published studies to date have examined the location of P4 receptors (PRs) in elasmobranch reproductive organs; this is generally needed to identify possible target organs and clarify potential roles for this hormone. Therefore, the goal of this study was to examine the location of PRs to identify possible targets in elasmobranchs. We examined the presence of PRs in histological sections of reproductive organs of female bonnetheads (*Sphyrna tiburo*) via immunocytochemistry using mouse monoclonal antibodies against PRs. Progesterone receptors were detected in multiple reproductive organs including the uterus, oviducal gland, and ovary. These data indicate multifaceted roles for P4 in elasmobranch reproduction. Data from other species of elasmobranchs will also be discussed to consider possible broad roles for P4 in elasmobranchs.

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## 0422 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016

Jim Gelsleichter<sup>1</sup>, R. Dean Grubbs<sup>2</sup>, John Carlson<sup>3</sup>

<sup>1</sup>*University of North Florida, Jacksonville, FL, USA*, <sup>2</sup>*Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA*, <sup>3</sup>*NOAA Fisheries Service, Panama City, FL, USA*

### **Updated information on the reproductive biology of the smalltooth sawfish *Pristis pectinata***

Due to overfishing and human destruction of its habitat, the smalltooth sawfish (*Pristis pectinata*) became listed as “endangered” under the U.S. Endangered Species Act in 2003 and it remains one of very few U.S. domestic marine fish to hold this undesirable designation. Because of this, conservation measures have been established to allow remnant U.S. sawfish populations to rebuild, but these efforts are hampered by a lack of information on sawfish life history, including reproduction. This study examined reproduction in adult male and female smalltooth sawfish using nonlethal approaches such as the analysis of circulating sex hormones and ultrasonography. Additional data were obtained from necropsies of sawfish that died unintentionally as a result of cold

stress or fishery interactions. Based on necropsy and hormone data, male sawfish appear to undergo spermatogenesis between fall and winter, after which they may exhibit male sperm storage and protracted mating activity until late spring. Based on necropsy data and ultrasonography, female sawfish appear to reproduce following a biennial cycle that includes follicular development from fall to spring, presumably followed by ovulation and mating in late spring, and a one-year gestation period from early summer to the subsequent spring. However, to date, sex hormone data has not been useful for clarifying female reproductive patterns. A hypothesized schedule for smalltooth sawfish reproduction is presented based on these multifaceted observations for use in management and conservation.

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### **0752 Fish Conservation, Galerie 3, Sunday 10 July 2016**

Anna George<sup>1</sup>, Duncan Elkins<sup>2</sup>, Sarah Hazzard<sup>1</sup>, Bernie Kuhajda<sup>1</sup>, Seth Wenger<sup>2</sup>

<sup>1</sup>*Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA*, <sup>2</sup>*University of Georgia River Basin Center, Athens, GA, USA*

### **Conservation Planning for Southeastern Aquatic Biodiversity**

The southeastern United States is a global hotspot of freshwater biodiversity, supporting almost two-thirds of the country's fish species, over 90% of the U.S. total species of mussels, and nearly half of the global total for crayfish species. Many of these species are narrow endemics. Unfortunately, this region is also a hotspot for imperilment; the number of imperiled freshwater fish species in the Southeast has risen 125% in the past 20 years. While the causes of this imperilment, including habitat modification or loss, development, and introduced species, have been extensively documented, efforts to reverse these trends have been hampered by limited funding and lack of public awareness. This project, funded by the National Fish and Wildlife Foundation, has used over 500,000 point records to compile range maps for 592 species of freshwater fishes. We used these ranges, combined with endemism and imperilment scores, to derive a set of priority areas that form the basis of an integrated conservation strategy at the watershed scale (8-digit HUC). This project's outcomes include a Southeastern Aquatic Biodiversity Conservation Strategy, a synthesis that identifies management actions, and policy recommendations appropriate to the threats and conservation capacity in each priority area. This strategy will serve as a guide for foundations interested in making investments in southeastern aquatic conservation, as well as for land and water conservation groups in the region.

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### 0344 Poster Session I, Acadia/Bissonet, Friday 8 July 2016

Elitza Germanov<sup>1</sup>, Andrea Marshall<sup>2</sup>, I Gede Hendrawan<sup>3</sup>, Neil Loneragan<sup>1</sup>

<sup>1</sup>Murdoch University, Perth, WA, Australia, <sup>2</sup>Marine Megafauna Foundation, Truckee, CA, USA, <sup>3</sup>Udayana University, Denpasar, Bali, Indonesia

#### **Plastics on the Menu: Microplastics are Present in the Feeding Habitats of Manta Rays**

Microplastic marine debris is a ubiquitous, multi-faceted environmental issue. Recent advances in research have shed light on global microplastics estimates, threats to biodiversity and key focal regions for intervention. Yet there is limited knowledge of the potential for microplastic ingestion by threatened large filter feeders, such as manta rays, in regions highly implicated with plastic pollution. Here, we characterize microplastics concentrations in critical feeding habitats for manta rays (*Manta alfredi*), in Nusa Penida, Indonesia, an area fraught with marine plastic pollution. Using a 200-micron plankton net, we evaluated micro (<5mm) and meso (5-200mm) plastic pollution in top 0.5m of the water column during twelve individual feeding events. The majority of plastic pieces were in the 1-5mm size range (74.2%). Plastic pieces were comprised of soft (48.9%) or hard (38.8%) secondary micro and mesoplastics, with polystyrene beads and nylon fibers comprising the rest. Overall, the average concentration of plastic pieces in the feeding location was  $1.12 \times 10^{-4}$  pieces per cubic meter. Given the large quantities of water manta rays must filter to meet their daily energy demands, feeding activity in the study location will likely result in microplastic ingestion. We recommend that plastic waste cleanup and prevention be prioritized for critical feeding habitats for manta rays and other resident or seasonal large filter feeders.

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### 0031 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016

Mackenzie Gerringer<sup>1</sup>, Thomas Linley<sup>2</sup>, Alan Jamieson<sup>2</sup>, Jeffrey Drazen<sup>1</sup>

<sup>1</sup>University of Hawaii, Honolulu, HI, USA, <sup>2</sup>University of Aberdeen, Aberdeen, Scotland, UK

#### **Feeding Ecology of Abyssal and Hadal Fishes**

The snailfishes, family Liparidae (Scorpaeniformes), have found notable success in the hadal zone from 6,000 – 8,200 m, comprising the dominant ichthyofauna in at least five trenches worldwide. Little is known about the biology of these deepest-living fishes, nor the drivers of their success at hadal depths. Using recent collections from the Mariana and Kermadec Trenches and neighboring abyssal depths, this study investigates the potential role of trophic ecology in structuring fish communities at the abyssal-hadal boundary. Stomach contents were analyzed from two hadal snailfishes, *Notoliparis kermadecensis* and a newly-discovered species from the Mariana Trench. Amphipods comprised the majority (Kermadec: 95.18%, Mariana: 97.36% index of relative importance) of stomach contents in both species. Decapod crustaceans, polychaetes (N.

*kermadecensis* only), and remains of carrion squid and fish made up the remainder of contents. These results are compared to diet analyses of abyssal species (families Macrouridae, Ophidiidae, Zoarcidae) collected from near the trenches and the literature. These also contained amphipods however macrourids had a higher diversity of prey items, with larger proportions of carrion and fish remains, a trophic plasticity also found in previous studies. Suction feeding fishes like hadal liparids may find an advantage to descending into the trench – where amphipods are abundant. More generalist feeders and scavengers relying on carrion, such as macrourids, might not see this same nutritional advantage. This study provides the first focused look at the feeding ecology of the ocean's deepest-living fishes and informs new understanding of trophic interactions in the hadal zone.

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## **0648 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Michael Ghedotti<sup>1</sup>, Matthew Davis<sup>2</sup>

<sup>1</sup>Regis University, Denver, Colorado, USA, <sup>2</sup>St. Cloud State University, St. Cloud, Minnesota, USA

### **Phylogenetic relationships of three fossil *Fundulus* species and the timing of divergence within the North American topminnows (Teleostei: Fundulidae)**

The relationships of the fossil North American Topminnows and killifishes in the Family Fundulidae (Cyprinodontiformes) remain unclear despite the abundant material available for three of the fossil species. The availability of morphological and molecular data for the Fundulidae and the presence of dated fossil species from the western United States provide an opportunity to incorporate fossil evidence into our understanding of the evolution of the Fundulidae. In this study we address the relationships of the species †*Fundulus detillae*, †*F. lariversi*, and †*F. nevadensis* and the implications for the timing of the major speciation events in the family using morphological and DNA-sequence data for four genes. Our results support many of the prior hypotheses of relationships within the family. We confirmed †*Fundulus detillae* as a member of the subgenus *Plancterus*. The Miocene fossil species do not form a monophyletic group, and do not represent a discrete western radiation of *Fundulus*. †*Fundulus lariversi* is a member of subgenus *Fundulus* and †*F. nevadensis* is related to the subgenera *Plancterus* and *Wileyichthys*, but based on current evidence is not placed in a subgenus. The genus *Fundulus* diverged into its two component clades likely in the Eocene or Oligocene (mean age 34.6mya, 53-23mya) with both of these clades present in far western North America in the Miocene.

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**0712 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
ICHTHYOLOGY**

Sarah Gibson

*University of Kansas, Lawrence, Kansas, USA*

**Three-Dimensional Fish Fossils from a Triassic Texas Pond: Novel Anatomical Insights and Systematic Placement of a New Species of Redfieldiid Fish (Osteichthyes: Actinopterygii)**

Fishes of the order Redfieldiiformes (~16 genera, 26 spp.) are an extinct group of lower actinopterygian fishes found globally in geologic deposits from the Early Mesozoic. Most specimens are either laterally or dorsoventrally flattened due to the weight of overlaying rock layers during the fossilization process, and are rarely found preserved uncrushed and in three dimensions. Reexamination of museum collections has produced several new partial specimens from the Upper Triassic Dockum Formation. These redfieldiiform specimens are exceptionally preserved in three dimensions, providing new insights into the anatomy of the skull. These specimens represent a new species diagnosable by a combination of unique traits found in the skull, including shape of maxilla, shape of preoperculum and associated cheek bones, pattern and articulation of bones in the snout, and patterns of sensory line canals in the dermal skull bones. Specimens of this new species display novel patterns in the sensory line canals of the skull that have never been observed in any other redfieldiiform. This new species is placed within a phylogenetic hypothesis of evolutionary relationships of redfieldiiform fishes.

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**0642 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Michael Gilbert, Michael Collyer

*Western Kentucky University, Bowling Green, Kentucky, USA*

**Impacts of Habitat Fragmentation on the Trophic Morphology of a Threatened Desert Fish (*Cyprinodon pecosensis*)**

Drastic alterations to the North American Southwest's hydrology have highly influenced resident fish communities. In New Mexico and Texas, the Pecos River has been severely altered as a result of water manipulation, isolating backwaters and various habitats that were once connected to the main river. *Cyprinodon pecosensis* (the Pecos pupfish) has been highly impacted due to the effects of anthropogenic water manipulation, as well as species introductions. *C. pecosensis* populations have become isolated and scattered, residing in sinkholes, remnant lakes, and static backwaters, thus creating numerous micropopulations. The purpose of this study was to assess the morphological variation in feeding morphology that occurs in response to varied habitats, especially in terms of environmental factors and species co-occurrence. Landmark-based geometric morphometrics was used to assess shape variation across numerous populations comprising four general habitat types and 27 different localities, each with varied



community structures and salinities. Results from this study suggest that head and mandible morphology vary temporally, with year to year variation, as well as among different localities. As *C. pecosensis* is a threatened species, this research has important implications for future conservation and management. Additionally, these results could further aid in the understanding of preserving species in fragmented landscapes.

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### **0734 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Morgan Gilbert, Allison Pease

*Texas Tech University, Lubbock, Texas, USA*

#### **Use of Habitat Fragments by Larval and Juvenile Fishes in Transitional Zones of an Aging Reservoir**

Isolated coves formed by sedimentation provide novel habitats in Lake Texoma, an aging reservoir in Oklahoma and Texas, USA. These habitat fragments are periodically connected to the broader river-reservoir ecosystem on the arms of two physicochemically distinct rivers entering the reservoir (Red River and Washita River). Our objective was to examine the use of these habitats as nursery grounds by fishes associated with the reservoir and riverine ecosystems. Sampling was carried out from March through August in 2014 and 2015 using light traps and push nets to target larvae and juveniles. Differences in YOY fish abundance and assemblage structure were observed between river arms and individual fragments. Analyses using NMS and ANOSIM revealed significant differences in the structure of larval assemblages between years, and diversity was higher in the very wet, flooded 2015 season. While habitat generalists were dominant throughout our study area, some habitat fragments hosted species that are known to use river floodplain habitats for reproduction, especially during the year with more extensive hydrological connectivity. This work should provide managers with insights into the role that these novel habitats play in supplementing river-reservoir fish assemblages.

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### **0117 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Anthony Gill<sup>1</sup>, Jeffrey Leis<sup>2,3</sup>

<sup>1</sup>*Macleay Museum, University of Sydney, Sydney, New South Wales, Australia,*

<sup>2</sup>*Ichthyology, Australian Museum Research Institute, Sydney, New South Wales,*

*Australia,* <sup>3</sup>*Institute for Marine and Antarctic Research, University of Tasmania, Hobart, Tasmania, Australia*

#### **More than archetypal coral-reef fishes: Revision and relationships of the Acanthuroidei based on adult and larval morphology**

Acanthuroid fishes are often considered archetypal coral-reef fishes. We use characters of both larvae and adults to redefine Acanthuroidei to include the traditional

acanthuroid families (Acanthuridae, Ephippidae, Luvaridae, Scatophagidae, Siganidae, Zanclidae) and taxa usually placed within the Percoidei (*Antigonia*, Chaetodontidae, Drepaneidae, Leiognathidae, Lobotidae, Pomacanthidae). These taxa share a specialised tooth ontogeny. Based on larval morphology (particularly head spination, skull sculpting, early developing posteriorly-placed pelvic fins, pigmentation, and body shape) and adult morphology (dorsal gill-arches) Lobotidae is newly diagnosed to include *Lobotes*, *Datnioides* and *Hapalogenys*. These three genera are traditionally placed in Lobotidae, Datnioididae and Haemulidae, respectively. Three-item analysis shows Lobotidae is sister to the remaining acanthuroids. *Antigonia* and Leiognathidae are nested within the traditional acanthuroids on the basis of synapomorphies including single postcleithrum,  $\leq 5$  branchiostegal rays, absent interarcual cartilage and larval morphology. We compare this acanthuroid phylogeny with recent gene-based phylogenies. The different gene-based phylogenies agree on some aspects, but disagree on others. Similarly, the morphology-based phylogeny has areas of both agreement and disagreement with the gene-based phylogenies. Areas of agreement include: removal of *Hapalogenys* from Haemulidae; inclusion of *Lobotes*, *Datnioides* and *Hapalogenys* in Lobotidae; Lobotidae, *Antigonia* and Leiognathidae related to at least some of the acanthuroid taxa as defined here; Luvaridae and Zanclidae included in Acanthuroidei. The redefined Acanthuroidei includes species that live in a wide variety of habitats: coral reefs, epipelagic oceans, muddy and sandy bottoms, outer continental shelves and slopes, estuaries, mangroves and even fresh water, but most acanthuroid species live on coral reefs.

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**0871 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Adam Gilles, Renae Reed, Ross Black

*Eastern Washington University, Cheney, WA, USA*

**Diet swap: Is trading native prey for invasive species impacting predator fitness?**

Native predators are known to adapt to introduced prey species and sometimes act as a control on those species. Multiple cases have been documented of native Natricine snakes switching their diet to non-native fishes and, in some cases, suppressing the non-native populations. In the Turnbull National Wildlife Refuge (Cheney, WA) such a case may be occurring. The brook stickleback (*Culaea inconstans*) is a non-native fish that has invaded a number of waterways on the TNWR, displacing native fish and amphibians. The wandering garter snake (*Thamnophis elegans vagrans*) may be utilizing brook stickleback as food source due to displacement of their native prey. This study explores the influence of the brook stickleback on three populations of wandering garter snake by examining individual fitness, feeding behavior and diet at different levels of exposure to brook stickleback. When comparing individual snake fitness, inferred with a scaled mass index, no significant differences between the populations were found. During lab-based

predation trials, snakes regularly exposed to brook stickleback had significantly lower successful predation rates than those historically or never exposed. The presence/absence of common prey DNA, and brook stickleback DNA, in snake fecal matter will be analyzed using PCR. The presence of the brook stickleback in the TNWR, while altering the diet and behavior of the wandering garter snake, may not significantly impact its fitness.

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**0855 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
ICHTHYOLOGY**

Matthew Girard, Leo Smith

*University of Kansas, Lawrence, KS, USA*

**Carangiformes: Relationships and Anatomical Investigation**

Carangiformes is a recently identified clade of 26 families, 1,072 species, which includes the traditional Pleuronectiformes and representatives of the traditional Percoidei and Scombroidei. Carangiforms are found in a diversity of habitats that range from Lake Tanganyika to the deep sea. This variation in habitat is mirrored by tremendous morphological variation, particularly modifications to their cranial and axial skeletons. Preliminary investigations and prior work on carangiform subgroups have shown that the external dorsal-fin structure and its internal supports are highly modified and a valuable source of phylogenetically informative characters. An expanded survey of variation in this skeletal system will be conducted and combined with other morphological features and DNA sequence data to work toward a well-supported phylogeny of the Carangiformes.

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**1087 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Melissa Giresi

*Texas A&M University, College Station, TX, USA*

**One *Mustelus*, two *Mustelus*, three *Mustelus*, more; assessing biodiversity of  
smoothhound sharks in the western Atlantic**

Taxonomic difficulties in distinguishing among species of smoothhound sharks present challenges in estimating biodiversity and in developing management plans that are in-line with species-specific sustainability. First, I will discuss the current state of knowledge of smoothhounds in the western Atlantic, including species composition, the availability of type specimens, species ranges, and conservation status for each of the species currently described from the region. Issues with species accounts and research gaps will be noted. Next, I will discuss assessments of genetic divergence among smoothhound species, including initial analyses showing that there may be undescribed species in the western Atlantic. Lastly, I will describe a collaborative effort to

collect voucher specimens and genetic samples from countries throughout the western Atlantic with the goal to accurately determine the species composition/biodiversity of smoothhound sharks in the western Atlantic.

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#### **0464 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Donna A. Glinski<sup>1</sup>, W. Matthew Henderson<sup>2</sup>, Robin J. Van Meter<sup>3</sup>, S. Thomas Purucker<sup>2</sup>

<sup>1</sup>Oak Ridge Institute of Science and Education, Athens, GA, USA, <sup>2</sup>U.S. EPA, Office of Research and Development, NERL, Athens, GA, USA, <sup>3</sup>Washington College, Chestertown, MD, USA

#### **Using *In Vitro* Derived Metabolic Rate Constants to Inform Amphibian Pesticide Exposure**

Understanding pesticide exposure to non-target species is necessary to accurately assess the ecological risks these compounds pose. To evaluate the potential metabolic activation of pesticides in amphibians, *in vitro* metabolic rate constants were derived for atrazine (ATZ), triadimefon (TDN), fipronil (FIP) as well as their metabolites using non-linear fit of velocity versus concentration. For *in vitro* and *in vivo* exposures, ATZ was metabolized into deisopropyl atrazine (DIA) and desethyl atrazine (DEA); TDN was metabolized into two diastereomers of triadimenol (TDL), A and B, and FIP was primarily metabolized into fipronil sulfone. *In vitro* studies utilized American toad liver microsomes while 48 hr exposures with Fowler's toads were used for *in vivo* body burden determinations. Following *in vitro* studies, metabolic rate constants were calculated for all three pesticides and used to inform *in vivo* body burdens. DEA and DIA both exhibited similar maximum rates of velocity ( $V_{max}$ ) while the substrate concentration at half  $V_{max}$  ( $K_m$ ) for DIA was higher than DEA. In concordance, *in vivo* DIA concentrations were an order of magnitude higher than DEA. All *in vivo* time points investigated for TDL exhibited higher body burdens for the TDL B metabolite. Fipronil sulfone's  $V_{max}$  and  $K_m$  were 177.9 pmol/min/mg and 10.9  $\mu$ M, respectively. This *in vitro* to *in vivo* extrapolation can provide a high throughput method for testing pesticides on amphibians. Gaining knowledge on species-specific differences in metabolism of pesticides is important in estimating risk to amphibians since the toxicity of pesticide metabolites can differ from the parent compound.

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**0933 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Brad Glorioso, Hardin Waddle

*U.S. Geological Survey, Lafayette, LA, USA*

**Effect of Salinity on Anuran Occupancy in Big Thicket National Preserve, Texas**

Coastal wetlands along the Gulf of Mexico are vulnerable to increased salinization due to coastal wetland loss, sea level rise, and surge associated with tropical storms and hurricanes. The Lower Cypress Tract of Big Thicket National Preserve is a low-lying tidally-influenced forested wetland along the Neches River near Beaumont, Texas. It is located downstream of the Neches River saltwater barrier, which ensures freshwater for human use. Anurans are particularly vulnerable to increased salinity, due to their water-permeable skin and aquatic egg and tadpole stages. In 2011 we sampled 32 randomly chosen sites south of the saltwater barrier. Then in 2012, an additional 20 sites were randomly chosen upstream of the saltwater barrier. We have sampled each of the sites 4-6 times per year from 2011-2015 using a combination of time-constrained nighttime visual encounter and manual call surveys. Salinities varied within and among years at our southern sites, from a high of 17 ppt during a 2011 drought to essentially fresh during high flow periods. We used dynamic occupancy modeling to determine the probability of occurrence over time for each anuran species at southern sites subject to salinity compared to the northern freshwater sites. Preliminary results show that occupancy rates are relatively stable, but some species had higher occupancy at northern sites, at least one species had a higher occupancy at southern sites, and some species showed no differences. Though short-term pulses in salinity may negatively affect individual anurans, chronic long-term exposure to salinity may eventually alter anuran communities.

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**0976 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Alicia Godersky

*University of Washington School of Aquatic and Fisheries Sciences, Seattle, WA, USA*

**Distribution of Larval Fishes in Puget Sound**

Most marine fishes spend a period of their early life history as pelagic larvae, during which they are considered members of the zooplankton community. In Puget Sound, a uniquely deep estuary, information about spatial and temporal distribution, abundance, and water conditions associated with fish larvae is almost completely unavailable.

Larval fishes were sorted from plankton samples collected in April and May 2011 from 61 sites across Puget Sound. These samples were collected as part of a collaborative effort between the National Marine Fisheries Service, Washington Tribes, and several researchers at the University of Washington who aimed to describe the structure of the food web throughout Puget Sound's nearshore habitat. Larvae were identified and rare

taxa were excluded from analysis. Thirty taxonomic groups were identified in at least five percent of samples, including 20 at the species level, two at the generic level, and eight at the family level. The following question was posed: Does month or basin explain the presence of a particular larval fish species. Generalized linear models (GLM's) were built to predict the presence of three taxa (*Clupea pallasii*, *Ammodytes personatus*, and *Platichthys stellatus*) based on month and basin. Results suggest that May explained the absence of *Clupea pallasii* and *Ammodytes personatus* relative to April. Additionally, Rosario Basin explained the presence of *Platichthys stellatus* and South Basin explained the absence of *Ammodytes personatus* relative to the other basins. Larval fish distribution appears to differ between basin and month in Puget Sound.

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**0322 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
HERPETOLOGY**

Cody Godwin

*Southeastern Louisiana University, Hammond Louisiana, USA*

**Assessment of ATV Impacts on Softshell Turtle Nests**

Recreational vehicle use (e.g., all terrain vehicles or ATV's) has become increasingly popular in recent years, and is particularly prevalent in the southeastern U.S. Numerous studies have indicated negative effects of ATV's on the environment, especially in and around wetlands, including wetland degradation, soil erosion, destruction of vegetative communities, and direct animal mortality via impact. However, the impact of ATV's on nest success of fresh water turtles has not been documented. The beaches of the Comite River in southeastern Louisiana bring into close contact ATVs and the nesting sites for two species of softshell turtles (*Apalone mutica* and *Apalone spinifera*). The present study aims to understand the impacts of the ATVs on softshell turtle nests and thus the turtle populations. A study performed in 1993-1994, when ATVs were absent, provides a baseline for assessing the current impacts. Preliminary analyses from the first field season show that ATV's impacted 35% of nests including 25% entirely destroyed. Second season objectives will be discussed.

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**0609 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Scott Goetz<sup>1</sup>, Craig Guyer<sup>1</sup>, Scott Boback<sup>2</sup>, Christina Romagosa<sup>3</sup>

<sup>1</sup>*Auburn University, Auburn, AL, USA*, <sup>2</sup>*Dickinson College, Carlisle, PA, USA*,

<sup>3</sup>*University of Florida, Gainesville, FL, USA*

**Snakes Fail to Recognize the Costs of Eating Invasive Cuban Treefrogs,  
*Osteopilus septentrionalis***

Native predators may incur sublethal costs by consuming nonindigenous prey that possess novel defensive toxins. In this study, we examine the prey preferences and

growth rate of a native generalist snake (Eastern Gartersnakes, *Thamnophis sirtalis*) in response to the chemically defended Cuban Treefrog (*Osteopilus septentrionalis*). We compared responses from snakes collected from uninvaded regions and those within the invasive range of *O. septentrionalis*. To assess prey preference, we explored the predatory responses of *T. sirtalis* to cues from *O. septentrionalis*, native Green Treefrogs (*Hyla cinerea*), and controls. Specifically, we assayed both digestively naïve neonatal and wild-caught adult snakes. To evaluate the nutritional value of *O. septentrionalis*, we monitored weight changes of wild-caught *T. sirtalis* fed exclusive diets of either *O. septentrionalis*, *H. cinerea*, or native fish (Golden Shiners, *Notemigonus crysoleucas*). We found that all three *T. sirtalis* experimental groups failed to exhibit a significant preference for *H. cinerea* prey scent over stimuli from *O. septentrionalis*, including neonates from invaded regions ( $P = 0.99$ ), adults from invaded regions ( $P = 0.14$ ), and neonates from noninvaded regions ( $P = 0.33$ ). However, we found *T. sirtalis* gained significantly less weight in the *O. septentrionalis* diet treatment in both the invaded region (ANOVA;  $F_{2, 28} = 4.82$ ,  $P = 0.016$ ) and noninvaded region (ANCOVA;  $F_{2, 24} = 3.55$ ,  $P = 0.04$ ). Observations suggest *O. septentrionalis* toxins disrupt snake digestion. Our results indicate that *O. septentrionalis* could represent an evolutionary trap because *T. sirtalis* fails to recognize the inferior nutritional value of this nonindigenous species.

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**1068 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Cory Goff<sup>1</sup>, Caitlin Gabor<sup>2</sup>, Susan Walls<sup>3</sup>

<sup>1</sup>Texas State University, San Marcos, Texas, USA, <sup>2</sup>Texas State University, San Marcos, Texas, USA, <sup>3</sup>US Geological Survey, Gainesville, Florida, USA

**Are Declining Populations of the Ornate Chorus Frog, *Pseudacris ornata*, More Stressed Than Stable Populations?**

Climate change has become a significant driver in ecology, causing changes in environmental factors like temperature, humidity, precipitation, and sea level rise. In addition, other anthropogenic disturbances also alter habitat and reduce habitat quality. Together, populations may reach their tolerance limits whereby populations decline and become more isolated physically and genetically. One mechanism to assess how individuals and populations respond to changing conditions is to assess their physiological health. We examined stress hormone concentrations for populations of *Pseudacris ornata* throughout its range in Florida and southern Georgia. This species has shown rapid declines in the Florida peninsula yet populations appear to be stable in the Florida panhandle region. We obtained baseline water-borne corticosterone (CORT) release rates for tadpoles from multiple sites in four locations across an east-west transect in northern Florida and one location in southern Georgia. We also obtained stressed induced corticosterone levels for each site. We compared baseline and stress responses among sites. We predict that locations where the population has been declining will not show a stress response and that CORT will differ from the more stable

populations. We also explored environmental variables and related them to CORT release rates for each site. Together our study may aid in identifying factors affecting the observed declines and provide management implications.

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## **0189 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Rachel Goodman<sup>1</sup>, Amber Wright<sup>0</sup>

<sup>1</sup>Hampden-Sydney College, Hampden Sydney, VA, USA, <sup>2</sup>University of Hawaii at Manoa, Honolulu, HI, USA

### **Survey of Ranavirus and *Batrachochytrium dendrobatidis* in Introduced Frogs in Hawaii**

Ranavirus and *Batrachochytrium dendrobatidis* (Bd) are two emerging wildlife diseases that threaten amphibian populations globally. Hawaii does not have any native species of amphibians. However, there are six species of introduced amphibians, which may predate upon or compete with native species, and serve as reservoirs for pathogens. While Bd has been documented in *Eleutherodactylus coqui* frogs on the Island of Hawaii, it has not been surveyed in other amphibians or on other islands. The presence of ranavirus in amphibians or other ectothermic hosts has not yet been investigated in Hawaii. We report on a survey of the pathogens ranavirus and Bd in four introduced frog species on the island of Oahu. We collected 20-30 individuals per life stage from one or more populations of *Rana rugosa*, *Rana catesbeiana*, *Bufo marinus* and *Dendrobates auratus*. Skin swabbing was done externally according to the standard for Bd sampling. Frogs were humanely euthanized and necropsied, and samples of liver, intestine, and kidney were collected for ranavirus sampling. We extracted DNA from all samples and used qPCR to test for the presence of Bd in swab samples and ranavirus in organ samples. We then compared presence and prevalence of the two pathogens among the species sampled. This study of pathogen surveillance in Hawaii has the potential to contribute to managing introduced frog populations, native wildlife, and global amphibian populations, as the islands are a major hub between Asia, the Pacific, and North America.

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### 0329 Herp Biogeography, Salon D, Friday 8 July 2016

Andrew Gottscho<sup>1</sup>, Brad Hollingsworth<sup>3</sup>, Julio Lemos-Espinal<sup>4</sup>, Tod Reeder<sup>2</sup>

<sup>1</sup>Smithsonian Institution, Washington, DC, USA, <sup>2</sup>San Diego State University, San Diego, CA, USA, <sup>3</sup>San Diego Natural History Museum, San Diego, CA, USA, <sup>4</sup>Facultad de Estudios Superiores, UNAM, Iztacala, MX, Mexico

#### **Phylogeography of Peninsular Brush Lizards (Squamata: Phrynosomatidae: *Urosaurus*) in Baja California, Mexico using Restriction-Associated DNA Sequencing**

The Black-tailed Brush Lizard (*Urosaurus nigricaudus*) and its sister species, the Baja California Brush Lizard (*U. lahtelai*) are endemic to the Baja California Peninsula, a region with a dynamic climatic and geologic history. Whereas *U. nigricaudus* is widespread across the peninsula, *U. lahtelai* is confined to a small region of granitic outcrops in the vicinity of Cataviña in the north-central peninsula, surrounded by *U. nigricaudus*. Furthermore, the validity of the taxon *U. microscutatus*, currently in synonymy with *U. nigricaudus*, has been recently supported and its synonymy may have been premature. We used restriction-associated DNA sequencing (RADseq) to investigate the phylogeography and species delimitation of *Urosaurus* in Baja California. We analyzed over 1,000 short-read loci for 42 individuals of *U. nigricaudus* and 6 individuals of *U. lahtelai*. Using a combination of population genetic clustering algorithms, concatenated phylogenies, and coalescent species tree/isolation-with-migration models, we found compelling evidence that *U. nigricaudus* is composed of two species (i.e. *U. microscutatus* is a valid species). Discrete phylogeographic breaks were found at the mid-peninsular region (Vizcaíno Desert) and in the southern peninsula (the western slope of the Sierra la Giganta), consistent with phylogeographic patterns in other co-distributed squamate reptile species. We found that northern populations have lower heterozygosity and are recently derived with respect to southern populations, with a northern range expansion into the range of *U. lahtelai*, most likely having occurred in the late Pleistocene. Possible taxonomic implications and comparative phylogeography of the peninsula as a whole will be discussed.

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### 0970 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016

Johana Goyes-Vallejos<sup>1</sup>, Kentwood Wells<sup>1</sup>, T. Ulmar Grafe<sup>2</sup>

<sup>1</sup>Ecology and Evolutionary Department, University of Connecticut, Storrs, CT, USA, <sup>2</sup>Faculty of Science, Universiti Brunei Darussalam, Gadong, Brunei Darussalam

#### **Parental care behavior in males of the Smooth Guardian Frog *Limnonectes palavanensis* of Borneo**

Amphibians have a great diversity of reproductive modes. However, only a few of these are associated with some kind of parental care. In Southeast Asia, species in the genus

*Limnonectes* exhibit a spectrum of parental care modes: from egg deposition in terrestrial nests to internal fertilization and tadpole viviparity. The smooth guardian frog *Limnonectes palavanensis*, found in Borneo, is one of only two species in the genus with egg attendance and tadpole transport. I studied the parental care behavior of *L. palavanensis* in the laboratory and in the field. After the eggs are laid on the forest floor, males stay with the clutch from oviposition until hatching, a process that takes between 9 and 11 days. Males do not call while caring for eggs and do not attract additional females. Using infrared video cameras, I found that tadpole retrieval can take up to 90 minutes. Tadpoles can break out of the egg capsule alone, but the male apparently stimulates hatching by touching the clutch with his fingers and chin. When free, tadpoles wriggle onto the male's back. Males transport the tadpoles to rain pools, intermittent streams and pig wallows. I observed males transporting numbers of tadpoles consistent with the clutch sizes observed in the laboratory, suggesting that males only take care of one clutch at a time. Due to this prolonged parental care, males might be removed from the mating pool and females may have difficulty finding receptive males. This could lead to female-female competition and a reversal in sex-roles.

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### **0111 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Mark Grace<sup>1</sup>, Laura Dias<sup>2</sup>, Lance Garrison<sup>3</sup>, Keith Mullin<sup>1</sup>, Kathy Maze-Foley<sup>4</sup>, Carrie Sinclair<sup>1</sup>

<sup>1</sup>NOAA/NMFS/SEFSC/Mississippi Laboratories, Pascagoula, MS, USA, <sup>2</sup>Cooperative Institute for Marine and Atmospheric Studies, Univ. of Miami, Miami, FL, USA, <sup>3</sup>NOAA/NMFS/SEFSC/Miami Laboratory, Miami, FL, USA, <sup>4</sup>NOAA/NMFS/SEFSC Beaufort Laboratory Affiliate, Beaufort, NC, USA

### **Ectoparasitic Predators; Cookie Cutter Shark Bite Wounds on Cetaceans of the Gulf of Mexico**

Cookie cutter sharks (Dalatiidae, Squaliformes) are often described as ectoparasitic predators of a variety of high trophic level prey species including cetaceans, tunas, billfishes, and squids. These sharks employ a unique feeding behavior that allows them to use their cookie-cutter like teeth to excise a nearly symmetrical oval flesh plug from the body of their prey. A data element of NOAA/NMFS/SEFSC surveys of Gulf of Mexico cetaceans is the documentation of the fresh wounds or scars that can be observed on cetaceans that approach vessels to bow ride or if they are otherwise close enough to allow observation. Cookie-cutter bite wounds were observed on eight percent of sightings (solitary or groups) represented by 11 dolphin species and two whale species. Pantropical spotted dolphin sightings (*Stenella attenuata* Gray 1846) had the most records of cookie cutter bite wounds (40%). In addition, during a Gulf of Mexico midwater trawling study targeting cetacean prey aggregations (fish and invertebrates), two cookie cutter sharks were sampled for stable isotopes (*Isistius brasilensis* Quoy & Gaimard 1824 and *I. plutodus* Garrick & Springer 1964). The ratio analysis of <sup>13</sup>C and <sup>15</sup>N positions these

ectoparasitic sharks in a high trophic level and provides verification that they feed on other high trophic level species.

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**0016 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Molly Grace, Daniel Smith, Reed Noss

*University of Central Florida, Orlando, Florida, USA*

**Patterns of Anuran Abundance near Roads are Explained by Life History Traits**

Roads and their associated effects (road-kill, pollution, etc.) have a largely negative impact on animals, especially amphibians, but not all species are affected to the same degree. Variation in life histories may explain some of these differences. Here, we test how abundance of anuran species in roadside habitats is correlated with an aspect of reproductive life history: number of eggs produced by a female per year. We found that as the average number of eggs produced increases, more individuals of that species are found in roadside habitats compared to control habitats. This implies either that populations of species with a greater reproductive rate are able to rebound more quickly from negative road impacts, or that there is a strong selective pressure on species with low reproductive rates to avoid roads.

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**0844 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

Jessica Grady, Courtney Weyand, Zachary Holtel, Eva Urdiales, C.M. Gienger, Rebecca Blanton

*Austin Peay State University, Clarksville, TN, USA*

**Scale shape variation in a speciose and highly imperiled group of fishes, the darters (Percidae: Etheostomatinae)**

The species-rich darter clade (Percidae: Etheostomatinae) has a vast research history, however, studies of variation in scale microstructure have been limited to a small number of species. To describe phenotypic variation in darter scales and evaluate variation in the context of modern estimates of diversity and phylogeny, a pilot study was conducted using confocal microscopy. Darter scale shape and meristic data were taken from 236 individuals, representing 80 species, all genera, 26 subgenera, and 29 darter clades. Variation in number of ctenii and radii was observed among genera, subgenera and clades (*Percina* ctenii, radii: =19.9, 9.3; *Nothonotus*: =25.3, 13.4; *Etheostoma*: =24.9, 13.4; *Crystallaria*: =11.0, 6.3; *Ammocrypta*: =8.1, 6.9). Principle components analysis revealed *Ammocrypta* and *Crystallaria* have shorter scale lengths and shorter ctenii relative to other genera. Variation among species and clades within each genus,

particularly *Percina* and *Etheostoma*, was also noted. Given the observed variation as well as previous work demonstrating that the morphological diversity of darters has been attributed to environmental conditions of streams, future work will investigate the impact of environment, behavior, and phylogeny on darter scale shape using geometric morphometrics. Because scales aid in reducing drag and facilitating movement, understanding the relative impact these factors have on morphological variation in darters will enhance knowledge of the response of this group of fishes to environmental changes.

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## **0932 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Rachel Graham<sup>1</sup>, Ivy Baremore<sup>1</sup>, Samantha Strindberg<sup>2</sup>

<sup>1</sup>MarAlliance, San Pedro, Belize, <sup>2</sup>Wildlife Conservation Society, California, USA

### **A Tale of Two Atolls: Differences in Elasmobranch Abundance and Density Between Two Offshore Atolls in Belize**

Turneffe and Lighthouse Reef Atolls are two of the Atlantic Ocean's four atolls, forming part of the Meso-American Barrier Reef in Belize, with sharply contrasting protection status. Located approximately 50 km east of Belize City, Turneffe Atoll was recently declared a multi-zoned marine protected area; although gear types are restricted, it is still easily accessible to fishers. Lighthouse Reef Atoll is more remote and provides open access to fishing, bar two fully protected sites. The study examined the status of elasmofauna using three methods: longlines, Baited Remote Underwater Video (BRUV), and in water Distance Sampling (DS). Surveys were conducted at fixed stations from 2014-2016. Stations were randomly positioned at evenly-spaced locations throughout three habitat types: forereef, backreef, and lagoon. Data analyses included: catch-per-unit-effort (CPUE) for longline, MaxN and frequency of occurrence for BRUVs, and population size and density estimates from DS data. Generalized Linear Models (GLM) were used to assess differences in abundance by year, habitat, location, protection status, depth and environmental parameters. Results from the three consecutive survey years indicate that Lighthouse Reef Atoll, though much smaller, has significantly higher abundance and occurrence of shark species than Turneffe Atoll. Density and population size estimates of rays were similar between atolls. CPUE and MaxN were highest at both atolls for sharks on the windward forereef habitats. This study suggests high historic fishing mortality at Turneffe Atoll, where proximity to population centers negatively affects shark populations. Continued monitoring will help to determine the effectiveness of Turneffe Atoll in protecting elasmobranchs.

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**0902 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday  
10 July 2016**

Jennifer Granneman, Steve Murawski, Ernst Peebles

*University of South Florida, College of Marine Science, St. Petersburg, FL, USA*

**Metal Exposure, as Documented in Otoliths, may be Detrimental to Gulf of Mexico Fish Health**

The incidence of external lesions on Gulf of Mexico (GoM) fishes increased just after the Deepwater Horizon (DWH) oil disaster, and then declined, yet a lack of baseline data makes it difficult to definitively link cause and effect. Our objectives were to: (1) determine if fish were exposed to metals associated with the DWH oil during the time period of the oil spill, and (2) examine patterns of oil-associated metal exposure, particularly among lesioned and non-lesioned fish. Otoliths record both fish age and microchemistry, enabling us to describe the lifetime chemical histories of fish. We analyzed otoliths from six offshore fish species collected from 2011 to 2013 in the GoM. Otoliths were analyzed for a suite of trace metals known to be associated with DWH crude oil. We found that the concentrations of oil-associated metals did not significantly change before, during, or after the DWH oil spill; however, metal exposure varied according to species-specific life history patterns. Additionally, lesioned fish had distinctive trace metal compositions in their otoliths, with  $^{60}\text{Ni}$  and  $^{64}\text{Zn}$  responsible for distinguishing lesioned from non-lesioned fish groups. Lesioned fish often had elevated otolith  $^{60}\text{Ni}$  and  $^{64}\text{Zn}$  before and after the DWH oil disaster. These findings suggest that lesioned individuals were exposed to a persistent source of metals in the GoM prior to the oil spill; this may have made them vulnerable to the DWH oil spill and resulted in lesion formation in response to DWH oil exposure.

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**0004 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D,  
Friday 8 July 2016**

David Green, Andrew Hendry

*McGill University, Quebec, Canada*

**Eco-evolutionary dynamics - Introduction to the symposium**

Evolutionary changes in organisms are driven by ecological changes their surroundings. That much is obvious, but much less well known is how these interactions play out over short time scales, including periods of time most relevant to conservation and management. In the face of environmental change, when and how rapidly must accommodation via phenotypic plasticity yield to heritable adaptation via evolution? How does rapid contemporary evolution, in turn, influence population dynamics, community composition or ecosystem function on similar time scales? Many of the best examples of research into the dynamic interactions between ecology and evolution are studies of fishes, amphibians or reptiles and this symposium is intended to showcase that research.

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**0336 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Madeline Green<sup>2</sup>, Blanche D'Anastasi<sup>3</sup>, Jean-Paul Hobbs<sup>4</sup>, Kevin Feldheim<sup>5</sup>, Rory McAuly<sup>6</sup>, Sterling Peverell<sup>7</sup>, Jason Stapley<sup>7</sup>, Sharon Appleyard<sup>8</sup>, William White<sup>8</sup>, Colin Simpfendorfer<sup>1</sup>, Lynne van Herwerden<sup>3</sup>

<sup>1</sup>Centre for Sustainable Tropical Fisheries and Aquaculture, James Cook University, Queensland, Australia, <sup>2</sup>Institute for Marine and Antarctic Studies, University of Tasmania, Tasmania, Australia, <sup>3</sup>College of Marine and Environmental Sciences, James Cook University, Queensland, Australia, <sup>4</sup>Department of Environment and Agriculture, Curtin University, Western Australia, Australia, <sup>5</sup>Laboratory for Systematics and Evolution, the Field Museum, Chicago, IL, USA, <sup>6</sup>Western Australian Government, Department of Fisheries, Western Australia, Australia, <sup>7</sup>Queensland Department of Primary Industries and Fisheries, Northern Fisheries Centre, Queensland, Australia, <sup>8</sup>National Research Collections Australia, CSIRO, Tasmania, Australia

**Population Connectivity of Narrow Sawfish (*Anoxypristis cuspidata*) in Australia and Papua New Guinea using genetic markers**

The Narrow or Knifetooth sawfish (*Anoxypristis cuspidata*) belongs to the most endangered family within the Class Chondrichthyes; the sawfishes. This species has undergone significant declines in range and abundance due to anthropogenic activities including fishing and habitat loss. Very little is known of adult movements and sex-biased behaviour that may be exhibited by Indo-Pacific populations. In order to better manage and protect this threatened species, understanding habitat usage and behaviour is critical. Using a combination of mitochondrial and nuclear (microsatellites) markers, this study identified the population structure of *A. cuspidata* in Australia and Papua New Guinea (PNG). Significant mitochondrial structuring was found for the east Australian coast population and other sampled locations both in northern Australia and PNG. Suggesting residency or philopatric behaviours are likely for females specifically on the east coast of Australia. Similarly, microsatellite markers identified a lack of connectivity between the east coast and all other locations across northern Australia (microsatellite markers were unavailable for PNG populations). Results from this work show the east Australian population of *A. cuspidata* have no genetic connectivity with other sampled Australian and PNG locations. Consequently, the east Australian population is likely to be less resilient than others if localised anthropogenic pressures remain. Microsatellite results require further investigation due to the low number of suitable markers available for the species. However, given the endangered status and lack of knowledge for *A. cuspidata* this study presents important findings, which can be used to improve management outcomes.

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**0477 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Dan Greenberg

*Simon Fraser University, Burnaby, Canada*

**Historical Diversification and Contemporary Extinction in Amphibians**

Some clades diversify rapidly over time, while others remain depauperate. The causes for this are various, but many biological traits can influence the rates of speciation and extinction. Traits hypothesized to increase speciation rate include limited dispersal capacity, low and fluctuating population abundance, and ecological specialization. Many of these same traits are also associated with heightened rates of extinction, suggesting that rates of speciation and extinction may be correlated. Though this has long been recognized in fossil taxa it is rarely considered in the context of modern biodiversity loss. As amphibians are experiencing the highest rates of modern vertebrate extinction they provide an ideal system to test whether young and rapidly evolving clades also have the greatest extinction risks. I calculated net diversification rates for 275 genera of amphibians across different biogeographic regions and compared this to the proportion of assessed species threatened in each clade according to IUCN threat categories. I found that clades with higher diversification rates also had a greater proportion of threatened species, suggesting that the processes of speciation and extinction may indeed be coupled in amphibians. I explore possible mechanisms for this pattern, including the distribution of geographic range size and climatic specialization across these clades. These results suggest that, contrary to certain birds and mammals, the youngest and most speciose amphibian clades are likely to suffer disproportionately in the loss of amphibian diversity in the future.

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**0557 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Kathryn Greene, Shannon Pittman, Michael Dorcas

*Davidson College, Davidson, NC, USA*

**Factors Affecting the Dispersal and Settlement Decisions of Juvenile Spotted Salamanders (*Ambystoma maculatum*)**

Spotted salamanders (*Ambystoma maculatum*) are pond-breeding amphibians that disperse into terrestrial habitat from natal wetlands after undergoing metamorphosis, relying on small-mammal burrows and coarse woody debris for refugia. Traversing through novel habitats dispose recently metamorphosed salamanders to risks that include density effects and predation. Salamanders may mitigate these risks via movement decisions, but movement strategies that reduce density effects may not be the optimal strategies for reducing predation pressure. To explore this potential behavioral trade-off, we conducted behavioral laboratory trials using 58 recently metamorphosed salamanders to determine how salamanders select burrows in the presence of

conspecifics. Our results show that salamanders were 84% more likely to settle in a burrow that was occupied by a conspecific than settling in an unoccupied burrow, indicating that juvenile salamanders may show conspecific attraction and/or trailing behavior during the dispersal phase. While conspecific attraction would increase the risk of density-dependent mortality, we hypothesized that trailing would reduce the impact of predation pressure through the dilution effect. To explore this concept, we used powder tracking to measure movements of anurans around the edge of salamander breeding ponds in night field surveys and used those data to parameterize individual-based simulation models to explore how trailing behavior and the resulting high densities of salamanders impact predation risks. We found that trailing behavior decreased the risk of predation, but only under certain assumptions about predator dispersion and behavior. These results suggest that behavioral trade-offs may be important drivers of salamander movement patterns.

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#### **0104 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Patrick Gregory

*University of Victoria, Victoria, BC, Canada*

#### **ASIH: A View from the North**

By area, Canada is the world's second largest country, but, by population size, it ranks 37<sup>th</sup>. Canada's herpetofauna is also small and, like the human population, most of it is concentrated along the country's southern border. In the 1960s, when I developed my interest in herpetology, there were virtually no academic herpetologists in Canada and I had to seek out ichthyologists for career advice, which led me to another ichthyologist, with whom I ended up doing my PhD. Thus, my relationship with ichthyologists is long-standing and it was only natural to me to turn to ASIH as my major professional affiliation. I attended my first ASIH meeting in 1970 in New Orleans and have attended almost every meeting since then. It also has been my pleasure to host two meetings and to serve the society in various capacities. Although I belong to other herpetological societies, including a now thriving one in Canada, ASIH remains my main professional home. My association with ASIH has had a tremendous influence on the development of my career, both in research and in administration. It also has given me enduring friends and colleagues. For me, the influence of ASIH extends well beyond its journal, *Copeia*, and well beyond the borders of the United States. Science and society need organism-based associations like ASIH and I hope that it will continue to prosper with the membership and active participation of new young scientists.

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**0144 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

Aaron Griffing<sup>1</sup>, Juan Daza<sup>2</sup>, Aaron Bauer<sup>1</sup>

<sup>1</sup>Villanova University, Villanova, Pennsylvania, USA, <sup>2</sup>Sam Houston State University, Huntsville, Texas, USA

**Developmental Osteology of Parafrontal Bones in *Aristelliger* and *Teratoscincus* (Squamata: Sphaerodactylidae)**

Well-resolved phylogenetic hypotheses and ontogenetic data are often necessary to investigate the evolution of structural novelty. The Sphaerodactylidae comprises several genera of miniaturized geckos, including one of the smallest known amniotes. The genera *Aristelliger* and *Teratoscincus* are exceptions, with taxa reaching snout-to-vent lengths of up to 150 mm. These genera possess enigmatic, neomorphic, supraorbital ossifications, parafrontal bones, which are unique among squamates. Originally believed to be a product of evolutionary convergence, these structures have remained uninvestigated since their discovery. Though relationships between other Old World sphaerodactylids remain unresolved, recent molecular and morphological data has supported a close relationship between *Aristelliger* and *Teratoscincus*. We investigated the ontogeny of these bones in both *Aristelliger* and *Teratoscincus* to better understand the putative homology between the two genera and relationship between body size and the presence of parafrontal bones in sphaerodactylids. We hypothesized that the parafrontals of *Aristelliger* and *Teratoscincus* are homologous and that there is a threshold body size in sphaerodactylids, below which parafrontals do not develop, thus explaining their absence in miniaturized taxa. Histology was used to corroborate parafrontal homology. Cleared and stained, radiographed, and skeletonized specimens of various ontogenetic stages were used to verify the presence of parafrontals, and if present, measure the total surface area they occupied in seven species of *Aristelliger*, six species of *Teratoscincus*, and their respective sister taxa. Our data suggest that parafrontals are likely homologous and that the onset of parafrontal development is dependent on the ontogenetic stage, not a strict threshold size.

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**0729 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS**

Matt Grisnik, Alexander Murray, Herman Mays

Marshall University, Huntington, West Virginia, USA

***Necturus* Phylogeny**

The genus *Necturus* is made up of medium to large neotenic salamanders. Endemic to the Eastern half of North America, these salamanders can be found in most freshwater environments. There are currently five species recognized within the genus, but arguments have been made for further species division. Current members of this genus

**CANCELLED**

may be later classified as subspecies or may achieve full species status, although their current status remains debatable. As many as seven species are accepted by some and disagreement exists surrounding the species *Necturus maculosus* and *Necturus beyeri*. Previous studies have created phylogenies from allozymes, and more recently 4 nuclear genes, however the direct relationships between species within this genus are still under contention. The goal of this study is to establish phylogenetic relationships between members of the genus *Necturus*. This will be done by creating a phylogenetic tree using a combination of nuclear (nDNA) and mitochondrial DNA (mtDNA). The only other extant member of the family Proteidae, *Proteus anguinus* will be used as the outgroup. To date 6 nuclear loci and 2 mitochondrial loci have been amplified and sequenced. Specimens have been collected for all currently recognized species, and will be stored as museum specimens in various museum collections.

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**0091 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Iwo Gross<sup>1</sup>, Yong Wang<sup>1</sup>, Callie Schweitzer<sup>2</sup>

<sup>1</sup>Alabama A&M University, Huntsville, Alabama, USA, <sup>2</sup>USDA Forest Service Southern Research Station, Huntsville, Alabama, USA

**Habitat use and dispersal of neonatal Copperheads (*Crotalinae*; *Agkistrodon*) in a managed southeastern forest**

Recent studies have identified the neonatal snake cohort as an important dispersal vector in several species. Unfortunately, the comprehensive examination of early-life characteristics in snakes is logistically challenging as a result of ineffective tracking techniques and low detection probabilities in wild populations. In this study, we will examine the activity patterns, habitat use, and overwintering habitat requirements of gravid female Copperheads (*Agkistrodon contortrix*) and their offspring that inhabit Bankhead National Forest in northern Alabama. In advance of parturition, our radiotracked, gravid females will be placed in hardware cloth enclosures at their parturition sites until they give birth. Select neonates >4g will be tracked using harmonic direction finder (HDF) tags, which function by re-emitting incoming radio signals at a harmonic frequency that can be detected by a handheld transceiver and pinpointed using basic telemetry methods. These tags require no batteries, are lightweight (ca. 8 mg), and have a detection range appropriate for tracking small organisms. Macro- and microhabitat surveys will be conducted alongside tracking efforts of both age classes throughout the activity season. The simultaneous implementation of these methods will help us draw conclusions concerning vital snake nesting and overwintering habitat, and the variation in habitat use and survival across Copperhead age classes. Preliminary findings indicate that neonatal dispersal progresses in a linear "beads-on-a-string" pattern, and neonates favor microhabitat features associated with early-successional habitat types. Further application and development of our methodologies could address

other queries regarding the ecological role and characteristics of the neonatal snake cohort.

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**0722 ASIH: Lessons From, and Lessons For Symposium, Salon D, Sunday 10 July 2016**

Gary Grossman

*University of Georgia, Athens, GA, USA*

**Long-term Data in a Changing World: Lessons from Stream Fishes**

We are in a time of unprecedented environmental change, which makes the collection and analysis of long-term population data sets essential. Using examples from long-term data sets on a variety of common stream fishes from southern Appalachian streams, I discuss a variety of aspects of the collection, and analysis of long-term fish data sets including: 1) potential research questions, 2) sampling, 3) temporal scales, 4) approaches to data analysis, and 5) examination of the effects of density-dependent and density independent forces on these fishes. I also discuss issues of quality control and quality assurance for the analysis of existing data sets by scientists who were not involved in their collection. Quantifying the relative importance of density-dependent and density-independent on population persistence in fishes will be more important as climatic variability increases. The presence of density-dependence in populations suggests that they will have the capability to respond to environmental change, however, this may not be true for populations in which disturbance is the main cause of mortality and low abundance.

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**0795 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

R. Dean Grubbs<sup>1</sup>, John Carlson<sup>2</sup>, Mark Bond<sup>3</sup>, Bianca Prohaska<sup>4</sup>, Johanna Imhoff<sup>4</sup>

<sup>1</sup>Florida State University Coastal and Marine Lab, St. Teresa, FL, USA, <sup>2</sup>NOAA Fisheries - SEFSC, Panama City, FL, USA, <sup>3</sup>Florida International University, Miami, FL, USA, <sup>4</sup>Florida State University, Tallahassee, FL, USA

**Smalltooth Sawfish in Florida and the Bahamas - National Parks as Potential "Lifeboats" for Recovery**

The smalltooth sawfish (*Pristis pectinata*) is listed as *Critically Endangered* in the IUCN Red List of Threatened Species and *Endangered* under the United States' Endangered Species Act. The species is restricted to the Atlantic Ocean and populations declined throughout the range due to overfishing and habitat loss. Bycatch remains the largest source of direct mortality and continued habitat loss from urban development, agriculture, and freshwater diversion likely hinders recovery. Southwest Florida in the U.S. and the west side of Andros Island in the Bahamas are the only known regions where significant numbers of smalltooth sawfish remain. Both systems are

characterized by extensive mangrove estuaries with highly variable salinity and proximity to relatively deep shelf-edge habitats that are buffered from seasonal temperature extremes. Both systems also include substantial national parks that offer habitat protection (Everglades National Park – ENP; Andros West Side National Park - AWSNP) and telemetry data suggest there is little movement of sawfish between them. The human population density in southwest Florida is orders of magnitude higher than around Andros which influences water quality as well as fishing mortality risk. Recreational and charter fishing effort is very high in ENP, but very low in AWSNP. Similarly, commercial longline, trawl, and trap fisheries exploit the deeper shelf-edge habitats occupied by sawfish off Florida but similar habitats off the Bahamas are exposed to few commercial fishers. Florida and Andros Island may be critical to smalltooth sawfish recovery, therefore habitat quality and bycatch risk should be monitored closely.

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## **0052 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Michael Grundler

*University of Michigan, Ann Arbor, MI, USA*

### **SquamataBase: The Squamate Diet Database - Building a "next-generation" natural history database for ecology and evolutionary biology**

Comparative studies on the evolution of squamate reptile feeding ecology stand to benefit enormously if data in the rich natural history literature on squamate diets become available in a digital format. In this talk I introduce and describe SquamataBase, which is an online relational database that I designed and developed as a repository to store and query published predator-prey observations involving squamate reptiles in nature. I describe the underlying database philosophy, introduce the website where data can be uploaded and accessed, and describe how other researchers can help contribute and curate data to increase the taxonomic and geographic breadth of the database.

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## **0040 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Leonardo Guida<sup>1</sup>, Terence I. Walker<sup>1</sup>, Cynthia Awruch<sup>2</sup>, Richard D. Reina<sup>1</sup>

<sup>1</sup>*Monash University, Clayton, Victoria, Australia*, <sup>2</sup>*University of Tasmania, Hobart, Tasmania, Australia*

### **Physiological Responses to the Pre-natal Stress of Fisheries Capture in Pregnant Southern Fiddler Rays (*Trygonorrhina dumerilii*) and Their Neonates**

Assessing fisheries impacts on elasmobranch populations has largely focused on quantifying both immediate and delayed mortality rates. However, very little is known about the sub-lethal effects of capture stress, particularly in pregnant females. Our study

is the first to investigate the consequences of capture on a pregnant elasmobranch species, the southern fiddler ray (*Trygonorrhina dumerilii*). Nineteen pregnant females were collected by hand in Swan Bay, Australia, and transported to aquaria where nine females were subjected to trawl capture (8 hr) followed immediately by air exposure (30 min). Immediately prior to, and for up to 28 days post trawling, all females were routinely sampled to monitor changes in total body mass (TBM), sex-steroid levels (17beta-estradiol, progesterone, testosterone) and granulocyte to lymphocyte ratio (G:L). At parturition, neonates were measured for total length (TL), TBM and where possible, G:L was also calculated. Trawling reduced maternal TBM and elevated the G:L for up to 28 days post trawling. Trawling did not significantly affect any sex-steroid titers, however all females reported lower than expected concentrations in all sex-steroids at 28 days post trawling. Neonates who experienced pre-natal stress were lower in TBM and TL, and had an elevated G:L. Our results suggest that depending on the magnitude of environmental stress experienced by a pregnant female, a single capture event (or multiple) is sufficient to influence current and future reproductive efforts.

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#### **0041 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Leonardo Guida, Terence I. Walker, Richard D. Reina

*Monash University, Clayton, Victoria, Australia*

#### ***Just chill & survive* - How the Behaviour of the Gummy Shark During Longline Capture Reduces the Physiological Stress Response**

Many factors influence the physiological stress response to fisheries capture in elasmobranchs. However, the influence of sea surface temperatures (SST) and behaviour are unknown and crucial considering global fishing pressures. We investigated the effect of SST and behaviour on the physiological stress response to capture of the gummy shark, *Mustelus antarcticus*. Capture time for 23 *M. antarcticus* ranged 32-241 min as measured by hook timers or time depth recorders (TDR) in SSTs ranging 12-20°C. TDR data from 13 *M. antarcticus* were analysed to quantify capture behaviour as the percentage of time spent moving during capture. Several physiological variables measured from blood samples obtained immediately upon the animals' landing indicated that although warmer SSTs increased metabolic rate, the stress response to capture was not exacerbated by capture duration. During capture, movement occurred for an average of 10% of the time and since *M. antarcticus* can respire whilst stationary, restricted movement probably mitigated potential influences of increased SSTs and capture duration on the stress response. We highlight the importance of seasonal water temperatures and capture behaviour when assessing the resilience to fisheries capture and the implementation of appropriate fisheries management strategies.

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**0833 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Steven Guidos, Collin Waldrop

*University of North Carolina Wilmington, Wilmington, NC, USA*

**Food habits of spiny dogfish (*Squalus acanthias*) in coastal North Carolina waters**

Spiny dogfish total catch limits established for commercial fisheries for the eastern United States favor northern states where high catch rates occur during the onset of a southward winter migration. Commercial fisheries regulations currently allocate portions of a coastwide quota to respective states assuming a single harvested population. There has been speculation that more than one population exists along the U.S. East Coast and that management strategies may require amendment. To explore this question, we examined the diets of spiny dogfish harvested in North Carolina coastal waters during winter 2016. Percent weight, frequency and occurrence for prey items were measured and compared to data published for localities north of Cape Hatteras. Preliminary findings indicate that dogfish prey on Atlantic menhaden, pigfish and amphipods while overwintering off North Carolina. Comparisons of dietary patterns across regions will be presented and implications for fisheries management will be discussed.

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**1027 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jill Guillette, Jason Ortega, Larry Kamees, Steven Beaupre

*University of Arkansas, Fayetteville, AK, USA*

**Response of Leukocyte Profiles to Corticosterone Manipulation in the Prairie Rattlesnake (*Crotalus viridis*)**

Prior work has shown that when animals are stressed they have altered leukocyte profiles. The use of leukocyte profiles could provide an inexpensive and efficient method for determining stress. Here we present a validation of the use of leukocyte profiles for showing induced stress in Prairie Rattlesnakes (*Crotalus viridis*). Snakes (N=19) with masses ranging from 682g to 137g were used in a repeated measures design to examine the effect of hormone manipulation on leukocyte profiles. During each trial snakes were dosed with either corticosterone and sesame oil (1.1µg/g) or only sesame oil. Prior to dosing, baseline blood samples were collected to analyze a pre-dosing leukocyte count. Immediately after blood draw, snakes were placed into small chambers that would facilitate dosing located in an undisturbed room; 24 hours after baseline samples animals were dosed. The dosing mixture was left to be absorbed for 24 hours and a final blood sample was taken. Whole blood from each snake sample was used to create blood smears. Blood smears were stained with Wright-Geimsa stain. Slides were scored to determine the ratio of lymphocytes to neutrophils. Results of this study will be used in conjunction with plasma corticosterone assays to validate the use of leukocytes profiles for determining stress levels in pitvipers.

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**0360 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Theresa Gunn, Christine Bedore

*Georgia Southern University, Statesboro, Georgia, USA*

**Environmental control of yellow stingray camouflage**

Many reef fishes exhibit dynamic coloration and body patterns that can change under nervous control. Lowe et al (1996) showed that hammerheads in high UV environments have higher skin melanin concentrations, which likely functions as a protective mechanism against UV damage. However, several species of benthic sharks and rays likely alter melanin concentrations in the skin to provide background matching for camouflage. The yellow stingray (*Urobatis jamaicensis*) is a small, reef-dwelling elasmobranch with elaborate spot patterns that differs dramatically from other local stingrays, which are primarily uniformly drab. Because yellow stingrays likely match their environment as a predator avoidance strategy, melanin responses to UV may also be controlled by other environmental mechanisms such as background (e.g. sand, reef) color. To investigate the environmental parameters that induce changes in melanin concentration of yellow stingrays, we housed rays in one of four color environments: completely white, completely black, black walls and a white bottom, and white walls and a black bottom and one of two light environments: 24h light (UV present) and 24h dark (UV absent). We observed that the rays changed the brightness of their skin to match that of the bottom of their experimental tanks, regardless of presence or absence of UV light. We plan to further examine the underlying visual and physiological mechanisms that control color change in the yellow stingray.

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**0345 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Tristan Guttridge<sup>1</sup>, Lucy Howey-Jordan<sup>3</sup>, Maurits Van Zinnicq Bergmann<sup>1</sup>, Jean-Sebastien Finger<sup>2</sup>, Steven Kessel<sup>5</sup>, Jill Brooks<sup>6</sup>, William Winram<sup>7</sup>, Mark Bond<sup>4</sup>, Lance Jordan<sup>3</sup>, Christopher Bolte<sup>1</sup>, Rachael Cashman<sup>1</sup>, Nathaniel Grimes<sup>1</sup>, Emily Tolentino<sup>2</sup>, Samuel Gruber<sup>8</sup>

<sup>1</sup>Bimini Biological Field Station Foundation, Bimini, Bahamas, <sup>2</sup>Humboldt University, Berlin, Germany, <sup>3</sup>Microwave Telemetry, MD, USA, <sup>4</sup>Florida International University, Miami, FL, USA, <sup>5</sup>Windsor University, Windsor, Canada, <sup>6</sup>Carleton University, Ottawa, Canada, <sup>7</sup>Watermen Project, Geneva, Switzerland, <sup>8</sup>University of Miami, FL, USA

**Better in the Bahamas? Regional connectivity and seasonal residency of the great hammerhead shark in the U.S.A. and the Bahamas**

The great hammerhead shark *Sphyrna mokarran*, is a large bodied, broadly distributed tropical shark typically restricted to coastal and shelf habitats. It is highly valued for its fins (in target and incidental fisheries), suffers high bycatch mortality coupled with low fecundity, and as a result is considered vulnerable to over-exploitation and population depletion. Although there is very little species specific data available, the absence of recent catch records give cause to suspect 25-year population declines across its range. Here, using a combination of satellite and acoustic telemetry we assessed the movement patterns and habitat use of the Endangered (IUCN Redlist) *S. mokarran* tagged in Bimini, The Bahamas, and Jupiter, Florida, USA. Since 2011, ten individuals were implanted with V16 acoustic transmitters and tracked through an acoustic array data share consortium off the coast of Jupiter. In January 2014 and 2015 in Bimini, 18 *S. mokarran* were fitted with V16 acoustic tags and four were tagged with high rate pop-off archival satellite tags. A receiver array was established in various habitats in Bimini to monitor their local movements. Results revealed large scale return migrations (up to 1200 km), seasonal residency to local areas (some for 5 months), site fidelity (annual return to Bimini and Jupiter for many individuals) and numerous international movements. These findings significantly enhance our understanding of the movement ecology of *S. mokarran* and will contribute to their improved conservation and management.

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## **0385 General Herpetology, Galerie 2, Thursday 7 July 2016**

Jacquelyn Guzy, Clint Bush, Kelly Halloran, Meredith Swartwout, Chelsea Kross, John D. Willson

*University of Arkansas, Fayetteville, AR, USA*

### **Distribution and Abundance of Introduced Seal Salamanders (*Desmognathus monticola*) in Northwest Arkansas, USA**

Invasive species are one of the primary threats to global biodiversity and cause substantial economic damage worldwide. Invasive reptiles and amphibians are gaining recognition as an emerging group of harmful species [e.g. Burmese python (*Python m. bivittatus*), brown tree snake (*Boiga irregularis*), cane toad (*Rhinella marina*), and American bullfrog (*Lithobates catesbeianus*)]. In 2003 an introduced population of Seal Salamanders (*Desmognathus monticola*), was found in Northwest Arkansas, in Spavinaw Creek and genetic evidence confirmed an introduction from northern Georgia. Very little is known about the distribution and abundance of this non-native Arkansas population of *D. monticola*, thus, the primary objective of this study was to assess the current distribution and abundance of non-native *D. monticola* along Spavinaw Creek. To map the distribution of the species, we conducted repeated low intensity visual surveys along the Arkansas extent of Spavinaw Creek to examine occupancy probability relative to river mile and habitat covariates. We also conducted a short-term capture-mark-recapture study to estimate abundance of *D. monticola* at the original collection site on Spavinaw Creek. We found a clear geographic pattern of *D. monticola* distribution, with individuals found throughout the upper 10 km of Spavinaw Creek headwaters, at very high densities of up to 14.5 *D. monticola* per m<sup>2</sup>. Our results reveal that this recent invader is more widely distributed than previously recognized, and this distribution, in conjunction with high densities, suggests that *D. monticola* could have negative impacts on the ecosystems of Spavinaw Creek and surrounding watersheds in the Ozark highlands.

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## **0798 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Travis Hagey<sup>1</sup>, Christofer Clemente<sup>0</sup>

<sup>1</sup>*Michigan State University, East Lansing, Michigan, USA*, <sup>2</sup>*University of the Sunshine Coast, Sippy Downs, Queensland, Australia*

### **Variation in Limb Length Across Lizards**

Evolutionarily convergent traits are typically assumed to occur as a result of similar ecological conditions or genetic, developmental, or mechanical constraints. Although many examples of convergent morphologies have been described, convergence has rarely been looked at across large clades. We will quantify lizard limb and body length, investigating variation in slope and y-intercept values across clades. We hypothesize that different clades will exhibit unique regression values with ecologically convergent species also converging in limb length morphospace.

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## 0709 Fish Systematics II, Salon F-H, Saturday 9 July 2016

Dominik Halas

*University of Toronto Scarborough, Toronto, Canada*

### **Nuclear loci support morphological, not mitochondrial, species delimitations in the *Notropis rubellus* species group**

Over the past several decades, molecular phylogenetic data have revolutionized the study of the relationships of North American freshwater fishes; gene sequences are now available for the vast majority of taxa. Most taxa were initially assessed using mitochondrial genes only; frequently, the results of these studies suggested that traditional, morphologically-based species delimitations were incorrect. However, the increasing use of multi-locus genetic data in systematic studies is demonstrating, in many cases, that morphological-mitochondrial discordance is often due to mitochondrial introgression between species, rather than due to homoplastic and misleading morphological characters. The *Notropis rubellus* species group, a group of minnow species in the family Cyprinidae distributed throughout eastern North America, is one such case. Two previous studies, one using only mitochondrial data and the other using only morphological data, showed several incongruities in the geographical limits of species within the group. Now, using five nuclear loci in addition to mitochondrial sequences, I demonstrate that species boundaries within the group as determined using nuclear genetic data match those determined using morphological information, and that the incongruity of the mitochondrial data is due to introgression. This study serves as a warning that taxonomic decisions should not necessarily be made when discordance is discovered between mitochondrial and morphological data, until the cause for the discordance is determined.

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## 0697 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016

Dominik Halas, Nathan Lovejoy, Nicholas Mandrak

*University of Toronto Scarborough, Toronto, Canada*

### **Goldfish (*Carassius* spp.) Diversity in North America: Implications for Invasive Species Management**

The Goldfish, *Carassius auratus*, a global invader, was first introduced to North America in the 1600s as a food fish and continues to be imported by the food and pet trades. This species and its five additional congeners have been shown to have negative ecological impacts in many areas where they have been introduced. As result, many North American jurisdictions have conducted risk assessments on, and developed regulations to prevent the introduction of, the other *Carassius* species. Most of these morphologically similar species are also raised for food or pets and have been introduced outside their

native ranges and, in some cases, this has led to hybridization. In this study, we genotyped North American specimens of wild-caught fish identified morphologically as *C. auratus* to confirm their true identity. We found that genetic diversity in North American *C. auratus* is minimal; one widespread cytochrome *b* haplotype is found in the vast majority of specimens. The Asian and eastern European species *Carassius gibelio* was confirmed to exist in Alberta and Saskatchewan, and the Japanese endemic *Carassius langsdorfii* is reported in North America for the first time. This study demonstrates that several species of *Carassius* have been introduced across North America under the guise of the common Goldfish. These findings have implications for proposed regulations on the importation of goldfishes other than *C. auratus* – some of them are already in North America!

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## **0442 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Amber Hale, Mark Merchant

McNeese State University, Lake Charles, LA, USA

### **Structure and expression analysis of crocodylian NF- $\kappa$ B in American alligators**

We are interested in crocodylian immune function, specifically Nuclear Factor kappa B (NF- $\kappa$ B) which is a pleiotropic transcription factor that plays a vital role in a variety of biological processes. Its regulatory role in the early phases of inflammation is critical for proper immune function. We found the NF- $\kappa$ B gene in all three lineages of crocodylians, and the deduced amino acid sequences show a high degree of identity with mammalian and avian species. We identified Dimerization, Death, and Rel domains, a nuclear localization signal, a signal sequence, and ankyrin repeats. Western blot analysis showed the presence of both the 50 kDa mature protein and the 105 kDa precursor protein in alligator liver (*Alligator mississippiensis*) liver. Immunohistochemistry was performed on livers taken from both healthy alligators and alligators inoculated with bacteria 24 hour prior. Immunohistochemistry shows a reduction of NF- $\kappa$ B in the cytoplasm and an increase of NF- $\kappa$ B presence in the nucleus of the hepatocytes from the inoculated alligator as compared to the hepatocytes of the healthy alligator. Because the structure, processing, expression, and nuclear translocation of crocodylian NF- $\kappa$ B is similar to the mammalian analog, we presume that the function is similar.

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## 0523 Squamate Biology, Balconies L & M, Sunday 10 July 2016

Ben Halliwell<sup>1</sup>, Tobias Uller<sup>2</sup>, Erik Wapstra<sup>1</sup>, Geoffrey While<sup>1</sup>

<sup>1</sup>University of Tasmania, Tasmania, Australia, <sup>2</sup>Edward Grey Institute, University of Oxford, Oxfordshire, UK

### **Habitat structure mediates social and mating behaviour in a family living lizard**

The occurrence of kin-based social organisation represents a turning point in evolution whereby local genetic relatedness can be exploited to increase gene frequencies through behavioural cooperation with relatives. Insights into the factors responsible for both the diversity and stability of social systems are crucial for enhancing our understanding of key evolutionary processes. However, the precise conditions that favour the origin and maintenance of sociality remain unclear. Both theoretical and empirical studies suggest that physical characteristics of the environment play a key role in mediating social complexity. Using experimental techniques in a semi-natural setting, we investigated how the physical structure of habitats influenced various aspects of social behavior in the family living skink, *Liopholis whitii*. We show that habitat structure influences several key aspects of social and mating behaviour, including male-female overlap, formation of social pair bonds and opportunities for sexual selection, but does not affect rates of polyandry or polygyny. We also present results from follow-up experiments investigating factors that mediate offspring dispersal and discuss our findings in the context of the origin and diversification of social complexity.

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## 0384 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016

Kelly M. Halloran<sup>1</sup>, Jacquelyn C. Guzy<sup>1</sup>, Jessica A. Homyack<sup>2</sup>, John D. Willson<sup>1</sup>

<sup>1</sup>University of Arkansas, Fayetteville, AR, USA, <sup>2</sup>Weyerhaeuser Company, Vanceboro, NC, USA

### **Effect of Timber Harvest on Survival and Movement of the Ouachita Dusky Salamander (*Desmognathus brimleyorum*)**

Clearcut timber harvesting drastically alters forest ecosystems. In addition to conspicuous structural changes, timber harvesting can negatively affect some plethodontid salamanders. Using a Before-After-Control-Impact design, we are examining the effects of clearcut timber harvesting on a stream-dwelling salamander endemic to the Ouachita Mountains, *Desmognathus brimleyorum*. Due to their sensitivity to anthropogenic habitat alteration, amphibians like *D. brimleyorum* are considered bioindicators of ecosystem health, but few studies of forestry effects have focused on stream-dwelling salamanders or evaluated mechanisms driving observed shifts in abundance (e.g., mortality vs. movement). Under a robust design sampling framework, we conducted a capture-mark-recapture study at three streams within intensely managed pine forests in west-central Arkansas from May 2014-June 2016. The pinelands

surrounding two of the streams were harvested in January 2015 and 2016 respectively. For each capture/recapture, we recorded the location of each individual salamander to assess movement in the stream before and after harvest. Using program MARK, we estimated salamander survival over the course of two years and compared rates of change between the harvested and control streams. The results of this study will help inform management decisions aimed at conserving biodiversity and ecosystem integrity in landscapes managed for timber production.

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## **0971 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Brian Halstead<sup>1</sup>, Patrick Kleeman<sup>2</sup>

<sup>1</sup>U.S. Geological Survey, Dixon, CA, USA, <sup>2</sup>U.S. Geological Survey, Point Reyes, CA, USA

### **Ecology of California Red-legged Frogs (*Rana draytonii*) in Coastal Dune Systems**

Habitat restoration is generally viewed as a positive conservation measure for plants and wildlife, but conflicts can arise if rare or endangered species rely upon non-native species or altered habitats. In much of coastal California, humans have stabilized inherently unstable coastal dune systems with non-native plants such as European beachgrass (*Ammophila arenaria*) and iceplant (*Carpobrotus edulis*), and efforts are underway to remove these invasive plants and re-establish dynamic dune systems dominated by native species. During dune restoration activities at Point Reyes National Seashore, California red-legged frogs (*Rana draytonii*) were found inhabiting coastal dune drainages. We studied the occurrence, spatial ecology, and habitat selection of California red-legged frogs in coastal dune drainages to understand their ecology in this ecosystem. We surveyed 25 sites in 20 seasonal drainages that run through dunes with independent double-observer surveys and found > 90% occupancy by California red-legged frogs. Radio telemetry of 22 adult frogs in three drainages indicated that from April through September, monitored frogs moved a mean distance of 78 m (range 0 - 620 m) between initial capture and last known location, and all frogs remained in the drainage in which they were initially captured, even though the habitat dried considerably. Frogs selected log jams and the bottom of drainages, and avoided invasive non-native plants. California red-legged frogs are widespread in coastal dune systems degraded by non-native vegetation at Point Reyes National Seashore; how they will respond to dune restoration remains a mystery.

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## **0502 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Gregor Hamilton<sup>1</sup>, Randy Jennings<sup>1</sup>, Bruce Christman<sup>2</sup>, Erika Nowak<sup>3</sup>

<sup>1</sup>Western New Mexico University, Silver City, NM, USA, <sup>2</sup>Private Conservation Herpetologist, Albuquerque, NM, USA, <sup>3</sup>Northern Arizona University, Flagstaff, AZ, USA

### **Effects of Invasive Crayfish on Dermal Scarring in Indigenous Gartersnakes (*Thamnophis*) in Southwestern New Mexico**

Many freshwater ecosystems encounter stresses from climate change, habitat alteration, and invasive species. Organisms in freshwater ecosystems of the arid southwest are particularly susceptible to these stresses. The Gila and San Francisco River drainages in southwestern New Mexico are host to invasive crayfish. Three species of gartersnakes (*T. rufipunctatus*, *T. elegans*, and *T. cyrtopsis*), indigenous to southwestern New Mexico, are dependent on aquatic prey to varying degrees due to diverse diets and foraging strategies. Crayfish are thought to negatively impact gartersnake species through predation and through direct/indirect resource competition, although supporting data are limited. This study assessed the following aspects of gartersnake ecology related to dermal scarring as an indicator of injury: 1- differences in scarring among sites or correlated with the presence of invasive species of crayfish; 2- differences in scarring among gartersnake species; 3- differences in scarring among ages of gartersnakes; 4- effect of scarring on the health of garter-snakes (using SVL adjusted mass as a surrogate). Three study sites with recent populations of these snakes were surveyed during field seasons in 2014 and 2015: Tularosa River; Middle Fork of Gila River; and Saliz Creek. Scarring was not correlated with crayfish presence for any gartersnake species. *Thamnophis elegans* exhibited more scars at the Middle Fork than at other sites and exhibited more scars than *T. rufipunctatus*. *Thamnophis rufipunctatus* may be a more sensitive species to perturbations (negative correlation between scarring and health). These results were likely influenced by recent catastrophic wildfires and associated flooding.

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## **0414 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Neil Hammerschlag<sup>1</sup>, Shanta Barley<sup>2</sup>, Duncan Irschick<sup>3</sup>, Jessica Meeuwig<sup>2</sup>, Emily Nelson<sup>1</sup>, Mark Meekan<sup>4</sup>

<sup>1</sup>University of Miami, Miami, Florida, USA, <sup>2</sup>University of Western Australia, Perth, Western Australia, Australia, <sup>3</sup>University of Massachusetts at Amherst, Amherst, Massachusetts, USA, <sup>4</sup>Australian Institute of Marine Science, Perth, Western Australia, Australia

### **Fishery depletion of sharks cause morphological changes in prey**

The ecological and evolutionary consequences of shark population declines on ecosystems are of scientific and conservation concern. Here, we examine the indirect effects of humans on ecological communities via the depletion of sharks in large

ecosystems spanning hundreds of kilometers. We provide evidence that the removal of sharks drives changes in the morphological traits of seven different prey fishes that vary in behavior, body type, diet and trophic guild. On coral reefs that have experienced the selective removal of sharks, fishes have significantly smaller caudal fins and eyes compared to similar reefs with relatively intact shark populations. We suggest that these morphological changes represent a case of rapid evolution due to predator removals. Our findings further demonstrate the ecological and evolutionary importance of sharks and their need for effective and timely conservation.

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**0234 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Dawei Han<sup>1</sup>, Bruce Young<sup>2</sup>

<sup>1</sup>Truman State University, Kirksville, MO, USA, <sup>2</sup>A.T. Still University, Kirksville, MO, USA

**The Root of Audition in Snakes**

The neural pathway for audition in snakes has never been detailed, and the limited previous studies have been contradictory. Snakes are likely to differ from the "typical" reptilian pattern due to: 1) the loss of internal coupling between the middle ears and the tympanum; 2) a biophysical preference for vibration detection over sound pressure detection; and 3) the apparent loss of all of the high frequency portion of the auditory response. Previous studies have shown little interspecific variation in the auditory performance of snakes, but habitat-related differences in the vestibular apparatus. In reptiles the peripheral portion of the VIIIth cranial nerve consist of anterior and posterior branches which lead to respective ganglia; axons from these ganglionic neurons project to the first-order cochlear and vestibular nuclei in the brainstem. Since the anterior and posterior branches can be mixed (containing both vestibular and cochlear axons), a clear understanding of this system is essential to a detailed map of the auditory system. A variety of species were selected for their phylogenetic position and habitat preferences. Complete serial histological sections were made through the auditory region, and 3-D neural reconstructions made of anterior and posterior branches and ganglia. Considerable variation was found in the size and branching pattern of both peripheral components of the VIIIth nerve; the relative size and spatial position of ganglia also varied. The pattern of variation suggests that phylogeny, rather than sensory specializations associated with specialized habitats, has the greatest influence on this portion of ophidian neuroanatomy.

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**0168 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Alexander Hansell<sup>1</sup>, Janne Haugen<sup>1</sup>, Sofia Gabriel<sup>1</sup>, Kim Friedman<sup>2</sup>, Steven Cadrin<sup>2</sup>

<sup>1</sup>Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts - Dartmouth, Fairhaven, MA, USA, <sup>2</sup>Marine and Inland Fisheries Branch, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy

**Impact of CITES Listing, Cop16, on the Scalloped Hammerhead, *Sphyrna lewini*, in Brazil**

The Convention on International Trade in Endangered Species (CITES) is an international regulatory agreement between 181 countries that aims to ensure international trade does not threaten the survival of endangered species. In 2013, at the Conference of Parties to CITES (CoP16) the scalloped hammerhead (*Sphyrna lewini*) was listed in Appendix II, with a deferred activation date of 2014. To evaluate the effectiveness and impacts of this listing, a fishery assessment framework was created, to assess 5 key categories of the fishery i) governance, ii) fishers, iii) stocks, iv) trade and v) socio-cultural issues. This framework was applied to scalloped hammerhead fisheries in Brazil, as hammerhead captures in Brazil were noted as globally high before the CoP16 legislation. Changes across three subsections for each category and gaps in implementation, with suggestions for activities to address deficiencies, were documented. Information was obtained from reports and interviews from the United Nations Food and Agriculture Organization and Brazilian fisheries. This case study demonstrates the utility of a new fishery assessment framework to determine 'what is' and 'what isn't' working in managing a fishery for a CITES Appendix II listed species. Preliminary results reveal changes in all five categories and highlights growing artisanal fisheries and shark meat trade. Highlighting and monitoring a broad range of CITES related impacts on the Brazilian scalloped hammerhead fishery offers valuable feedback to management to evaluate current policy initiatives and drive adaptive management.

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## 0170 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016

Alexander Hansell<sup>1</sup>, Steven Kessel<sup>3</sup>, Steven Cadrin<sup>1</sup>, Gregory Skomal<sup>4</sup>, Samuel Gruber<sup>5</sup>, Tristan Guttridge<sup>2</sup>

<sup>1</sup>Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts - Dartmouth, Fairhaven, MA, USA, <sup>2</sup>Bimini Biological Field Station, South, Bimini, Bahamas, <sup>3</sup>University of Windsor, Great Lakes Institute for Environmental Research, Windsor, ON, Canada, <sup>4</sup>Massachusetts Division of Marine Fisheries, New Bedford, MA, USA, <sup>5</sup>Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, Miami, FL, USA

### **Demographics and Local Abundance Trends for the Coastal Shark Assemblage of Bimini, Bahamas**

Understanding population dynamics is essential for implementing effective conservation and management of coastal sharks. Fishery-independent surveys can offer valuable information for data-limited situations. A 12-year (2004-2015) standardized, shallow water longline assessment was conducted monthly in the eastern coastal waters of Bimini, Bahamas. Each survey was comprised of five longline sets, totaling 75 hooks, with a soak time of 24 hours. A total of 684 sharks from nine species were caught over the course of the study with tiger (*Galeocerdo cuvier*), nurse (*Ginglymostoma cirratum*), blacktip (*Carcharhinus limbatus*) and lemon (*Negaprion brevirostris*) sharks comprising 94.9% of the catch. Based on total length, the majority of tiger (91.3%), nurse (54.4%), and lemon (81%) sharks were immature, while most blacktip sharks (84.6%) were mature. A sexual bias was noted in the data. The tiger (77.3%) and blacktip (58.3%) sharks were more often female, while the majority of lemon (73%) and nurse (56.8%) sharks were male. Furthermore, seasonal trends indicate an abundance of nurse, blacktip, and lemon sharks during the summer. Annual trends indicate an increasing tiger shark population and stable nurse, blacktip, and lemon shark populations. General additive models indicate that catch rates are influenced by month, year, temperature, tide, soak time, and lunar cycle.

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## 0113 Poster Session I, Acadia/Bissonet, Friday 8 July 2016

Emma Hanslowe<sup>1</sup>, Bryan Falk<sup>1</sup>, Robert Reed<sup>2</sup>

<sup>1</sup>United States Geological Survey, Homestead, Florida, USA, <sup>2</sup>United States Geological Survey, Fort Collins, Colorado, USA

### **Assessing Establishment Risk of Exotic Large-bodied Constrictor Snakes to the Florida Keys**

The first reports of exotic large-bodied constrictor snakes from the Florida Keys occurred in 2002 and have since increased in frequency and credibility. A comprehensive summary of these reports is important for understanding propagule pressure and spatiotemporal trends of boas, pythons, and other large-bodied constrictors in the

Florida Keys. We compiled records of exotic constrictor snakes from the Florida Keys using available sources of information (Early Detection and Distribution Mapping System, Everglades National Park, Florida Museum of Natural History, Monroe County Sheriff's Office, our records, media accounts, and local contacts) and cross-referenced them to eliminate duplicates. We assigned credibility scores to each record. Over 100 specimens and/or reported sightings of exotic constrictor snakes have occurred in the Florida Keys over the past 14 years. Burmese pythons (*Python molurus bivittatus*), boa constrictors (*Boa constrictor*), and ball pythons (*Python regius*) are the most frequently reported species. Key Largo is the northernmost island of the Florida Keys and is adjacent to the established mainland population of invasive Burmese pythons. A recent spike in Burmese python captures on Key Largo implies that python population increases on the mainland may be driving dispersal to Key Largo and therefore increasing establishment risk. Increased public outreach as well as effective early detection and rapid response may be needed to prevent establishment and associated ecological impacts of boas and pythons in the Florida Keys.

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**0067 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Maggie Hantak, Shawn Kuchta

*Ohio University, Athens, Ohio, USA*

### **Color Polymorphism in the Eastern Red-backed Salamander: Are the Morphs Equally Camouflaged?**

Color polymorphism is the presence of two or more discrete, genetically determined color morphs in a population. In many cases, the ecological and evolutionary dynamics maintaining polymorphisms are not well understood. One hypothesis is that polymorphism is maintained by interactions with visual predators, either by way of apostatic selection, or by being differentially camouflaged in different microhabitats or seasons. In general, organisms that better blend into their background have an increased chance of survival. The Eastern Red-backed Salamander, *Plethodon cinereus*, contains two common color morphs, a striped morph and an unstriped morph. Presently, it is not known which of these two morphs is more cryptic, or if the answer to this question is context dependent. To address this question, I studied three populations in Ohio: a monomorphic striped population, a monomorphic unstriped population, and a polymorphic population. At these populations information was gathered on whether the two morphs differ in their relative camouflage across seasons, light conditions, and habitats. A spectrometer was used to collect reflectance measurements from color patches, providing measures of brightness, hue and chroma. Reflectance measurements were collected from background colors (leaf-litter), and salamanders from each population. I am running this color data through mathematical models of the avian and mammal visual system to quantify how well each morph blends into the background. Overall, this study will provide essential data for better understanding the adaptive basis of the polymorphism, and what evolutionary and ecological dynamics might be involved in its maintenance.

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**1056 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Antony Harold<sup>1</sup>, Dana Warheit<sup>1</sup>, Miranda Brooker<sup>1</sup>, Tasneem Dossaji<sup>1</sup>, Michelle D'Aguillo<sup>2</sup>

<sup>1</sup>College of Charleston, Charleston, South Carolina, USA, <sup>2</sup>Duke University, Durham, North Carolina, USA

**Ontogeny of jaw and pharyngobranchial dentition in the naked goby, *Gobiosoma bosc* (Teleostei: Gobiidae)**

We undertook a study of the ontogeny of jaw and pharyngobranchial teeth in *Gobiosoma bosc*, a western North Atlantic estuarine goby species. A series of about 40 specimens ranging in size from 17 to 52 mm SL were cleared and counter-stained using standard methods. The lower jaw and the pharyngobranchial apparatus were removed in order that teeth could be oriented for measurement using an eye piece reticle. Based on our observations, in the smallest gobies (17 to 23 mm SL) teeth located on the premaxilla and dentary were slightly elongate and conical, and distributed in a villiform field. At body sizes of about 25 to 28 mm SL jaw teeth begin to be differentiated in three distinct types: a lateral row of robust, elongate and slightly recurved teeth, a medial row of similar, but more recurved teeth, and between those two series there is a field of short, straight teeth in a villiform field. Pharyngobranchial teeth are elongate, less curved and shorter than the enlarged jaw teeth in the same individual. The development of the two series of differentiated slightly hooked teeth of the jaws in larger naked gobies may be an adaptation for grasping the relatively large and mobile prey that form the bulk of their diet.

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**0568 Herp Biogeography, Salon D, Friday 8 July 2016**

Sean Harrington

San Diego State University, California, USA

**Phylogeographic structure within the Red Diamond Rattlesnake (*Crotalus ruber*) of Baja California: A genomic perspective based on RADseq data**

The Red Diamond Rattlesnake, *Crotalus ruber*, is a large rattlesnake endemic to Baja California and Southern California. The distribution of *C. ruber* spans the entire Baja California Peninsula and extends north to Southern Los Angeles and San Bernardino Counties. Many mtDNA-based studies have investigated the phylogeographic structure of lineages that span the Baja California Peninsula and found spatially congruent breaks among taxa. However, studies using nuclear DNA to investigate the genetic structure and phylogeographic history of squamates across the peninsula have been scarce. We investigated the phylogeography of *C. ruber* to determine if this species shows breaks congruent with other species and characterize the processes that have produced spatial genetic structure. We used a next-generation DNA sequencing approach to obtain

thousands of RADseq loci from across the genome of individuals spanning the mainland range of *C. ruber*. Using a combination of clustering, phylogenetic, and population genetic modelling approaches, we show that mainland *C. ruber* is composed of distinct northern and southern populations that contact near Loreto, Baja California Sur, congruent with the contact zone between the traditionally recognized subspecies *C. ruber ruber* and *C. r. lucasensis* and major breaks between lineages in other groups. These populations show evidence of high levels of migration and admixture, particularly from the southern population into the northern population. We hypothesize that the observed structure is the result of historical isolation of these populations followed by secondary contact.

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### **0346 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Phillip Harris<sup>1</sup>, Do Van Tu<sup>2</sup>

<sup>1</sup>The University of Alabama, Tuscaloosa, AL, USA, <sup>2</sup>Vietnam Academy of Science and Technology, Ha Noi, Viet Nam

#### **The Freshwater Fishes of the Nam Chan River Basin, Vietnam**

In March and November 2015, researchers from the Vietnamese Academy of Science and Technology and The University of Alabama conducted a preliminary survey of freshwater fishes in the Hoang Lien-Van Ban Nature Preserve and Nam Chan River basin in northwestern Vietnam. Although this nature preserve is a recognized biodiversity hotspot in Vietnam for terrestrial taxa, aquatic taxa within the nature preserve and remaining river basin have never been surveyed despite development of multiple headwater hydroelectric dams in the nature preserve. We collected approximately 33 species of fishes from 15 locations in the basin. Within these collections are undescribed species of *Rhinogobius* (Gobiidae) and, possibly, *Vanmanenia* (Balitoridae).

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### **0317 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Bret Harvey, Jason White

USFS Redwood Sciences Lab, Arcata, CA, USA

#### **Axes of Fear for Stream Fish: Water Depth and Distance to Cover**

To better understand habitat-specific predation risk for stream fish, we used an approach that assumes animals trade off food for safety and accurately assess risk such that predation risk can be measured as a foraging cost: animals demand greater harvest rates to occupy riskier locations. We measured the foraging cost of predation risk for juvenile salmonids at locations that varied in water depth and distance to cover. Measurements relied on a food delivery apparatus and direct observations that allowed estimation of giving-up harvest rates. Juvenile steelhead about 120 mm fork length

exhibited sharp increases in the harvest rates they demanded with decreasing water depth and refused to use the feeding device even when offered extreme food delivery rates in water  $\leq 20$  cm deep. Distance to cover also affected giving-up harvest rates, particularly between 25 cm and 75 cm from cover, but to a lesser extent overall than did water depth. Assuming the gradients we observed in giving-up harvest rates reflect predation risk, the results of this study can be applied to spatially explicit models of stream fish populations that incorporate risk into both habitat selection and mortality due to predation.

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### **0766 Snake Ecology, Galerie 3, Sunday 10 July 2016**

Jessica Harvey, Karl Larsen

*Thompson Rivers University, Kamloops, British Columbia, Canada*

#### **Rattlesnake migration in Canada and its relationship to the thermal properties of landscapes**

The selection of habitat by reptiles based on thermal criteria has been well-studied at smaller scales (i.e. microsite), but larger scale selection also may be important, particularly in colder climates. In Canada, Western Rattlesnakes (*Crotalus oreganus*) reach their northern limits in the province of British Columbia. Here, recent work has shown that the snakes not only use warm, low-elevation grasslands, but also higher-elevation forests. We investigated the reasons and implications of this dichotomy by monitoring the migratory movements of 35 snakes from 10 den sites, and comparing their habitat use to thermal landscape maps generated through GIS. We verified that this variation in migratory behaviour exists throughout the region, and also showed that the snakes using the forests moved relatively further during their migration, and also tended to use warmer areas within the landscape, thus compensating for this large-scale habitat use. These snakes also had better body condition. Potential benefits from using this migratory tactic also include outbreeding and food availability, other areas we are now beginning to explore. Overall, insight into the patterns and repercussions of using these different habitats will allow conservation plans to be tailored more specifically, perhaps even to individual dens. Climate change also has obvious, potential implications for the snakes due to shifting ecosystem boundaries and thermal regimes.

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## 0310 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016

Philip Hastings<sup>1</sup>, Kevin Conway<sup>2</sup>

<sup>1</sup>Scripps Institution of Oceanography, La Jolla, California, USA, <sup>2</sup>Texas A&M University, College Station, Texas, USA

### **A New Species of Clingfish (Teleostei: Gobiesocidae) from Los Frailes Submarine Canyon, Gulf of California, Mexico, with Comments on Depth Distributions of Clingfishes**

A new species of clingfish of the genus *Gobiesox* is described from a single specimen collected from 300 meters depth in the Los Frailes submarine canyon in the southwestern Gulf of California. The "Canyon Clingfish" is unique in the genus *Gobiesox* in having a lanceolate caudal fin, and is also distinguished by the combination of 14 dorsal-fin rays (first tiny and unsegmented), 11 anal-fin rays, 28 pectoral-fin rays, anus slightly closer to anal-fin origin than to posterior margin of pelvic disc, and dorsal-fin origin in front of vertical from anus. It is most similar to another eastern Pacific species, *Gobiesox eugrammus* Briggs, 1955, known from southern California, the coast of outer Baja California, and Isla Guadalupe. Heretofore the deepest record for a species of the genus *Gobiesox* is 82 m (*G. eugrammus* type locality at Guadalupe Island). While most species of clingfishes are found in relatively shallow waters, several genera have representatives in deep waters with only two species, *Alabes bathys* Hutchins, 2006 (known to 348 m) and *Kopua nuimata* Hardy, 1984 (to 337 m), found deeper than the Canyon Clingfish.

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## 0623 Lightning Talks, Galerie 2, Saturday 9 July 2016

Jeff Hathaway

*Scales Nature Park, Orillia, ON, Canada*

### **Next steps for the Saving Turtles at Risk Today (START) Project**

The Saving Turtles at Risk Today (START) project is a multi-species project involving staff, trained volunteers, and community members. The large study area comprises approximately 2000 km<sup>2</sup> of relatively natural Precambrian shield in central Ontario, Canada, with a mosaic of wetlands, water bodies, forests, and human habitation. Four years into this long-term project, one M.Sc. student has finished and two more are starting. Overall achievements, challenges and future directions will be briefly presented to elicit feedback and facilitate discussion. These include: habitat protection through species at risk observations, changes to marking methods, measuring the contribution of anthropogenic nest sites (i.e. roadsides) to the population using DNA techniques to develop a 'family tree', and the expansion of the project into an adjacent highly anthropogenic landscape.

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## **0155 AES Conservation & Management I, Balconies L & M, Friday 8 July 2016**

Janne B. Haugen<sup>1</sup>, Steven X. Cadrin<sup>1</sup>, Alexander C. Hansell<sup>1</sup>, Sofia M. Gabriel<sup>1</sup>, Cate O'Keefe<sup>1</sup>, Tobey H. Curtis<sup>2</sup>, Kim Friedman<sup>3</sup>

<sup>1</sup>*Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts - Dartmouth, Fairhaven, MA, USA,* <sup>2</sup>*National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, Gloucester, MA, USA,* <sup>3</sup>*Marine and Inland Fisheries Branch, Food and Agriculture Organization of the United Nations, Rome, Italy*

### **Evaluating the Impacts of CITES on the Northeast Atlantic Porbeagle (*Lamna nasus*) Stock**

The porbeagle shark (*Lamna nasus*) was listed in the Convention on International Trade in Endangered Species (CITES) Appendix II in 2013, with the effective date in 2014. To evaluate the effectiveness of the adoption of porbeagle sharks into CITES, we created a broad fishery assessment framework to review and monitor impacts of this recent trade regulation. Information and data were collected for five sections of the framework: i) Governance, ii) Fishers, iii) Stocks, iv) Trade and v) Socio-Cultural issues, from the Food and Agriculture Organization and European fishery sources. Workshops and interviews with local communities and fishery managers were organized to generate feedback and input on the design and indicators used in the framework. We identified changes under three subsections of each of the five sections of the framework, and assessed the effectiveness and impacts of these changes, as well as the need for future support. Most of the impacts of the CITES listing, such as changes in policy and management, landings and handling of by-catch, were under sections i-iii in the framework, with less information available on the trade value chain, livelihoods and community awareness. Determining CITES related impacts on porbeagle shark stocks through time offers feedback to policy and management on what is and is not working, to ensure productive and sustainable management of porbeagle fisheries. This case study may serve as a demonstration of how a fishery assessment framework can be used for evaluation of other CITES listed species, including more data-limited elasmobranchs.

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## **0746 NIA BEST STUDENT PAPER, Salon A-C, Friday 8 July 2016**

Frances Hauser<sup>1</sup>, Katriina Ilves<sup>2</sup>, Ryan Schott<sup>1</sup>, Hernan Lopez-Fernandez<sup>3</sup>, Belinda Chang<sup>1</sup>

<sup>1</sup>*University of Toronto, Toronto, ON, Canada,* <sup>2</sup>*Pace University, New York, NY, USA,* <sup>3</sup>*Royal Ontario Museum, Toronto, ON, Canada*

### **Evolutionary Dynamics of the Dim-Light Visual Pigment in Neotropical Cichlid Fishes**

Cichlid fishes of South and Central America comprise one of the most diverse fish families in the region, and vary considerably in trophic morphology, body shape, and

life history. Recent studies in this group also provide support for substantial increases in functional and lineage diversification in cichlids that invaded Central America. A comparatively understudied aspect of Neotropical cichlid ecology and evolution is the visual system. While evolutionary studies of African lake cichlids have underscored the importance of visual pigment (opsin gene) variation in their adaptive radiation, little is known of the visual pigment diversity in their Neotropical relatives. Moreover, few studies have investigated the ecological factors mediating opsin evolution in riverine, rather than lake-based radiations. We used cross-species hybrid enrichment to sequence opsin genes from 130 Neotropical cichlid species, spanning the diversity of the clade. Molecular evolutionary analyses of rhodopsin support high levels of positive diversifying selection across the Neotropical cichlid tree. The three most diverse Neotropical cichlid tribes (Cichlasomatini, Geophagini, and Heroini) showed evidence for strong positive selection in rhodopsin, and the highest molecular evolutionary rates were consistently found in Central American cichlids. Clade-based partitioning analyses supported divergence of rhodopsin following invasion into Central America, and recovered unique sites under positive selection, suggesting a divergence in rhodopsin function between South and Central American cichlids. These results highlight the efficacy of using ecological hypotheses to guide molecular evolutionary analyses, and also reveal key insights into visual pigment evolution in cichlid fishes.

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**0019 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Malorie Hayes

*Auburn University, Auburn, AL, USA*

### **Mentorship and Membership, two keys to a successful future**

When preparing to give a talk for the ASIH Centennial, I reflected on the turning points in my early career. The path I am on now was never the path I intended to take. Instead, I started working closely with some passionate ichthyologists, and passion is contagious. When dealing with people who work with a group as amazing and diverse as fish, you find equally amazing and diverse people. Through the example of my personal experience, I hope to convey the importance of mentorship in building successful organismal biologists. Establishing strong, supportive relationships among experienced scientists and upcoming (and sometimes uncertain!) students will be one factor in sustaining the ASIH over the next 100 years.

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**0018 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
ICHTHYOLOGY**

Malorie Hayes, Jonathan Armbruster

*Auburn University, Auburn, AL, USA*

**A new genus of minnow in West Africa and a new species from the Ogooué River Basin in Gabon (Cypriniformes: Cyprinidae)**

Genus *Enteromius* (formerly '*Barbus*') includes nearly 300 species that lack informative phylogenetic placement, and the genus is likely composed of multiple genera in need of a diagnosis. This study describes a new genus formerly included in *Enteromius* as well as a new species. The new genus can be diagnosed by its lack of barbels, incomplete lateral line, and presence of a pseudotympanum. Five species are placed within the new genus: *Enteromius jae* (Boulenger 1903), *E. condei* (van den Bergh and Teugels 1998), *E. nounensis* (van den Bergh and Teugels 1998), and *E. parajae* (van den Bergh and Teugels, 1998), as well as the new species. A molecular phylogeny is also presented demonstrating the placement of the new genus and species in the context of *Enteromius*.

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**0229 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Mark Hayes

*Cherokee Nation Technologies/USGS, Fort Collins, Colorado, USA*

**Temporal Patterns of Invasion by Non-native Reptiles in Florida**

In southeastern United States the number of documented occurrences of non-native reptiles is increasing, suggesting that increasing densities of non-native reptiles may be adversely impacting ecosystems and native species of conservation concern. To help inform management decisions related to non-native reptiles, I used polynomial regression, Akaike information criterion (AIC), multi-model inference, and resulting polynomial functions to investigate temporal patterns of invasion by 14 non-native reptiles documented in Florida using 20 years of data in the Early Detection and Distribution Mapping System (EDDMapS) dataset. For each species I compiled occurrence data and fit third- and fourth-order polynomial functions to data representing unique occurrences, then selected the best fitting model using AIC. I then used this function for each species as a first approximation model and used first and second derivatives of each function to estimate whether the number of new occurrences was increasing or decreasing, and whether such change was accelerating or decelerating. This analysis suggests the empirically-derived hypotheses that the number of unique occurrences documented for Argentine black and white tegus (*Tupinambis merianae*) and Green iguanas (*Iguana iguana*) are rapidly increasing relative to other species in Florida, and the number of unique locations documented for Nile monitors (*Varanus niloticus*) and Burmese pythons (*Python molurus*) are decreasing relative to other species. I conclude by briefly discussing potential biases in the EDDMapS data for reptiles, and

how these and similar results can be synthesized with species distribution models and spatial spread models to better understand biological invasions by non-native reptiles.

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**1069 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Robert Heathcote<sup>2</sup>, [James Stroud](#)<sup>1</sup>

<sup>1</sup>Florida International University, Miami, FL, USA, <sup>2</sup>University of Exeter, England, UK

**Social networks and species coexistence of *Anolis* lizards**

The use of social network theory (SNT) to examine how social network structure (SNS) might influence the social dynamics of non-human animals is still in its relative infancy. Even more overlooked are those animals formerly considered 'non-social', such as the reptiles. Using replicated allopatric and sympatric populations we investigated the underlying mechanisms which allow two ecologically and morphologically similar lizards - the Cuban brown anole (*A. sagrei*) and the Puerto Rican crested anole (*A. cristellus*) - to coexist in Miami FL. We then trialed a new research method to construct social networks of both species across these conditions. This research aims to understand how species coexistence may affect sociality.

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**0782 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Steven Hein<sup>1</sup>, Joshua Banta<sup>2</sup>, Kate Hertweck<sup>2</sup>, Mitch Barazowski<sup>2</sup>, [John Placyk](#)<sup>2</sup>

<sup>1</sup>Miami University, Oxford, OH, USA, <sup>2</sup>University of Texas at Tyler, Tyler, TX, USA

**A Phylogenetic Reassessment of the Western Massasauga, *Sistrurus tergeminus*, and its Putative Subspecies**

The massasauga rattlesnake was recently divided into two distinct species, the Eastern, *Sistrurus catenatus*, and the Western, *S. tergeminus*, with the latter further being subdivided into the Prairie, *S. t. tergeminus*, and the Desert, *S. t. edwardsii*. The subspecies boundaries between *S. t. tergeminus* and *S. t. edwardsii* were originally based on, in part, unreliable and highly variable morphological characteristics, requiring more modern approaches to testing the validity of these subspecies distinctions. Ecological niche models based on *a priori* geographical subspecies assignments display significantly different ecological niches between *S. t. tergeminus* and *S. t. edwardsii*. However, if these ecological distinctions are reflective of true evolutionary divergence as opposed to, for example, morphological plasticity to different habitat types or segregating genetic variation within a single species, then phylogenetic data should reveal reciprocal monophyly between the two subspecies. We used genetic data from eight genes, five nuclear and three mitochondrial, to evaluate the phylogenetic relationship between *S. t. tergeminus* and *S. t. edwardsii*. Our data indicate that *S. t. tergeminus* and *S. t. edwardsii* are not reciprocally monophyletic. Therefore, the ecological differences are not reflective of

the evolutionary history within the species, and the validity of these two subspecies as discrete taxa should be reconsidered. This work illustrates that ecological niche modeling can be misleading when morphological characteristics are used to classify the subspecies to be used for the models. Future studies should employ more sensitive molecular techniques, such as microsatellites or RAD Sequencing, to assess the gene flow populations.

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**0233 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Berlynn Heres, Shane Welch, Anne Axel, Thomas Pauley, Jayme Waldron  
*Marshall University, Huntington, WV, USA*

**Ambush Site Selection in Eastern Diamondback Rattlesnakes Using Vegetation Analysis and Radio Telemetry**

We examined foraging site selection in Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*, EDB). The EDB is an imperiled, ambush predator endemic to southeastern pine savannas and woodlands. Eastern diamondbacks prey on grainivores, such as rodents, who in turn feed primarily on nuts and berries (hard and soft mast). In this study, we hypothesized that intra-seasonal shifts in masting vegetation would cause intra-season shifts in ambush site selection in EDBs. We quantified EDB foraging site selection using radio telemetry data and vegetation analysis within a naturalized study site. When EDBs were encountered in ambush posture, i.e. tightly coiled, we quantified vegetation structure at the 'selected' location and at two random locations. We measured understory, overstory structure and masting characteristics within each vegetation plot. Over the study period (June-August), we quantified vegetation structure at 35 ambush sites and paired random locations, totaling 105 plots. We used conditional logistic regression to examine to model ambush site selection. We selected five *a priori* models to examine ambush site selection, including soft mast presence, hard mast presence, and canopy cover as predictors. Our top models supported our hypothesis, indicating a significant association with soft mast producing vegetation during times when soft mast was present. Hard mast presence was also an important predictor of EDB ambush sites. The results of this study indicate that EDB foraging site selection reflects mast availability, which should be considered in efforts to manage EDB populations and their prey.

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## 0204 Lightning Talks, Galerie 2, Saturday 9 July 2016

John Herman, Wendy Brosse

*Florida Gulf Coast University, Fort Myers, FL, USA*

### **Movement ecology and natural history of *Crotalus adamanteus* (Eastern Diamondback Rattlesnake) in South Florida**

*Crotalus adamanteus* (Eastern Diamondback Rattlesnake) is a large charismatic, although often misunderstood and maligned, species found in Southeastern USA. While reports about the decline of this species have been given for decades the majority of our knowledge is based on northern populations, e.g. Georgia and South Carolina. Here we present some of our preliminary findings about the movement ecology and natural history of a southern population with some comparisons to the current "northern" knowledge base. We recommend that future conservation management plans consider a more regional approach to account for natural history differences in wide-ranging species, such as many large-bodied snakes.

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## 0911 Lightning Talks, Galerie 2, Saturday 9 July 2016

Rafael Hernández Guzmán<sup>1</sup>, Luis H. Escalera-Vazquez<sup>1</sup>, Ileri Suazo<sup>2</sup>

<sup>1</sup>*Cátedras CONACYT– Instituto de Investigaciones sobre los Recursos Naturales, Universidad Michoacana de San Nicolás de Hidalgo., Morelia, Michoacán, Mexico,*

<sup>2</sup>*Instituto de Investigaciones sobre los Recursos Naturales, Universidad Michoacana de San Nicolás de Hidalgo., Morelia, Michoacán, Mexico*

### **Predicting the Distribution of *Ambystoma ordinarium* Under Different Climate Scenarios in Central Mexico**

Amphibians are susceptible to the effects of changing climates due to their restrictive physiological requirements and low vagility; however, little is known about which species are vulnerable to climate change. Species distribution models (SDMs) are used to assess the relationship between climate variables and species distributions, and to forecast changes in species distributions under climate change. Our objective in this study was to forecast changes in the distribution of *Ambystoma ordinarium* regarding different climate scenarios. Forty-eight records were selected to model current potential distribution and two scenarios based on 2070 climate projections (CCSM4-RCP 2.6 and CCSM4-RCP 8.5) using MaxEnt model. A total of six scenarios were simulated: three scenarios with two different threshold rules (minimum training presence (mtp) and the 10 percentile training presence (10ptp)). Output maps were restricted to five physiographic sub provinces (four located in the Mexican Volcanic Belt and one located in the Sierra Madre del Sur). For all scenarios, the average training AUC for the replicate runs were higher than  $0.985 \pm 0.002$ , representing a good performance for current and projected geographical distributions of *A. ordinarium*. Under a conservative scenario, an average potential distribution area around 19,700 km<sup>2</sup> was defined for current conditions, increasing to 20,300 km<sup>2</sup> for CCSM4-RCP 2.6 and decreasing by 2,200 km<sup>2</sup> if

CCSM4-RCP 8.5 scenario is expected. Results are useful for future conservation plans, and to identify changing landscapes related to climate change and it's the potential resilience of the habitat of *A. ordinarium* in the face of climate change.

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**0281 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C,  
Friday 8 July 2016**

Alexandra Herrera<sup>1</sup>, Kevin de Queiroz<sup>2</sup>

<sup>1</sup>George Washington University, Washington, DC, USA, <sup>2</sup>National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

**Comparative Phylogeography of Three Widespread *Anolis* Species Across the Puerto Rico Bank**

Geographic distribution of populations is the result of historical processes, including vicariance and dispersal. Tectonic movements and sea level changes affecting the Puerto Rican Bank (PRB; Puerto Rico and the Virgin Islands) indicate that the constituent islands have been isolated and reunited several times since the Miocene. *Anolis cristatellus*, *A. pulchellus* and *A. stratulus* are widely distributed on the PRB. We used DNA sequences to study genetic variation in these species, and contrast it with isolation patterns across the PRB. Analysis of population structure, phylogenetic analyses, divergence time estimation, and species delimitation analyses were performed for each species. Within *A. pulchellus*, a strongly supported divergence separates populations in south Puerto Rico (PR) from those in northeast PR and the Virgin Islands. This divergence occurred in the Pliocene, during the orogenesis in PR. *Anolis stratulus* exhibited a strongly supported divergence between populations in PR, Culebra and Vieques versus those in the Virgin Islands. This divergence occurred at the end of the Pliocene, after the formation of the Virgin Passage. Three populations are strongly supported within *A. cristatellus*, where East PR is sister to a clade formed by the Virgin Islands and south PR. Divergence between east PR and south PR+Virgin Islands was estimated at the Miocene-Pliocene transition, when the Mona and Virgin Passages formed. Divergence between south PR and the Virgin Islands was estimated at ca. 1.18 ma, during a glaciation event. Our results indicate that the three species have been differentially affected by the geological phenomena that shaped the PRB.

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## **0061 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Michelle Heupel<sup>1</sup>, Colin Simpfendorfer<sup>2</sup>

<sup>1</sup>*Australian Institute of Marine Science, Townsville, Qld, Australia*, <sup>2</sup>*James Cook University, Townsville, Qld, Australia*

### **Drivers of reef shark movement: what's most important?**

Predator presence has been reported to influence the movement and behaviour patterns of prey species in various ecosystems. The movement of predators is thus key to the behaviour patterns of prey populations and defining their corresponding movements. However, the drivers of movement patterns in predators are much more difficult to define, especially in aquatic environments. Here we explore the movement patterns of reef sharks as a case study in drivers of marine predator movement. Long-term acoustic telemetry data collected from reef sharks (grey reef, blacktip reef, silvertip, tiger and bull sharks) within the Great Barrier Reef over a five year period were examined to determine potential drivers of movement. Telemetry data revealed complex movement patterns of reef sharks that vary by size, sex, species and habitat type. Some of the common drivers for coastal species, such as environmental conditions, appear to be irrelevant to most reef shark movements. This indicates biological drivers are more important in the movement patterns of these individuals. This talk will consider the importance of various drivers of reef shark movements and the implications of these drivers for defining ecosystem dynamics and within the context of conservation management.

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## **0112 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Diana Hews<sup>1</sup>, Ryan Seddon<sup>1</sup>, Cuauhcihuatl Vital-Garcia<sup>2</sup>, Jaime Zúñiga-Vega<sup>3</sup>, Emília Martins<sup>4</sup>

<sup>1</sup>*Indiana State University, Terre Haute, IN, USA*, <sup>2</sup>*Universidad Nacional Autónoma de México, Mexico City, DF, Mexico*, <sup>3</sup>*Universidad Autónoma de Ciudad Juarez, Juarez, CH, Mexico*, <sup>4</sup>*Indiana University, Bloomington, IN, USA*

### **Phylogenetic Analyses of *Sceloporus* Lizards Reveal that Species with Abdominal Blue Patches Have Higher Plasma Testosterone Levels**

Lineages with evolutionary losses and gains of sexually-selected traits are of special interest to biologists that study male and female correlations in trait expression. In male *Sceloporus* lizards, blue abdominal patches are ancestral, while absence of male blue patches is derived and has evolved several times. In the several species that have been studied, early exposure to androgens hormonally organizes the skin and blue patches are permanently expressed in adult males. The blue is exposed with specific postural displays used during male-male aggression. Hence expression of male blue in a given species may be associated with higher levels of territorial display behavior and activity, both of which are androgen-mediated behaviors. We test the hypothesis that males in blue species will have higher breeding-season levels of testosterone than males in non-

blue species. We selected blue-loss species and a closer blue relative of each, in several clades within *Sceloporus*. Analyses controlling for phylogeny (using phylogenetically independent contrasts and phylogenetic generalized least squares) revealed that, in species in which males are blue (*grammicus*, *parvus*, *graciosus*, *occidentalis*), both males and females have significantly higher plasma testosterone than the comparable sex in species in which males have lost the blue patches (*megalepidurus*, *cozumelae*, *siniferus*, *virgatus*). Hence breeding-season levels of testosterone appear to co-evolve with presence of blue abdominal patches in males, and females may simply show correlated responses. However, three study taxa had female gain of abdominal blue, and females in these species had the highest androgen levels and exhibit aggression, suggesting blue functionality.

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### **0109 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Toby Hibbitts<sup>1</sup>, Wade Ryberg<sup>1</sup>, Dalton Neuharth<sup>1</sup>, Connor Adams<sup>1</sup>, Drew Dittmer<sup>1</sup>, Johanna Harvey<sup>1</sup>, Gary Voelker<sup>1</sup>, Ben Labay<sup>2</sup>, John Paul Pierre<sup>2</sup>, Brad Wolaver<sup>2</sup>, Travis LaDuc<sup>2</sup>

<sup>1</sup>Texas A&M University, College Station, TX, USA, <sup>2</sup>University of Texas, Austin, TX, USA

### **Current Distribution and Phylogenetic Relationships of *Holbrookia lacerata* in Texas**

The Spot-tailed Earless Lizard (*Holbrookia lacerata*) has been thought to be an uncommon species over most of its distribution. Surveys conducted in 2009 were only able to detect the species at or near 12 of the 219 historic localities and only one locality within the distribution of *H. l. subcaudalis*. Based on the few records observed in the 2009 surveys and the apparent extirpation of the species at locations in the south and east of the lizard's distribution it was petitioned for federal listing. Also, the USFWS found in its review of the petition that this species warranted further research to determine if federal listing was needed. In this study we conducted surveys across the entire historic distribution to determine the current species distribution and to collect tissues to determine if the northern (*H. l. lacerata*) and southern subspecies (*H. l. subcaudalis*) were genetically distinct from one another. We based our selection of survey sites on distribution modeling, visual inspection of habitat, and accessibility to low-traffic public roads. We used mtDNA (ND2) and nDNA (rag1) to investigate the validity of the two currently recognized subspecies.

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**0785 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Jeremy M. Higgs<sup>1</sup>, Jill M. Hendon<sup>1</sup>, Dana M. Bethea<sup>2</sup>, James A. Sulikowski<sup>3</sup>, Eric R. Hoffmayer<sup>4</sup>, William B. Driggers<sup>4</sup>

<sup>1</sup>The University of Southern Mississippi, Gulf Coast Research Laboratory, Center for Fisheries Research and Development, Ocean Springs, MS, USA, <sup>2</sup>National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL, USA, <sup>3</sup>University of New England, Department of Marine Sciences, Marine Science Education and Research Center, Biddeford, ME, USA, <sup>4</sup>National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA

**Age and growth of the finetooth shark, *Carcharhinus isodon*, in the northern Gulf of Mexico: a multi-model approach**

Age, growth, and size and age at maturity estimates were examined for finetooth sharks (*Carcharhinus isodon*) in the northern Gulf of Mexico (GOM). Life history data were examined from a total of 711 finetooth sharks (424 female; 287 male) collected in coastal waters between Apalachicola Bay, Florida and East Bay, Louisiana from April 2007 through September 2013. Size and age at which 50% of the finetooth population was estimated to be mature was 1032 and 962 mm fork length (FL) and 4.1 and 3.6 years for females and males, respectively. The observed maximum size and age was 1384 and 1130-mm FL and 9.4 and 6.5 years for females and males, respectively. Sex-specific, two and three parameter von Bertalanffy, Gompertz, and logistic growth models were fitted to the size-at-age data and were found to be statistically significant  $p < 0.05$ . Examination of models of best fit to the data indicated female growth was best described by the logistic model and male growth was best described by the three parameter von Bertalanffy. Three parameter von Bertalanffy model estimates for females and males were:  $L_{\infty} = 1308$ -mm FL and  $k = 0.26/\text{yr}$  and  $L_{\infty} = 1164$ -mm FL and  $k = 0.32/\text{yr}$ , respectively. The findings of this study further expand knowledge of the life history estimates of finetooth sharks in the nGOM.

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**0702 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Cory Hillard, David Penning

*University of Louisiana at Lafayette, Lafayette, Louisiana, USA*

**Quantitative Effects of Body Temperature on Snake Strike Performance: New Insights Into the Elastic-Recoil Hypothesis**

For many ectotherms, temperature has a profound effect on performance, such as for the sprint speeds of lizards. However, elastic-recoil mechanisms have allowed other



ectotherms to partially circumvent temperature dependence, such as the tongue-projection mechanisms of some salamanders and chameleons. Based on pre-strike muscle activation in a viper, previous work hypothesized that striking behavior in snakes is accomplished by elastic recoil of the muscle-tendon complex. With elastic-recoil mechanisms being partially independent of temperature, we would expect strike performance in snakes to be independent of temperature under the elastic-recoil hypothesis. However, work on another viper has shown that temperature significantly affects strike performance. Here, we set out to test the effects of temperature on defensive strike performance in adult western ratsnakes (*Pantherophis obsoletus*). To do this, we tested each snake across 5 temperatures (15-35°C) and recorded 3-8 defensive strikes at each body temperature using a high-speed camera (250 fps) and Tracker 4.87 software. We analyzed peak performance values for each of four strike variables: maximum strike distance (m), minimum strike duration (s), maximum strike velocity (ms<sup>-1</sup>), and maximum strike acceleration (ms<sup>-2</sup>). We treated each strike variable as a dependent variable and the temperature category as the independent variable (repeated measure) in order to characterize the effects of body temperature on strike performance.

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## **0098 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Eric Hilton

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

### **ASIH History, Personal Reminiscences, and an Introduction to the Symposium: Setting the Stage for the Next 100 Years**

Following the advice of William E. Bemis, my Ph.D. advisor, who upon my entry into graduate school guided me to find "my" professional society, the ASIH has, in a sense, been central to my professional life. This society seemed to be a natural fit, as my early exposure and first love of organismal biology stemmed largely from the influence of Alan M. Richmond and my experiences volunteering in the Herpetology collection at UMass, Amherst (only later did Willy bring me over to ichthyology!). I delivered my first professional research presentation at the 1997 meeting of the ASIH in Seattle. I published my first sole-authored paper in *Copeia*, which resulted from the first project I solely developed and saw through to publication; coincidentally this same paper was also the first I had rejected - both great learning experiences! I have since gone on to become involved with the Society in several capacities, and it was a particular honor to be asked to chair the committee charged with "appropriately celebrating the centennial" of the ASIH. This centennial process has been enlightening, as it has given me the opportunity to collaboratively delve into the history of ichthyology and herpetology from the perspective of the Society. It has also allowed me to interact with other members of the Society, from students to established ichthyologists and herpetologists, as we reflect on the role of the ASIH now and into the future. From these perspectives, this presentation will be partially historical, partially autobiographical, and partially prospective.

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**0682 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Eric Hilton<sup>1</sup>, Ann Matarese<sup>2</sup>, Duane Stevenson<sup>2</sup>

<sup>1</sup>Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA, <sup>2</sup>NOAA-Fisheries, Alaska Fisheries Science Center, Seattle, WA, USA

**Development of the Skeleton of the Northern Ronquil, *Ronquilus jordani*,  
With Notes on the Ontogeny and Osteology of Other Members of the Family  
Bathymasteridae (Zoarcoidei)**

Bathymasteridae comprises seven species in three genera (*Ronquilus*, *Rathbunella*, and *Bathymaster*) distributed along the coast of the North Pacific Ocean. The family is often considered to be the basal-most family of Zoarcoidei; recent molecular studies recover it as a basal paraphyletic grade of the suborder. We examined the ontogeny of the skeleton in *R. jordani* based on cleared and stained specimens (8.2-115 mm SL) to better understand the skeleton of these fishes. Cartilages of neural and haemal arches are present in our smallest specimens, and centra are ossified by 15.0 mm. Ossification of the axial skeleton begins near the midpoint of the caudal vertebrae, and proceeds anteriorly and posteriorly from there. By 19.0 mm the axial skeleton is completely formed, and by 34 mm the median-fin rays are completely developed. At 8.2 mm the first cartilaginous elements of the caudal fin are present, and at 29.7 mm the caudal fin skeleton is completely ossified. Within the paired fins the dermal components of the pectoral girdle are among the first bones to form (e.g., cleithrum present by 8.2 mm), whereas the pelvic girdle forms later, with the pelvic bone just becoming differentiated at 13.5 mm. Ongoing work will extend this investigation to the elements of the cranium, forming a baseline for comparative ontogenetic studies within the family and among zoarcoid taxa.

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**0968 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Alice Hirschmann, Nelson Fagundes, Luiz Malabarba

UFRRGS, Porto Alegre, RS, Brazil

**Why the young smiling tetra, *Bryconamericus lethostigmus*, doesn't smile  
(Characiformes: Characidae)**

*Bryconamericus lethostigmus* was described as the type species of the monotypic characid genus *Odontostoechus*. Recently, a new proposal of classification of the Stevardiinae placed *Odontostoechus* as a junior synonym of a monophyletic genus *Bryconamericus sensu stricto*, while other studies comparing mouth morphology found it related to the genera *Bryconacidnus*, *Ceratobranchia*, *Monotocheiroidon*, *Othonocheiroidus*, *Rhinopetitia* and *Rhinobrycon*. We redescribe *B. lethostigmus* and analysed the mouth shape and the origin of a single tooth series in the premaxilla in a species of a group characterized by the presence of two tooth series. A total of 319 specimens were analysed morphologically.

This study demonstrates that the single tooth row in *B. lethostigmus* is originated from the merging of the external tooth row with the inner row during ontogeny, and disagrees with the primary hypothesis of homology between the mouth characters found in the *B. lethostigmus* and the genera *Bryconacidnus*, *Ceratobranchia*, *Monotocheirodon*, *Othonocheirodus*, *Rhinopetitia* and *Rhinobrycon*.

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**0771 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Caitlin Hirsh, Jason Ortega, Steven Beaupre

*University of Arkansas, Fayetteville, AR, USA*

**Validation of the use of doubly labeled water for measuring metabolic rate in Timber Rattlesnakes (*Crotalus horridus*)**

The doubly labeled water method is an isotopic technique for measuring field metabolic rate and water flux rates of free-living animals. We present a validation of the use of doubly labeled water for measuring metabolic rate and water loss in Timber Rattlesnakes (*Crotalus horridus*). For this study seven animals of varying body size were used with masses ranging from 148 to 650 grams. Prior to dosing, blood samples were taken to establish background isotope levels for each animal. Snakes were injected with water enriched with isotopes of oxygen ( $^{18}\text{O}$ ) and hydrogen ( $^2\text{H}$ , deuterium). The injected isotopes were then allowed to equilibrate with the animals' body water pool for 3 hours and then a second blood sample was taken. Following the second blood sample, animals were placed into metabolic chambers and metabolic rates ( $\text{VCO}_2$  and  $\text{VO}_2$ ) were measured using open-flow respirometry for 20 days. During metabolic measurements water loss for each snake was estimated via Drierite uptake. On the 20<sup>th</sup> day, final blood samples were taken to determine isotope turnover rates. Measured  $\text{CO}_2$  production by gas exchange will be compared to  $\text{CO}_2$  production calculated from isotopic data. Water flux measured by Drierite uptake will be compared to water flux calculated from isotopic data. Despite years of application of the DLW technique, validation studies are few: our data are the first such validation in pitvipers.

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**0206 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Nathaniel Hitt, Erin Snook, Danielle Massie

*US Geological Survey, Leetown Science Center, Kearneysville, WV, USA*

**Inference from long-term data for theoretical and applied freshwater fish ecology**

We describe the utility of long-term fish community data for (a) testing ecological theory, (b) assessing climate and land use change, (c) monitoring ecological restoration,

and (d) modeling invasive species spread. We review a series of case studies from our research to demonstrate each topic. First, we describe a test of community assembly rules from resampling Burton and Odum (1945) sites in Virginia. We show that temporal variation exceeds spatial variation in several cases. Second, we describe several studies evaluating climate drivers for native brook trout populations in Appalachia. We show that brook trout recruitment is most sensitive to winter flows, and that this inference required multiyear data. Third, we describe inferences for monitoring fish population recovery after a dam removal in Virginia, highlighting the utility of time-series forecasting. Fourth, we show how long-term data enable analysis of invasive fish abundances in the Potomac River using hierarchical Bayesian modeling. We show that the precision of change-estimates increases (i.e, CIs decrease) with the length of the time-series. Central themes from the case studies are (a) long-term data are necessary for many theoretical and applied questions in fish ecology and (b) coordination with multiple investigators and institutions is often required to build sufficient datasets in this regard.

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**0572 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Joshua Hittie

*Loyola University Chicago, Chicago, IL, USA*

### **Evolution of Life-History Characteristics in Gadiform Fishes**

Life -history characteristics (e.g., age and growth) have been used extensively to understand the temporal population dynamics of fish species. Few studies have examined these characteristics in a phylogenetic framework. Or even if such characteristics have phylogenetic signal. This study examines how life-history characteristics may have evolved in the suborder Gadoidei (cods), and how much of a phylogenetic foundation there may be for the evolution of these traits. A phylogeny of Gadoidei based on molecular data and incorporating representatives from all genera was constructed. Within this phylogenetic framework, life-history traits, including growth rates, age at maturity, and longevity were mapped to determined when these characteristics evolved, if they are broadly shared among the studied groups or if they characterize each group separately. To determine to what extent, common ancestry plays a role in the development of life-history traits in Gadoidei, ecological data, including habitat and trophic data, was analyzed for each target species in the study. If a group shares a close ancestry and has different ecologies but shares similar life history traits, it is hypothesized that phylogenetics plays a strong role in the evolution of life-history traits in addition to environmental pressures. This study will provide foundational information for future studies of Gadoidei in the face of climate change constraints.

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**0087 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Mackenzie Hlesciak, C. Tristan Stayton

*Bucknell University, Lewisburg, PA, USA*

**Analysis of evolutionary patterns and rates of sexual size dimorphism and sexual shape dimorphism in turtles**

We investigated large-scale patterns of the evolution of sexual shape dimorphism (SShD) and sexual size dimorphism (SSD) in turtles, through the following hypotheses: H1) Female and male turtles consistently differ in shape in all turtle species. H2) Female and male turtles show additional differences within certain habitats. H3) Rates of evolution of SSD and SShD vary among turtle families. H4) Rates of evolution of SSD and SShD vary among habitats. Hypotheses were tested using data from 255 turtle species (of which 226 had both males and females). We tested our first hypothesis by creating separate phylomorphospaces for both females and males, and analyzing the differences using phylogenetic MANOVA. We tested for differences in rates of SSD evolution using a Brownian model of rate variation, and for differences in the rates of SShD evolution using a modification of the `compare.evol.rates` function in the R package `geomorph`. There was no evidence of consistent shape differences between females and males across all turtles. SSD in aquatic species evolved significantly faster than in terrestrial species. SSD in aquatic species may evolve faster because of a greater variety of selective pressures that may be encountered in water as opposed to land, or different modes of sexual selection in different environments. The lack of consistent differences between sexes was surprising, but females and males of different species may achieve the same functional result with a variety of different shapes. Future studies will analyze SSD and SShD in turtles of different sizes, latitudes, and ecosystems.

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**0077 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Christopher Hoagstrom

*Weber State University, Ogden, Utah, USA*

**Using long-term data to solve a minnow-conservation puzzle**

The U.S. Fish & Wildlife Service, with the New Mexico Department of Game & Fish, began long-term monitoring for federally protected (threatened) Pecos bluntnose shiner in 1992 as part of a five-year multi-agency Memorandum of Understanding, funded by the U.S. Bureau of Reclamation. This was in response to a jeopardy opinion targeting operation of Sumner Dam as an immediate threat to the protected population. Reclamation continues to support monitoring. Monitoring data from equably spaced locations sampled several times per year documented population crashes associated with dewatering, confirming that river desiccation jeopardized the population. Data

also confirmed perpetual restriction of adults to a less degraded river reach where shallow waters flowed across shifting sands. Length measurements made on all individuals captured from 1994 on allowed detailed population analyses, indicating population size reflected annual recruitment and suggesting negative relations of annual recruitment versus discharge. This supported the inference that high-flow associated spawning and propagule vulnerability to drift combined to reduce recruitment via elevated displacement when prolonged reservoir releases filled the degraded river channel. However, distributional data supported other evidence of some propagule retention in a less degraded reach. There was also support of independent evidence for inter-reach connectivity via apparent upstream dispersal of some displaced individuals. Long-term population data provided a context for hypothesis-driven studies, creating potential for focused management. But, many more years of comparable data are needed to better assess inter-decadal trends and allow independent assessment of recruitment in typical years (i.e. no desiccation) versus exceptional years (i.e. prolonged desiccation).

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#### **0105 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Kelly Hodgskins, Stephanie Greenleaf, Jonathan Hillman, Bruce Stallsmith

*University of Alabama in Huntsville, Huntsville, AL, USA*

#### **Reproductive Schedule of the Silver Shiner (*Notropis photogenis*) in the Flint River of Alabama**

Many river-dwelling species of fish are dependent upon and stimulated by fluctuations in river flow for successful reproduction. This is especially true of pelagophils, a reproductive guild whose eggs and larvae require free drifting on river currents for several days. *Notropis photogenis* (Silver Shiner) is a rheophilic species with a broad distribution from Ontario to the southeastern United States including northern tributaries to the Tennessee River in Alabama. Little is known of its reproductive biology. The purpose of this study was to describe aspects of reproductive biology such as timing and pattern of ovarian development and oocyte maturation of *N. photogenis* in the Flint River of Alabama. We investigated whether and how abiotic cues such as river discharge and temperatures were related to ovulation and spawning. Monthly fish collections were made from August, 2011, to July, 2013. From these collections monthly gonadosomatic index (GSI) was evaluated, along with the status of ovarian maturation, oocyte maturation and size, and oocyte counts to establish fecundity and clutch size. Median monthly river discharges in cubic feet per second for 1999–2015 were obtained from the U.S. Geological Survey database. Observations over two years showed associations between daily mean discharge and months of peak GSI (February–April). Mean GSI peaked in March of both 2012 and 2013 when median flow was approximately 600 cfs. Large synchronous spawning events appear to occur during times of steady substantial discharge increases but after peaks of discharge > 3000 cfs.

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## **0372 General Herpetology, Galerie 2, Saturday 9 July 2016**

Erin Hodson, Richard Lehtinen

*The College of Wooster, Wooster, Ohio, USA*

### **Decline of an Adaptation in a Coral Snake Mimic**

Much research has attempted to elucidate the ways in which new adaptations arise. However, fewer studies have examined the ways in which former adaptations may be lost. One famous adaptation among vertebrates is found in harmless or mildly venomous snakes that mimic the coloration of highly venomous coral snakes. A lineage of particularly precise coral snake mimics are known in the genus *Erythrolamprus* (Dipsadidae). However, one species in this lineage is a relatively poor coral snake mimic: *E. ocellatus* endemic to the Caribbean island of Tobago. It has been suggested that this species is in the process of losing its coral snake mimic coloration. To assess hypotheses related to the apparent loss of effective mimicry in *E. ocellatus*, we took coloration measurements on museum specimens, conducted a field experiment on the islands of Trinidad and Tobago (the latter lacks coral snakes while they are present on the former), and reconstructed the evolutionary history of this lineage using molecular markers. Coloration data confirmed that *E. ocellatus* is an imperfect mimic and our field experiment showed that coral snakes and their mimics receive no protection from predators compared to controls on Tobago. Lastly, our phylogenetic analysis revealed *E. ocellatus* to be a relatively derived member of the coral snake mimic clade of *Erythrolamprus*. Together, these data support the mimetic breakdown hypothesis for imperfect mimicry in *E. ocellatus* and suggest that selection against coral snake resemblance in allopatry drove the decline of this adaptation.

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## **0783 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Eric Hoffmayer, Adam Pollack, William Driggers, Christian Jones, Matthew Campbell

*National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA*

### **Neritic distribution of bonnetheads, *Sphyrna tiburo*, indicates limited use of inshore nurseries in the western Gulf of Mexico**

The bonnethead, *Sphyrna tiburo*, is a small coastal shark species known to inhabit coastal waters of the northern Gulf of Mexico during spring, summer and fall. Despite showing a clear preference for shallow waters (10-25 m) during warm months, bonnetheads migrate to offshore deeper waters during winter; however, little is known about these seasonal movements or utilization of neritic waters. The objective of this study was to use fishery-independent bottom trawl data to describe the spatial distribution of bonnetheads in the northern Gulf of Mexico. From 1987-2014, 645 bonnetheads (274-1220 mm STL) were captured at 362 stations, with the majority of individuals collected (61%) being young-of-the-year. Catch rates of bonnetheads were higher in the western

Gulf of Mexico and their occurrence was relatively rare in neritic waters east of Mobile Bay. Sharks were captured in depths ranging from 5 to 71 m, with the majority of the sharks captured between 10 and 30 m. Despite their reported preference for shallow waters, 40% of bonnetheads were captured in waters deeper than 25 m. Furthermore, the use of deeper waters (25-55 m) by 46.4% of the young-of-the-year sharks suggests that nursery areas may not be as discrete as previously thought. It is widely stated that blue crabs are the primary prey of bonnetheads; however, stomach content analysis of 25 young-of-the-year individuals collected during the 2015 fall trawl survey indicated that mantis shrimp (*Squilla sp.*) was their primary prey and spatial analysis revealed that the distribution of the two species were highly correlated.

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**0788 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Matthew Holding, Lisle Gibbs

*Ohio State University, Columbus, OH, USA*

**Migration, Drift, and the Outcomes of Coevolution between a Rattlesnake and its Venom-resistant Prey**

Predators and prey coevolve to produce some of the most extreme and fascinating characteristics of animals, such as the toxic venoms of snakes and physiological venom resistance in their prey. But coevolution is not a simple race to the top: multiple contextual factors affect whether coevolution occurs, its strength, and its outcomes in geographically distinct populations. Recently, we showed a range wide signal of local adaptation of Northern Pacific Rattlesnake (*Crotalus o. oreganus*) venom to overcoming venom resistance in California ground squirrels. However, there is considerable variation in the strength and direction of this functional adaptation from one location to the next, with some locations showing patterns consistent with squirrels being ahead of the snakes. Coevolutionary theory predicts that two demographic factors, effective population size and migration, might explain these variable outcomes, because the species with the relatively higher migration rate and lower power of genetic drift is predicted to more easily climb peaks in the adaptive coevolutionary landscape. I have generated next-generation RAD-sequencing data for over one hundred individuals of both rattlesnakes and ground squirrels across 12 populations, and will use it to test these hypothesized links between demography and coevolution in these vertebrate enemies. Identifying and ranking the factors that drive variable coevolutionary outcomes among populations deepens our geographic mosaic understanding of the coevolutionary process, and relates coevolution to the maintenance of extreme phenotypic diversity within a single species, as exemplified by functional variation in the venoms of pitvipers.

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## 0474 Fish Genetics, Salon D, Sunday 10 July 2016

Christopher Hollenbeck, David Portnoy, John Gold

Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA

### Population Genomics of Red Drum, *Sciaenops ocellatus*

Next-generation sequencing technologies have enabled cost-effective screening of thousands of genetic markers for nearly any species, allowing for the assessment of the relative effects of micro-evolutionary phenomena that impact the genome as a whole (e.g., genetic drift) and phenomena that have locus-specific impacts (e.g., natural selection). A population genomics assessment of red drum in the Gulf of Mexico (hereafter Gulf) and U.S. Atlantic Ocean (hereafter Atlantic) was conducted. A total of 563 juvenile (0-3 year old) red drum were sampled between 2008 and 2015 from 11 localities in the Gulf and Atlantic; spanning from South Carolina to Texas. Individuals were genotyped using double-digest Restriction Site-associated DNA (ddRAD) sequencing at 2,860 SNP loci, which were then collapsed into 1,539 multi-allelic RAD haplotype loci. Analysis of population structure with putatively neutral loci revealed three distinct genetic units of red drum, corresponding to western Gulf, eastern Gulf, and Atlantic regions. Population structure analysis with  $F_{ST}$  outlier loci, putatively under selection, suggested the presence of local adaptive differences among the three regions. A genetic linkage map was used to explore genomic patterns of differentiation and revealed distinct physical clustering of outlier loci and comparative genomics identified candidate genes in the regions of interest. The data highlight the value of combining dense genome-wide sampling of genetic markers with genomic position data to provide insight into the micro-evolutionary forces that create patterns of genomic variation in marine fishes.

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## 0811 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016

Lisa Hollensead<sup>1</sup>, Dean Grubbs<sup>1</sup>, John Carlson<sup>2</sup>, Dana Bethea<sup>2</sup>

<sup>1</sup>Florida State University, Tallahassee, FL, USA, <sup>2</sup>NOAA NMFS, Panama City, FL, USA

### Assessing Residence Time and Habitat Use of Juvenile *Pristis pectinata* Using Acoustic Monitoring in a Nursery

Highly productive estuaries have been shown to serve as nurseries for many marine fishes. However, few studies quantitatively measure the biotic characteristics that often drive a habitat's function as a nursery. This information is critical when developing recovery plans for endangered species, such as the smalltooth sawfish (*Pristis pectinata*). This study incorporated a combination of acoustic telemetry monitoring and quantification of biotic attributes in order to assess nursery habitat use of juvenile smalltooth sawfish. In order to monitor movements, thirty-two VEMCO VR2w receivers were deployed within Everglades National Park during 2011. The array was used to

quantify seasonal residency, determine emigration timing, and identify migration corridors. Benthic grain size and organic content along with mangrove prop root density and limb overhang were quantified throughout the study area. These habitat variables were used to construct logistic models in order to test for any relationship between habitat attributes and presence of tagged sawfish. Monitoring results of twenty sawfish were variable. Observed residency within the backcountry nursery ranged from days to several months with overwintering (N=5) occurring along Chokoloskee Island. Three individuals tagged in the backcountry exhibited directed emigration into Chokoloskee Bay in summer via the Lopez River which may be a migration corridor. Results also indicated that sawfish quickly moved through deep-water, narrow creeks and rivers between shallow tidally-influenced bays. A step wise regression analysis of hits per hour incorporating all habitat variables indicated that sawfish had an increased probability of being encountered in areas with high prop root density.

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**0505 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD  
ICHTHYOLOGY**

Watcharapong Hongjamrassilp, Philip Hastings

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

**Evolution of the Unusual Gaping Display in the Sarcastic Fringehead  
(Blenniiformes: *Neoclinus blanchardi*)**

The gaping display in which an open mouth is presented toward an intruder is one of the visual communication displays used by a variety of fishes and other vertebrates for territory defense. While it can be found in many groups of animals, the gaping display of *Neoclinus blanchardi* is exceptional compared to that of other fishes. This display is greatly amplified by lateral flaring of the extremely long maxillae, which makes the fish appear bigger, and by a bright color inside the oral cavity. To decipher the evolution of this display, we described the osteology and musculature associated with this display, and used the heterochrony framework to describe the morphological changes of the maxilla in an evolutionary timescale among three closely related species of *Neoclinus*: *N. stephensae*, *N. uninotatus*, and *N. blanchardi*. Geometric morphometry and PCA were used to quantify ontogenetic shape changes in males and females of all three species, and thin-plate spline analysis was used to generate a deformation grid of maxilla morphology. The results suggested that three structures are related to the exaggeration of this display in *N. blanchardi*: the buccopalatal membrane, the anterior joint system and posterior elongation of the maxilla, and the adductor mandibularis muscles. The enlarged maxilla of male *N. blanchardi* evolved via peramorphosis (acceleration) compared to the other species. In the largest males, the maxilla extends posteriorly well past the operculum and the expansion area comprises soft (unossified) tissue which is postulated to reduce the cost of this display.

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## **0570 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Jan Jeffrey Hoover<sup>1</sup>, Daniel P. Zielinski<sup>2</sup>, Peter W. Sorensen<sup>2</sup>

<sup>1</sup>US Army Engineer Research and Development Center, Vicksburg, MS, USA,

<sup>2</sup>University of Minnesota, St. Paul, MN, USA

### **Swimming Performance and Hydraulic Containment of Bigheaded Carp (*Hypophthalmichthys* spp.)**

High velocity flow fields have been suggested as a technique for containing invasive populations of Bighead Carp (*Hypophthalmichthys nobilis*) and Silver Carp (*H. molitrix*) but swimming performance of adult fish has not been described quantitatively. In spring 2015, we used a newly-designed and constructed 2935 L mobile swim tunnel to measure endurance at prolonged and burst swim speeds (< 10 min endurance) of both species in water velocities 76-244 cm/s. Carp 53.5-104.0 cm TL, 1.5-12.3 kg, were collected from a side channel of the Mississippi River and tested on-site in local water 13.1-25.9 C. Both species exhibited significant linear declines in endurance with increased water velocity, described by log-linear regression models. Maximum observed burst swim speeds for both species were low, < 3.0 body lengths/sec (BLS), but Bighead Carp (N=17) exhibited a steeper decline in endurance, and less point scatter ( $R^2 = 0.78$ ,  $p < 0.0001$ ) than Silver Carp (N = 43) which responded gradually to changes in water velocity and exhibited greater point scatter ( $R^2 = 0.19$ ,  $p = 0.0033$ ). Multiple regression models and an ontogenetic analysis of swimming endurance for both species demonstrated that water temperature and size of adults were negligible and non-significant influences respectively on endurance. Silver Carp, however, exhibited greater variation in behavior (e.g., non-performance, leaping) and in morphology (i.e., variation in length of lower caudal lobe) than Bighead Carp. These data may be used to develop guidelines for hydraulic containment of carp at lock-and-dams in the Upper Mississippi River.

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## **0808 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Charlene Hopkins, Shawn Kuchta, Willem Roosenburg

Ohio University, Athens, Ohio, USA

### **Amphibians Hit the Road: Assessing Roadway Mortality and Ecopassage Utilization along a Two-lane Highway**

As roadways reduce amphibian population sizes, disrupt connectivity, and degrade habitat mitigation measures are increasingly being implemented. Barriers and ecopassages are a common strategy used to mitigate roadway impacts. Barriers limit access to roadways and may direct animals toward ecopassages, which are corridors designed to conduct animals safely over or under the roadway. The effectiveness of these mitigation measures for small animals remains poorly studied. We quantified levels of roadway mortality, ecopassage use, and amphibian populations, to assess the effectiveness of a barrier-ecopassage system along a two-lane highway. We also

conducted roadway crossing behavior, ecopassage use, and ecopassage style choice experiments. We will be presenting our findings thus far and directions for future research.

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**0634 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Ariel Horner<sup>1</sup>, Eric Hoffman<sup>1</sup>, Anna Savage<sup>1</sup>, Tyler Hether<sup>0</sup>

<sup>1</sup>University of Central Florida, Orlando, FL, USA, <sup>2</sup>University of Idaho, Moscow, ID, USA

**Cryptic chytridiomycosis in declining anuran populations of the southeastern United States**

Infectious disease is a well-known driver of faunal declines worldwide. In recent decades, emerging infectious diseases (EIDs) have increased for both humans and wildlife. Multiple herpetofaunal groups have been affected by pathogens, but amphibians have had the most significant population declines due to EIDs. North American amphibians have been impacted by two major emerging pathogens, the fungus *Batrachochytrium dendrobatitis* (*Bd*) and iridoviruses in the genus *Ranavirus* (*Rv*). Amphibian populations have responded differently to these disease stressors; some populations have been almost wiped out while others have managed to persist. Environmental factors and host genetics may play important roles in disease dynamics, but few studies incorporate both of these components into their analyses. Our study investigates the effect of environmental and genetic factors on *Bd* and *Rv* infection prevalence and severity in a biodiversity hot spot, the southeastern US. We conducted a retrospective EID infection study on three amphibian species, using quantitative PCR to understand how emerging infectious pathogens have potentially impacted natural populations. By combining genetic factors and environmental variables into a general linear model for species with pathogen infection, we elucidate the relative roles of host genetics and environmental variables on predicting disease impact and spread. We conclude that by incorporating both genetic and environmental factors into conservation plans for amphibians, more effective management strategies can be developed to help protect the Southeast's amphibian biodiversity.

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## **0410 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Blake Hossack<sup>1</sup>, Ken Honeycutt<sup>1</sup>, Todd Preston<sup>2</sup>, Holly Puglis<sup>3</sup>, William Battaglin<sup>4</sup>, Kelly Smalling<sup>5</sup>, Douglas Kent<sup>6</sup>, Isabelle Cozzarelli<sup>7</sup>, Katherine Skalak<sup>7</sup>, Joanna Thamke<sup>8</sup>, Bruce Smith<sup>4</sup>, Chauncey Anderson<sup>9</sup>

<sup>1</sup>US Geological Survey, Missoula, MT, USA, <sup>2</sup>US Geological Survey, Bozeman, MT, USA, <sup>3</sup>US Geological Survey, Columbia, MO, USA, <sup>4</sup>US Geological Survey, Denver, CO, USA, <sup>5</sup>US Geological Survey, Lawrenceville, NJ, USA, <sup>6</sup>US Geological Survey, Menlo Park, CA, USA, <sup>7</sup>US Geological Survey, Reston, VA, USA, <sup>8</sup>US Geological Survey, Helena, MT, USA, <sup>9</sup>US Geological Survey, Portland, OR, USA

### **Potential Effects of Waste Waters from Oil and Gas Extraction on Amphibians: Preliminary Results from a Multi-partner Investigation**

Development of unconventional techniques for oil and gas extraction has fueled an unprecedented expansion of energy extraction and associated economic growth in the northern Great Plains. A large portion of this expansion has occurred in the Williston Basin and Prairie Pothole regions, a landscape with broad expanses of prairie and wetlands that have enormous ecological and economic value. Although disposal practices for waste waters produced during oil and gas extraction have improved greatly, occasional releases can result in large quantities of high-salinity brines that persist in the environment. There is a growing body of work focused on water and sediment chemistry in these areas, but research into effects of wastes on higher trophic levels in wetlands has been limited. We built on existing research and leveraged the work of multiple groups within USGS to conduct a controlled experiment that tests effects of sediment from reference and waste-affected wetlands on survival and growth of amphibian larvae, and estimated species richness and abundance of amphibians across several wetlands spanning a contamination gradient. We also performed chemical analysis of sediment, groundwater, surface water, and amphibian tissues. Results are intended to help inform management decisions about wildlife conservation in the region, efficacy of remediation actions, and improve protocols for management of future oil and gas wastes.

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## **0051 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Md Anwar Hossain<sup>1</sup>, Benjamin S. Thompson<sup>2</sup>, Gawsia Wahidunnessa Chowdhury<sup>1</sup>, Samiul Mohsanin<sup>2</sup>, Zubair H. Fahad<sup>2</sup>, Heather J. Koldewey<sup>3</sup>, Md Anwarul Islam<sup>1</sup>

<sup>1</sup>Department of Zoology, University of Dhaka, Dhaka, Bangladesh, <sup>2</sup>WildTeam, Dhaka, Bangladesh, <sup>3</sup>Zoological Society of London, London, UK

### **Sawfish exploitation and status in Bangladesh**

Sawfish are among the world's most threatened and understudied marine fishes. There are few studies on sawfish from outside Australian and USA waters - a significant

knowledge gap considering their circumtropical distribution and migratory nature. This paper presents the first assessment of sawfish exploitation and status in Bangladesh. A countrywide rapid assessment was undertaken between December 2011 and November 2012, using an interdisciplinary methodology. Fish landing stations, dry fish markets, and fishing villages were visited and a sawfish medicine maker was found and interviewed. In addition, interviews with national specialists at academic and fisheries institutions were undertaken. In total, 203 questionnaire surveys were conducted with fishers and traders in order to understand the extent of decline, potential drivers of declines, and local perceptions and uses of sawfish. Eighteen rostra were documented from museum archives and private collections, and unpublished data were sourced. Two sawfish species, *Pristis pristis* and *Anoxypristis cuspidata* were confirmed to be present in Bangladesh. General population declines were revealed. The average annual sawfish encounter rate (observations and catches) declined from 3.7 individuals using lifetime recall data (~22-year), to 1.5 using 5-year recall data, and further to 0.7 using 1-year recall data. The consensus from social research methods was that sawfish were caught as bycatch, with drift gill nets being cited as the most damaging gear type. Every respondent perceived sawfish as a useful animal. Conservation measures are proposed, including a local education and outreach programme to seek behavioural changes - primarily to release live sawfish.

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### **0351 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Kyle Hovey, Emily Seiter, Erin Johnson, Ralph Saporito

*John Carroll University, University Heights, Ohio, USA*

#### **Do Variable Alkaloid Defenses in the Dendrobatid Poison Frog *Oophaga pumilio* Provide Equal Protection from Microbial Pathogens?**

Amphibians produce the majority of their defensive chemicals, but alkaloid defenses in poison frogs are instead sequestered from dietary arthropods. Alkaloids function as a defense against predators, and certain alkaloids appear to inhibit microbial growth. However, alkaloid defenses vary considerably among populations of poison frogs, reflecting geographic differences in availability of dietary arthropods. Consequently, environmentally driven differences in poison frog alkaloid defenses may have significant implications regarding their protection against pathogens. While natural alkaloid mixtures in poison frogs have recently been shown to inhibit growth of non-pathogenic bacteria and fungi, no studies have examined the effectiveness of alkaloids against microbes that infect frogs. Herein, we examined how alkaloid defenses in the strawberry poison frog, *Oophaga pumilio*, affect growth of the known anuran pathogens *Aeromonas hydrophila* and *Klebsiella pneumoniae*. Frogs were collected from five locations throughout Costa Rica that are known to vary in their alkaloid profiles. Alkaloids were isolated from individual skin samples, and extracts were assayed against both pathogens. Microbe subcultures were inoculated with extracted alkaloids to create dose-response curves, and spectrophotometry was used to compare growth between treatments. GC-MS was used to characterize and quantify alkaloids in frog extracts, and

our results suggest that variation in alkaloid defenses lead to differences in inhibition of these pathogens. This study provides the first evidence that alkaloid variation in a dendrobatid poison frog is associated with differences in inhibition of frog pathogens. Furthermore, our study provides further support that alkaloid defenses in poison frogs confer protection against both pathogens and predators.

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## **0641 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Hunter Howell<sup>1</sup>, Donald McKnight<sup>2</sup>, Richard Seigel<sup>1</sup>

<sup>1</sup>Towson University, Towson, MD, USA, <sup>2</sup>James Cook University, Townsville, Queensland, Australia

### **A Novel Method of Collecting Spotted Turtles (*Clemmys guttata*)**

Effective sampling methods are important for accurate population size estimates and assessing long-term viability of threatened or endangered species. Because different sampling methods are biased towards captures of different sexes or different life stages of a population, it is necessary to determine which sampling method will most reliably and efficiently document a species of interest while minimizing systematic error. Spotted Turtles (*Clemmys guttata*) are listed as a threatened species in Canada, and are listed as an endangered species by the International Union for Conservation of Nature. They are also included in Appendix II of the Convention on International Trade of Endangered Species, and are currently under review for listing under the United States Endangered Species Act. It is, therefore, imperative to be able to effectively monitor *C. guttata* populations, but adequate survey methods for this species are currently lacking. Historically, *C. guttata* have been captured in the field by hand capture surveys and muddling. However, because *C. guttata* is a small, secretive, and cryptic species, hand capture surveys may not be the most effective sampling method. Traditionally, hoop net traps have been used as a collection method for many species of aquatic turtles and multiple variations of these traps exist. Recently, collapsible mesh minnow traps have become an important tool for collecting amphibians and reptiles; however, their effectiveness as a means of capturing *C. guttata* has not been tested. Here, we demonstrate the effectiveness of collapsible mesh minnow traps for collecting *C. guttata* at a site in central Maryland, USA.

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**0736 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Christopher Howey, Michaleia Mead, Mark Herr, Tracy Langkilde

*Pennsylvania State University, University Park, PA, USA*

**Thermoregulation and Predation Risk Trade-offs at Timber Rattlesnake Rookery Sites**

Gravid timber rattlesnakes use open, rocky habitat as gestation rookeries where they are able to elevate body temperatures and meet increased energetic demands. Thus, thermal characteristics of rookery sites have fitness implications for snakes that occupy them. Rookery sites vary in how open the area surrounding the rookery is, which may affect thermal characteristics and exposure of snakes to visual predators. This study investigated whether a trade-off exists between thermal quality and risk of predation at rookery sites of varying openness. We found that as the amount of open area surrounding a rookery site increased, the percent canopy cover over the rookery decreased and the thermal environment improved (more often above preferred body temperature). There was no difference in the number of predators that visited the rookery sites, but more open rookeries were visited by a greater variety of predator species that may pose differential threats to adult versus juvenile snakes. These results suggest a possible ecological trade-off between thermal quality and risk of predation. Rookery sites more enclosed by trees had poorer thermal quality which may prolong gestation times and lead to a decreased survival rate for offspring if parturition is too delayed, but may increase survival rates of adults by excluding their visual predators. By contrast, more open rookeries could reduce gestation times and increase survival for offspring, but decrease survival of adults if they are seen by a potential predator.

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**0854 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Steven Hromada<sup>1</sup>, C.A.F. Howey<sup>2</sup>, C.M. Gienger<sup>1</sup>

*<sup>1</sup>Austin Peay State University, Clarksville, TN, USA, <sup>2</sup>Pennsylvania State University, State College, PA, USA*

**The Impacts of Prescribed Burns on Reptile and Amphibian Communities in Oak/Hickory Forests**

Prescribed fire can have important impacts on an ecosystem. These impacts can be direct, in the form of injury and mortality to individuals, or indirect, in the form of changes to preferred resources available within the environment. Most research has focused on the direct impacts of the initial burn, and not on the indirect impacts of a recurring fire regime. Changes in habitat structure (such as a decrease in canopy cover or an increase in forb cover) from prescribed fire can increase availability of preferred microhabitats for some species while reducing the availability of preferred microhabitats of other species. We examined the responses of herpetofaunal communities to a prescribed fire regime in an Oak/Hickory forest located in Land Between the Lakes



National Recreation Area, KY. Four plots were established in an area that received large scale prescribed burns, and four were established in a similar area that has not received any recent fire treatment. Herpetofaunal communities were sampled using drift fences and artificial cover object arrays, and habitat attributes were sampled via transects. Although species richness did not differ between treatments, differences in relative abundances of reptile and amphibian species between treatments reflected differences in habitat structure between treatments. These results suggest that the habitat changes caused by a prescribed fire regime can have indirect impacts on reptile and amphibian populations and community structure.

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**0089 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Eric Hsu, Kate Jackson

*Whitman College, Walla Walla, Washington, USA*

**Developing a Multi-Access Key for Identification for West and Central African Snakes**

For centuries, dichotomous keys have been the standard tool for identification of taxa. However, the effectiveness of conventional dichotomous keys is limited by the sequential nature of the couplets. If the information involved with any given couplet is unavailable, the key is unlikely to yield a correct identification. Multi-access keys have the potential to overcome this limitation; however, they present some challenges of their own. We created two multi-access keys for identification of snakes from West and Central Africa to the genus level, using data on 62 genera of snakes across 35 morphological characters in an effort to facilitate snake identification. Here, we describe the process and mechanics behind development of our multi-access key. We also comment on the benefits and shortcomings of multi-access keys - with a particular emphasis on the digital format - compared with dichotomous keys in particular and specimen identification in general.

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**0714 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Yinan Hu, Jacqueline F Webb

*University of Rhode Island, Kingston, RI, USA*

**Ontogeny of the Olfactory and Gustatory Systems in *Elacatinus* spp. (Gobiidae): Potential for Chemosensory-Guided Navigation in Pelagic Fish Larvae?**

The ability of pelagic fish larvae to locate appropriate settlement sites has been attributed to their swimming abilities and to interpretation of cues by several different sensory modalities (e.g., vision, hearing, olfaction). The morphological analysis of the ontogeny of the peripheral sensory organs can shed light on their functional capacities,

when evaluated in the context of what is known about structure-function relationships in other species. Ontogenetic series of two gobies in the genus *Elacatinus* (*E. lori* [3-14 mm, n=33], *E. colini* [3.5-15 mm, n=24]), from day-of-hatch through settlement, were prepared histologically (transverse serial sections; glycolmethacrylate resin or Paraplast, 5 or 8  $\mu\text{m}$  thickness) and stained to visualize the olfactory epithelium and taste buds. Results show that during larval development, the thickness of the well-developed olfactory epithelium does not change appreciably, but the size of the sensory epithelium increases with fish size. The olfactory epithelium invaginates and becomes enclosed in a blind sac (the olfactory organ) with two nares around settlement; however, neither lamellae nor accessory nasal sacs (which would indicate the capacity for active nasal ventilation) are present. Taste buds are located on the lips, buccal valves, roof of mouth, gill arches [including pharyngeal jaws] and “tongue”, and increase in number throughout ontogeny (with some inter-species differences), but the number of taste buds in the rostral portion of the mouth, in particular, increases around settlement. The functional implications of these ontogenetic trends for larval navigation will be discussed. Funded by NSF grant 1459546 to JFW.

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**0124 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday  
7 July 2016**

Joshua Hubbell, Jake Schaefer

*University of Southern Mississippi, Hattiesburg, MS/Southeast, USA*

**Occupancy Modeling of the Yazoo Darter within the Upper Yazoo River System**

The capacity of information that exists on many North American freshwater fishes distribution and niche requirements is surprisingly limited. Such information is necessary to aide in the conservation and management of rare species, in particular those that are listed as threatened or endangered. Site occupancy is a prevalent metric for evaluating populations, and occupancy models that account for the undetectability of a study’s target species are useful tools providing solutions to these problems. In this study, I used a method that allows for spatial replication during a single visit to assess the current status of the Yazoo Darter *Etheostoma raneyi* within the Upper Yazoo River system. The modeling approach in this study enabled comparisons of covariates that influenced occupancy at two spatial scales (catchment and site). The results suggest that the percent occurrence of woody debris is the most important habitat component that influences the probability of occurrence of Yazoo Darters at the site scale. Furthermore, drainage area ( $\text{km}^2$ ), and stream link magnitude appear to be the important hydrological components that influence the probability of occurrence at the catchment scale. Finally, occupancy models suggest that even small increases in urban cover in small headwater systems negatively affect Yazoo Darter populations.

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## **0644 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Jeanette Huber<sup>1</sup>, Gavin Naylor<sup>1</sup>, Tanya Darden<sup>2</sup>

<sup>1</sup>University of Charleston, South Carolina, Charleston, South Carolina, USA, <sup>2</sup>South Carolina Department of Natural Resources, Charleston, South Carolina, USA

### **From past to present: A global population structure and genetic diversity study of a critically endangered fish using historical specimens**

The largemouth sawfish *Pristis pristis* (Linnaeus, 1758) is among the most critically endangered marine vertebrate species primarily due to anthropogenic effects compounded by their low intrinsic growth rates. Once globally abundant, they have been locally extirpated from much of their historical range over the last 200 years. However, due to their iconic and unique appearance, sawfish rostra are often well represented in museum collections around the world. Archival sawfish tissues can supplement contemporary samples in population genetic studies as well as assess the susceptibility of this coastal elasmobranch to genetic erosion. This study will take advantage of DNA hybridization gene capture and next generation sequencing (NGS) techniques that are optimal for obtaining whole mitochondrial genome sequences from even degraded tissues typical of historical specimens. A total of 163 samples representing 5 ocean basins will be used to examine, characterize and contrast genetic variation in historical and contemporary sawfish populations. Results will be used to identify contemporary management units and provide a historical baseline to guide global and regional sawfish conservation strategies.

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## **1002 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Sarah Huber, Peter Konstantinidis, Eric Hilton, Deborah Steinberg

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

### **Lessons Learned from Larval Fish Workshops at the Virginia Institute of Marine Science's Nunnally Ichthyology Collection**

The Nunnally Ichthyology Collection at VIMS is conducting a project aimed at safeguarding its large collection of larval fishes, with the goals of: 1) improving storage of specimens; 2) identifying specimens; and 3) cataloging specimens and linking associated environmental data and images in a publicly accessed database. As part of this project, VIMS hosted two workshops (October 5-16, 2015, and June 6-17, 2016) for students, collection managers, research scientists, and volunteers. Participants learned how to sort and identify larval fishes, acquired information on preparation, storage, and curation of larval-fish collections, and learned imaging techniques. Here we present the results of these workshops, including assessment data on participant preparedness and the numbers of fishes that were processed. In October 2015, thirteen participants identified 4,694 individual fishes in 811 lots, comprising 100 families; nine of these families were new additions to the VIMS Collection. At the end of the workshop participants felt significantly more prepared to identify larvae, access identification

resources, store/organize collections, digitize specimens, and clear and stain larval fishes. A repeated theme in many comments on post-workshop assessments echoed the importance of the hands-on nature of this workshop, with immediate practice in identification of a broad diversity of larval fishes under the watchful eyes of internationally recognized larval fish taxonomists. Results of the June 2016 workshop will also be presented.

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## **0663 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jessica Hultberg, Stephen Drozda, John Steffen

*Penn State Behrend, Erie, PA, USA*

### **Sexual Dichromatism in Painted Turtles**

Sexual dichromatism is used for intersexual and intrasexual communication in many different species of animals. The purpose of this experiment was to determine if male and female turtles differ in red, yellow and UV colors. Painted turtles were collected in various ponds around Erie County. All the turtles were marked and their colors on various spots on their body were measured using reflectance spectrometry. The data collected from spectrometry ranged from 300 to 700nm. Male turtle chin stripes showed greater yellow chroma and overall brightness than females, greater leg stripe UV chroma than females, and greater neck stripe UV and carotenoid chroma than females. This suggests that turtles may use skin and shell color to indicate sex.

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## **0939 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Elizabeth Hunt<sup>1</sup>, Stuart Willis<sup>1</sup>, Kevin Conway<sup>2</sup>, David Portnoy<sup>1</sup>

<sup>1</sup>*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*, <sup>2</sup>*Texas A&M University, College Station, TX, USA*

### **Inferring the phylogenetic relationships within two genera of fishes: insights into the biogeography of the northern Gulf of Mexico**

A suture zone can be defined as a geographic area where there is overlap between faunal assemblages and in which pairs of sister species may come back into contact and experience hybridization. While identifying these areas in terrestrial and freshwater environments is an active area of research, barriers to dispersal in the marine environment are less apparent. In the northern Gulf of Mexico (GOM) at least 15 putative sister taxa meet, with some evidence of hybridization, in an area roughly centered on Mobile Bay (~88°W), consistent with the presence of a northern GOM suture-zone, despite no obvious historical barriers. The present study aims to use enrichment of ultra-conserved DNA elements and next-generation sequencing to generate a robust phylogenetic hypothesis for *Ogcocephalus* batfishes and *Spheroides*

pufferfishes, two genera with sister taxa distributed on either side of the hypothesized suture zone. Resolving phylogenetic relationships within each genus will provide the necessary context to test the hypothesis that each pair of putative species are indeed sister taxa experiencing introgression in this zone. Genealogical concordance within these taxa and others would also provide evidence of a shared historical biogeographic event that influenced gene flow. This study serves as a prerequisite for future studies focusing on patterns of gene flow and selection as it relates to the northern GOM suture zone.

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### **1034 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Nigel Hussey<sup>1</sup>, Amanda Barkley<sup>1</sup>, Jack Orr<sup>2</sup>, Robert Hodgson<sup>2</sup>, Steven Ferguson<sup>2</sup>, Aaron Fisk<sup>1</sup>

<sup>1</sup>University of Windsor - GLIER, Windsor, Ontario, Canada, <sup>2</sup>Fisheries and Oceans Canada, Winnipeg, Manitoba, Canada

#### **Tracking the impossible at depth: mark report satellite tags reveal a large-scale directed migration of Greenland sharks**

The complexity of studying deep-sea ecosystems has resulted in relatively little focused research compared to coastal and photic zones. The remoteness of the Arctic compounds this further resulting in major knowledge gaps for a region heavily impacted by climate change and increasing anthropogenic activity. In a novel approach to track Greenland sharks (*Somniosus microcephalus*), multiple mark report (mrPATs) and a pop up archival (miniPAT) satellite tag were attached to five individual sharks in Seineos Fjord, the high Arctic. The tags were set to release every  $8 \pm 2$  days (mean  $\pm$  SD) over a total of  $38 \pm 4$  days, resulting in five locations for three sharks and four locations for the last two. All tags successfully transmitted accurate locations within the first day of transmission except one. The tags revealed a highly directed movement of Greenland sharks traversing northern Baffin Bay from Jones Sound to Northwest Greenland that was consistent in time and distance among individuals. This is the first study to successfully track the continuous horizontal movements of Greenland sharks over large distances, and opens a new avenue for studying horizontal movements of deep-water species. The recorded temperature and depth time series data, combined with locations, also provide a tool to examine bathymetric and vertical temperature profile models to reconstruct horizontal movements. As deep-water species are typically some of the most vulnerable to over-exploitation as well as the most difficult to study, this new technology is providing a window into large-scale movements that can inform fisheries and conservation management.

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**0817 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Curtis Hutchinson<sup>1</sup>, Catherine Malone<sup>1</sup>, Gordon Schuett<sup>2</sup>, Warren Booth<sup>3</sup>

<sup>1</sup>Utah Valley University, Orem, UT, USA, <sup>2</sup>Georgia State University, Atlanta, GA, USA, <sup>3</sup>University of Tulsa, Tulsa, OK, USA

**Facultative Parthenogenesis in North American pitvipers**

Facultative parthenogenesis (asexual reproduction in a normally sexually reproducing organism) in reptiles has been gaining attention and appears to be quite prevalent in advanced snakes, such as pitvipers. Up to this point, parthenogenesis has been reported (through genetic confirmation or captive records) in three species of rattlesnake, *Crotalus horridus*, *C. unicolor*, and *C. viridis*, as well as three other pitvipers, the Copperhead (*Agkistrodon contortrix*), cottonmouth (*A. piscivorus*) and Fer-de-lance vipers (*Bothrops asper*). In an attempt to increase the knowledge and understanding of this reproductive phenomenon in advanced snakes, we will report on molecular analysis of four rattlesnake species, for which facultative parthenogenesis has gone previously undocumented. The four species of rattlesnake that we tested were: two specimens of Mexican Dusky rattlesnake (*C. triseriatus*), three specimens of Eastern Diamondback (*C. adamanteus*), two specimens of Prairie rattlesnake (*C. viridis*) and five of Western Massasauga (*Sistrurus tergeminus*). Blood and skin shed were collected from the 12 individuals, from which DNA was extracted and PCR performed for 18 different microsatellite loci. Genotypes were visualized and scored using the Li-Cor gel imaging system and analyzed for heterozygosity between mother and offspring within the same species.

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**0361 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jacob Hutton, Kate Donlon, William Ensign

Kennesaw State University, Kennesaw, Georgia, USA

**The Diets of Cave Salamanders (*Eurycea lucifuga*) from Pigeon Mountain Examined Using Non-Lethal Gastric Lavage Techniques**

The Cave Salamander, *Eurycea lucifuga*, is a lungless plethodontid salamander broadly distributed in the southeastern United States. *Eurycea lucifuga* life history is well documented, but diet studies are limited and there is no information on fall diets. This study investigates fall diets of *E. lucifuga* in northern Georgia caves using non-lethal gastric lavage methods. A total of 31 prey items from five invertebrate orders were identified. Overall, we found less diversity than previous studies which is likely due to differences in sampling techniques and seasonal changes in insect availability. The stomach contents frequently had mucus coated boluses of non-prey items. Similar boluses have been observed in other studies and suggest that *E. lucifuga* has less than complete success in its attempts at prey capture.

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