

Abstracts

Krabbenhoft-Nash



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0592 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

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Development of Genetic Markers for Sex Determination, Parentage Assessment, and Population Genetics of Razorback Sucker, *Xyrauchen texanus* (Cypriniformes: Catostomidae)

We present results from a RAD-seq study of 192 individual razorback (*Xyrauchen texanus*) and flannelmouth suckers (*Catostomus latipinnis*). RAD-seq data were used to identify single nucleotide polymorphisms (“SNPs”) for parentage analysis, and hybridization and population genomic studies of the Federally Endangered razorback sucker. Samples included adult males and females, which allowed us to identify potential sex-specific markers for genetic sex identification. We map putative sex-linked markers in razorback to the zebrafish (*Danio rerio*) genome to test whether a previously identified sex-determining region on chromosome 4 in zebrafish is also found in catostomids.

0586 Fish Genetics, Trinity, Saturday 15 July 2017

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Transcriptomics Identifies Genes Associated with Phenotypic Differences among Great Lakes Ciscoes (*Coregonus* spp.)

We sequenced expressed genes (“transcriptome”) from the heads of eight individuals from each of the four species of ciscoes found in Lake Superior (*Coregonus artedii*, *C. hoyi*, *C. kiyi*, and *C. zenithicus*). This approach identified sequence polymorphisms (SNPs) within many expressed genes. A number of these SNPs were taxonomically informative (e.g., $F_{ST} > 0.20$) and comparison annotated fish genomes indicated that many of these genes are associated with lipid metabolism (associated with buoyancy and depth preferences) and head shape development (associated with trophic morphology). Patterns of variation in the transcriptome were largely concordant with morphological differences among samples. High- F_{ST} SNPs in genes associated with functional phenotypic variation provide candidates for local adaptation in the cisco species flock. Future studies will be aimed at validating these results with larger sample sizes and more detailed functional genetic analyses.

**0519 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II,
Trinity, Friday 14 July 2017**

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Differentiating Between Invasive and Native Populations of Bighead and Silver Carp Using MS-AFLP

Invasive species often face the challenge of overcoming reduced genetic diversity as a result of the founder effect and subsequent population bottlenecks. Epigenetic modifications, such as DNA methylation, have been shown to contribute to phenotypic variation and may be responsible for the ability of invasive species to rapidly adapt to novel environments despite reduced genetic diversity. Silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*H. nobilis*) are two species of invasive carp native to freshwater rivers in eastern Asia. They were introduced to the United States in the early 1970s, and both species have quickly become established in many rivers throughout the United States, including the Illinois River. These two species of invasive Asian carp pose a significant threat to native biota, as well as to lucrative trout and salmon fisheries in the Great Lakes. To test whether the success of silver and bighead carp in the United States is due to increased epigenetic variation, methylation sensitive AFLP (MS-AFLP) markers were used to screen for the presence of DNA methylation. Variation in methylation states between invasive populations of silver and bighead carp from the Illinois River were then compared to populations of carp from the Yangtze, Pearl, and Gan Rivers in their native China.

0217 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Brazos, Friday 14 July 2017

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Local Adaptation Does Not Lead to Genome-Wide Differentiation in Lava Flow Lizards

Adaptation to novel environments can lead to genome-wide divergence when reproductive isolation accumulates between differentially adapted populations. However, local adaptation can also occur without the accumulation of reproductive isolation and correlated genome-wide divergence. Here we study natural replicates of three lizard species on lava flows in the US Chihuahuan desert to investigate the relationship between local adaptation and genomic differentiation. We compare lava and non-lava populations on three different lava flows, which range in age from 5,000 to

750,000 years-old. We collected phenotypic data and find that, although all populations were reported as melanistic in the literature, only lizards on the youngest and most homogeneously dark lava flows are significantly darker than surrounding non-lava flow lizards. Lizard coloration thus appears to lighten over time as lava flows become older and more interspersed with light sand. However, despite local adaptation to lava flow environments, none of the population comparisons show genome-wide differentiation among habitat types. We collected RADseq data and find only patterns of isolation by distance without any added genetic discontinuities based on habitat transitions. Thus, in this system, genome-wide differentiation does not accompany local adaptation. We discuss our results in the light of peripatric color evolution, the genetics of adaptation and selection-migration balance.

0487 SSAR SEIBERT CONSERVATION, San Antonio, Friday 14 July 2017

Chelsea Kross, JD Willson

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Effects of non-native vegetation on larval development of a prairie specialist, the Crawfish Frog (*Lithobates areolatus*)

Land-use change is a primary cause of amphibian population declines. Many natural landscapes have been altered for agricultural or urban land-use, resulting in loss or degradation of habitat. Furthermore, nearby land-use change can impact intact breeding wetland vegetation composition. However, the mechanisms by which vegetation alteration impacts amphibian demography are poorly understood, particularly for prairie-associated species. We used a mesocosm approach to investigate how vegetation composition (native prairie or non-native agriculture-associated vegetation [tall fescue grass; *Festuca arundinacea*]), surrounding breeding wetlands and timing of oviposition affected development of the Crawfish Frog (*Lithobates areolatus*), a prairie specialist of conservation concern. Specifically, we measured survival, time to metamorphosis, and size and mass at metamorphosis of larvae added to tanks either 7- or 22-days post-litter addition. We found that larval survival differed between litter types in the 7-day oviposition treatment, with nearly 100% mortality in the fescue grass treatments. Conversely, survival rates were similar across litter types in the 22-day treatment (~43%), and larvae in fescue litter metamorphosed more quickly and were larger post-metamorphosis than larvae raised in prairie vegetation. To investigate mechanisms for mortality in the fescue grass treatment, we conducted a subsequent experiment examining the effects of litter type on dissolved oxygen concentrations. We found very low DO concentrations (<2.0 mg/L) in fescue treatments persisting up to two weeks post-litter addition. These results suggest that amphibian breeding ponds in agricultural landscapes can support successful breeding, but could be ecological traps when timing of inundation and breeding occur simultaneously.

0078 SSAR SEIBERT CONSERVATION, San Antonio, Friday 14 July 2017

Ariel Kruger, Peter Morin

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Green Frogs Harbor Microbes that Inhibit *Batrachochytrium dendrobatidis*, a Deadly Fungal Pathogen

The cutaneous microbial community can influence host health in amphibians exposed to *Batrachochytrium dendrobatidis* (*Bd*), a fungal pathogen that is a main cause of current amphibian declines. Bacteria isolated from amphibian skin have been shown to confer disease resistance by inhibiting *Bd* growth. Identifying anti-*Bd* cutaneous microbes for use in bioaugmentation strategies is increasingly important with the spread of *Bd*. We aimed to determine if green frogs harbored bacterial strains that inhibit *Bd in vitro* and whether the presence of these microbes varied by site. We swabbed and cultured microbes from the skin of green frog adults and tadpoles at three sites that varied in pH. Bacterial colonies were used in *in vitro* assays to determine if isolated bacteria could inhibit *Bd*. Tadpoles and adult green frogs at all sites harbored cutaneous microbes that completely inhibited *Bd* growth *in vitro*. Green frog adults and tadpoles at the near-neutral pH site harbored the largest number of unique isolates (ANOVA, $p=0.11$). At each site, tadpoles harbored a higher frequency of inhibitory isolates than adults, but the differences were not significant across sites (ANOVA, $p=0.53$). In this study, we identified bacteria that could be used as probiotics applied to the skin of susceptible individuals to confer disease resistance and showed that sites that vary in pH do not differ in the frequency of inhibitory isolates present on amphibian skin. Understanding how the cutaneous microbiome changes across sites and life stages will inform conservation strategies for protecting amphibians against *Bd*.

0156 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Trinity, Friday 14 July 2017

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Ontogeny of the Pectoral Spine in Siluroid and Loricarioid Catfishes

Catfishes (Siluriformes) are characterized by several skeletal autapomorphies including the modification of the anteriormost pectoral-fin ray into a lockable spine. This pectoral-fin spine exhibits wonderful variation in size, shape and ornamentation (including serrations, denticulations and presence of odontodes). Numerous studies have investigated different aspects of the spine in adult stages, including how it locks into place, how it grows through the addition of distal segments and, how it is involved in the production of sound in some taxa. Though well studied in adult stages, relatively little information is available on the early development of the catfish pectoral-fin spine. In order to further our understanding of this unique structure, we document and

compare the earliest stages of pectoral-fin spine formation in representative siluroid (*Noturus gyrinus* and *Ictalurus punctatus*) and loricarioid (*Corydoras panda* and *Ancistrus* sp.) catfishes using a combination of clearing and double staining and serial sectioning. Despite being quite different in the adults, formation of the pectoral-fin spine appears to follow a common ontogenetic pathway independent of the species.

0325 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES SYMPOSIUM - APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

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Variation in Sensory Morphology of Scalloped Hammerhead Sharks *Sphyrna lewini* and Trophic Implications

Though the variation in the design of the shark is vast, few iterations are as bizarre or recognizable as the hammerhead's laterally expanded and dorsoventrally flattened heads, termed a "cephalofoil." The uniqueness of this structure among sharks has led to many theories positing its purpose, for instance, that the laterally positioned eyes and nostrils allow for greater sampling ability (klinotaxis) in this family of sharks. In order to assess intra-specific variation of gross morphology, which would identify the conserved or more variable features associated with sensory perception, the external features of the olfactory, optic and electrosensory systems of scalloped hammerheads, *Sphyrna lewini*, were analyzed. Thirty-two juvenile scalloped hammerhead heads were obtained from Panamanian fishermen and photographed for later analysis with ImageJ, and a small dermal tissue sample was saved for a $\delta N15$ and $\delta C13$ stable isotope analysis to assess trophic level. Preliminary results from multi-dimensional scaling indicate a high degree of similarity among the features that maximize possible sampling area (ex. Maximum Narial Distance) and among the features associated with more direct access of sensory information (ex. light, chemical traces) to receptor organs (ex. Narial Length or Eye Diameter), and both of these groups appear distinct from each other. This would seem to indicate a trade-off on the individual level between sensitivity-favoring and resolution-favoring individuals. The results from the stable isotope analyses will be included when they are available. An additional ontogenetic parameter will also be assessed if any adult *S. lewini* are collected by the time of presentation.

0332 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brianna Ladd, Jaime Alvarado-Bremer

Texas A&M Galveston, Galveston, TX, USA

Microsatellite Discovery in the Common Shovelnose Ray (*Glaucostegus typus*) using Massive Parallel Sequencing Data

The common shovelnose ray is a species of guitarfish found in the Indo West Pacific and is considered threatened by the IUCN redlist. The first documented successful live birth at the downtown aquarium in Houston, Texas yielded 11 stillborn pups with one female and two males of sexual mature size occupying the tank. This study is employing next generation sequencing technologies to identify any genetic polymorphisms that can be amplified using PCR. Primers for microsatellite markers are being used to determine paternity of the pups and to establish whether this species exhibits multiple paternity. Double digest-restriction associated DNA sequencing (ddRAD) was performed on one of the pups and bioinformatics analysis resulted in the identification of thousands of microsatellites. A panel of 15 microsatellites was selected based on certain criteria of optimality, and corresponding primer pairs were developed *in silico* using the QDD 3.1 software using a four step pipe-line in sequence. Additional primer pairs will be developed and tested on various other species of elasmobranchs.

0636 Lizard Conservation, Sabine, Saturday 15 July 2017

Travis LaDuc¹, Brad Wolaver¹, Ben Labay², Jon Paul Pierre¹, C. Michael Duran³, Toby Hibbitts⁴, Wade Ryberg⁴, Ian Wright¹, Matt Fujita⁵, Corey Roelke⁵

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Unraveling the Natural History of the Enigmatic Spot-tailed Earless Lizard (*Holbrookia lacerata*) through Collaborative Research

Little natural history data exists for the wary and infrequently seen Spot-tailed Earless Lizard (*Holbrookia lacerata*). In 2011, the US Fish and Wildlife Service (FWS) found substantial information that listing this species may be warranted. In 2013, the Texas Legislature earmarked money for research studies, through a program in the office of the Texas Comptroller of Public Accounts (TCPA), on species awaiting FWS listing determination. A group from The University of Texas at Austin and The Nature Conservancy were awarded one of the first grants under this new program to work on *Holbrookia lacerata*. Work initiated in 2014 focused on lizard surveys and creating models of lizard habitat and fragmentation of habitat. Because of the potential impacts of a future FWS listing of the lizard species, a species working group composed of stakeholders was organized by the TCPA to provide a direct line of communication between researchers and stakeholders. Following discussions within this group, additional data gaps were identified and approved for additional research funding. Collaborators from Texas A&M University and The University of Texas at Arlington have joined the group to expand field surveys and initiate genetic work. Studies on lizard diet and morphology as well as models projecting future habitat/development have been initiated. An invitation from the FWS to the research group to lead the

compilation of the Species Status Assessment for *Holbrookia lacerata* represents a significant step towards transparency and a paradigm shift in the FWS listing process.

0398 SSAR SEIBERT ECOLOGY II, Glass Oaks, Thursday 13 July 2017

Stephanie Lamb, Eric Liebgold

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Estimating Habitat and Population Parameters of Spotted Turtles (*Clemmys guttata*) on the Delmarva Peninsula

Habitat loss, habitat fragmentation, and the pet trade have led to the decline of many reptilian species, including spotted turtles (*Clemmys guttata*), which is a species of conservation concern in eastern North America. Little is known about populations of these turtles, including population sizes and habitat preferences. If the populations are small, this can cause: sex ratio biases, allee effects, increased nest predation, as well as inbreeding depression or genetic drift. I used mark-recapture methodology to study four populations of *C. guttata* on the Delmarva Peninsula in Maryland and Delaware. Program MARK was used to determine whether the encounter probability of *C. guttata* depends on sex or date, as well as, determines the model with the highest likelihood to estimate population size and sex ratio. I also analyzed habitat preferences, which is vital to understand as *C. guttata* is a habitat specialist. I found that pH, dissolved oxygen, and salinity did not affect *C. guttata* numbers, at least in the range of conditions we tested. These habitat parameters were also used to determine if there is an effect on the number of turtles captured in each breeding pond and the sex ratio. Population sizes were mostly small, with sex ratios varying throughout the season in breeding ponds. These results were used to discuss the implications for the future conservation status of *C. guttata* and how and where *C. guttata* should be managed on the Delmarva Peninsula.

0318 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Dirk Michael Lang¹, Maria del Mar Romero-Aleman², Maximina Monzon-Mayor²

¹*University of Cape Town, Cape Town, South Africa*, ²*University of Las Palmas, Gran Canaria, Spain*

Axon Regeneration in the Visual Pathway of the Canary Island Lizard, *Gallotia galloti*

Unlike mammals, many anamniotic vertebrates possess remarkable capacity for tissue repair and regeneration, including the central nervous system (CNS). Teleost fish and urodele amphibians can regenerate severed axons throughout the CNS, while axon regeneration in adult anurans appears restricted to the optic pathway. In reptiles, however, there is a paucity of data on post-injury processes in the CNS. We therefore studied regeneration of retinal ganglion cell (RGC) axons in the visual pathway of the

Canary Island lizard, *Gallotia galloti*. This species has a well-developed visual system, allowing for easy experimental manipulation of the optic nerve and behavioural testing. Using anatomical tracing techniques and immunohistochemical analysis, we detected first signs of re-growth of RGC axons two months after optic nerve transection (ONS). The axon regeneration process continued for the entire observation period of up to two years. Partial recovery of behavioural responses to visual stimuli was observed by one year after ONS. These observations suggest successful axon regeneration, but with an unusually prolonged time course. Against this background, we also studied the expression of neurite-growth inhibitory (NI) proteins, known to prevent CNS axon regeneration in mammals. Our findings indicate that major NI proteins are present, but fail to inhibit RGC axon re-growth in the lizard visual pathway. Up-regulation of axon growth-promoting extracellular matrix proteins (laminin and fibronectin) during the regeneration process was observed and may contribute to successful RGC axon regeneration in *Gallotia galloti*, making this lizard an interesting model for the study of CNS repair.

0674 Herp Environment, Brazos, Saturday 15 July 2017

Michael Lannoo¹, Rochelle Stiles²

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Effects of Short-term Climate Variation on a Long-lived Frog

Amphibians have long been considered sensitive indicators of environmental health, and amphibian body condition indices offer a high-resolution metric for tracking this relationship. At mid-continental sites, climate change involves temperature and precipitation extremes with rapid shifts. Recent research shows the effects of climate variation can vary at different temporal scales, and at small scales can drive selection. Here, we address the response of Crawfish Frogs (*Lithobates areolatus*), a long-lived frog, to short-term variations in temperature and precipitation. We assess climate using the Palmer Drought Severity Index (PDSI), and assess body condition using the scaled mass index (SMI). Over the seven years of this study, PDSI values were not correlated with date of first breeding ($r^2 = 0.36$, $P = 0.15$) or with date of peak breeding ($r^2 = 0.11$, $P = 0.47$), but were highly correlated with the date frogs exited breeding wetlands ($r^2 = 0.93$, $P < 0.001$) and, consequently, with length of breeding period ($r^2 = 0.98$, $P < 0.001$). SMI values ranged from an annual average of 90 g to 118 g in gravid females, and from 98 g to 125 g in pre-breeding males. Differences in SMI were positively correlated with PDSI values four months prior to breeding ($r^2 = 0.57$; $P = 0.048$). Fecundity also varied with PDSI, with an average difference in fecundity between wet and dry years of 2,662 eggs per female. This translates into an estimated difference of 137 breeding adults recruited into this population between wet and dry years.

0414 Lizard Ecology, Trinity, Sunday 16 July 2017

Matthew Lattanzio

Christopher Newport University, Newport News, Virginia, USA

Cool and Connected: The (Spatial) Thermal Ecology of a Montane Lizard

Laboratory data on the thermal sensitivity of performance traits are often used to provide insight into the fitness consequences of variable environmental conditions in nature. However, for territorial lizards exploiting thermally-heterogeneous habitats, individuals should vary in their ability to successfully exploit preferred thermal resources, favoring a population spatial structure where lizards may either cluster centrally around those resources or occupy more-isolated, peripheral areas. Consequently, those peripheral lizards should experience differing environmental conditions compared to centrally-positioned members of their population, which may ultimately affect their body temperatures (T_b) and the form of their thermal reaction norms. I addressed these considerations for adults of a territorial montane lizard species, *Sceloporus jarrovi*, with respect to the thermal sensitivity of their maximum bite force. In general, centrally-located lizards had smaller heads and lower maximal bite force and T_b values compared to lizards on the population periphery. My thermal performance curves revealed that bite force increases with head size, and central lizards had a wider performance breadth than peripheral lizards. Optimal bite force occurred at a T_b similar to that for other physiological traits, but also fell below their preferred T_b. Interestingly, only central lizards exhibited the cooler T_b values sufficient to attain their maximal performance capacity. In contrast, the higher T_b values and narrower performance breadth of peripheral *S. jarrovi* lizards may enhance their susceptibility to environmental variability. I frame my findings with respect to other ecological data on this population to highlight the potential influence of socio-spatial dynamics on a species' thermal physiology.

0435 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kayla Lauger, Erika Nowak, Scott Nichols

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Preliminary Hematology Assessments in Narrow-headed Gartersnakes (*Thamnophis rufipunctatus*)

We examined hematology and plasma biochemistry parameters in captive populations of narrow-headed gartersnakes (*Thamnophis rufipunctatus*), focusing on blood cell types that typically serve as indicators of infection. *T. rufipunctatus* is a federally threatened species with established breeding facilities to aid in species recovery. However, captive individuals in geographically distinct breeding facilities have had multiple incidences of infection, sometimes leading to mortality. Erythrocytes, leukocytes (e.g., lymphocytes, azurophils, heterophils etc.) and thrombocytes are often used as indicators of disease in reptiles as their relative numbers change in response to different kinds of infection.

Currently, no reference ranges exist for hematological values in *T. rufipunctatus*, which warrants cross-species comparisons. As such, we compared peak-season (May-August) hematological values in captive *T. rufipunctatus* to reference values for wild giant gartersnakes (*T. gigas*) and valley gartersnakes (*T. sirtalis fitchi*) as a preliminary assessment. We found that 1) median values for lymphocytes in *T. rufipunctatus* were 25% lower than *T. gigas*, and 50% lower than *T. s. fitchi*; 2) median values for azurophils for *T. rufipunctatus* were 33% lower than in *T. gigas*; and 3) median values for heterophils were 25% lower in *T. rufipunctatus* than *T. gigas*, and 20% higher than *T. s. fitchi*. Our preliminary analysis suggests that hematological reference ranges for other species of gartersnake are not appropriate for *T. rufipunctatus*. Establishing species-specific reference ranges for hematology and plasma biochemistry parameters from wild *T. rufipunctatus* may inform health assessments in captive breeding programs, improving conservation efforts.

0751 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Clay Laughrey, Carmen Montana, Christopher Schalk, Kelsey Kralman
Sam Houston State University, Huntsville, Texas, USA

Distribution of Larval Amphibians Along Environmental Gradients in Pond Microhabitats

Microhabitat use reflects a tradeoff between maximizing access to resources while minimizing exposure to antagonistic interactions. Understanding the microhabitats utilized by various organisms is essential in determining how interactions between coexisting species scale up to affect freshwater community structure. Herein we present results from microhabitat surveys in two East Texas fishless ponds, which vary in their habitat heterogeneity. From January 2017 – June 2017, we used a pipe sampler to survey larval amphibians and macroinvertebrates along gradients of water depth and substrate diversity. We measured ten abiotic factors and quantified species richness and abundance at each microhabitat sample. Species richness and abundance were higher in Pond 1, which had greater microhabitat heterogeneity and less canopy cover. In both ponds, tadpole abundance and biomass increased with increasing water depth. We found that large-bodied predators (Order Odonata) occurred in microhabitats with deeper water, dense aquatic vegetation, and flat/sandy substrates. Shallow microhabitats typically contained small-bodied tadpoles. The large-bodied predator species may be displacing the smaller-bodied and more vulnerable organisms to shallower microhabitats. Our findings suggest that water depth, substrate type, and indirect effects by predators may influence distributions of co-existing larval amphibians in lentic environments.

0646 Reptile Conservation, Trinity, Sunday 16 July 2017

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The Cutting Edge: A Rapid Loss of Beach Front Habitat for Reptile Communities in Costa Rica

Costa Rica hosts nearly 6% of the world's biodiversity despite being only the size of West Virginia. As a country lined with beaches on both coasts, much of this biodiversity relies on coastal habitats. This is no different with Playa Tortuga on the Pacific Coast in Ojochal, Osa Region, Costa Rica. Playa Tortuga holds a unique position tucked up against the mountains and at the mouth of the Térraba River, the largest in Costa Rica. Over the past few years, Playa Tortuga has had noticeable loss in beach, threatening shoreline vegetation and reducing eligible habitat for two species of sea turtles and multiple species of snakes and lizards. Resident research organization, Reserva Playa Tortuga, in collaboration with the Jekyll Island Georgia Sea Turtle Center, used low-cost repeatable techniques to quantify erosion on Playa Tortuga from August 2016 to December 2016, the peak of the rainy season. After only two months, the beach experienced a loss of over 13,000 square meters and by the end of the four months over 15,000 square meters had been lost, along with multiple trees and other vegetation. This rapid beach dynamic threatens the stability of the coastal habitat and the wildlife that relies upon it. Using real time data over a four-month interval allowed for mapping of trends, hotspots, and rates of loss providing insight into possible causes and future management plans that can be extended to U.S. coastlines experiencing rapid erosion.

0246 Lizard Ecology, Trinity, Sunday 16 July 2017

Daniel Leavitt¹, Christopher Schalk²

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Functional perspectives on the dynamics of desert lizard assemblages

New perspectives of community disassembly and reassembly have emerged as environments depart from baseline conditions. A trait-based approach can provide insights as to how changes affect performance of a species and their subsequent response in an assemblage. We quantified dynamics in lizard species and functional diversity in Big Bend National Park (BBNP), USA. BBNP was subjected to and then released from intensive grazing, which has resulted in changes to vegetative composition and cover. We examine changes in local assemblages in the context lizard functional traits, including thermal niche breadth. We hypothesized that temperature specialists were more likely to colonize or be lost from local sites. Species richness was lowest in the 1950s (N = 3 species), and subsequent surveys revealed that species richness increased in both the 1960s and 2000s (N = 6 and N = 8 species, respectively),

but not all sites responded uniformly. Functional diversity in this system was not affected by this drastic increase species richness, indicative of functional redundancy in species traits. Lizards that were added to sites tended to be smaller bodied with lower thermal tolerances. Lizards with high preferred body temperatures were locally extirpated from high elevation sites that experienced high shrub encroachment, likely due to a reduction in the preferred thermal gradients these species. These results reveal that long-term desert lizard functional diversity was maintained, but the consequences of changes to functional diversity at the local scale need to be examined further.

0085 ASIH STOYE CONSERVATION II, San Antonio, Friday 14 July 2017

Taylor Lee, Brook Fluker

Arkansas State University, Arkansas, USA

Environmental DNA vs. Traditional Sampling: a Case Study Using the Federally Threatened Leopard Darter, *Percina pantherina*

Traditional methods may not always be reliable when sampling for rare or endangered species. However, the recent development of environmental (e)DNA techniques represents a valuable tool to help counteract inefficiency associated with traditional sampling. One example for which eDNA may be valuable in the detection of a rare species of fish is that of the Leopard Darter, *Percina pantherina*. This federally threatened fish, endemic to the Little River system in Arkansas and Oklahoma, is experiencing a decrease in genetic variation due to drastic population decline. Traditional sampling has failed to detect *P. pantherina* in the Robinson Fork since 2006 and in the Cossatot River since 2011 in annual surveys. The objectives of this project are as follows: 1. compare the effectiveness of eDNA water and substrate sampling techniques; 2. compare potential differences in detectability of *P. pantherina* between eDNA, and traditional methods; and 3. determine if there are extant populations of *P. pantherina* in the Cossatot River and Robinson Fork. Species-specific primers that amplify a fragment of the cytochrome *b* gene were designed and revealed a high degree of specificity for *P. pantherina*. Using PCR, these primers were used to test detectability of *P. pantherina* from eDNA samples. Traditional sampling during 2016 resulted in zero detection of *P. pantherina* within our focal systems. Preliminary eDNA results suggested possible positive hits for *P. pantherina* in all four seasons from 2016.

0818 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Dana Leigh¹, David Mifsud², Maegan Stapleton², Katherine Greenwald¹

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Genetic Diversity and Effective Population Size of Mudpuppy Salamanders (*Necturus maculosus*) in the St. Clair-Detroit River System

Mudpuppy salamanders are experiencing declines in many parts of their range due to habitat degradation, influx of invasive species, lampricide application, and over-collection. Therefore there is a pressing need to assess the extent of declines and the effective population size of remaining populations. Our study focuses on assessing the genetic structure of past (1990s) and present-day mudpuppy populations in the St. Clair-Detroit River System. We will examine genetic diversity, population structure, and effective population size using microsatellite data. We predict that populations in more isolated or degraded areas will have significantly lower genetic variation and lower effective population size, and will show signatures of recent declines. We also predict reduced genetic diversity in present-day populations when compared to samples collected thirty years ago. Understanding the genetic structure of mudpuppy populations will allow for conservation initiatives targeting those populations most in need of management action.

**0615 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES
CARRIER AWARD**

Samantha Leigh, Donovan German

University of California, Irvine, Irvine, CA, USA

The Resource Acquisition Strategies of Seagrass-eating Bonnethead Sharks

Sharks have guts optimized for digesting high-protein/high-lipid foods, including many teleosts that humans depend on as food and economic resources. Conversely, omnivores face the difficulty of digesting foods that are low in protein and lipid, and are sheathed in rigid cell walls. Interestingly, the bonnethead shark (*Sphyrna tiburo*) is known to consume copious amounts of seagrass (up to 62% of gut content mass), yet maintains a gut that morphologically reflects its carnivorous ancestry. The objective of this project is to investigate *S. tiburo* digestion to understand whether they can digest seagrass. Bonnethead sharks were held in captivity and fed a 90% seagrass diet equaling 5% of their body weight daily for three weeks. By growing seagrass in chambers enriched with $^{13}\text{CO}_2$, the seagrass tissues become labeled with ^{13}C . Blood drawings from the sharks will show (via stable isotope analysis) whether they are assimilating nutritional components of the seagrass. The activities of various digestive enzymes (amylase and cellulase) were measured to determine if bonnetheads have the biochemical tools capable in aiding with seagrass digestion. Growth rate, along with digestibility of seagrass macronutrients were also measured. Preliminary results show that 56% of the total organic matter in seagrass is digested by *S. tiburo*. Since seagrass is approximately 60% fibrous material (cellulose), it is clear that *S. tiburo* are retaining some of the nutrients in seagrass. This project could provide groundbreaking evidence that bonnethead sharks, animals that were previously thought to be solely carnivorous, can benefit from the digestion of seagrass.

0627 AES GRUBER AWARD I, Wedgewood, Thursday 13 July 2017

Samantha Leigh¹, Sarah Hoffmann², Adam Summers³, Donovan German¹

¹University of California, Irvine, Irvine, CA, USA, ²Florida Atlantic University, Boca Raton, FL, USA, ³University of Washington, Friday Harbor, WA, USA

Spiraling into Control: Investigating the Function of the Spiral Intestine in Elasmobranchs

Elasmobranchs (sharks, skates and rays) have an expansion of the intestine that contains a convoluted internal structure called the spiral intestine (SI). It has been supposed, with little basis, that the SI in sharks slows digesta transit rate. We experimentally tested the flow rate using water. The flow rate is slowed by 3.5x through the SI as compared to the straight tube of the proximal intestines (PI) in *Squalus suckleyi*, *Sphyrna tiburo*, *Sphyrna lewini*, and *Carcharhinus limbatus*; four species with radically different intestinal morphology. We found resistance is higher in the SI compared to the PI. In the SI, resistance is higher in the reverse direction, which helps maintain anteroposterior directional flow. We measured the contraction rate of the intestinal smooth muscle of *S. suckleyi*, and found that an average of 48 contractions is necessary for complete transit of a medium viscosity (20 Poise) substance. Finally, we provided the first 3D images of spiral intestines for *S. suckleyi*, *Dasyatis say*, *Rhinoptera bonasus*, and *Sphyrna tiburo*. These 3D reconstructions from CT scans of lyophilized spiral intestines provide a modern replacement for the heavily cited Parker (1885) illustration. This investigation provides a new way of quantifying intestine volume, surface area created by the intestinal folds, and visualizing how flow may occur through the spiral structures. We also provide a mechanism for the quantification of the functional morphology of the SI and open the door to examining the function of the gastrointestinal tract of fishes and sharks through both experimentation and modeling.

0577 Turtle Conservation, Sabine, Saturday 15 July 2017

Erin Levesque, Andrew Grosse

South Carolina Department of Natural Resources, Charleston, SC, USA

An Evaluation of Culturing Diamondback Terrapins, *Malaclemys terrapin*, in Charleston, SC

During the 2014-2016 mating/nesting season (May through July), viable clutches (1,089 eggs total) from 130 *Malaclemys terrapin* females captured in trammel nets and viable clutches from 24 land-captured terrapins were collected and incubated at either male-producing (27°C) or female producing (31°C) temperatures. There was no difference in hatching success between these groups ($p > 0.05$). There was a positive correlation with larger females producing more eggs per clutch and a greater mean egg size. Growth of hatchlings in Year 1 fed one of three diets (fresh fish, ZooMed pellets, or Mazuri pellets) was assessed from October 2014 through April 2015 to evaluate feed type; both groups fed commercial pelleted diets grew significantly more than those fed fish only. A total of

411 “headstarted” (juveniles raised in a hatchery to accelerate growth) terrapins and 227 hatchlings have been released into the Charleston Harbor Estuarine system since 2014. Seventy-seven individuals have been retained to confirm sex, and twenty-three remain in a culture pond at the Waddell Mariculture Center for future investigations of accelerated time to maturity of head-started individuals. Results from this study provided information about how to efficiently capture females, harvest eggs and grow hatchlings/juveniles in order to supplement depleted wild populations. Access to the large number of hatchlings and juveniles that can be cultured in the laboratory also allows investigation of the biology of these naturally cryptic life stages that will allow us to better manage wild populations.

0616 Lizard Conservation, Sabine, Saturday 15 July 2017

Brenna A. Levine, Marlis R. Douglas, Whitney J. B. Anthonysamy, Casey Brewster, Hayden D. Elliot, Michael E. Douglas

University of Arkansas, Fayetteville, AR, USA

Contemporary Population Connectivity of the Eastern Collared Lizard (*Crotaphytus collaris collaris*) in Arkansas

The Eastern Collared Lizard (*Crotaphytus collaris collaris*) is a species of conservation concern in Arkansas. Although historically common, suppression of the natural fire regime has resulted in fragmentation and loss of the glade habitat the species depends on. Remnant populations are small and isolated, and are hypothesized to experience little or no gene flow and high levels of genetic drift. To stem further decline, habitat restorations were initiated in Arkansas, but despite these efforts, recent extinctions of local populations have been documented. Translocations among sites are planned to supplement populations and increase genetic diversity through managed gene flow. Prior to such actions, and to avoid negative consequences of outbreeding depression, it is necessary to understand genetic structure and contemporary connectivity among remnant populations. To generate a genetic baseline against which to gauge effects of conservation actions, DNA samples (N = 282) were collected from 15 locations in Arkansas over a five-year period (2011 = 2016) and genotyped at 10 polymorphic microsatellite loci. Bayesian assignment identified eight distinct gene pools and F_{ST} analyses revealed significant genetic structure at both local and regional scales. Genetic divergence was not a function of geographic distance between sites, but likely due to genetic drift. These findings underscore the importance of evaluating genetic structure and connectivity prior to translocations when remaining populations are small and fragmented, as in the case of Eastern Collared Lizard in Arkansas.

0606 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brenna A. Levine¹, Marlis R. Douglas¹, Julie A. Savidge², Bjorn A. Lardner², Robert N. Reed³, Michael E. Douglas¹

¹University of Arkansas, Fayetteville, AR, USA, ²Colorado State University, Fort Collins, CO, USA, ³United States Geological Survey, Fort Collins, CO, USA

Preliminary Estimates of Relatedness and Kinship in an Experimental Population of Brown Treesnake (*Boiga irregularis*) on Guam

The highly invasive Brown Treesnake (*Boiga irregularis*; 'BTS') has caused ecological and economic harm to Guam since its accidental introduction following World War II. Evaluation of existing control is necessary to ensure that these approaches maintain their efficacy over time. Current BTS control is largely accomplished by baited traps as well as by visual detection and removal by hand. Yet, there is individual heterogeneity in susceptibility to these control efforts, some of which is unexplained by capture-mark-recapture models. The variation among individuals in susceptibility to these methods prompts concern that existing approaches may inadvertently select for a population that is refractory to trapping. But are close kin more similar to each other in trappability than are non-kin, and is this vulnerability a heritable trait? Population genomic approaches, combined with relatedness and kinship analyses, can yield accurate identification of relationships among individuals. Capture histories and trapping data can then be analyzed in the context of relatedness estimates and kinship assignments to address the above questions. Here, we present preliminary estimates of relatedness and kinship among 300 BTS, sampled from a closed, experimental population on Guam, as estimated via analyses of thousands of single nucleotide polymorphisms that were identified by Illumina sequencing of double-digest restriction site associated DNA (ddRAD). Juxtaposition of relatedness and kinship estimates with capture and trapping data will provide insight into whether trappability is a heritable trait.

0181 Reptile Conservation, Trinity, Sunday 16 July 2017

Craig Lind¹, Ignacio Moore³, Jeffrey Lorch⁴, Terence Farrell²

¹Stockton University, Galloway, NJ, USA, ²Stetson University, Deland, FL, USA, ³Virginia Tech, Blacksburg, VA, USA, ⁴USGS National Wildlife Health Center, Madison, WI, USA

Patterns of Circulating Corticosterone in a Population of Rattlesnakes Afflicted with Snake Fungal Disease: Stress Hormones as a Potential Mediator of Seasonal Cycles in Disease Severity and Outcomes

Fungal pathogens are often associated with a physiological stress response mediated by the hypothalamo-pituitary-adrenal axis (HPA), and afflicted individuals may incur steep coping costs. Nothing is known regarding how snake fungal disease (SFD) relates to HPA activity, or how seasonal shifts in environment, life history, or HPA activity may interact to drive seasonal patterns of infection severity. To test the hypothesis that SFD is associated with increased HPA activity and to identify potential environmental or

physiological drivers of seasonal infection, we monitored corticosterone, severity of SFD clinical signs, innate immune function, foraging success, body condition, and reproductive status in a population of pigmy rattlesnakes afflicted with SFD. Both plasma corticosterone and the severity of clinical signs of SFD peaked in the winter. Corticosterone levels were elevated and immunocompetence was low in the fall prior to the seasonal rise in SFD severity. Snakes with severe clinical signs were in low body condition and had elevated corticosterone levels compared to uninfected snakes and those with moderate clinical signs. The severity of SFD in the population was negatively related to population-wide estimates of foraging success, body condition, and temperature, and positively correlated with corticosterone levels. Females with clinical signs of SFD were less likely to enter reproductive bouts compared to females without obvious disease. We propose the hypothesis that the seasonal interplay among environment, host energetics, and HPA activity initiates tradeoffs in the fall which drive the increase in SFD prevalence and severity of clinical signs observed in the population through winter.

0483 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Craig Lind², Fatima Ramis¹, Donna-Jael Paredes¹, Ignacio Moore³, Terence Farrell¹

¹Stetson University, DeLand, FL, USA, ²Stockton University, Galloway, NJ, USA,

³Virginia Tech, Blacksburg, VA, USA

Does maternal Energetic Status, Corticosterone, or Arginine Vasotocin Influence Maternal Care in the Rattlesnake, *Sistrurus miliarius*?

Pitvipers, including pigmy rattlesnakes, display maternal care of free living offspring. We examined the relationships among maternal energetic status, stress hormones, arginine vasotocin (AVT), and maternal care in postpartum pigmy rattlesnakes. We collected 31 pregnant *S. miliarius* in Volusia County, Florida and held them in field enclosures until parturition. We manipulated AVT by intraperitoneal injection and measured both circulating corticosterone (cort) and body condition index (BCI) in postpartum rattlesnake mothers. Mother-offspring spatial relationships were analyzed to measure aggregation for four days after parturition. Despite large variation in postpartum energetic status, no significant relationship between maternal body condition and cort was observed in rattlesnake mothers, and no significant relationship was evident between cort and the level of maternal association with offspring. Our results did not support the hypothesis that energy limited mothers have elevated cort, or that cort is negatively related to maternal care. Injection of AVT did not stimulate maternal care. There was a strong and repeatable positive relationship between postpartum energetic status (BCI) and the level of maternal association. The lack of a significant correlation between BCI and cort indicates that a postparturient glucocorticoid response did not drive the body condition-dependence of association with offspring. We are currently conducting an experimental investigation of the

impacts of supplemental feeding of pregnant females to better understand the relationship between energetic status and the quality of maternal care in rattlesnakes.

0407 ASIH STOYE CONSERVATION II, San Antonio, Friday 14 July 2017

Luke J. Linhoff, Maureen A. Donnelly

Florida International University, Miami, Florida, USA

Evidence of domestication processes in captive-bred amphibians and implications for conservation reintroductions

Captive-bred animals reintroduced to the wild may have lower survival or fitness than wild-born translocated animals because of maladaptive behaviors or physiology derived from captivity. Experiential or genetic changes caused by domestication selection processes may lead to innate and learned behaviors that differentiate captive-bred animals from wild conspecifics. While modern amphibian conservation utilizes captive breeding programs for dozens of threatened species, almost nothing is known about how domestication processes in these programs might impact amphibians, or how domestication may affect reintroduced individuals. We will present the results of three experiments comparing captive-reared and wild anurans (*Dendrobates auratus* and *Oophaga pumilio*). We hypothesized that captive bred amphibians may become 1) habituated to a looming stimulus (e.g. hand entering a cage) that is similar to an approaching predator, 2) develop a reduced tonic immobility defensive response resulting from frequent handling, and 3) exhibit an altered basal metabolic rate from little thermal variation in a captive environment. To test our first hypothesis, we recorded animal's responses when presented with an overhead computer monitor that displayed a looming stimulus that simulated a swooping predator. Second, we compared the anuran's frequency and length of tonic immobility behaviour under a simulated predatory event. Lastly, we compared the anuran's basal metabolic rates during the simulated predatory event. Our experiments showed the first quantitative evidence of the effects of domestication on amphibians, which has broad implications for amphibian ex situ conservation.

**0130 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD:
PHYSIOLOGY & MORPHOLOGY; Poster Session I, Rio Grande Exhibit Hall,
Friday 14 July 2017**

Allison Litmer, Chris Murray

Tennessee Technological University, Cookeville, TN, USA

**The Critical Thermal Capacity of Dispersal: Comparative Niche Breadth
Among Populations of Mediterranean Gecko (*Hemidactylus turcicus*)**

Niche theory and the theory of island biogeography have provided widely accepted explanations for patterns of dispersal, ecological community structure, and geographic distribution. By combining these two theories, trends among distribution and population attributes become apparent. The fundamental niche, and the breadth of that niche, result from evolution on multiple individual traits. Recent work in evolutionary physiology has correlated niche breadth with climatic variation experienced by a lineage. Thus, we can predict that dispersal is constrained by physiological parameters. Dispersing individuals may encounter novel environments and if the physiological capacity to withstand such changes is present then colonization may occur. Therefore, successful dispersers may have broader fundamental niche breadths than non-dispersers. I hypothesize that physiological niche breadth is positively correlated with the distance from the core or "mainland" of a species distribution. Alternatively, niche breadth is correlated with genetic variation, which is known to be greater at the core of a species' population or distribution, and the physiological niche breadth could be negatively correlated with distance from the core of a species distribution. I aim to use comparative assessments of the critical thermal capacity among populations of the invasive Mediterranean gecko (*Hemidactylus turcicus*) to test this idea.

0679 ASIH STOYE ECOLOGY & ETHOLOGY IV, Sabine, Friday 14 July 2017

Ryan Logan, Christopher Lowe

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

Area Use and Spawning Activity of Three Exploited Gamefishes on a Large Artificial Reef Inferred from Passive Acoustic Telemetry

Kelp bass (*Paralabrax clathratus*), barred sand bass (*P. nebulifer*) and California sheephead (*Semicossyphus pulcher*) are three important recreational gamefish species in southern California and as such contribute significantly to the local economy. To restore depleted populations, artificial reefs have been used with the assumption that the new habitat will increase fish productivity over time. Here, we describe the fine-scale area use at a range of temporal scales, and presumed spawning related activity inferred from passive acoustic telemetry methods on the largest artificial reef in the United States. Degree of site fidelity to the artificial reef varied considerably across species over a two year monitoring period, with sheephead exhibiting the highest site fidelity. On average, kelp bass had the largest home ranges (0.33 ± 0.13 km²; 95% kernel utilization distribution), but the amount of area used was similar among species. Area use was also similar to previous findings using comparable methodology. Tagged kelp bass exhibited two different activity patterns during spawning months described as "transient" and "sedentary", and ~40% of tagged barred sand bass displayed seasonal migratory behavior. Male California sheephead were significantly more active among seasons than females; however, both showed increased activity patterns in summer months. Results of this study indicate that artificial reefs can provide suitable habitat to support depleted gamefish species, although some may benefit more than others. Additionally, assumed

spawning related activity implies artificial reefs can be worthwhile management tools to mitigate depleted coastal marine fishery populations.

0376 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brett Longwith, Brooke Bedal, Mollie F. Cashner

Austin Peay State University, Clarksville, TN, USA

Utility of Eight Microsatellite Loci in Population Genetic Analyses of Southern Redbelly Dace, *Chrosomus erythrogaster*

Species-specific loci allow for differentiation between populations of the same species. These loci may be used to assess gene flow or genetic drift. Allelic diversity was assessed for eight microsatellites loci previously developed for the Blackside Dace, *Chrosomus cumberlandensis*, using two populations (Lab-reared and Millers Creek tributary) of the Southern Redbelly Dace, *Chrosomus erythrogaster*. Lab reared individuals are from a known limited parental stock (2-3 females, 2 males), while the wild population has unknown parentage contribution. Moreover, the lab-reared parental stock originates from a different stream than the wild population, although both populations are from the Cumberland River system drainage. Our goals are to: (1) quantify allelic diversity; (2) assess HWE for the eight loci; (3) and determine the utility of these markers for assessing population structure between these two experimental groups. Due to the low number of cyprinid-specific microsatellite loci, the addition of these data will increase the toolkit available for future population genetic work in various cyprinid species, particularly in the diverse and T&E-rich genus of *Chrosomus*.

0730 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Karem López¹, Rebecca Tarvin³, Santiago Ron², Mileidy Betancourth⁴, Adolfo Amézquita⁴, David Cannatella³

¹*Universidad Central del Ecuador, Quito, Ecuador*, ²*Pontificia Universidad Católica del Ecuador, Quito, Ecuador*, ³*University of Texas at Austin, Austin, Texas, USA*, ⁴*Los Andes University, Bogotá, Colombia*

Is *Epipedobates boulengeri* a Species Complex? Molecular Phylogeny of an Inconspicuous Poison Frog

Most frogs of the genus *Epipedobates*, known as Chocoan poison frogs, are brightly colored and secrete alkaloids as anti-predator defense. A recent phylogenetic analysis of this group revealed very low genetic divergence among species and suggested that *Epipedobates boulengeri* is polyphyletic. The objective of this study was to expand the phylogeny of *Epipedobates boulengeri* and assess its species limits. Three mitochondrial and two nuclear markers were sequenced for 47 individuals across 28 populations

encompassing the whole range of *E. boulengeri*, from the Valle de Cauca, Colombia, to Cotopaxi, Ecuador, including the type-locality (Isla Gorgona, Colombia). We confirmed that some populations of *E. boulengeri* are more closely related to other species, but also identified possible cryptic species, indicating that the delimitation of this species should be reassessed. The low levels of genetic divergence among species of *Epipedobates* (e.g., 2.6% in the 16S gene) highlight the rapid phenotypic diversification of the group and make it an interesting case study for delimitation of species, population genetics and diversification processes. Our results contribute to the understanding of speciation in general and the identification of specific conservation concerns for *E. boulengeri*, which faces high rates of habitat destruction in the Chocó regions of Ecuador and Colombia.

0455 Lizard Conservation, Sabine, Saturday 15 July 2017

Robert E. Lovich¹, Daniel J. Leavitt⁰

¹Naval Facilities Engineering Command Southwest, San Diego, California, USA,

²Arizona Game and Fish Department, Phoenix, Arizona, USA

Celebrating 20 Years of Conservation: Flat-tailed Horned Lizard (*Phrynosoma mcallii*) Rangelwide Management Strategy

In 2017, the *Rangelwide Management Strategy* for the Flat-tailed Horned Lizard turned 20 years old. Given this large period of time, in lizard-years, we will summarize the history, successes, and failures of the *Rangelwide Management Strategy*. The strategy was established to protect the Flat-tailed Horned Lizard from requiring federal protection and is made up of over 15 partner agencies including municipal, state, and federal partners. Together these partners protect hundred's of thousands of Flat-tailed Horned Lizard habitat and hundred's of thousands of Flat-tailed Horned Lizards. For the last 10 years, monitoring of populations has resulted in learning new aspects of the life history of this species. Here we will share with you the nuts and bolts of the partnership success, the monitoring strategy, and the results of our monitoring.

0442 ASIH STOYE CONSERVATION III, San Antonio, Friday 14 July 2017

Kelsey Low¹, Matthew Allender², Christopher Phillips¹, Steven Kimble³

¹Illinois Natural History Survey, Champaign, Illinois, USA, ²UIUC College of Veterinary Medicine, Urbana, Illinois, USA, ³Towson University, Towson, Maryland, USA

A ranavirus-associated mass mortality event in an Illinois amphibian community

Ranavirus is an infectious pathogen affecting reptiles and amphibians associated with global amphibian population declines, and is one of two notifiable amphibian pathogens

to the OIE. The purpose of this study was to determine the background prevalence of FV3-like ranavirus in amphibian communities at sites in east-central Illinois with recurrent outbreaks in Eastern Box Turtles (*Terrapene carolina carolina*). The Wood Frog (*Rana sylvatica*) was to be used as a sentinel species due to its reported ranavirus sensitivity. 20 *R. sylvatica* individuals of each life stage were to be sampled at eight vernal ponds using skin and oral swabs for adults and metamorphs, and lethal tissue sampling for tadpoles. However, a mass mortality event began while monitoring tadpoles. In response to the mortality event, we collected deceased individuals of any observed species over the next eight weeks at the original eight ponds and at an additional 15 sites wherever mortalities were observed. The event included over 3,000 observed individuals of six species. The highest number of mortalities were observed in *R. sylvatica* (n=752), Silvery Salamanders (*Ambystoma platineum*; n=303), and Chorus Frogs (*Pseudacris* spp.; n=105). The viral isolate was classified as an FV3-like Ranavirus using sequence from several primer pairs, was detected at 10 of the 23 ponds sampled (44%), and infection prevalence ranged from 0% to 100%. Detection of this mortality event in progress highlights the need to continue monitoring this area for ranavirus in ectothermic vertebrates, as an event of this scale had not previously been observed within these sites.

0894 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Mary-Ruth Low¹, Nick Baker², John J. H. Wei³

¹Wildlife Reserves Singapore, Singapore, Singapore, ²Ecology Asia, Singapore, Singapore, ³Natural Area Consulting Management Services, Western Australia, Australia

Herpetofauna Roadkill Rates Bordering Forest Fragments in an Urban City State

Roads are ubiquitous in human-modified landscapes and are largely responsible for direct impacts on wildlife, especially with regard to vehicular collisions. Herpetofauna are generally susceptible to road-related mortality as they move close to the ground and are thus harder to detect. In Singapore, only ~3% of total land area comprises of protected nature reserve which is made up of old secondary forest and small fragments of primary forest. Nevertheless, these fragments act as habitat strongholds for fauna in a human-dominated landscape. The aims of our study were: 1) to identify the herpetofauna species most susceptible to road mortality, and 2) to determine if roadkill rates differed between roads bordering nature reserves and those bordering urban vegetation. From January-December 2015, fortnightly surveys were conducted on roads which bisect and border nature reserves (n=5) and roads which border urban young secondary forest or scrubland (n=5). Over 26 surveys, 53 carcasses belonging to 19 species were found (58% snakes, 26% lizards, 11% frogs, 5% turtles). More roadkill were found on roads near urban forests (67%) than roads near nature reserves (Mann-Whitney-Wilcoxon Test=45, p<0.01). The overall mean of roadkill per month was 4.4±2.7 individuals. Specifically, one roadkill was encountered on average every 7.27 km and

4.86 km of roads per month around nature reserves and urban forests respectively. The findings of these systematic surveys allow nature reserve managers to identify roadkill hotspots and the threatened species that may require impact mitigation by transport authorities.

0531 Herp Environment, Brazos, Saturday 15 July 2017

Mary-Ruth Low¹, David Bickford², Sonja Luz¹

¹Wildlife Reserves Singapore, Singapore, Singapore, ²Rimba, Selangor, Malaysia

Spatial Ecology of the Reticulated Python in Singapore

The reticulated python (*Malayopython reticulatus*) is the longest snake and the largest apex predator on the densely-populated island of Singapore. Human-python interactions are high, with approximately one encounter per day, often resulting in negative publicity for the species. While pythons are capable of reaching lengths of 9 meters and feed on large mammals elsewhere in their range, the adults are comparatively small in Singapore (average SVL=2.3±0.6 m, n = 1680) and they perform a key ecosystem service by subsisting on rats (*Rattus* spp.). However, negative perceptions regarding pythons as pests prevail. Since 2008, approximately 1700 snakes have been captured in conflict situations, marked and released in an ongoing study. Twenty-eight individuals (12 females, 14 males, 2 juveniles) were radio-tracked between Mar 2014 and Jan 2016. Overall, snakes were found to utilize underground burrows and storm drains in the city 76% of the time, indicating ability to adapt to human-dominated landscape. Males had larger home ranges (average 40.5 ha) compared to females (average 12 ha). A habitat composition analysis found that proximity to storm drain openings and forest edge habitats were important contributing factors to python movement. This finding is possibly linked to availability of prey and shelter sites. Knowledge of the species' urban ecology will be useful to help managers in urban areas in dealing with "conflict snakes", as well as allow conservation practitioners to evaluate its adaptability to natural habitat loss in other parts of its range.

0743 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Wedgewood, Saturday 15 July 2017

Christopher G. Lowe¹, Emily Meese¹, Sarah Luongo¹, Diego Bernal²

¹Calif. State Univ. Long Beach, Long Beach, CA, USA, ²Univ. Mass. Dartmouth, Dartmouth, MA, USA

New Advances in Measuring and Modeling Metabolic Costs of Elasmobranchs To Predict the Future

Understanding how changing environmental conditions and fluctuating biotic pressures influence the physiology, behavior and distribution patterns of elasmobranchs can aid in

the development of more successful management. Quantifying metabolic rates, metabolic thermal sensitivity, costs of transport, SDA and energy budgets of elasmobranch fishes has historically been limited to small, shallow water, non-obligate ram ventilating species (< 1 m TL) or juvenile stages of larger species (< 1.25 m TL). While methods for measuring metabolism, largely based on oxygen consumption rates, have been limited by respirometry technology, advances in telemetry and datalogging technology have allowed for a much more detailed estimate of energetic costs for larger, more active elasmobranchs in the wild. Despite these technological advances, there are still large gaps in knowledge on metabolism for batoids and deepwater species. Metabolic Q_{10} (temperature sensitivity) has been measured across a wide range of species ($n = 18$); however, still relatively little is known about the costs of physiological acclimation and how those costs change as animals approach thermal tolerance limits. Using growing databases of spatially explicit remote sensing environmental data, even baseline metabolic rate, metabolic Q_{10} , and cost of transport data can now be used to develop simple minimum energetic cost models as tools to predict future changes in species distributions and potential changes in migration patterns.

0098 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Glass Oaks, Saturday 15 July 2017

Winsor Lowe

University of Montana, Montana, USA

A grounded approach to dispersal research

We know dispersal and migration are fundamental ecological and evolutionary processes, but it is difficult to study these movement patterns directly in the field. Consequently, research on dispersal and migration often relies heavily on modeling and simulation. There is no doubt that modeling and simulation studies have helped advance theory and understanding of the role of population connectivity in species conservation. However, it is difficult to think of a case where empirical data on animal movement had a greater impact on understanding of species ecology and management than Ray et al.'s work on buffer zones for amphibian breeding ponds. This offshoot of his work on the ecology and evolution of pond-breeding amphibians grew into a long-term interest in the phenotypic and environmental drivers of amphibian movement – both dispersal and migration. This topic allowed him to combine his evolutionary and ecological interests, while remaining firmly grounded in the field. Ray's grounded approach to dispersal research, and the ecology/evolution interface that characterize his work, were great inspirations to me, and continue to be guiding principles of my research. In this talk, I will trace the influence of Ray's empirical approach to dispersal and migration in my own and other's research. I will show the inseparability of ecological and evolutionary perspectives on animal movement for advancing broad conceptual understanding and conservation strategies. Specifically, this overview of Ray's legacy highlights the importance of considering inter- and intraspecific variation in movement patterns,

identifying the phenotypic basis of this variation, and isolating key environmental mediators.

0541 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Cierra Lucas, Scott L. Parker, Amanda DiBella

Coastal Carolina University, Conway, SC, USA

Comparative Digestive Assimilation Efficiency of Snails, Crabs, and Fish in diamondback terrapins (*Malaclemys terrapin*)

Diamondback terrapins (*Malaclemys terrapin*) are important secondary consumers of southeastern saltmarshes. Analyses of fecal samples suggest that terrapins primarily consume periwinkle snails (*Littoraria irrorata*), followed by fiddler crabs (*Uca pugnax*), and small numbers of fish. Optimal foraging models predict that animals pursue food resources that provide the greatest energetic benefit at the lowest acquisition cost. The purpose of this study is to measure the energetic content of these three food items and determine the digestive efficiency associated with each prey type. Laboratory feeding trials were conducted using terrapins collected from the North Inlet National Estuarine Reserve in South Carolina. We measured assimilation efficiency and energy content of periwinkles, fiddler crabs, and mullet (*Mugil cephalus*) using oxygen bomb calorimetry. We predict that mass-specific energy content and assimilation efficiency is highest in fish, followed by fiddler crabs, and lowest in periwinkles. Our data suggest that in the field terrapins preferentially pursue periwinkles due to their low acquisition cost at the expense of lower overall energy content compared to fiddler crabs and fish.

0774 LFC Phenotypic Variation I, San Marcos, Thursday 13 July 2017

Stuart Ludsin¹, Kevin Pangle², Lucia Carreon-Martinez³, Alison Drelich¹, Brian Fryer³, Daniel Heath³, Timothy Johnson⁴, Julie Reichert¹, Jeffrey Tyson⁵, Kyle Wellband⁴

¹The Ohio State University, Columbus, OH, USA, ²Central Michigan University, Mt. Pleasant, MI, USA, ³University of Windsor, Windsor, ON, Canada, ⁴Ontario Ministry of Natural Resources and Forestry, Picton, ON, Canada, ⁵Ohio Department of Natural Resources-Division of Wildlife, Sandusky, OH, USA

Does variation in larval growth rate affect the recruitment of freshwater fishes? A case study with Lake Erie Yellow Perch

Fast growth during the larval stage has been hypothesized to benefit the subsequent recruitment of marine fishes by reducing predation risk. While this hypothesis has been extensively examined in marine fishes, it has been less studied in freshwater species, the recruitment of which is considered to be driven more by processes operating during the juvenile stage than those operating during the larval stage. Herein, we present findings

from a multidisciplinary investigation that used field collections (2006-2009), laboratory approaches (e.g., otolith growth and micro-chemical analyses; molecular identification of prey in predator diets), and spatially-explicit individual-based modeling to explore how growth rate affects the survival of larval Yellow Perch (*Perca flavescens*) to the age-0 juvenile stage, the life stage at which future recruitment to the fishery (at age-2) is set. We observed differential selection for growth rate during the larval stage, with faster-growing individuals recruiting to the juvenile stage better than their slow-growing counterparts during all study years. Further, we found that the selection against slow-growing larvae was greater outside of turbid nursery habitat than inside of it. Predation appears to underlie these differences, as both predation risk and mortality were found to be greater outside than inside of turbid nursery habitat. Overall, our collective findings highlight the importance of measuring phenotypic (growth-rate) variation in larval fishes in fisheries investigations, while simultaneously demonstrating that the "growth-selective predation hypothesis" has relevance to large freshwater ecosystems such as Lake Erie.

0272 ASIH STOYE GENERAL ICHTHYOLOGY II, Trinity, Thursday 13 July 2017

William Ludt¹, Christopher Burridge², Thomas Near³, Prosanta Chakrabarty¹

¹Louisiana State University, Baton Rouge, LA, USA, ²University of Tasmania, Hobart, TAS, Australia, ³Yale University, New Haven, CT, USA

Understanding Anti-Tropical Distributions in Centrarchiformes

The order Centrarchiformes contains 15 families whose relationships have been previously contested. Within this order there are several examples of anti-tropical distributions – a pattern where closely related groups occur on both sides of the tropics, yet are absent within. Several mechanisms have been proposed to explain this distribution pattern, yet the ultimate causes are still unknown for many species. Here we use over 500 ultraconserved elements to broadly examine the relationships among Centrarchiformes. Within Centrarchiformes our data strongly support a polyphyletic Cheilodactylidae, with the two South African species of *Cheilodactylus* forming a clade distantly related to the remaining species within the genus. We then used this phylogeny to specifically examine anti-tropical divergences within the remaining members of this genus, which primarily inhabit temperate rocky reef habitats in the southern Pacific, with four species occurring in the northern hemisphere. Using multiple fossil calibrations, we time calibrated our phylogeny to determine the timing of anti-tropical divergence events within this clade. We used this calibrated tree, coupled with stochastic character mapping, as well as multiple biogeographic models, to determine the fit of our data to the mechanisms proposed for anti-tropical distributions. Northern hemisphere species do not form a monophyletic group, suggesting multiple equatorial divergence events for these species. We find evidence supporting Miocene and Plio/Pleistocene divergence events across the tropics explaining the multiple invasions of the northern hemisphere. Together with our biogeographic models, our data suggest

that multiple mechanisms may be responsible for the anti-tropical distribution in this group.

0597 Fish Biogeography & Morphology, Trinity, Saturday 15 July 2017

Nathan Lujan¹, Mark Sabaj², Leandro Sousa³, Marcella Santos⁴, Lúcia Rapp Py-Daniel⁵, John Lundberg², Brice Noonan⁴

¹University of Toronto Scarborough, Toronto, ON, Canada, ²Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA, ³Universidade Federal do Pará, Altamira, PA, Brazil, ⁴University of Mississippi, Oxford, MS, USA, ⁵Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, AM, Brazil

Comparative population genomics of seven fish taxa spanning rapids of the lower Xingu River, Amazon Basin, Brazil

During three expeditions from 2013 to 2015, the iXingu Project inventoried aquatic biodiversity across >300 km of the lower and middle Xingu River, from its sea-level confluence with the Amazon to the Great Falls of the lower Iriri River at >120 m above sea level. A restriction associated DNA sequencing and bioinformatics pipeline was used to investigate genetic structure within seven fish genera that span all or most of this geographic range: *Bivibranchia* (Hemiodontidae), *Bryconops* (Characidae), *Cichla* (Cichlidae), *Geophagus* (Cichlidae), *Hypomasticus* (Anostomidae), *Spectracanthicus* (Loricariidae), and *Tometes* (Serrasalminidae). At the largest spatial scale, two morphologically cryptic yet genomically distinct populations of *Bivibranchia fowleri* were codistributed throughout the sample reach, with Pop1 being only collected from dry-season beaches and Pop2 from wet-season beaches. Six genera displayed a pattern in which populations or species were restricted to either the lentic mouth bay or the rapids upstream. Within the upstream rapids, only *Bryconops* displayed a pattern of narrowly restricted endemism in which two unrelated and morphologically distinct genotypes were only observed among high-energy rapids of the Xingu's Big Bend (Volta Grande). The most complicated and perplexing patterns have been those resulting from apparently widespread introgression between two species of *Spectracanthicus* (*S. punctatissimus*, *S. zuanoni*) and the closely related species *Parancistrus nudiventris*. Genomic data from almost 400 individuals of this species complex are being matched to phenotypic data in an effort to unravel mechanisms that maintain these largely distinct morphotypes despite apparently rampant hybridization.

0266 Texas and Mexican Blindcats/Desert Fishes, Sabine, Saturday 15 July 2017

John G. Lundberg¹, Dean A. Hendrickson², Kyle Luckenbill¹, Mariangeles Arce-H.¹

¹The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA,

²University of Texas, Austin, TX, USA

***Satan's* Skeleton Revealed**

Satan eurystomus Hubbs & Bailey 1947, the widemouth blindcat, is endemic to the deep Edwards Aquifer below San Antonio, TX. Monotypic *Satan* is one of four subterranean ictalurids, *Trogloglanis pattersoni*, *Prietella pheatophila* and *P. lundbergi*, that all exhibit common features of stygomorphs: loss of eyes and pigmentation, hypertrophy of some chemo- and mechano- sensory systems, small size, and variously reduced musculoskeletal system. Each species is distinctive in its own ways, and hypotheses about their phylogenetic positions range from separate ancestries of each scattered among the lineages of epigeic ictalurids to exclusive monophyly of a strictly subterranean clade. Specimens of *Satan* are rare, thus we used high-resolution CT scans to develop the first detailed, richly illustrated descriptive and comparative study of its skeleton. *Satan* exhibits typical and singular reductive features plus complex structures, e.g. 3 novel symphyses closing the posterior cranial fontanel; an unusually deep temporal fossa; and an ornately shaped dorsal-fin locking spinelet. *Satan* shares 15 synapomorphies with other ictalurid troglobites: the stygomorphisms plus bone and joint reductions. *Satan* shares 11 synapomorphies with *Pylodictis*, including increased numbers of cephalic sensory pores and paired fin rays, and several features associated with predatory suction feeding: wide gape, depressed head, expanded branchiostegal and opercular membranes and anterior extension of epaxial muscle. Incomplete character information, including lack of molecular data for *Satan* and *Trogloglanis*, poor quality of available skeletal preparations for *Trogloglanis* and *Prietella*, and uncertain identifications of some specimens of *Prietella* impede construction of a complete dataset for phylogenetic analysis.

0700 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD; AES SYMPOSIUM - APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Sarah Luongo, Christopher Lowe

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

Modeling the Effects of ENSO Events on the Metabolic Costs of the CA Horn Shark, *Heterodontus francisci*

Dynamic, heterogeneous thermal conditions are known to affect physiological processes in marine ectotherms, which influence movements, distribution and energetic costs. By quantifying physiological thermal sensitivity of ectothermic elasmobranchs, we can begin to make predictions on the degree to which minimum energetic costs may change across major oceanographic events (e.g., ENSO, PDO, global sea temperature rise). The estimated mean (\pm SE) standard metabolic rate (SMR; mg O₂ kg⁻¹ hr⁻¹) of the CA horn shark, *Heterodontus francisci*, increased with acclimated temperatures (14° - 30.6 \pm 3.4, 16° - 33.9 \pm 2.6, 20° - 45.4 \pm 2.7, and 22°C - 55.2 \pm 3.1). This resulted in a mean (\pm SE) acclimated metabolic Q₁₀ of 2.13 (\pm 0.28), providing a metric to generate predictive models to estimate minimum metabolic costs associated with ENSO events and global

sea temperature rise. The model included daily minimum caloric expenditure and average daily sea surface temperature (SST) over a 12 yr period bracketing a strong ENSO event for southern California. Our model indicated a 18.6% increase in average minimum metabolic costs for the CA horn shark between 2012 and 2015. When comparing change in average minimum metabolic costs from previous ENSO events (2006 and 2009) to the most recent (2015), we see a 16.3% increase in costs over those years. Increasing metabolic costs attributed to the strong 2015 ENSO event, coupled with loss of certain prey may result in reduced population growth of horn shark and influencing emigration from areas of previously suitable habitat.

0386 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Marvin M. F. Lutnesky¹, Brian B. Pasko², Thomas R. Brown²

¹Texas A&M University - San Antonio, San Antonio, TX, USA, ²Eastern New Mexico University, Portales, NM, USA

How May Population Density Influence Rates of Sex Change in Fishes?

Social control of sex change in fishes is widespread. The frequency of social cues that may stimulate or inhibit sex change may be dependent on movement patterns, and thus rates of cue reception may be density dependent. Exploitation (including fishing) may alter population densities, and thus potentially cue frequency. Using a published Individual Oriented Model computer simulation in which individuals optimize movement patterns through space (encounter rates), we explore how the processing of social cues using simple rules (absolute rates, ratio rates, or differential rates) may alter patterns of sex change in fishes as a function of population density. The simulation (typically 10,000 167 min. simulations [samples] resulting in convergence on an encounter rate) consisted of an alpha female moving through territorial space and encountering the male (inhibitory cues) and lower-ranking females (stimulatory cues) that share her territory. We found that different patterns of sex change emerge dependent on the rule used to process information. For example, densities that trigger sex change over a range of territory sizes using the difference rule (stimulation - inhibition) remain fairly stable, but decrease dramatically when using the ratio rule (stimulation / inhibition). Thus, rates of sex change, and potentially the ability of a species to recover from exploitation, may be due in part to how the brain processes information. This work is timely due to the diversity of fishes that change sex, and its multiple and independent evolution. Different management strategies for conservation may be needed if the rules for information processing vary among species.

0305 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Kady Lyons, Katherine Wynne-Edwards

U Calgary, Calgary, AB, Canada

Gestational Steroid Hormone Profiles in Plasma and Histotroph of Pregnant Stingrays: Indications of Embryonic Steroid Synthesis Early in Development

Hormones play a crucial role in the initiation and maintenance of pregnancy in live-bearing vertebrates. Despite the range of maternal provisioning strategies, little research has been investigated into the pathways of communication between elasmobranch embryos and their mothers, particularly with regards to hormone signaling. Pregnant round stingrays (*Urobatis halleri*) were captured from two sites in southern California and samples of plasma and uterine fluid (histotroph) were sampled at multiple points through their gestational period. Tissue samples were analyzed for a suite of steroid hormones using a liquid chromatography system connected with tandem mass spectrometer equipped with electrospray ionization source. Many more hormones were detected in histotroph samples compared to their plasma pairs and often at higher concentrations. In particular, progesterone and testosterone significantly increased in histotroph during early gestation and declined thereafter. Interestingly, the peak in histotroph hormone concentrations coincided with the appearance of secondary sex characteristics (i.e. presence/absence of claspers). This study represents one of the first to examine a suite of steroid hormones in elasmobranch histotroph over the course of gestation and the findings indicate that embryonic steroidogenesis not only comes online early in gestation, but likely also has a hand in sexual differentiation of early-term embryos.

0298 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Wedgewood, Saturday 15 July 2017

Kady Lyons¹, Dovi Kacev², David Gillett³, Antonella Preti², Heidi Dewar², Suzanne Kohin²

¹U Calgary, Calgary, AB, Canada, ²Southwest Fisheries Science Center, La Jolla, CA, USA, ³Southern California Coastal Water Research Project, Costa Mesa, CA, USA

Using Organochlorine Contaminants as a Tool to Examine Ecological Physiology in Three Species of Pelagic Sharks

Elasmobranchs typically occupy higher trophic levels in food webs and, consequently, have a propensity to accumulate high organochlorine contaminant (OC) concentrations. However, not all sharks accumulate the same types of contaminants or at the same rate, making use of OCs a potential ecological tool. Bioaccumulation with respect to ontogeny was examined among three species of pelagic sharks (Shortfin Mako *Isurus oxyrinchus*, Common Thresher *Alopias vulpinus*, and Blue Shark *Prionace glauca*) that have varying diets and life history characteristics. Using recently collected and archived tissue from sharks caught in southern California, an area known for high contaminant levels, organic contaminants (polychlorinated biphenyls and chlorinated pesticides) were measured in livers of both females and males from a range of size classes for all species. Significant differences were found in OC concentrations among species and by

size. In addition, random forest analysis was able to distinguish species based on their contaminant signatures with a high degree of accuracy. The results of this study suggest that foraging ecology and species-specific life history characteristics impact the accumulation of organic contaminants.

0358 AES Conservation & Management I, Pecos, Saturday 15 July 2017

Catherine Macdonald¹, Julia Wester²

¹*University of Miami, Miami, FL, USA*, ²*Field School, Coconut Grove, FL, USA*

Media Coverage of Shark Attacks in Cape Town, South Africa, 1850-2000

This paper uses newspaper articles (n=231) from the Cape Times and Cape Argus, published in Cape Town, South Africa, to measure changing human attitudes towards sharks and the risk of shark attack between 1850 and 2000. It analyzes popular reporting on the risks, causes, and social responses to human-shark interaction over time, tracing patterns of incidents and assessing ways in which public attitudes and journalistic approaches have evolved during the last 150 years. Findings, based on both qualitative analysis of articles and quantitative data (generated through word counts and topic coding) suggest that the types of information considered important and the discourse around shark attack has changed gradually but significantly. Evidence from this data set shows that a shift in the way the media talked about sharks was underway even at the height of hysteria surrounding the release of the movie "Jaws," long before explicit conversations about shark conservation were commonly part of public discourse. Findings reveal that historical data can help us understand the human-shark relationship diachronically, over longer time scales than are typically studied, and that this perspective could helpfully be factored into future management and conservation of shark species.

0220 HL GRADUATE RESEARCH AWARD, Pecos, Friday 14 July 2017

Andrew MacLaren, Shawn McCracken, Michael Forstner

Texas State University, San Marcos, Texas, USA

Automated Detection of the Endangered Houston Toad's (*Bufo* [= *Anaxyrus*] *houstonensis*) Vocalization

Monitoring for many threatened or endangered anurans is carried out by detection of auditory vocalizations alone. This includes the Houston Toad, a relictual species endemic to East-Central Texas. Improved methods for producing survey data are of primary interest to researchers. Here we describe the development of a recognizer capable of detecting the call of the Houston Toad with a high degree of certainty using the software's SongScope and Kaleidoscope. Additionally, we utilize these data to re-evaluate the environmental conditions that induce male chorusing in this endangered

toad. Audio monitoring was achieved using SongMeter Acoustic Recorders placed near breeding locations. A subset of data were gathered and subdivided into three independent categories: training-data, incorporated into our recognizer; test-data, possessing a known number of vocalizations, a benchmark for recognizer performance; validation-data, audio captured from a single site in a single season, analyzed digitally and manually (i.e. human listener) to compare efficacy of each approach. These methods were repeated for Kaleidoscope. The successful recognizer was then applied to all audio collected in years 2010-2016. The presence/absence of Houston Toad chorusing was correlated with environmental data provided by NOAA. Our recognizer built in SongScope proved >97% effective at detecting Houston Toad vocalizations. Kaleidoscope proved more effective, simply by correcting for errors inherent in earlier software generations. Our autecological study utilizing automated detection data revealed male chorusing response to barometric pressure, temperature, and humidity inconsistent to previous reports from human performed call surveys.

0866 Herp Ecology II, Pecos, Friday 14 July 2017

John Maerz, Jillian Howard, Kira McEntire

University of Georgia, Athens, GA, USA

Climate affects spatial patterns of hybridization between two salamander species

Models of climate effects on species rarely address ecological or evolutionary interactions between species. Recent syntheses suggest that studies of hybrid zones can directly address this challenge. Adaptive introgression within hybrid zones can create novel phenotypes that may alter species' responses to environmental change in ways that cannot be predicted by current models. Despite recognition of the importance of introgression, particularly among taxa that have undergone recent radiation, there remain relatively few studies of animal hybrid zone dynamics and eco-evolutionary responses to climate. *Plethodon shermani* and *P. teyahalee* hybridize extensively within the 4000 acre Coweeta basin in western North Carolina. We used color phenotype scores of more than 5,000 individuals from 96 sites across the basin to demonstrate the strong relationship between hybrid phenotype distribution and climate, most notably mean annual precipitation. Our results show that traits of both parent lineages are distributed within hybrids in relation to local climate. We hypothesize that the parent lineages of *P. shermani* and *P. teyahalee* represent broader "phenotypic syndromes" adapted to wetter or drier climates, respectively, and that the high spatial heterogeneity in climate is creating novel, adaptive phenotypes. If confirmed, adaptive introgression between these species would potentially alter species' responses to the shifting climate.

0359 LFC Physiological Performance II, San Marcos, Sunday 16 July 2017

Edward Mager

University of North Texas, Denton, TX, USA

Gulf of Mexico Oil Pollution and Larval Fish Physiology

Much has been learned in the years following the 2010 Deepwater Horizon (DWH) event regarding the impacts of crude oil exposure on the survival and physiology of larval fish native to coastal and pelagic habitats of the northern Gulf of Mexico (GoM). Nearly a decade's worth of research prior to DWH focused on elucidating the morphological and functional effects of polycyclic aromatic hydrocarbons, the primary toxic component of oil, on the cardiovascular system in developing early life stage fish. This work revealed a suite of functional and morphological defects (e.g., impaired cardiac looping, reduced ventricular contractility, bradycardia) that may vary among species, yet consistently culminate in a characteristic phenotype of pericardial edema. While the cardiotoxic phenotype is also clearly elicited in GoM larval fish exposed to oil, additional novel physiological impacts have recently come to light for such species with likely implications for survival. Notably, oil exposure to the pelagic mahi-mahi at elevated temperature increases energy consumption and yolk depletion rate as well as induces premature negative buoyancy and increases the sinking rate of embryos. Additionally, recent time-course studies of embryonic/larval GoM fish have revealed novel transcriptional responses to oil exposure suggesting developmental impairment to the neurological, renal and skeletal muscle systems and altered cholesterol biosynthesis. Follow-up studies focusing on neurological impacts have provided potential links from such transcriptional responses to, among other effects, reductions in visual acuity of oil-exposed larvae. Supported in part by a grant from GoMRI (Grant No: SA-1520) to the RECOVER consortium.

0199 Herp Morphology & Development, Brazos, Saturday 15 July 2017

Jessica Maisano¹, Travis LaDuc¹, Christopher Bell¹, Diane Barber²

¹The University of Texas, Austin, Texas, USA, ²Fort Worth Zoo, Fort Worth, Texas, USA

The Cephalic Osteoderms of *Varanus komodoensis* as Revealed by High-Resolution X-ray Computed Tomography

Osteoderms constitute a morphological system that plays an important role in squamate systematics. However, their study has always been difficult due to their isolated occurrence in the skin, among the first organs to be removed during the skeletonization process. High-resolution X-ray computed tomography (HRXCT) offers a nondestructive means of visualizing osteoderms both in their natural relationship to each other and to the underlying cranial bones. While it is often stated that *Varanus komodoensis* has a 'chain mail' of osteoderms, this morphological system was never described in this charismatic taxon. Further, given its size, it can be expected that *V. komodoensis* would present the pinnacle of osteoderm development in extant varanids, a group that tends to have weakly-developed cephalic osteoderms or none at all. Indeed, our HRXCT scan of a 19-year-old captive individual from the Fort Worth Zoo reveals an elaborate mesh of

cephalic osteoderms that are incredibly numerous and morphologically diverse. We describe this skeletal system and compare it to the cephalic osteoderms in other varanoids.

0104 ASIH STOYE CONSERVATION III, San Antonio, Friday 14 July 2017

Christopher Malinowski¹, Felicia Coleman², Christopher Koenig²

¹Florida State University, Tallahassee, FL, USA, ²Florida State University, Coastal and Marine Laboratory, St. Teresa, FL, USA

Mercury in Atlantic Goliath Grouper (*Epinephelus itajara*): sources, bioaccumulation patterns, and potential impacts to population recovery

Coastal fish populations are facing burgeoning and unprecedented threats to their health and sustainability, and many have undergone substantial declines in recent decades. Along with overfishing and habitat destruction, elevated levels of industrial contaminants are at the epicenter of this issue. Of particular concern is mercury because of its neurotoxic effects, its ability to bioaccumulate in some forms, and because we have tripled mercury levels in the upper ocean since the beginning of the Industrial Revolution. For large, long-lived fishes, like the Atlantic Goliath Grouper (*Epinephelus itajara*) (i.e., can grow up to ~3 m/400 kg), mercury toxicity may result in severe tissue damage, neurological impairment, reduced growth and development, starvation, disrupted blood chemistry (e.g., immune system function), reduced reproductive success, and higher rates of mortality. Goliath Grouper life history and behavioral traits – long-lived, late maturation, large, and strong site fidelity – make them a useful species to model regional, habitat-specific, and ontogenetic patterns in bioaccumulation of mercury and its effects. For this study, we investigated (1) the effects of mercury on health and reproduction; and (2) diet and stable isotope patterns (N, C, S) to determine the sources of mercury and the relationship between mercury intake, assimilation and accumulation.

0613 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Trinity, Friday 14 July 2017

Nadya Mamoozadeh, Jan McDowell, John Graves

Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA

An Assessment of Genetic Population Structure for Striped Marlin (*Kajikia audax*) in the Pacific and Indian Oceans Using Genome-wide SNPs

A major challenge to the management of highly migratory marine fishes is the identification of management units appropriate for species that display long distance

movements, frequently traverse international boundaries, and that may comprise seasonally mixed stocks. A variety of approaches have been used to infer the number of biological units present for a marine fish species in a particular region, including population genetic assessments based on the use of molecular tools; however, the ability to resolve the low levels of genetic differentiation anticipated for populations of many marine fishes has traditionally been limited by the use of small numbers of molecular markers. Recent widespread availability of next-generation sequencing technology now facilitates powerful genome-wide assessments of intraspecific connectivity. In this study, the genetic population structure of striped marlin (*Kajikia audax*) is evaluated using a genomic approach and sample collections from throughout the Pacific and, for the first time, Indian oceans. Results from this study suggest the presence of a genetically distinct population of striped marlin in the Indian Ocean, and provide key insights into inter-oceanic connectivity between striped marlin from the Pacific and Indian oceans. A number of genetically distinct populations were also detected in the Pacific Ocean and is consistent with inferences from previous studies. Collectively, results from this study provide information useful for reducing uncertainties currently associated with the management of striped marlin throughout the species range, and demonstrate the utility of genome-wide assessments of intraspecific connectivity in highly migratory marine fishes.

0791 General Ichthyology II, Trinity, Sunday 16 July 2017

Nicholas Mandrak, Conrad Pratt

University of Toronto Scarborough, Toronto, Canada

Using Batch Photography to Non-Lethally Identify and Voucher Freshwater Fishes

Freshwater fish biodiversity surveys are routinely undertaken globally and typically take vouchers specimens to verify identification. Although the need to undertake such surveys continues to rise for fundamental (e.g. systematics) and applied (e.g. biological indicators) reasons, the ability to undertake such sampling is becoming more limited due to conservation and welfare concerns and declining expertise. A potential solution to these issues in applied surveys is to conduct field sampling, photograph all fishes caught in fish viewers, release the fishes, and identify the species based on the photographs. To determine the effectiveness of this method, we sampled stream sites in the Greater Toronto Area using three-pass backpack electrofishing and three-haul seining. Using a fish viewer, we photographed the collections from each site in unique batches of 5-15 fishes and separately preserved each batch for later lab identification. We then conducted an online survey that had 20 sets of 5-10 photographs, each set representing one haul. We asked participants to rate their identification skills on a scale of 1-5 and to identify fishes in a least one randomly chosen set of photographs. Based on over 100 responses, correct identification rates were relatively low and varied by the 20 species collected, number of individuals in the viewer, and skill level. Rarefaction curves indicate that not all images need to be viewed to estimate species richness. This method

may reduce the number of lethal samples taken in the field, but reinforces the continued need for expertise in fish identification.

0635 AES Trophic Ecology/Physiology, Wedgewood, Friday 14 July 2017

Kaitlyn A. Manishin¹, Kenneth J. Goldman², Margaret Short¹, Curry J. Cunningham³, Peter Westley¹, Andrew C. Seitz¹

¹University of Alaska Fairbanks, Fairbanks, AK, USA, ²Alaska Department of Fish and Game, Homer, AK, USA, ³NOAA, Juneau, AK, USA

Estimates of annual salmon shark consumption

Salmon sharks (*Lamna ditropis*) are relatively large, endothermic sharks that inhabit the top trophic level in the Bering Sea. Though they are thought to be an apex predator, their role in the ecosystem remains poorly understood. For example, the biomass of prey fish annually consumed by salmon sharks is unknown. To better understand one aspect of predation by salmon sharks in the Bering Sea, we estimated annual food consumption for an average adult salmon shark. Per capita consumption estimates were calculated using three different methods drawing on a mixture of literature from salmon sharks and closely related species: 1) a percentage of predator body weight per day (daily ration), 2) the fitted parameters of a generalized von Bertalanffy growth curve, and 3) a bioenergetics mass balance equation. The agreement (or disagreement) of these estimates acts as a measure of uncertainty around the calculated values. Scaling per capita consumption estimates to a population level is most sensitive to the population size of salmon sharks, which is unknown. As a result, we present a range of population consumption estimates examined in comparison to biomass removed by commercial fisheries.

0080 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Kyle Mara¹, Avi Kaplan², Michael Balsai², Jennifer Cromley³, Tony Perez⁴, Ting Dai², Yona Davidson²

¹University of Southern Indiana, Evansville, IN, USA, ²Temple University, Philadelphia, PA, USA, ³University of Illinois, Champaign, IL, USA, ⁴Old Dominion University, Norfolk, VA, USA

How Instructors Can Enhance Biology Students' Motivation, Learning, and Grades Through Brief Relevance Writing and Worked Examples Interventions

The high failure rates of students in "gateway" STEM courses has been a persistent problem for biology programs nationwide. Common wisdom contends that addressing this problem requires major curricular overhauls. As large systematic changes are often impractical, we propose an alternative approach: supplementing the regular instruction with brief online modules targeting specific motivational and cognitive (learning)

mechanisms. We conducted an intervention study to test the effects of different combinations of cognitive and motivational modules on undergraduate Introductory Biology students' motivation, biology reasoning, course achievement, and intentions to remain in science. Introductory Biology students at a large urban university were randomly assigned to a no-treatment control condition or one of nine combinations of cognition-motivation modules. In this poster, we report on a subset of these data: the cognitive module of Worked Examples (demonstrations of biology problem solving) and the motivation module of Relevance Writing (brief open-ended writing assignments about connections of biology concepts to one's life). While the overall study may necessitate collaboration between biology instructors and educational science researchers, Worked Examples and Relevance Writing interventions are easy to implement and integrate with existing course content. Increased student engagement in these modules led to higher motivation, biology reasoning, and course grades. These findings support the effectiveness of delivering brief supplemental cognition-motivation modules online to students' success in introductory biology courses. This easily implemented intervention can utilize online tools such as Blackboard, Canvas, or Moodle, and takes the burden off faculty to radically change their instruction when such change is not practical.

0599 LFC Contributed III, San Marcos, Saturday 15 July 2017

Katrin Marancik¹, David Richardson², Jeffrey Guyon³, Molly Lutcavage⁴, Benjamin Galuardi⁶, Chi Hin Lam⁴, Harvey Walsh², Sharon Wildes³, Douglas Yates³, Jonathan Hare²

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Discovery of a Slope Sea spawning ground for Atlantic bluefin tuna (*Thunnus thynnus*)

The movements of Atlantic bluefin tuna (*Thunnus thynnus*) are among the best documented of any highly migratory species, but how to interpret these migrations within the broader context of life history and population structure remains controversial. Currently, Atlantic bluefin tuna are managed as an early-maturing eastern stock, which spawns in the Mediterranean Sea, and a late-maturing western stock, which spawns in the Gulf of Mexico. However, electronic-tagging studies show that many bluefin tuna, assumed to be of a mature size, do not visit either spawning ground during the spawning season. Evidence of a Slope Sea spawning ground has existed since a longline cruise in the area from June to July 1957, but targeted surveys for bluefin tuna larvae in the Slope Sea were never performed, and most research over the past few decades has dismissed the idea that substantial levels of spawning occur in the western Atlantic outside of the Gulf of Mexico. Here, we use multiple years of

opportunistic and targeted ichthyoplankton sampling to present unequivocal evidence that the Slope Sea is an important bluefin tuna spawning ground. Overall, the discovery of a bluefin tuna spawning ground highlights the need to further integrate traditional shipboard sampling with electronic tagging studies in testing many of the long-held assumptions that underlie the management of this iconic species. The possibility that there are additional undocumented bluefin tuna spawning grounds should continue to be evaluated.

0382 SSAR SEIBERT ECOLOGY III, Glass Oaks, Friday 14 July 2017

Kelsey A. Marchand¹, Christopher M. Somers¹, Ray G. Poulin²

¹University of Regina, Regina, Saskatchewan, Canada, ²Royal Saskatchewan Museum, Regina, Saskatchewan, Canada

You are Where you Eat: Isotopic Resource Use of Urban Western Painted Turtles (*Chrysemys picta bellii*) in Regina, Saskatchewan

Stable isotope analyses enable unprecedented insight into the ecology of aquatic species using only a small tissue sample. Recently developed Bayesian statistical methods also generate a unique quantitative perspective on niche and resource use. In this study, we used stable isotopes of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) in nail samples from western painted turtles ($n = 77$) in Regina, Saskatchewan to examine resource-use variation within and among individuals in an urban population. Western painted turtles are known to be generalist omnivores, so we predicted that there would be little systematic isotopic variation by sex, location, or age class. In contrast to our predictions, standard isotopic ellipses varied by habitat, and there was only ~30% isotopic niche overlap between the sexes. Mixing models for source apportionment in MixSIAR revealed that the documented isotopic variation was influenced by a variety of factors, including sex, body size, habitat, and primary diet items. For example, adult female turtles consume substantially more crayfish than adult males or subadults of either sex. To our knowledge, this is the first application of stable isotopes derived from nail samples to examine resource use in western painted turtles.

0357 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Zachary J. Marcou¹, Josh B. Pierce², D. Craig Rudolph², Stephen J. Mullin¹

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Detection and Activity Patterns of Snakes in Large Parcels of Contiguous Habitat

Traditional methods for the sampling of snake communities do not lend themselves well to effective assessment of community composition over large areas of suitable habitat (>100 ha). Furthermore, they rarely provide accurate depictions of the activity patterns of the species therein, on either a daily or seasonal basis. This is especially true if resources with which snakes typically associate (e.g., overwintering sites, water bodies, migration routes, etc.) are limited in their availability, not localized, or in some other way, difficult to monitor. Recent advances in technology have improved the resolution and efficiency of wildlife cameras, allowing detection of snakes at the species level. We sampled snakes in a ~7000-ha portion of the Angelina National Forest (ANF; east Texas) using 20 game cameras that captured images every 30 sec at the open intersections of drift fence arrays. We detected an assemblage of 18 species representing three families of snakes: Colubridae, Elapidae, and Viperidae. We determined whether or not the time of detection correlated with other variables (e.g., habitat or weather conditions), and how seasonal shifts in some species' diel cycles might influence the frequency of their detection. We discuss our results as they pertain to management of ANF and snake conservation in the region.

0817 Amphibian Conservation III, Wedgewood, Sunday 16 July 2017

Madeleine Marsh, Shashwat Sirsi, Michael Forstner

Texas State University, San Marcos, TX, USA

Evaluating the effects of Red Imported Fire Ants (*Solenopsis invicta*) on Juvenile Houston Toads (*Bufo* = [*Anaxyrus*] *houstonensis*) in a Coastal Prairie Grassland in Southeast Texas

First described in 1953 in Houston, Texas, the Houston toad (*Bufo* = [*Anaxyrus*] *houstonensis*) was among the first amphibians to be listed as federally endangered in the United States. Houston toads have suffered range-wide declines primarily due to habitat loss, while predation by invasive species is also considered contributory to declines. In this study, we investigated the effects of the invasive red imported fire ant (RIFA) (*Solenopsis invicta*), on the survival of juvenile Houston toads at the Attwater Prairie Chicken National Wildlife Refuge (APCNWR). Formerly, APCNWR was the focus of a reintroduction project, but was considered ineffective as no subsequent occurrence was observed and the site was deemed unsuitable for the toad. Impacts by RIFA on Houston toad juveniles during reintroduction efforts are one reason implicated for that lack of suitability. To examine potential RIFA impacts, we evaluated growth and survival among treatments using a mixed-effects for repeated measures model and Program MARK, respectively, for treated and untreated plots. Based on our results, we found that RIFA had no effect on growth or survivorship of juvenile toads. Additionally, we were able to draw some conclusions of Houston toad habitat based on other trends present in the data that support connectivity of habitats being vital to the success of the juveniles of this species. APCNWR represents juvenile dispersal habitat, one of the most critical and least understood ecological aspects for Houston toad management. The results from this

study also assist with assessing new sites for reintroduction and population restoration efforts.

0033 Fish Ecology II, San Antonio, Sunday 16 July 2017

Edie Marsh-Matthews, William Matthews

University of Oklahoma, Norman, OK, USA

Temperature affects recruitment of Western Mosquitofish, *Gambusia affinis*, in mesocosms.

Our analyses of long-term collections in Oklahoma streams by the late Jimmie Pigg suggested that population size of Western Mosquitofish in July was correlated with temperature the previous April. To examine this correlation experimentally, we stocked 16 pregnant female mosquitofish in each of eight mesocosm units at the University of Oklahoma Aquatic Research Facility on 9 May 2014. Four units were covered with shade cloth and four were left exposed. Water temperature in exposed units was as much as 5 C higher than that in shaded units on days with full sun. The experiment was ended on 21 July 2014 (74 days later) at which time all fish were retrieved from mesocosms and preserved for enumeration in the laboratory. In most units, all females originally stocked were retrieved, so it was possible to determine which individuals had been born in the mesocosms. Overall, there were significantly more recruited individuals in the exposed mesocosm units than in the shaded units. These results are consistent with the field observations and suggest that variation in recruitment in mosquitofish populations is related to environmental temperatures, with higher recruitment in warmer waters. Given that *Gambusia* species are known to be invasive outside of their native ranges, these results have important implications for the potential interaction between climate change and introduction of mosquitofishes.

0445 AES Genetics, Systematics, & Biogeography, Pecos, Sunday 16 July 2017

Andrea Marshall¹, Tom Kashiwagi¹, Harry Webb³, Al Dove³

¹*Marine Megafauna Foundation, Truckee, California, USA*, ²*Center for Fisheries, Aquaculture, & Aquatic Sciences, Southern Illinois University Carbondale, Carbondale, Illinois, USA*, ³*Georgia Aquarium, Atlanta, Georgia, USA*

Growing Evidence for a Distinct Third Species of Manta Ray

Devilrays (Family Mobulidae) are currently divided into two distinctive genera, *Mobula* Rafinesque, 1810 and *Manta* Bancroft, 1828, however recent analyses show the genus *Mobula* as paraphyletic with the inclusion of *Manta* species. Once considered to be monotypic, the genus *Manta* was revised in 2011, with two living species described, *Manta alfredi* and *Manta birostris*. A third putative species was additionally proposed but lacked conclusive molecular support and a clear morphological description. Field

surveys as well as comprehensive reviews of historical records and examinations of museum specimens support a growing body of evidence of a third species of manta ray. Examination of living specimens housed in the Georgia Aquarium, USA has confirmed that individuals of the putative species have distinct diagnostic characteristics. The putative species appears, for the most part, to be geographically isolated from other *Manta* species, although interactions with *Manta birostris* are believed to occur within its range. Its geographic distribution is still being clarified but preliminary findings show it to occur exclusively within the Atlantic and associated water bodies. Seasonal aggregation areas have been identified but population-level studies are in their infancy and there is a distinct paucity of ecological information on this putative species. As a regional endemic, with a smaller distribution than the other two species of *Manta*, which are currently listed as Vulnerable to Extinction on the IUCN Redlist of Endangered Species, research on this putative species should be a priority.

0106 Herp Ecology I, Pecos, Friday 14 July 2017

Christopher Marshall¹, Joshua Cullen¹, Mehsin Al-Ansi²

¹Texas A&M University, Galveston, TX, USA, ²Qatar University, Doha, Qatar

Hawksbill Sea Turtle (*Eretmochelys imbricata*) Spatial Movement in an Extreme Environment: The Arabian Gulf as a Living Laboratory for Investigating Organismal Response to Climate Change

Sea turtles are an interesting model system to investigate organismal responses to extreme habitats. Air and water temperatures of the Arabian Gulf regularly exceed 50°C and 30°C, respectively and marine habitats are hypersaline. Female hawksbill sea turtles in Qatar exhibit a significantly smaller body size and reduced fecundity presumably due to life in this extreme environment. Our goal was to investigate movement and habitat use of hawksbills as part of a conservation program in Qatar. Turtles were captured in-water by hand or on the beach post-nesting. Satellite tags were affixed onto the hard shells and deployed. A Bayesian state space model was used to calculate error-adjusted geolocations from Argos-derived movement tracks. Additionally, an incorporated behavioral switching model provided insights into habitat use and a mixed model investigated which environmental parameters were influential to hawksbill movement. Hawksbill sea turtles remained within the Gulf, but moved widely throughout the southern basin. Behavior was variable, but overall turtles traveled directly and quickly to distinct shallow habitats and then remained in discrete regions for weeks at a time, presumably foraging. Sea surface temperature had the most significant effect on movement. During summer months, turtles consistently moved toward a steep drop-off consistent throughout the southern gulf at the 30-40 m isobath. We hypothesize that turtles sought out thermal refuge since these areas coincided with the cooler waters of the southern Arabian Gulf loop current. The need to spend time over cooler but deeper habitat may negatively impact energy acquisition, growth and reproductive output.

0684 SSAR SEIBERT SYSTEMATICS & EVOLUTION, Brazos, Friday 14 July 2017

Thomas Marshall¹, Carlos Baca¹, Decio Correa², Michael Forstner¹, Dittmar Hahn¹, David Rodriguez¹

¹Texas State University, San Marcos, TX, USA, ²University of Texas at Austin, Austin, TX, USA

Population Genomics of Amphibian Chytrid in Central and East Texas

Chytridiomycosis, an emerging infectious disease caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), is responsible for declines in amphibian populations worldwide. *Bd* was first described in the 1990s, and there is still much to learn about its regional diversity and origin. The Global Panzootic Lineage (*Bd*-GPL) has been responsible for devastating amphibian population declines and extinctions in Central and South America, Australia, and the western U.S., while a few localized endemic lineages have been discovered in regions of Brazil and Asia that have not experienced such severe chytridiomycosis outbreaks and mortality events. There are still several geographic gaps in our knowledge of *Bd* genetics, and relatively few studies have focused on regions in which *Bd* exhibits low virulence, creating a bias in our current knowledge of the pathogen's diversity. One such region that has not seen disease-associated declines is the state of Texas. Although this pathogen has been detected from amphibians in the state, strains had not been characterized genetically prior to this study. Here, we isolated, cultured, and used next-generation sequencing to characterize strains of *Bd* in Central and East Texas. Our results indicate a diversity of *Bd* genotypes, but all strains analyzed thus far belong to the invasive GPL. By turning our attention to regions such as Texas, we seek to gain a more complete evolutionary picture of *Bd*, and a better understanding of why chytridiomycosis outbreaks that impact amphibian populations tend to occur in certain areas and not others.

0338 Lightning Talks I, Glass Oaks, Friday 14 July 2017

Amanda Martin, Karen Root

Bowling Green State University, Bowling Green, OH, USA

Comparing Complementary Tracking Methods for Reptiles in Ohio

Reptiles are facing large global declines as a result of habitat loss, which makes it crucial to understand their interactions with the environment. Radio telemetry examines spatial patterns by identifying home ranges, habitat use, and dispersal; however it has limitations when examining fine-scale movements. Fine-scale movement patterns provide important insights for managers (e.g., habitat connectivity). Researchers have used thread trailing, a well-established method, and fluorescent powder, a relatively new method to examine detailed paths. We examined fine-scale movement patterns of eastern box turtles (*Terrapene carolina carolina*) using fluorescent powder, thread trailing, and radio telemetry to better understand daily movement patterns. We found that

thread trailing and radio telemetry underestimated movement patterns compared to fluorescent powder. Thread trailing had more linear pathways, while fluorescent powder delineated more curves. Fluorescent powder provides similar results as thread trailing and we suggest that fluorescent powder is a more useful tool for examining movement patterns because it is less invasive. Radio telemetry is useful for relocating turtles, but it is an insufficient method for identifying distance traveled. Our study found that radio telemetry underestimated distance traveled by half because it uses straight-line path analysis. To continue our work, we are using radio telemetry combined with fluorescent powder to track reptiles in the Oak Openings Region in northwestern Ohio. We will expand our work by including several snake species to test whether fluorescent powder is a suitable method for tracking them and to compare movement patterns. We expect to find differential movement patterns among reptilian species.

0705 Snake Biology II & Snake Genomics, Brazos, Sunday 16 July 2017

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¹University of Arkansas, Fayetteville, AR, USA, ²Arizona State University, Tempe, AZ, USA, ³University of Northern Colorado, Greeley, CO, USA

Population Genomics of the Western and Desert Massasaugas (*Sistrurus catenatus tergeminus* and *S. c. edwardsii*)

The Western (*Sistrurus catenatus tergeminus*) and Desert (*S. c. edwardsii*) Massasauga are distributed across the midwestern and southwestern United States, respectively, and both are of conservation concern. Their populations are declining, in part, due to habitat loss and fragmentation, and both are spread across wide geographic areas in which population structure may be apparent. The presence of several small, geographically isolated populations (e.g., in Missouri and Colorado) may also represent distinct gene pools. Thus, our goals were to 1) identify population structure within *S. c. tergeminus* and *S. c. edwardsii*, and 2) assess admixture near contact zones between the two taxa. To do so, we assayed Single-Nucleotide-Polymorphism (SNP) variation across the genome of ~45 *S. c. tergeminus* and ~20 *S. c. edwardsii*, as well as ~15 Eastern Massasauga (*S. c. catenatus*), using double digest restriction-site associated DNA (ddRAD) sequencing. Our data indicate population structure within *S. c. tergeminus*, and we found populations within *S. c. edwardsii* that appear to have a high occurrence of admixture with *S. c. tergeminus*. These analyses provide valuable insight for conservation strategies, including potential designation of Management Units (MUs). Furthermore, the extent of admixture seen between *S. c. tergeminus* and *S. c. edwardsii* may be indicative of recent habitat degradation.

0831 SSAR SEIBERT CONSERVATION, San Antonio, Friday 14 July 2017

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A Comparison of Species Distribution and Occupancy Models for Informing Reptile Conservation

Conservation planning requires an understanding of how environmental factors influence wildlife distributions. This data-based planning is particularly relevant for species that may not be able to respond adequately to a rapidly-changing environment. Here, we are interested in how different modeling approaches could be used to inform conservation planning for the Texas Horned Lizard (*Phrynosoma cornutum*), a species thought to be in decline in the Great Plains. This region is characterized by gradients across natural (e.g., temperature, precipitation) and anthropogenic (e.g., habitat loss) attributes, and is suited for investigation of relationships between environmental variation and reptile distributions. Species Distribution Models (SDMs) are one approach used in this effort. While SDMs enable use of historic records of occurrence (i.e., detections), modeled estimates of occurrence don't account for imperfect detection, and don't have associated estimates of precision. Occupancy models do account for imperfect detection and provide estimates of precision, but require somewhat more robust data collection methods. Defensible conservation plans should incorporate measures of uncertainty and account for bias caused by imperfect detection. We compare contemporary SDMs and Occupancy models of the Texas Horned Lizard distribution in the Great Plains. Based on this comparison, we suggest approaches for data collection and analysis that would enable validation of these models and reduce sampling bias. Results from this effort will improve insight into environmental drivers of change in reptile distributions, and better inform conservation actions.

0585 ASIH STORER ICHTHYOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Lindsey Martin, Brook Fluker

Arkansas State University, Jonesboro, AR, USA

Effects of Black-spot Disease on the Body Condition of Bleeding Shiners, *Luxilus zonatus*

Black-spot disease is common in freshwater fishes and results from encystment of digenetic trematodes into the fins and flesh of the fish. The fish serves as an intermediate host in the life cycle of the trematode, and deposits melanin around the cyst as an immune response, producing the black spots for which the disease is named. Several studies have documented the occurrence of black-spot disease on game fishes, but little is known about how the trematode infestations affect the health or body condition of small stream fishes. The objective of this study was to evaluate the prevalence of black-

spot infection in the Bleeding Shiner (*Luxilus zonatus*) throughout Myatt Creek, a tributary to the Spring River in northeastern Arkansas. Specimens collected in the 1970s were obtained from the Arkansas State University Museum of Zoology (ASUMZ) and examined for abundance and location of black-spot infection. Infection rates will be compared to body condition (weight/length ratios) and overall body shape using geometric morphometric techniques. In order to compare potential changes in infection rates in Myatt Creek over the past 40 years, ASUMZ specimens collected in the 1970s will be compared to freshly collected specimens.

0625 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Rene Martin, Matthew Davis

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

Repeated Evolution of Heterodonty in Lanternfishes (Teleostei: Myctophiformes)

Lanternfishes (Teleostei: Myctophiformes) are among the most species-rich (~250 species) and abundant (~50% of midwater fish biomass) mesopelagic (200–1000 m) fish lineages in oceanic systems worldwide. They are characterized by bioluminescent photophores and structures that produce and emit light. Few studies have focused on the anatomical structures associated with feeding in lanternfishes. Recent work indicates that there is considerable variation in mouth sizes across lanternfishes, which may be indicative of niche differentiation in the open ocean. This study seeks to investigate variation in dentition of the oral jaws of lanternfishes, with a focus on the repeated evolution of heterodonty in these fishes. When placed in context of a novel data-rich hypothesis of evolutionary relationships for lanternfishes, we have identified that heterodonty has repeatedly evolved across the lanternfish radiation, and is present in over 1/3 of lanternfish biodiversity. We find that oral jaw bones with heterodonty are restricted to the dentary and premaxilla, while other tooth-bearing bones of the oral jaws (palatine and mesopterygoid [=endopterygoid]) lack heterodont dentition.

0565 Fish Morphology, Trinity, Saturday 15 July 2017

Christopher Martinez¹, Matthew McGee², Peter Wainwright¹

¹University of California, Davis, Davis, CA, USA, ²Monash University, Victoria, Australia

Evolution of Feeding Kinesis in African Cichlids

Evolution of the feeding apparatus in modern bony fishes has been dominated by a trend of dissociation among skeletal components in the head and jaw, resulting in increasingly mobile forms. We are interested in the relationship between head and body shape and the capacity for kinesis during feeding. We compared feeding strikes in the

trophically and morphologically diverse cichlids of the East African rift lakes, Malawi and Tanganyika. We used geometric morphometrics to quantify feeding kinesis as trajectories of shapes through multidimensional shape space. We analyzed videos recorded at 1000 f/s of 326 feeding strikes from 56 species, all of which are represented in a published phylogeny, based on ultraconserved elements. While starting head and jaw shape was significantly related to the degree of kinesis achieved while feeding, it explained only about 10% of the total variance. This is a surprisingly weak relationship given that the cichlid feeding mechanism is considered to be a series of mechanical linkage systems with determinant motion. Thus, a major feature of the cichlid feeding system, the amount of output kinesis it produces, cannot be explained by head and jaw morphology alone. We also find a significant but weak relationship between body shape and feeding kinesis, indicating largely independent evolution between these body regions.

0781 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Jackson Martinez, Travis Richards, Jay Rooker, R.J. David Wells

Texas A&M University at Galveston, Galveston, TX, USA

Feeding Ecology of the Sargassum Frogfish (*Histrio histrio*) in the Gulf of Mexico

Due to the lack of structure in the pelagic environment, it is hypothesized that *Sargassum* mats provide predation refuge for many species including several economically valuable fish species. As a locally abundant ambush predator permanently residing within the *Sargassum*, the Sargassum Frogfish, *Histrio histrio*, potentially represents a persistent top-down influence within a habitat critical to the survival of juvenile fishes. The objective of this study is to describe the feeding ecology of the Sargassum Frogfish and to elucidate its role as a potential predator within the *Sargassum* habitat. 46 frogfish samples were collected during research cruises in June and July of 2015 and 2016 and were analyzed for stomach content and stable isotope analysis. Stomach content analysis yielded 66 prey items including caridean shrimp, polychaete worms, isopods, and teleost fishes. Stable isotope data of $\delta^{13}\text{C}$ suggest frogfish utilize carbon derived from pelagic sources (phytoplankton) while $\delta^{15}\text{N}$ data suggest frogfish function as mid-level predators. It is hypothesized that Sargassum Frogfish undergo an ontogenetic shift in diet but due to a limited size range within our samples, no clear shift was identified. However, with additional samples, we expect to see a change in diet from invertebrates to teleost fishes. This study will provide insight into the feeding ecology of the Sargassum Frogfish and will further our understanding of its role within *Sargassum* communities.

0907 Fish Conservation I, San Antonio, Sunday 16 July 2017

Ángel L. Martínez-González¹, Fredys F. Segura-Guevara¹, Glenys Tordecilla-Petro², Charles W. Olaya-Nieto¹

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Length-Weight Relationship of Mayupa *Sternopygus macrurus* in the Low Sinu River, Colombia

The length-weight relationship of Mayupa *Sternopygus macrurus* Bloch collected in the Low Sinu River, Colombia, was estimated. The length-weight relationship and condition factor were estimated with the equation $TW = a TL^b$ and $Cf = TW/TL^b$, respectively. The size ranged between 39.5-112.0 cm TL, the total weight between 132.0-1847.0 grams, and the mean length in the catch estimated was 73.4 cm TL. Length-weight relationship estimated was $TW = 0.028 (\pm 0.17) TL^{2.39 (\pm 0.09)}$, $n = 542$, $r = 0.91$, were the monthly growth coefficient ranged between 1.57 (September) and 2.88 (June), being negative allometric for the study year, with statistically significant differences, while the condition factor ranged from 0.004 (June) and 1.011 (September), without statistically significant differences. Analyzing the condition factor, spawning season of Mayupa and hydrological cycle of Sinu River, correlation was found between them only in descending and low waters.

0568 ASIH STOYE CONSERVATION I, San Antonio, Thursday 13 July 2017

Katie Mascovich, Kimberly Andrews

Odum School of Ecology, University of Georgia, Athens, Georgia, USA

Messages in the Sand: Nesting Loggerhead Sea Turtle (*Caretta caretta*) Crawl Behavior on a Developed Beach

A nesting sea turtle's path indicates the amount of that animal's energy expenditure; more energy is spent as a path becomes less direct. To better understand how anthropogenic factors influence crawl behavior, we collected data on 132 loggerhead sea turtle (*Caretta caretta*) tracks on Jekyll Island, Georgia, USA. We used a straightness index (straight distance to water divided by distance the turtle crawled) and path index (distance the turtle crawled divided by number of turns along the crawl divided by straight distance to water) to examine the effect of human intervention and infrastructure on track patterns. A turtle's out-crawl (return to ocean) was classified as being undisturbed, program (followed by education program), and restrained (restrained for processing). The mean straightness indices for undisturbed, program, and restrained out-crawls were 0.91, 0.92, and 0.77, respectively. A Kruskal Wallis test with post hoc pairwise comparisons showed that restrained crawls differed significantly from undisturbed and program out-crawls ($\chi^2_2 = 25.76$, $p < 0.05$). A one-way ANOVA with post hoc Tukey HSD determined that path indices for natural (0.41) and restrained (0.16) out-crawls were significantly different from each other, but neither significantly differed from program out-crawls (0.28; $F_{2,127} = 14.69$, $p < 0.0001$). Additionally, the type of light visible from crawls was classified as none visible, only ambient, only point-source, or both ambient and point-source. Neither the straightness nor path indices

significantly differed between lighting groups. These results indicate that intervention by managers is an effective technique to mitigate human interaction and lighting infrastructure.

0550 Herp Genetics, San Antonio, Saturday 15 July 2017

Audrey Matheny, Laura Kimmel, Gary Thomas, Emily Gertrand, Susan McKenna, Samah Houmam, Allyson Fenwick

University of Central Oklahoma, Edmond, OK, USA

Comparative Genetic Structure of Mediterranean Geckos (*Hemidactylus turcicus*) across Central Oklahoma

Exotic species are good models for understanding ecological and evolutionary processes because they adapt to new habitats over observable time periods. Mediterranean geckos engage in commensal relationships with humans and have been introduced throughout the world. Central Oklahoma is at the northern edge of the U.S. range and likely near the limit of the species' climate tolerance. During 1963-1965 and 1985-1997, geckos were repeatedly introduced from Goose Island State Park in Texas to Howell Hall at the University of Central Oklahoma (UCO). At the Oklahoma City Zoo, geckos escaped from the Herpetarium at an unknown date. Geckos escaped from labs at the University of Oklahoma (OU) near the current locations of Sutton Hall and the old Clock Tower before the mid-1960s. We expect the UCO and Texas populations to cluster together and the OKC Zoo and OU populations to cluster separately from each other and UCO and Texas. Within the UCO, OKC Zoo, and OU populations we expect to find evidence of stepping stone pattern of colonization from the source building. We collected tissue samples from 10-20 individuals on occupied buildings at each location and genotyped 16 previously published microsatellites. Preliminary STRUCTURE and differentiation analyses show two genetic clusters; one including UCO and Texas as expected, and the other including OKC Zoo and OU, which is unexpected. We are also analyzing RAD-Seq libraries for a subset of UCO samples. Future research will expand sampling to gecko introductions along a north/south corridor.

0255 AES Ecology II, Glass Oaks, Sunday 16 July 2017

Philip Matich¹, Jeremy Kiszka², Johann Mourier³, Serge Planes³, Michael Heithaus²

¹Sam Houston State University, Huntsville, TX, USA, ²Florida International University, Miami, FL, USA, ³Centre de Recherches Insulaires et Observatoire de l'Environnement, Perpignan, France

Species co-occurrence affects the trophic interactions of two juvenile reef shark species in tropical lagoon nurseries in Moorea (French Polynesia)

Coastal ecosystems serve as nursery habitats for a variety of taxa, including sharks, highlighting their ecological importance. However, these ecosystems are some of the most threatened in the world. Changes in environmental conditions, resource availability, and habitat quality are leading to shifts in species distributions and abundances, which theory predicts will have considerable effects across food webs. As such, understanding the adaptive capabilities of species is critical for identifying species and habitats of concern. We used plasma ^{13}C and ^{15}N values from juvenile blacktip reef sharks (*Carcharhinus melanopterus*) and juvenile sicklefin lemon sharks (*Negaprion acutidens*) in Moorea, French Polynesia to investigate how species co-occurrence affects niche shifts and trophic flexibility. Previous research suggests that juvenile sharks are capable of adjusting their foraging tactics to account for changes in food availability, and our findings here suggest that juvenile sharks are also able to account for changes in competition. Co-occurrence led to shifts in the trophic interactions of both blacktip reef sharks and sicklefin lemon sharks, leading to trophic niche partitioning, which did not appear to affect life history traits. Trophic plasticity suggests these sharks are able to account for changes in community structure, resource availability, and intra-guild competition, and may fill similar functional roles in the absence of the other species, which is important as environmental change and human impacts persist in coral reef ecosystems.

0257 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Philip Match¹, John Mohan², Jeffrey Plumlee², Tom TinHan², R.J. David Wells², Mark Fisher³

¹Sam Houston State University, Huntsville, TX, USA, ²Texas A & M University Galveston, Galveston, TX, USA, ³Texas Parks and Wildlife Department, Rockport, TX, USA

Factors shaping the co-occurrence of two juvenile shark species along the Texas Gulf Coast

Top-down effects are ubiquitous across ecosystems, however continued declines of many predators suggests that the reduction and loss of direct and indirect effects predators impose may lead to considerable changes in community structure. Coastal sharks have been particularly affected, with declines not only altering community composition, but potentially shark behavior and life histories, compounding effects on food web structure and resilience. As such, understanding interactions among sharks is important for predicting the consequences of potential future declines. Using data from long-term coastal gill net surveys in Texas, USA, we quantified blacktip shark (*Carcharhinus limbatus*) and bull shark (*C. leucas*) concentrations, and evaluated how environmental factors and shark sizes affected co-occurrence within and across species as an important step in understanding the factors that lead to greater spatial overlap and competition. Co-occurrence varied spatially and temporally, with a significant increase in co-occurrence from the 1970s-2010s, and a significant decrease in bull shark concentrations through time. Changes in environmental conditions, specifically

increasing salinities, may have been responsible for increased blacktip and bull shark co-occurrence, which in turn may have led to decreased bull shark concentrations as a mechanism to reduce intraspecific competition. Plasticity in habitat use patterns suggest that each species is capable of adjusting to changing salinities attributed to sea level rise and variability in freshwater inflow, which may be important as climate change and human impacts alter hydrologies within Gulf Coast estuaries.

0032 Fish Ecology II, San Antonio, Sunday 16 July 2017

Bill Matthews¹, Bob Nairn¹, Nick Shepheard¹, Zach Zbinden², Aaron Geheber³,
Edie Marsh-Matthews¹

¹*University of Oklahoma, Norman, OK, USA*, ²*University of Arkansas, Fayetteville, AR, USA*, ³*University of Central Missouri, Warrensburg, MO, USA*

Fishes of a Heavy Metal Contaminated Superfund Stream (Tar Creek, Oklahoma) after Operation of a Passive Treatment System

Mining in the Tri-State Mining District of Oklahoma, Kansas, and Missouri from 1891 to 1971 resulted in massive excavation of huge underground rooms, and extraction of many millions of tons of lead and zinc. After cessation of mining operations, these huge caverns slowly filled with water, until artesian pressure resulted in extrusion of heavily contaminated waters to the surface through bore holes or other exit points within the Tar Creek Superfund site. Fishes in the Tar Creek watershed have been heavily impacted by this heavy metal contamination such that in some natural stream channels only Western Mosquitofish and a few Green Sunfish survived. From 2004 to 2007 we monitored fishes in an Unnamed Tributary (UT) to Tar Creek, Tar Creek proper, and reference sites. In 2008, a passive treatment system (PTS) of ponds was installed to treat the contaminated water and remove or reduce heavy metals. The system decreased concentrations of iron, zinc, lead, cadmium and arsenic by more than 96% and produced an effluent meeting hardness-adjusted, in-stream water quality criteria. From 2009 through our most recent samples in 2016, there was marked improvement of the fish community at sites within the receiving system. But a new source of highly contaminated water is now being treated with a new PTS that came on line in February 2017. We shall follow effects of the new PTS on fishes for the next several years.

0686 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Trinity, Friday 14 July 2017

Jessica Maxfield, Kathleen Cole

University of Hawaii Manoa, Honolulu, HI, USA

Shifting From Egg to Sperm Production in Bisexual Fishes: What Does an Ovotestis Have to do?

There are five clades in the family Gobiidae that have evolved hermaphroditism, possibly independently. Here we examine changes in ovotestis structure for two serially hermaphroditic species representing two different clades, *Eviota epiphanes* and *Lythrypnus dalli*. We focused on the transition from oocyte to sperm production among same 'sex' pairs, using histology to generate a morphological time series of transitional states. We found that the basic processes of transition were similar for both species. However, differences were also observed. In *L. dalli* the spermatogenic tissue had two clear sites of origin in the gonad while in *E. epiphanes*, there were no clear points of origin of spermatogenic tissue. Among *E. epiphanes* pairs, both individuals started to transition in 29% of all pairs, suggesting a contest for who would become male. Among *L. dalli* pairs, such contests were rarer, with only 14% of all pairs initiating joint transformation. The ovotestis transformation to sperm production in *L. dalli* was also initiated and completed more rapidly. Interestingly, the larger-size *L. dalli* also produced much smaller-sized sperm than *E. epiphanes*. While still in its early stages, our study indicates that the process of transitioning from ova to sperm production in these two serial hermaphrodites is not identical. Next, we will be looking at gene expression patterns during transition in these two species to see if differences in gene networks and/or pathways exist.

0511 ASIH STOYE CONSERVATION III, San Antonio, Friday 14 July 2017

Brittany L. McCall, Brook L. Fluker

Arkansas State University, Jonesboro, AR, USA

Stability at Low Densities or Endangered? Spatiotemporal Population Dynamics of the Caddo Madtom (*Noturus taylori*)

The Caddo Madtom (*Noturus taylori*), an endemic to the Ouachita Mountain Ecoregion, was one of 404 species petitioned for listing on the Endangered Species Act by the Center for Biological Diversity. A previous survey stressed concerns of a population decline with evidence of small effective population sizes, historical between-drainage differentiation, and recent reservoir-induced within drainage differentiation. With microsatellite DNA loci, mitochondrial (mt) cytochrome *b* DNA sequence data, and intensive seasonal sampling we tested multiple hypotheses involving patterns of within and among drainage connectivity, spatiotemporal population dynamics, and habitat preferences. Preliminary Bayesian phylogeographic analysis of mtDNA using coalescent models resolved the Caddo and Ouachita river drainages as reciprocally monophyletic with recent divergence in the late Pleistocene (approx. 125,000 years ago). Microsatellite DNA data suggest a similar pattern of significant between drainage differentiation ($F_{st} = 0.20$, $P < 0.001$). Of 15 historic localities, 11 have been thoroughly sampled for presence/absence, with presence at 8 of the 11 localities. For the five localities included in the seasonal survey, an increase in mean relative abundance was observed from spring to summer in the Caddo River (0.29 to 9.05 CPUE, respectively) and in the Ouachita River (0.09 to 4.75 CPUE, respectively). Analyses of habitat preference using nonmetric multidimensional scaling suggest differences between the Caddo and

Ouachita drainages, as well as differences between headwater and mainstem localities. Results from this study will aid in future listing decisions by U.S Fish and Wildlife, and state rankings by the Arkansas Game and Fish Commission.

0520 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Brittany L. McCall, Brook L. Fluker

Arkansas State University, Jonesboro, AR, USA

Status Survey and Conservation Genetic Assessment of the Paleback Darter, *Etheostoma pallidorsum*

The Paleback Darter (*Etheostoma pallidorsum*), an endemic to the Ouachita Mountain Ecoregion, is a Species of Greatest Conservation Need in Arkansas. Additionally, in response to concern of a population decline from a prior allozyme study, *E. pallidorsum* is one of 404 species petitioned for listing on the Endangered Species Act by the Center for Biological Diversity. The objectives of this project were to survey historic localities, estimate size-distribution data and relative abundance on a seasonal basis, and assess population dynamics with microsatellite DNA loci. Average relative abundance (catch per unit effort) for all four seasonal sites was similar between winter and spring (0.36 and 0.39, respectively), with highest values in the summer (0.94). Over all seasons, relative abundance was similar between Caddo and Ouachita drainages (0.59 and 0.54, respectively). Preliminary analyses of microsatellite DNA loci revealed low, but significant genetic structure among localities ($F_{st} = 0.054$, $P < 0.001$), with the highest levels of structure observed between river drainages. Population genetic diversity is relatively low (mean $H_e = 0.59$; mean alleles per locus = 5.06), but comparable to close relatives *E. boschungii* (mean $H_e = 0.67$; mean alleles per locus = 6.74) and *E. tuscumbia* (mean $H_e = 0.57$; mean alleles per locus = 5.53). Preliminarily, these results suggest that *E. pallidorsum* is relatively stable and abundant at sampled historic localities. Future analyses will provide updated information on range-wide presence/absence, and a better understanding of historical and contemporary connectivity among the Caddo and Ouachita river drainages.

0845 Lightning Talks II, Glass Oaks, Friday 14 July 2017

John McCall, Michael Sandel

University of West Alabama, Livingston, Alabama, USA

Invasive Green Swordtails (*Xiphophorus helleri*) at Two North Florida Sites

The green swordtail (*Xiphophorus helleri*) is invasive in a number of locales around the world. Native to Mexico and Central America, *X. helleri* has established itself at widespread sites in the U.S. This report documents the presence of feral populations

of *X. helleri* in two North Florida streams on opposite ends of the Florida panhandle. Collections made in 2007, 2014, and 2016 revealed the presence of a reproductive population of *X. helleri* in a small stream flowing through Hurlburt Field, a U.S. Air Force installation in Okaloosa County in the western part of the panhandle. The invasive swordtails made up 80% of the fish assemblage, which also included the mosquitofish (*Gambusia holbrooki*) and the least killifish (*Heterandria formosa*). Later in 2016, *X. helleri* was collected from Little Fishweir Creek in Jacksonville, Florida. Again, the fish assemblage was dominated by the invasive poeciliid. This stream is a tributary of the larger Big Fishweir Creek, which empties into the St. Johns River. The sampling site is less than one mile from the St. Johns. The presence of *X. helleri* in these two widely separated locations in the Florida panhandle suggests that it may, in fact, be relatively widespread throughout North Florida. It should be noted that the streams share certain attributes. Both are small streams supporting a relatively low diversity of native fish species, flowing through heavily populated areas. Such streams are likely highly subject to aquarium release and subsequent invasions.

0603 Amphibian Conservation III, Wedgewood, Sunday 16 July 2017

Emily McCallen, Bart Kraus, Nick Burgmeier, Songlin Fei, Rod Williams

Purdue University, West Lafayette, IN, USA

Movement and Habitat Use in Eastern Hellbenders (*Cryptobranchus alleganiensis alleganiensis*) Following Population Augmentation

Eastern Hellbenders (*Cryptobranchus alleganiensis alleganiensis*) are threatened in many parts of their range. Conservation actions, including population augmentations and reintroductions, may be necessary to ensure the future viability of vulnerable Eastern Hellbender populations. In Indiana, the rapidly declining population is now restricted to a single river. While augmentation may improve recruitment within this population by increasing local densities, it is important to understand the effects of these management actions on both long-term residents and translocated individuals. In order to determine the suitability of such an approach in Indiana, we monitored the movement and habitat use of 42 Eastern Hellbenders at two sites that underwent population augmentations. We radio-tracked three cohorts over multiple seasons: wild, adult residents; captive-reared, juvenile translocates; and wild, adult translocates. We examined general patterns of dispersal and calculated linear and mean convex polygon home ranges for each tracked hellbender. We used a series of generalized linear mixed models to compare movement patterns and habitat use between groups. We saw a low incidence of dispersal from translocation sites even among wild, adult translocates. Wild, adult translocates had larger home ranges than residents, but the magnitude of these differences decreased over time. Captive-reared, juveniles had similar home range sizes as adult translocates, but appeared to utilize suboptimal habitats compared to adults. This is the first study to demonstrate the suitability of population augmentations in low-density Eastern Hellbender populations. It also establishes the potential of techniques

such as soft-releases and habitat enrichment to improve translocation success in Hellbenders.

0675 AES Behavior, Pecos, Sunday 16 July 2017

Michael McCallister¹, Manuela Sales¹, Andrew Smith², John Mandelman³, Andy Danylchuck⁴, Matthew Ajemian¹

¹Florida Atlantic University, Harbor Branch Oceanographic Institute, Fort Pierce, FL, USA, ²gassProductions Ltd., Grey Gables, Tatsfield, UK, ³New England Aquarium, Anderson Cabot Center for Ocean Life, Boston, MA, USA, ⁴University of Massachusetts, Department of Environmental Conservation, Amherst, MA, USA

Field Observations of Mating Behavior in Two Species of Myliobatid Stingrays

Information on the mating behavior of elasmobranchs has been historically limited to observations in captivity. For batoids, observations of mating behavior from the wild are limited to a few species. Here, we present video documentation of two new cases of wild mating behavior in two species of myliobatid stingrays. On July 20, 2013, a male and female cownose ray (*Rhinoptera bonasus*) were observed mating in shallow coastal waters off New Jersey. On August 19, 2014, two spotted eagle rays (*Aetobatus narinari*) were observed mating in Harrington Sound, Bermuda. In both cases, video footage documented all stages of the mating sequence previously described in the literature: 1) close following, 2) pre-copulatory biting, 3) copulation/insertion, 4) resting, and 5) separation. The mating behavior observed for both *A. narinari* and *R. bonasus* is consistent with observations in mating behavior described for both captive spotted eagle rays and the flapnose ray (*R. javanica*), a sister species of *R. bonasus*. To our knowledge, this is the first time a complete mating sequence has been documented in the wild for either species. Additionally, in both cases, we noted that the female ray was considerably darker in color than the male, which may be evidence of a visual pre-copulation cue, as seen in other fishes. The similarity of the mating behaviors presented here, and those observed in other ray species (e.g., *M. birostris*, *M. californica*, and *D. americana*) provides further support to the hypothesis that mating behavior may be highly conserved among the batoids.

0403 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Trinity, Friday 14 July 2017

Evan McCartney-Melstad¹, Jannet Vu², H. Bradley Shaffer¹

¹University of California, Los Angeles, Los Angeles, CA, USA, ²Stony Brook University, Stony Brook, NY, USA

Fine-Scale Population Genomics of Protected Tiger Salamanders (*Ambystoma tigrinum*) on Long Island, NY Reveals a Highly Structured Species Impacted by Major Roads

We sequenced thousands of nuclear loci in hundreds of individuals to characterize the population structure of state-endangered tiger salamanders (*Ambystoma tigrinum*) on Long Island and quantify the impacts of human development. We uncovered highly genetically structured populations over an exceptionally small spatial scale (approximately 40 km²) in an increasingly human-modified landscape. We explore the geological and anthropological drivers of this genetic structure, as well as factors influencing the effective population size of ponds on the landscape. This study demonstrates the added value of genomic approaches in molecular ecology, as these patterns were not apparent in an earlier study of the same system using microsatellite loci.

0030 AES Genetics, Systematics, & Biogeography, Pecos, Sunday 16 July 2017

Margaret McClain¹, Austin Gallagher², Neil Hammerschlag², Marcus Drymon³, Dean Grubbs⁴, Tristan Guttridge⁵, Toby Daly-Engel¹

¹University of West Florida, Pensacola, FL, USA, ²University of Miami, Coral Gables, FL, USA, ³University of South Alabama, Mobile, AL, USA, ⁴Florida State University, Tallahassee, FL, USA, ⁵Bimini Biological Field Station, Bimini, BS, Bahamas

Connectivity and Relatedness in Tiger Sharks between the Gulf of Mexico and the West Atlantic

Shark dispersal for the purposes of reproduction is generally poorly understood, including that of Tiger Sharks (*Galeocerdo cuvier*), a large, circumglobal, coastal-pelagic species (Randall, 1992, Werry et al, 2014). While it has been found that both gravid and non-gravid females will often group together without males, no discrete mating areas or nursery grounds for tiger sharks have yet been identified in the Gulf of Mexico or West Atlantic Ocean (Sulikowski et al, 2016). Juvenile tiger sharks show some site fidelity, but adults appear to have large ranges, and their movement patterns are largely unknown (Werry et al, 2014). This research aims to identify reproductive relatedness including patterns in site fidelity and kinship among sites within and between the Gulf of Mexico and the West Atlantic (Bahamas). Using highly polymorphic microsatellite DNA fragment analyses, we will examine the relatedness of individuals from four sites, two in the Bahamas and two in the northern Gulf. We will use assignment testing to identify potential distribution corridors and critical habitat for tiger sharks, and examine genetic connectivity between broad geographic regions. Based on dispersal patterns observed in other large coastal shark species (Blower et al, 2012), we hypothesize that there will be shallow structure between the different sample sites due to habitat variation and philopatry. We further hypothesize that this structure will be male-biased, reflecting the female dependence on coastal nursery habitat.

0881 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jan McDowell, Heidi Brightman

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

A genetic-based investigation of blueline tilefish (*Caulolatilus microps*)

Blueline tilefish, *Caulolatilus microps*, also known as grey tilefish (Goode and Bean 1878), is a bottom dweller found at depths of 240-780 feet. Blueline tilefish is a member of the family Malacanthidae and have historically been reported to occur along the continental shelf from Virginia to the Campeche Banks of Mexico, occupying the same habitat as groupers and snappers. Although North Carolina was previously considered to be the northern extent of the species range, concentrations have recently been discovered in Virginia and Maryland, with reports as far north as Montauk, NY. The life-history parameters of blueline tilefish make them particularly vulnerable to overfishing; they are long-lived and grow slowly, with an estimated lifespan of up to 43 years and a maximum size of 900 mm fork length. The recent development of an unregulated fishery from New Jersey northward led to a substantial increase in commercial and recreational landings in the U.S. mid-Atlantic, raising concern about the sustainability of the resource. Meanwhile, the lack of information about stock structure led to uncertainty concerning appropriate management. In this study we developed 25 polymorphic microsatellite loci and used these loci to analyze 490 samples from the U.S. east coast range from New York to the southern Florida Keys and 15 samples from western Florida in the Gulf of Mexico. Although the sedentary nature of adults suggests population structure, there was no evidence that blueline tilefish are comprised of genetically distinct populations along the U.S. East Coast.

0878 Fish Genetics, Trinity, Saturday 15 July 2017

Jan McDowell, Hamish Small

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

Genetic assessment of the population structure of Tautog, *Tautoga onitis*

Tautog, *Tautoga onitis* (Linnaeus, 1758), which aggregate around structured habitat (wrecks, rocks, and bridge pilings etc.), are slow to mature and have a low reproductive rate relative to other teleosts. Like other reef fishes, tautog is extremely vulnerable to overexploitation. Tagging studies indicate that tautog undergo limited movements, with an onshore offshore pattern of migration but no evidence of either long-range or north-south migration, suggesting that distinct stocks might exist along the Atlantic coast. In 2016 four regional management groupings were initiated to account for the limited north-south migration and regional harvest patterns. Given that overfishing is still occurring in two regional management units, understanding the stock structure is critical for appropriate management. To investigate the population structure of tautog,

we developed and applied 21 microsatellite loci to samples collected from North Carolina, Virginia, Maryland, Connecticut, and Massachusetts from 2014-2017. In addition, a subset of these samples were shipped to Diversity Arrays Technology in Canberra, Australia, for downstream genome reduction and next-generation sequencing, resulting in identification of 4148 short sequences (~70bp) containing SNPs. This data was used to test the hypothesis that tautog comprise a single genetic stock across its U.S. East Coast range.

0076 ASIH STOYE ECOLOGY & ETHOLOGY I, Sabine, Thursday 13 July 2017

Kira McEntire, John Maerz

University of Georgia, Athens, GA, USA

Integrating Biophysical and Individual Based Models to Simulate How Habitat Structure and Behavior Moderate Salamander Sensitivity to Climate

Understanding how climate affects species is a long-standing question in ecology. On an individual level, organisms directly interact with microclimate, which is altered by vegetative structure. Ultimately, the organism's integration with microclimate is governed by its physiology, but behavior can moderate these interactions. We used an individual based modeling (IBM) approach, incorporating biophysical models, to explore the interactions of vegetative structure and behavior on an organism's physiological interactions with climate using woodland salamanders (genus *Plethodon*) as a model organism. The IBM was simulated using four different versions across the same area of Southern Appalachia, where steep rainfall gradients naturally exist. We estimated salamander activity time for a climate only model (baseline), a model including vegetative heterogeneity (presence of midstory canopy plants across half of the area), a model including the ability to climb plants (a potential behavioral strategy to alter climate interactions), and a model including both vegetative heterogeneity and climbing behavior. The simulations suggest vegetative structure and behavior both act to moderate the impact of a rainfall gradient by boosting overall activity times. This effect was most pronounced for juvenile and hatchling salamanders. The two factors had seasonally distinguishable effects, with overall increases in foraging time primarily occurring in the fall. Activity increases were smaller in spring and summer months, with the increases focused in the drier areas. Future species distribution models (or similar) should consider the moderating influences of vegetative structure and behavior on species responses to climate change.

0438 ASIH STOYE GENERAL ICHTHYOLOGY III, Trinity, Friday 14 July 2017

Caitlin McGarigal, Chris Lowe

CSU Long Beach, CA, USA

Behavioral Effects of Angling and Handling Stresses on Kelp Bass, *Paralabrax clathratus*, in Southern California

Catch and release is a common regulatory strategy for many gamefish species, including kelp bass (*Paralabrax clathratus*), yet effects of capture-related stresses on fish physiology and behavior are species-specific and remain largely unknown. Quantifying these impacts, and identifying best practices, will aid in managing the economically and ecologically valuable kelp bass fishery in southern California. Fish movement and activity following catch and release were evaluated in the Catalina Island Marine Life Reserve using a VRAP receiver array and acoustic accelerometers (Vemco Ltd, USA; V9A). To evaluate effects of stress on behavior fish were caught on hook and line, force-fed a transmitter, and released; control fish were fed squid with a hidden transmitter underwater by divers. All fish were tracked until tag was regurgitated (range 2-8 d) and recovered. Area (m²) of the core range (50% KUD) and home range (90% KUD) were significantly reduced in fish caught and released for the first 6 hrs at liberty, but was similar to that of control fish by 18-24 hrs post-release. Kelp bass exhibit diel behavioral patterns with highest activity (acceleration, m/s²) during crepuscular periods. Caught and released fish exhibited fewer episodes of high activity (associated with normal foraging, predator avoidance, and reproductive activities) than control fish for 24 hr post-release, but resumed normal activity within 48 hr. Capture and handling stresses may result in some behavioral impacts (reduced area use and activity) but individuals appear to rapidly recover.

0103 Herp Environment, Brazos, Saturday 15 July 2017

Jay McGhee

Northwest Missouri State University, Maryville, Missouri, USA

Use of PVC Pipe Refugia to Assess Summer Pond Use in Cope's Gray Treefrogs

Ponds act as important breeding sites for amphibian species such as Cope's Gray Treefrog (*Hyla chrysoscelis*), and determining how individuals use such ponds can be important to conservation efforts. We examined the use of four ponds during the breeding season by this species on a site bordering Mazingo Lake in Nodaway County, Missouri over a two year period. We used arrays of PVC pipe refugia to monitor usage centered on randomly selected trees bordering the pond. Pipes were placed in a straight line in the following categories: 2m away from the tree in the direction moving away from the pond, attached to the tree, 2m away from the tree in the direction towards the pond, and 5m away from the tree in the direction towards the pond. We compared specific treefrog choice of PVC refugia relative to their pond in terms of canopy cover and internal pipe temperature. Eighty-four tree frogs made use of 52% of 64 pipes. We found that one pond was used by a greater number of treefrogs than the others ($\chi^2=22.78$, $df = 9$, $P = 0.0067$). Thirty-six percent of individual treefrogs (5 out of 14) significantly selected for PVC pipe refugia under canopy cover. No treefrogs selected for

internal temperature relative to randomly selected refugia (0 out of 9). These results suggest a high level of variation in pond selection during the breeding season, as well as variation in selection of pipe refuges with canopy cover being a potentially useful determinant of pipe choice.

0446 ASIH STOYE ECOLOGY & ETHOLOGY I, Sabine, Thursday 13 July 2017

Donald McKnight, Roger Huerlimann, Lin Schwarzkopf, Ross Alford, Deborah Bower, Kyall Zenger

James Cook University, Townsville, QLD, Australia

The Role of Microbial Communities in the Recovery of Rainforest Frogs

The amphibian chytrid fungus (*Batrachochytrium dendrobatidis*; *Bd*) has caused many amphibian species to decline worldwide. However, some of the species that declined have subsequently recovered. The cause of these recoveries is poorly understood, but changes in the frogs' microbiomes is a possible contributor. To test this possibility, we are comparing the microbiomes of the following four species of Australian frog in both low and high *Bd* prevalence locations: Stoney Creek frog (*Litoria wilcoxii*), green-eyed treefrog (*Litoria serrata*), waterfall frog (*Litoria nannotis*), and Australian lace-lid frog (*Litoria dayi*). All four species are found along the same streams and have persisted at warm, low-elevation sites (<300 m elevation), but each species has a different history with *Bd* at the cooler, upland sites. At high elevations, *L. wilcoxii* never declined, *L. serrata* declined and recovered, *L. nannotis* disappeared and has subsequently returned, and *L. dayi* disappeared and has yet to return. We are using next generation sequencing to examine the bacterial and fungal communities of these species at both high and low elevation sites. If microbial communities played a role in the history of declines and recoveries in these species, then we expect that *L. wilcoxii* populations and recovered upland populations of *L. serrata* and *L. nannotis* will have a high proportion of anti-fungal bacteria compared to populations of *L. dayi* and low elevation populations of *L. nannotis* and *L. serrata*. The results of this study will be presented and will have important implications for managing wild frog populations and designing recovery plans.

0039 Lightning Talks II, Glass Oaks, Friday 14 July 2017

Chris McMartin

Southwestern Center for Herpetological Research, Conroe, Texas, USA

Results of a Public Opinion Survey on Reptiles and Amphibians

The Southwestern Center for Herpetological Research conducted an online survey August-November 2015 soliciting opinions from the public on a wide range of herpetofauna-related topics. Areas of interest included discernment of venomous

species, thoughts on field herping and maintaining private collections, and general public perceptions of the enthusiast community. The survey received over 2,000 responses. Part of the survey's intent was to gauge potential collecting pressure and efficacy of laws pertaining to US native herpetofauna. Results provide insights into better state-level management and opportunities for enlisting the help of the growing citizen-science movement in expanding our knowledge base.

0432 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Christian McNabb, Megan Novak, Scott L. Parker

Coastal Carolina University, Conway, South Carolina, USA

A comparative analysis of microhabitat use by the southern copperhead (*Agkistrodon contortrix contortrix*) between a fragmented and non-fragmented environment in Horry County, SC

Habitat fragmentation influences spatial ecology and habitat use of many vertebrate species. The southern copperhead (*Agkistrodon contortrix contortrix*) is a common venomous snake in South Carolina and is found in both fragmented and non-fragmented habitats. The purpose of this study was to quantify microhabitat use of copperheads inhabiting fragmented (Coastal Carolina University, CCU) and non-fragmented (Waccamaw National Wildlife Refuge, WNWR) habitats in Conway, SC. From May to October, 2016, we actively searched for *A. contortrix* and tracked individuals (n = 72) using thread bobbins every other day. For each snake observation, microhabitat data (e.g. substrate type, canopy cover, herbaceous cover, woody debris, woody stem density) was recorded using a 1m² quadrat. Time of day, season, and habitat location (forest edge, core, open) were also recorded. At CCU, snakes preferred edge habitats (89% of observations) and preferred microhabitats consisting of pine straw or leaf litter (72% of observations). The remaining 38% of microhabitat observations consisted of other microhabitats (e.g. within woody debris, within shrubs, atop gravel, under soil). In contrast to CCU, snakes at WNWR were observed in core (52%) and in edge habitats (43%), with 5% of observations occurring in open habitat with no apparent difference in microhabitat preference (i.e. snakes were observed with relatively equal frequency among microhabitat types). Prey availability, habitat preference, and suitable thermal environment likely influences microhabitat choices. These results suggest that habitat fragmentation may alter how animals use the available habitat resources in their environment.

0194 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; Poster Session II, Rio Grande Exhibit

Hall, Saturday 15 July 2017; HL/SSAR/ASIH SYMPOSIUM - THE SCIENCE, MANAGEMENT, AND POLICY OF AMPHIBIAN CONSERVATION: EXTENDING THE LEGACY OF RAY SEMLITSCH

Jessica McQuigg, Michelle Boone

Miami University, Oxford, Ohio, USA

Examining the Effect of Host Condition and Temperature on Interactions between Amphibian Chytrid Fungus and Native Anurans

Amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), is an emerging infectious disease responsible for amphibian declines and extinctions globally, yet factors that influence disease outbreaks are not well understood. The complex host-pathogen interactions between amphibian species and Bd are influenced by environmental conditions, such as temperature, and host condition. The objective of this study was to examine how host condition influenced the susceptibility of American toad (*Anaxyrus americanus*) and wood frog (*Lithobates sylvaticus*) metamorphs to Bd exposure at 17°C or 25°C-temperatures within the thermal optima of Bd. I measured the effects of Bd exposure across temperatures on growth, and pre-winter and overwintering survival of small or large metamorphs. My central hypothesis was that anuran body condition and environmental temperature would interact to influence the impacts of Bd on growth and survival. Amphibians were reared to metamorphosis in mesocosms at high and low densities to produce small and large body sizes at metamorphosis respectively. Juveniles were exposed to Bd post-metamorphosis and examined for survival and growth for 82 days prior to overwintering. While temperature had no effect on the impact of Bd, Bd-exposed individuals experienced reduced terrestrial growth compared with control animals. Pre-winter survival was not impacted by Bd exposure, however, exposed American toads experienced 100% mortality overwinter and exposed wood frogs experienced increased mortality compared with control anurans. These results suggest that Midwestern amphibians may experience sub-lethal effects of Bd exposure and substantially decreased overwintering survival which could have impacts on population dynamics and increase the risk of local extirpation.

0356 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kenzie Medley, Alicia Mathis

Missouri State University, Springfield, MO, USA

When Territorial Salamanders Cheat: A Test of the Dear Enemy Phenomenon in Southern Red-backed Salamanders

The “dear enemy” hypothesis states that a territory owner shows reduced aggression toward a neighbor once territorial boundaries are established. Neighbors that do not restrict their activity to the agreed upon territory boundaries can be characterized as “cheaters” and might be subject to retaliation. To establish territory boundaries, we exposed each focal Southern Red-backed Salamander, *Plethodon serratus*, to reflections

produced from a mirror located on one side of an arena for a week. To simulate a cheating neighbor, we moved the mirror to the other side of the arena; a cooperating neighbor was simulated by replacing the mirror in its original location. Salamanders exposed to the cheating “neighbor” were significantly more aggressive than salamanders exposed to the cooperating “neighbor”. Discrimination against “cheating” neighbors is consistent with the dear enemy hypothesis.

0558 AES GRUBER AWARD II, Wedgewood, Thursday 13 July 2017

Emily Meese, Chris Lowe

CSULB Shark Lab, Long Beach, CA, USA

Diel movements and fine-scale activity patterns across heterogeneous thermal environments of the CA horn shark, *Heterodontus francisci*

Because water temperature influences internal body temperatures of ectothermic sharks, it is considered the key environmental variable to directly influence their physiology (e.g., metabolism) and behavior (e.g., movement patterns, feeding rates). This project uses active acoustic telemetry and accelerometer data loggers (ADLs) to quantify diel movements and fine-scale activity rates of horn sharks (*Heterodontus francisci*) as they move through a heterogeneous thermal environment. At Catalina Island, nine horn sharks (1.8 - 3.5 kg) were fitted with custom tag packages that include an acoustic transmitter (Vemco, V9-6L) and an ADL which records 3D body acceleration, depth, and temperature. Each shark was continuously tracked for 24 hrs. After being tagged, individuals tended to rest in shallower, warmer water during the day. Diel movement spaces ranged from 1,140 m² to 44,440 m² of space, with 67% of their movement activities occurring at night. Horn sharks spent approximately 65% of daytime hours resting, whereas only 32% of nighttime hours were spent resting. During the nighttime activity periods, sharks experienced up to a 10°C difference while traversing deeper (>30 m habitat). Sharks were found being active in temperatures from 9°C to 24°C. Differences by size and sex were additionally examined to determine what mechanisms influence horn shark activity. Quantifying horn shark movements and activity across heterogeneous environments will allow us to quantify their energetic landscape and to predict how changing ocean temperatures may affect the distribution and behavior of this kelp forest associated species.

0651 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Andrew Meiborg, John Peterson

University of Wisconsin-Platteville, Platteville, WI, USA

Effects of Weather Variability and Distance on the Viability of Automated Recording Systems for use in the Monitoring of Wisconsin's Endangered Cricket Frog, *Acris blanchardi*

The Blanchard's cricket frog is Wisconsin's only endangered amphibian. The Blanchard's cricket frog requires riverbanks with cracks and crevices in which to overwinter because they are not freeze tolerant. Riverbank development in Wisconsin has the potential to damage important habitat for this species. The Wisconsin DNR has put guidelines into place that minimize such practices in areas where cricket frogs are present. To determine cricket frog presence, surveys must be conducted by an individual approved by the Endangered Resources Review Program. Bringing an approved individual on site to conduct a cricket frog survey is expensive and paid for by the landowner. An option for reducing these costs is the use of recording devices in place of a human surveyor. To see if this is a viable option we compared recording devices to human surveyors and determined their ability to discern calls from various distances. Recorded cricket frog calls were broadcasted at a wetland and surveys were conducted at various distances and during variable weather conditions. Meters were found to be a viable analog for human observers when monitoring frog populations. Additionally, wind direction with respect to the call source was found to play a significant role in max call discernibility. Results would suggest placement of recording devices as well as human observers at a would have an impact on population monitoring.

0014 Amphibian Conservation I, Wedgewood, Sunday 16 July 2017

Joseph R. Mendelson III

Zoo Atlanta, Atlanta, GA, USA

10 Years of the Amphibian Ark: An overview of amphibian conservation-breeding programs

As part of the IUCN global Amphibian Conservation Action Plan, published in 2007, IUCN and World Association of Zoos and Aquariums formed the Amphibian Ark program to advise and build capacity for ex-situ conservation-breeding programs worldwide. The 10 year anniversary of the program offers an opportunity to review the successes, failures, and challenges of the captive breeding components of the overall ongoing challenges of amphibian conservation, including those directly associated with Amphibian Ark or not so.

0827 LFC Physiological Performance III, San Marcos, Sunday 16 July 2017

Jose Fernando Mendez Sanchez

Universidad Autonoma del Estado de Mexico, Estado de Mexico, Mexico

Physiology of Larval Air Breathing Fish

The same physiological mechanisms to get over the environmental threat experienced by water-breathing fish larvae plus an “on time” developmental program for an air-breathing organ are the survival challenges for the air-breathing fish larvae. Aquatic hypoxia is the main environmental pressure for the transition between the extraction of O₂ from the water and the extraction of O₂ from air. Thus, air-breathing fish larvae develop an air-breathing-organ which requires the ability to increase ventilation of the gas exchange organs, accompanied by appropriate changes in blood perfusion of these organs. This presentation reviews our state of knowledge of the air-breathing fish larvae physiological traits and the techniques to measure them. A comparative analysis of different species of air-breathing fish larvae is presented on how hypoxia affects the cardiovascular and respiration physiology and air-breathing-organ morphology as well as its consequences on survivorship, the promotion of developmental plasticity and different larval life styles. Additionally, the question is asked: How is the onset of key physiological processes related to the beginning of the air-breathing, and can this event be moved on the developmental time by the influence of hypoxia?

0250 Reptile Behavior, Sabine, Friday 14 July 2017

Mark Merchant¹, Dusty Savage¹, Amos Cooper², Chris Murray³

¹McNeese State University, Lake Charles, LA, USA, ²Texas Parks and Wildlife, Port Arthur, TX, USA, ³Tennessee Tech University, Cookeville, TN, USA

Nest Maintenance and Defense Regimens of the American Alligator (*Alligator mississippiensis*)

We employed camera traps, under the influence of small circuit boards, which captured photographs of alligator nest areas in a time-lapse fashion. The data revealed that alligators visit their nests frequently initially after the eggs are laid, and then nest attendance decreases rapidly during the first week of incubation. We observed a steady decline from 0.56 to 0.06 visits/nest/day during the first eight days of incubation throughout the first eight days of the first season (2011), and 0.42 to 0.08 during the second season (2012). However, nest visitation increased dramatically near the end of the 65-day incubation period. In addition, most of the visits occurred during the night time, with only 14.8 and 35.3% of visits during the daytime during the 2011 and 2012 field seasons, respectively. A large portion of the daytime visits were recorded during hatching and hatchling movement from the nest site.

0500 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Arianne Messerman, Manuel Leal, Raymond Semlitsch

University of Missouri, Columbia, Missouri, USA

Juvenile Survival Among Ringed Salamanders (*Ambystoma annulatum*)

Declining amphibian populations have been noted across the globe, and this taxon is now widely considered to be the most threatened among vertebrates. Mole salamanders in the genus *Ambystoma* are not exempt from this trend, with approximately 63% of these diverse species under federal protection in at least one country in which they occur. Life history data describing these at-risk species are needed to predict the responses of populations to differing management strategies and habitat changes. Such projections will be useful for selecting efficient conservation plans for declining populations. Due to the fossorial nature of juvenile and adult *Ambystoma* in many species, few data currently exist describing the vital rates of these life stages. To reduce this gap in our knowledge and inform models of *Ambystoma* population demography, I conducted an eight-month capture-mark-recapture study within outdoor enclosures to empirically estimate juvenile survival rates among ringed salamanders (*Ambystoma annulatum*). These survival estimates are some of the only available vital rate data for juvenile ringed salamanders, a rare endemic species of the Ozark and Ouachita Mountains. As a test of methodology, I further identified how survival rates and abiotic conditions changed between forested enclosures and enclosures designed to mimic forest habitat. In doing so, I have evaluated the realism of conditions in the non-forested enclosures, and improved the enclosure architecture for future studies examining vital rates in terrestrial ambystomatids. The results of this research will improve our ability to accurately model population dynamics and management outcomes for Ringed Salamanders and similar ambystomatids.

0480 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Matthew Metcalf, Wendy Brosse, John Herman

Florida Gulf Coast University, Fort Myers, Florida, USA

Population Dynamics of the Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) on Florida Gulf Coast University's Campus

Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*) are the largest venomous snakes in North America, endemic to the Lower Coastal Plains of the Southeastern United States. The species is not listed for state or federal protection but is currently under review due to habitat loss, fragmentation, and wanton killings. As an ambush predator, *C. adamanteus* may remain stationary for several days in wait of prey. Despite such a large body size, their sedentary lifestyle results in relatively small landscape movements. Limited studies have looked at the spatial ecology and population dynamics of this species, but is especially lacking in south Florida. This on-going research is being conducted on a university campus in southwest Florida which boasts approximately 160 hectares of conservation land (over half of its total land) surrounding its core facilities. Herein we report general home range use and morphometrics for these individuals as well as general information in regards to neonates occurring within the campus site.

0477 SSAR SEIBERT CONSERVATION, San Antonio, Friday 14 July 2017

Matthew Metcalf, Edwin M. Everham III, John Herman

Florida Gulf Coast University, Fort Myers, Florida, USA

Landscape Ecology of Eastern Indigo Snakes (*Drymarchon couperi*) in Southwest Florida

The Eastern Indigo Snake (*Drymarchon couperi*) is a large, non-venomous snake endemic to the southeastern United States. This species was listed as federally threatened in 1978 and still holds this status. Studies have documented *D. couperi* as having the largest home range for any native snake species in North America. However, a majority of these studies focused on populations from their northern ranges in southern Georgia and north-central Florida. Due to climatic and habitat differences between south Georgia and south Florida, basic life history may vary for this species. Additionally, southern populations are uniquely interacting with exotic sympatric species, such as the Burmese Pythons (*Python bivittatus*), that may affect *D. couperi* landscape use. We conducted a radio-telemetry study in the Rookery Bay National Estuarine Research Reserve in Collier County, Florida. Herein we report our data in regards to *D. couperi* home range sizes and spatial use in a southwest Florida nature reserve. These findings will allow a more complete understanding of *D. couperi* life history traits such as home range sizes, refugia use, seasonal variability, and general behavior in southwest Florida, which should inform management plans for the southern populations of this species.

0406 SSAR SEIBERT ECOLOGY I, Glass Oaks, Thursday 13 July 2017

Madeline Michels-Boyce¹, John Krenz¹, Rachel Cohen¹, Nora Ibarguengoytia²

¹*Minnesota State University, Mankato, Mankato, Minnesota, USA*, ²*Centro Regional Universitario Bariloche, Universidad Nacional del Comahue, San Carlos de Bariloche, Río Negro, Argentina*

Cold-climate adaptation in lizards: A common-garden experiment

In order to survive winters in cold climates, organisms may prepare physiologically by storing energy and reducing metabolism and behaviorally by retreating to a suitable refuge. In ectotherms, decreasing temperature or photoperiod or both can be the proximate cause of the onset of brumation but it's not clear whether both factors are necessary to stimulate physiological changes. If brumation in response to seasonal cues is an adaptation, then ecotypic variation in responses by latitude should exist. To detect such ecotypic variation, we collected five-lined skinks (*Plestiodon fasciatus*) from two latitudes (Minnesota and Texas). To distinguish the effects of photoperiod and temperature on brumation, we exposed lizards from both latitudes to either decreasing or constant regimes of each of the two factors (four treatments total). We predicted that behavioral responses (e.g., food consumption) would be cued by a reduced photoperiod,

while most physiological responses (e.g., liver glycogen levels, oxygen consumption, and others) would be cued by temperature. We also predicted that the lizards from the high latitude would store more energy and have lower critical thermal minima than lizards from the low latitude. Results for several response variables will be presented but, for example, decreasing temperatures increased mass-specific oxygen consumption but decreasing photoperiod decreased oxygen consumption. High-latitude lizards consumed more oxygen than low-latitude lizards. The presence of north-south ecotypic variation in cold adaptation and physiological responses to wintering cues would be important considerations in species conservation in the face of climate change.

0312 Fish Ecology II, San Antonio, Sunday 16 July 2017

Rosanna Milligan, Tracey Sutton

NOVA Southeastern University, Dania Beach, FL, USA

Quantifying Pelagic Habitat Use by Myctophids in the Northern Gulf of Mexico

Deep pelagic ecosystems are some of the largest on Earth but are amongst the least understood. As human impacts on the deep oceans continue to increase, there is an urgent need to understand the processes that influence pelagic fauna, particularly in deep waters. One of the most globally-important taxa are the Myctophidae, which are a ubiquitous component of the deep-pelagic micronekton and play key roles in the vertical and horizontal transfer of energy between ecosystems. In the present study, quantitative, depth-stratified trawl data were analysed to assess the distributions of the dominant myctophid species in relation to physical and chemical environmental variables in the northern Gulf of Mexico (GoM) during summer 2011. The data were collected through the NOAA-supported Offshore Nekton Sampling and Analysis Program. Significant correlations to meso-scale features associated with the Loop Current were observed at depths to 1000 m, but the effects were weak and only explained 6 - 11% of the observed variance in assemblage composition. These results indicate that myctophid assemblages were well-mixed in 2011 and suggest high dispersal rates across the study region (>500 km). These findings have implications for understanding the sensitivity of myctophid populations following different forms of disturbance.

0233 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Alice Millikin¹, Sarah Woodley³, Drew Davis², Jim Anderson¹

¹*West Virginia University, Morgantown, WV, USA*, ²*University of South Dakota, Vermillion, SD, USA*, ³*Duquesne University, Pittsburgh, PA, USA*

Factors Influencing Salamander Hormones in Created Wetlands

Small isolated wetlands are critical breeding habitat for many amphibians. Many of these wetlands are susceptible to destruction due to lack of regulation. Therefore, it is important to create new suitable habitat that can sustain healthy wildlife populations to mitigate loss. Concentrations of corticosterone, a hormone related to stress, development, and growth, can indicate a populations' physiological health and habitat quality. The objective of our research was to determine if habitat characteristics in created wetlands influence corticosterone levels of Spotted Salamander (*Ambystoma maculatum*) larvae. From May-June in 2015 and 2016, we sampled Spotted Salamander larvae (n=10/wetland) in 26 wetlands created between 2011 and 2014 in the Monongahela National Forest, West Virginia. We collected environmental data including vegetation cover and water quality at each wetland. Analysis indicates that larval total length and wetland water temperature are positively correlated with corticosterone and the best predictors for corticosterone levels. Vegetation cover also showed a positive correlation with corticosterone levels. Our results can improve understanding of the relationship between physiological conditions and habitat quality and how it can be used to interpret wildlife population health and habitat degradation.

0880 ASIH STOYE GENERAL ICHTHYOLOGY I, Trinity, Thursday 13 July 2017

Joshua Millwood¹, Michael Sandel¹, David Neely²

¹The University of West Alabama, Livingston, AL, USA, ²Tennessee Aquarium Research Institute, Chattanooga, TN, USA

Environmental and Phylogenetic Effects on the Dermal Microbiome of Mobile Basin Sculpin (Teleostei: *Cottus*)

The sculpin family (Cottidae) ranks among the lesser-known taxa comprising a freshwater biodiversity hotspot in the Mobile River Basin. Morphological conservatism among sculpin species has confounded efforts to resolve alpha taxonomy, to the extent that most recent descriptions have relied heavily on molecular phylogenetics. Eastern *Cottus* species are important water quality bioindicators, but this sensitivity to anthropogenic stressors correlates with relatively high extinction risk. This risk imparts a need to understand the physiological mechanisms associated with stress response, including protection from environmental pathogens. A relatively new area of study in fishes is the dermal mucosal microbiome. The importance of microbes within the human dermis has been well documented, but the dermal mucosa (slime) of teleosts represents an unexplored microscopic ecosystem. We investigate the microbial flora of these fishes to discover correlations among microbiome, host genetics, and environment while also examining the phylogenetics of known Mobile Basin populations. This study looks at the microbiome of the four recognized species/subspecies within the Mobile Basin and how they group within the Uranidea clade, while also examining the alpha diversity among the different populations. Two of these populations occur at the extreme southern reaches of the habitat range and are focused on for ecological and geographical

significance. These populations may be most important in regards to conservation efforts.

0148 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES SYMPOSIUM - APPLICATIONS OF PHYSIOLOGICAL ECOLOGY IN ELASMOBRANCH RESEARCH

Brittany Minnig¹, James Gelsleichter¹, Dean Grubbs²

¹University of North Florida, Jacksonville, FL, USA, ²Florida State University, Tallahassee, FL, USA

Plasma 8-hydroxy-2'-deoxyguanosine as a Biomarker of PAH Exposure in Gulper Sharks, *Centrophorus granulosus*, Exposed to the Deepwater Horizon Oil Spill

The Deepwater Horizon (DWH) Oil Spill was the largest oil spill in history, resulting in excessive amounts of contaminants released into the Gulf of Mexico. Polycyclic aromatic hydrocarbons (PAHs) are constituents found within the oil that pose the greatest health concern for marine life in and around the various contamination zones. These carcinogenic compounds have a high lipophilicity allowing them to bioaccumulate and localize in fat stores. PAHs are documented as being capable of inducing high amounts of intracellular reactive oxygen species (ROS), causing increased oxidative damage to biomolecules. Normally, antioxidants repair these damaged systems and replace depleted macromolecules, but this function is hindered when DNA degradation occurs and corrupts the integrity of the genome. 8-hydroxy-2'-deoxyguanosine (8-OHdG) is formed as a byproduct of oxidative DNA damage caused by ROS, making it a useful biomarker of pollutant exposure and effects. In the present study, plasma from gulper sharks, *Centrophorus granulosus*, collected from the spill zone between 2-6 years after the spill was tested for 8-OHdG. Higher concentrations of plasma 8-OHdG were exhibited in individuals 2-4 years after the oil spill, perhaps signifying increased oxidative stress during this period. However, a large decline in plasma 8-OHdG was observed in samples collected 4-5 years after the spill, likely suggesting recovery. To our knowledge, this is the first study of its kind to observe plasma 8-OHdG as a biomarker of exposure to pollutants in marine life.

0449 LFC Contributed IV, San Marcos, Saturday 15 July 2017

Tony Miskiewicz

Wollongong City Council, Wollongong, NSW, Australia

Comparative assessment of morphological and pigmentation characters during larval development of species of 10 genera of F. Gobiidae and two genera of F. Eleotridae

The Gobiidei are a very diverse group of fish comprising nine families with about 270 genera and 2,210 species. There have been a variety of studies undertaken using morphological, osteological and molecular characters of adults to investigate phylogenetic relationships within the group. Larval developmental series collected from southern Australian waters of 10 genera of F. Gobiidae (210 genera, 1,950 spp) *Arenigobius*, *Afurcagobius*, *Favonigobius*, *Gobiopterus*, *Paedogobius*, *Psuedogobius*, *Redigobius*, *Nesogobius*, *Bathygobius* and *Tasmanogobius*, and two genera of F. Eleotridae (35 genera 155 sp) *Hypseleotris* and *Philypnodon* were assessed. For larval development series of species from these 12 genera, ontogenetic changes in morphometric characters and pigmentation patterns and the size at development of fins, notochord flexion and transition to juveniles for each genus will be described and compared. There was considerable variation in these larval characters between the two families and between genera. The larval development characters are assessed to determine similarities and differences between genera and then compared with the proposed lineages for these genera based on adult characters.

0823 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kelsey Mitchell, Thomas Mast, Katherine Greenwald

Eastern Michigan University, Ypsilanti, Michigan, USA

Comparison of Skin Glands of Sexual and Unisexual *Ambystoma* Salamanders Using Scanning Electron Microscopy

Cutaneous mucous and granular glands are characteristic of amphibians and play an integral role in predator defense mechanisms. In *Ambystoma* salamanders, these dermal glands are concentrated along the back and dorsal ridge of the tail. Unisexual (all female) *Ambystoma* salamanders reproduce via kleptogenesis, in which insemination by a sympatric sexual male is necessary to trigger egg development. The zygote can develop gynogenetically or via incorporation of the male's genome into the ovum. This unique reproductive mode results in individuals having biotypes (genome combinations) ranging from diploid to pentaploid. Although unisexual salamanders have persisted for 6 million years, kleptogenesis has ecological drawbacks. For example, unisexual salamanders have low dispersal ability and reduced fecundity relative to sexual taxa. The purpose of this study was to ascertain if unisexual salamanders have a higher concentration of cutaneous glands on the dorsal ridge of the tail when compared to *Ambystoma laterale*, one of the sympatric sperm donors. Genotyped tail tips from both *Ambystoma laterale* and triploid unisexual salamanders were imaged using an Amray Scanning Electron 1820 Microscope. Preliminary data suggests that unisexual *Ambystoma* salamanders not only have higher concentrations of cutaneous glands on the dorsal tail ridge, but larger glands as well. The larger number and size of dermal glands may offer the unisexuals greater protection against predation when compared to sympatric sexual taxa.

0404 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Shawna Mitchell¹, Kasey Benesh², Fernando Serrano³, Bernie Kuhajda¹

¹Tennessee Aquarium Conservation Institute, Chattanooga, Tennessee, USA, ²Auburn University, Auburn, Alabama, USA, ³Young Harris College, Young Harris, Georgia, USA

Microhabitat preferences and diet competition with non-native centrarchid for the endangered Laurel Dace (*Chrosomus saylora*)

The Laurel Dace (*Chrosomus saylora*) is an endangered species endemic to the upper Tennessee River Basin in Tennessee. Laurel Dace historically occupied only eight streams on Walden Ridge of the Cumberland Plateau. Recent sampling indicates this species is currently restricted to five streams, and it is only common in one stream. Microhabitat variables and diet competition with non-native species were studied in order to understand possible drivers contributing to their small population size. A total of 66 sites (pools) were sampled in Bumble Creek and Lick Branch for microhabitat data, including presence of *C. saylora*, water volume, water depth, substrate type, canopy cover and silt depth. There was a significant correlation ($p < 0.05$) in mean water depth and mean water volume between pools where Laurel Dace were present versus absent. The stomach contents of Laurel Dace and its non-native competitors, Green Sunfish (*Lepomis cyanellus*) and Bluegill (*L. macrochirus*), were examined for five localities. Laurel Dace were obtained from preserved specimens at the University of Tennessee Etnier Ichthyological Collection. Based on limited data, *C. saylora* diet consisted primarily of terrestrial and aquatic invertebrates in warmer months and primarily plant matter (algae) in colder months. Overlaps in diet between *C. saylora* and centrarchids was evident. In order to protect this unique species, it is imperative that these studies expand to other occupied streams in order to better understand how the Laurel Dace interacts with both abiotic and biotic factors within its environment.

0249 Fish Conservation I, San Antonio, Sunday 16 July 2017

Shawna Mitchell¹, Bernard Kuhajda¹, Matt Kulp², Dave Kazyak³, Jason Henegar⁴, Tim King³, Anna George¹

¹Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA, ²Great Smoky Mountains National Park, Gatlinburg, TN, USA, ³U.S. Geological Survey, Leetown Science Center, Kearneysville, WV, USA, ⁴Tennessee Wildlife Resources Agency, Nashville, TN, USA

Assortative mating in a headwater Appalachian stream: a case study from the Great Smoky Mountains National Park

Southern Appalachian Brook Trout (*Salvelinus fontinalis*) have lost about 75% of their range in the Great Smoky Mountain National Park since the early 1900s due to logging and the introduction of non-native Rainbow Trout (*Oncorhynchus mykiss*). Following the removal of Rainbow Trout, about 320 Brook Trout from Indian Camp, Little Greenbrier

and Cosby Creeks were reintroduced into Leconte Creek, TN in 1999. Eleven years post restoration, 84% of all Brook Trout in Leconte Creek were derived from same source stream parentage. These findings suggested the presence of selective assortative mating among the genetically divergent source populations. In order to test if selective assortative mating was causing these findings, broodstock from Indian Camp, Little Greenbrier, and Cosby Creeks were brought to the Tennessee Aquarium Conservation Institute. Three control and six experimental crosses between these three streams were artificially spawned in a controlled hatchery setting and fertilized eggs were raised until the fry absorbed their yolk sac. After 2 years of spawning, 27 of 42 attempted crosses were successful (eggs hatched). Successful control crosses (9 out of 18 attempts) had an average fertilization rate of 91.5%, average eye up rate of 61.2% and an average hatch rate of 56.1%. Successful experimental crosses (18 out of 24 attempts) had an average fertilization rate of 95.3%, average eye up rate of 37.6% and an average hatch rate of 30.4%. Gamete production peaked at different times, suggesting that local adaptation to environmental cues may have had an effect on peak ripeness of these fish.

0265 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Tim Mitchell, Daniel Warner

Auburn University, Auburn, AL, USA

Seasonal Shifts in *Anolis sagrei* Reproduction Invoke Challenges for Scientific Reproducibility

The ability to reproduce experiments and results is a central component of the scientific method, yet exactly replicating experiments can be challenging when there is a field component. I leverage multiple iterations of anole breeding colonies to assess whether estimates of key reproductive traits of anoles are reliably repeatable. I used wild caught adult anoles (*Anolis sagrei*) to start three temporally replicated laboratory breeding colonies for egg and hatchling production within the same calendar year. These breeding colonies had nearly identical husbandry conditions yet varied by the capture date of the adult animals from the field. Preliminary results show that, despite consistency in breeding colony husbandry, anoles show variation in key reproductive traits such as egg and hatchling size consistent with seasonal shifts in reproductive effort. Further analyses will quantify variation in other reproductive traits, such as inter-clutch interval, total reproductive effort, and whether this variation is related to seasonal shifts in female body size. This project provides insights into seasonal shifts in reproductive effort in anoles. It also highlights that subtle differences in methodologies (such as capture date of study animals) may influence the interpretations of results. Though this suggestion may seem obvious, it also may be frequently overlooked.

0269 Lightning Talks I, Glass Oaks, Friday 14 July 2017

Tim Mitchell, Sarin Tiatragul, Renata Brandt, Josh Hall, Brian Folt

Auburn University, Auburn, AL, USA

Agama the Grouch: Testing Dumpster Selection of Non-Native Rock Lizards in an Urban Landscape

Understanding how animals use novel habitats is a key goal of invasion biology and urban ecology. The African Rock Agama (*Agama agama*) is native to sub-Saharan Africa but has been introduced and is reproducing in south Florida. The Rock Agama is a saxicolous lizard, yet natural rocks are nearly completely absent in parts of their introduced range in Florida. How do these lizards utilize the human-modified landscape, given the absence of the species' preferred habitat? Field observations suggested agamas use dumpsters as home sites because dumpsters provide refugia and attract invertebrate prey. In this study, we performed repeated surveys of commercial dumpsters (N = 50) interspersed within a neighborhood in Miami, Florida, where *Agama* occur in high density. We measured habitat variables hypothesized to influence agama site selection, including dumpster dimensions, dumpster contents, thermal properties of the dumpster, and surrounding habitat features. Because agamas use habitat narrow rock crevices in their natural range, we hypothesized that dumpster clearance (gap between pavement and bottom of dumpster) and contents (e.g., the presence of food resources) will strongly predict dumpster use. We discuss how our results have implications for predicting the spread of this and other invasive lizards across urban landscapes.

0230 Fish Morphology, Trinity, Saturday 15 July 2017

Iliana Mock, Kevin Conway

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

An Investigation of Oral Keratinization in North American Minnows (Teleostei: Cyprinidae)

Despite a lack of oral jaw teeth, algivory is widespread across the order Cypriniformes and is often accompanied by various morphological adaptations, including keratinization of the epithelium covering the mouthparts. Oral keratinization has been well studied in several algivorous species of Old World cyprinid yet little is known about the diversity, distribution and nature of oral keratinization in North American cyprinids, many of which are obligate algivores. In this study, we utilize a combination of scanning electron microscopy (SEM) and histology to investigate the distribution and nature of keratinized oral epithelia in 55 species representing 50 genera of North American minnows. Three general character states of keratinized oral epithelia were observed in the North American minnows examined, including: non-keratinized, keratinized-squamous, and keratinized-unculiferous. A phylogenetic comparative approach was used to investigate the relationships between the shape (s-shaped/coiled) and length of the gut tract relative to the type of keratinized oral epithelia present in members of the 'Western' and 'Shiner' clades of North American minnows. A positive correlation was detected between the type of gut tract and type of keratinized oral

epithelia present within the 'Western' clade though no such correlation was detected within the 'Shiner' clade. Keratinization of oral surfaces is not restricted to algivorous taxa amongst North American cyprinids and this suggests that keratinization of oral surfaces may serve a number of different roles in the life history of North American cyprinids.

0805 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Cassandra M. Modahl, Stephen P. Mackessy

University of Northern Colorado, Greeley, CO, USA

Unusual sources of mRNA: snake venoms

Venomous snakes and their venoms provide models for the study of molecular evolutionary processes leading to adaptation and genotype-phenotype relationships. To compare venom complexity and protein sequences, venom gland transcriptomes are assembled, which usually requires the sacrifice of snakes for tissue. However, toxin transcripts are also present in venoms, offering the possibility of obtaining cDNA sequences directly from venom. These unknown venom protein cDNAs are obtained by the use of primers designed from conserved signal peptide sequences within each venom protein superfamily. This technique was used to assemble a partial venom gland transcriptome for the Middle American Rattlesnake (*Crotalus simus tzabcan*) by amplifying sequences for phospholipases A₂, serine proteases, C-lectins, and metalloproteinases from within venom. Phospholipase A₂ sequences were also recovered from the venoms of several rattlesnakes and an elapid snake (*Pseudechis porphyriacus*), and three-finger toxin sequences were recovered from multiple rear-fanged snake species, demonstrating that the three major clades of advanced snakes (Elapidae, Viperidae, Colubridae) have stable mRNA present in their venoms. These cDNA sequences from venom were then used to explore potential activities derived from protein sequence similarities and evolutionary histories within these large multigene superfamilies. Venom-derived sequences can also be used to aid in characterizing venoms that lack proteomic profiles and identify sequence characteristics indicating specific envenomation profiles. This approach, requiring only venom, provides access to cDNA sequences in the absence of living specimens, even from commercial venom sources, to evaluate important regional differences in venom composition and to study snake venom protein evolution.

0795 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017; AES CARRIER AWARD

Brian Moe, Charles Cotton

Florida State University, Tallahassee, FL, USA

Estimates of age, growth, and maturity for the little gulper *Centrophorus cf. uyato* in the Northern Gulf of Mexico

Although half of all shark species occur below depths of 200 meters, very little is known about their basic life-histories. Deep-water sharks, are perceived to have much more conservative life-histories than coastal and pelagic species, likely making them more susceptible to overexploitation. The little gulper shark, *Centrophorus cf. uyato*, is a mid-size deep-water species inhabiting temperate to tropical latitudes globally. *Centrophorus cf. uyato* is presumed to have very conservative life-history characteristics, as has been documented for congeneric species. Though no fisheries presently target deep-water sharks in the Gulf of Mexico, there is a growing worldwide shift targeting deeper fishes with conservative life-histories which are especially susceptible to depletion. *Centrophorus cf. uyato* and other congeners in New South Wales experienced a 99% population decline after 20 years of commercial fishing. Furthermore, commercial trawl fisheries operate in the depth range of *C. cf. uyato*, likely resulting in substantial bycatch mortality. Therefore, it would be prudent to address critical information gaps in the life-history of *C. cf. uyato*, allowing for the proper management in active fisheries, and proactive regulations in areas where fisheries have not yet developed. This study provides the first descriptions of age, growth, and maturity for *C. cf. uyato* in the Northern Gulf of Mexico. This study shows that *C. cf. uyato* in the Gulf of Mexico lives over 60 years, matures at 85% of its maximum length, and produces just one pup per reproductive cycle. These results will inform demographic models for predicting population responses to fishing pressure.

0456 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Bekah Mongold¹, Abigail Berkey¹, Rayna Bell⁴, William Flint², Steve Gotte³, Oliver Hyman², Roy McDiarmid³, David McLeod², Daniel Mulcahy⁴

¹Eastern Mennonite University, Harrisonburg, VA, USA, ²James Madison University, Harrisonburg, VA, USA, ³United States Geological Survey, Suitland, MD, USA, ⁴Smithsonian Institution, Washington, DC, USA

A Biological Survey Unit Type Locality Project: Collecting Genome-Quality, Topotypic Vouchers for Salamanders in Virginia

Despite the importance of DNA evidence for taxonomic studies and conservation, many historical type materials lack corresponding genetic samples and DNA extraction from formalin-fixed type materials (i.e. most herpetological specimens) and older specimens is difficult. This absence of genome-grade tissue samples from type materials limits contemporary molecular research questions and restricts conservation and management decisions. A standardized model for collecting genome-quality, topotypic vouchers is needed. To this end, we conducted a pilot project to resurvey type localities and collect high-quality voucher specimens and genome-grade tissue samples from three focal areas in Virginia that represent 13 salamander type localities (2 families, 5 genera, and 17 species). Additionally, because chytrid fungi (Bd and Bsal) pose a threat to Virginia's

salamander diversity, we swabbed individuals to sample for these pathogens. Specimens and genetic vouchers were deposited in the National Museum of Natural History and distribution data added to the USGS Biodiversity Information Serving Our Nation (BISON) mapping resource. Undergraduate students enrolled in biology courses at two local institutions were involved in all aspects of the project from specimen collection to data processing and archiving. Our sampling protocol could easily be adapted by other regional institutions to "crowd-source" the effort to obtain genome-quality, topotypic vouchers for all North American vertebrate taxa.

0497 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Carmen G. Montana¹, Elford Liverpool², Donald C. Taphorn³, Hernán López-Fernández⁴, Karen Alofs⁵

¹Sam Houston State University, Huntsville, TX, USA, ²Centre for the Study of Biodiversity, Turkeyen, Guyana, ³Royal Ontario Museum, Toronto, Canada, ⁴Royal Ontario Museum, Toronto, Canada, ⁵Royal Ontario Museum, Toronto, Canada

Trophic relationships and mercury levels in a Neotropical river food web

Contamination of water bodies by inorganic mercury (Hg) due to mining activities in the lower Mazaruni River, Guyana, contributes to mercury concentration in fish tissues. We measured total mercury (THg) concentrations in fishes from mined and non-mined sites in the Lower Mazaruni River. We also used stable isotopes analysis ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) to estimate trophic position of fishes. Average THg concentrations of fish species varied between sites ranging between 0.20mg/kg to 8.80mg/kg in mined sites; and from 0.10mg/kg to 1.36mg/kg in non-mined sites. A positive relationship was observed between THg and $\delta^{15}\text{N}$ values of some fish species including omnivores, carnivores and piscivores. On average, non-mined sites appeared to have longer food chains than mined sites. Trophic magnification was observed above 1 mg/kg suggesting that mercury bioaccumulation occurs in the food web, and fish diet appears to be the main route for this element into the food chain. Several of the fish species surveyed and used for local food consumption had THg levels higher than the World Health Organization (0.5mg/kg). Our data suggest that Amerindian communities and settlements located along the riversides of the Mazaruni River are exposed to dangerous levels of mercury through fish consumption, but possibly also any other fish-eating wildlife. The freshwater fish fauna of the Mazaruni River is unique in the Neotropics, with high diversity and incredible endemism in its headwaters. The recent increase in gold mining operations seriously threaten riparian forest, the riverine fauna and all food-web components of the Mazaruni aquatic system.

**0677 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD:
CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit
Hall, Friday 14 July 2017**

Jennie Mook¹, Raymond Moody², Eric Schauber¹

¹*Southern Illinois University Carbondale, Carbondale, IL, USA*, ²*Tinker Air Force Base, Midwest City, OK, USA*

Harmonic Radar: Long-Term Herpetofauna Tracking Using a Tiny Tag

The Texas horned lizard (*Phrynosoma cornutum*) is an imperiled species that has experienced declines throughout much of its range. While there has been considerable research contributed on this species, there is still little known about the hatchling life stage. Until now, monitoring hatchlings has proven difficult due to their small size (<1 g) and our limited technology. However, harmonic radar has long been used as a method to track invertebrates and may be a viable method for tracking other small organisms. Harmonic radar tracks individuals by employing a device that serves as a transmitter and a receiver. This device emits a continuous radar wave which is then reflected back at twice the frequency by a transponder attached to an animal. The aim of this study was to evaluate the efficacy of harmonic radar for tracking hatchling horned lizards. From 2014-2016, we experimented with transponder design which resulted in using a Schottky barrier diode (S2) attached to an aluminum antenna and encased in PET plastic. This transponder weighed <0.05 g and had a detection distance of 6 m. Using this method, we successfully tracked 125 Texas horned lizard hatchlings and juveniles, 11 of which were monitored for 4-12 months. More transponder modifications are needed to increase the detection distance while minimizing the size and obtrusiveness of the design. Our work shows that harmonic radar has potential as an option for long-term tracking of very small vertebrates, particularly with improved transponder design.

0672 ASIH STOYE ECOLOGY & ETHOLOGY III, Sabine, Friday 14 July 2017

Jennie Mook¹, Raymond Moody², Eric Schauber¹

¹*Southern Illinois University Carbondale, Carbondale, IL, USA*, ²*Tinker Air Force Base, Midwest City, OK, USA*

The Social Behavior and Ecology of Hatchling Texas Horned Lizards (*Phrynosoma cornutum*)

Texas horned lizard (*Phrynosoma cornutum*) ecology and behavior has been well documented in the literature. However, little is known about the hatchling life stage of *Phrynosoma*, likely due to difficulties in monitoring them given their small size (< 1 g). During 2014-2016, we used harmonic radar to study hatchling *P. cornutum* survival, home-range size, and behavior on an urban air force base in Oklahoma. The mean (\pm SE) annual home-range size of hatchlings (n=129) was 0.10 ± 0.069 ha using 95% KDEs. Unlike adults that burrow separately underground during winter, we observed hatchlings clustering together and stacking on top of each other above ground. This behavior has never before been documented in *Phrynosoma* and suggests that *P. cornutum* may have more social complexity than currently understood. This study not

only elucidates the basic ecology and dormancy behaviors of an enigmatic life stage, but also provides a more complete understanding of an imperiled species facing declines throughout its range.

0807 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Brad Moon¹, Gabriel Spanghero Vicente Ferreira², David Penning³

¹University of Louisiana at Lafayette, Lafayette, LA, USA, ²Instituto de Biociências, Letras e Ciências Exatas - UNESP/IBILCE, São José do Rio Preto - SP, Brazil, ³Missouri Southern State University, Joplin, MO, USA

High Performance in a Tight Spot: Snake Predation Pressures Below vs. Above Ground

Many predators feed in microenvironments that may constrain their movements and obscure or block our observation and study. For example, constricting snakes probably often feed on mammals underground in tunnels, where space may be too limited for typical coiling and constriction. In such circumstances, some snakes will press prey against the wall of a tunnel with part of the snake's body, in a predatory behavior that has been called "pinioning." Pinioning serves the same purposes as constriction, to restrain and incapacitate prey before ingestion. However, pinioning behavior is not well known and pinioning performance in tunnels has not yet been quantified or compared to typical constriction on open surfaces. We measured the pinioning pressures of kingsnakes in simulated tunnels and compared them to typical constriction pressures on the surface. Pinioning and constriction pressures are good measures of predation performance because they reflect a key variable (pressure) that can directly incapacitate the prey. We found that pinioning pressures in tunnels were higher than constriction pressures on open surfaces. These results indicate that snakes can exert impressively high predation pressures underground as well as on the surface, and more generally that predation performance is not always reduced in microenvironments that impose constraints on predatory movements.

0582 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Shaundon Moore, Kirsten Nicholson

Central Michigan University, Mt. Pleasant, MI, USA

Linking Habitat Structure with Microgeographic Divergence in Red-backed Salamander (*Plethodon cinereus*) Behavior

Behavioral divergence can occur when populations inhabiting heterogeneous environments become locally adapted. For dispersal limited species, local habitat characteristics may promote behavioral divergence at small spatial scales within populations. Previous studies have focused on adaptive behavioral divergence across

distinct or fragmented landscapes, but relatively little is known regarding adaptive divergence within continuous landscapes. *Plethodon cinereus* is a lungless, terrestrial salamander native to eastern North American forests that occupies a diverse range of microhabitats. Here, we examine whether microhabitat characteristics may promote intra-population behavioral divergence within this species across a continuous landscape. Threats related to water loss and desiccation pose a significant physiological constraint on *P. cinereus* movement, and home-ranges are typically restricted to <25 m². Thus, there is potential for individuals to be locally adapted to microhabitat characteristics. We will quantify foraging and territoriality related behaviors in *P. cinereus* collected from survey plots established within an unfragmented field site within mid-Michigan. Environmental data will be collected at each capture location and ordination will be used to visualize and characterize the microhabitats occupied by each salamander. Observed behavioral patterns will be recorded across survey plots and capture locations from distances of 100 – 2000 meters. Distinct microhabitat features could separately explain some, but not all differences in foraging and territoriality behavioral traits. We expect to find that, for dispersal limited species, behaviors may be structured at fine-scale levels within continuous landscapes. However, the degree to which sub-populations diverge in behavioral characteristics depends on a combination of species ecology and environmental heterogeneity.

0538 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Naiti Morales¹, Erin Easton², Carlos Gaymer²

¹Universidad Catolica del Norte, Coquimbo, Chile, ²Nucleus for Ecology and Sustainable Management of Oceanic Islands, Coquimbo, Chile

The Lost Sharks of Easter Island, Not so Lost Anymore

Easter Island is considered the most isolated inhabited island and the south-eastern-most coral reef system in the Pacific Ocean. Historical fishing has dramatically reduced the number of large predatory fishes, such as jacks and snappers, and sharks are virtually absent with only rare sightings by locals. Given the lack of quantitative data and the extreme fragility of the ecosystem we used Baited Remote Underwater Video Systems (BRUVS) to study fish assemblages at Easter Island. BRUVS are an increasingly well-recognised and non-destructive technique that attracts fishes to the camera, especially carnivorous species, using bait. We recorded 12 species of fishes from a wide range of trophic groups, including the Galapagos shark, *Carcharhinus galapagensis*. The Galapagos shark typically inhabits oceanic islands. Its fragmented geographic distribution, with unknown levels of connectivity, and high levels of fishing pressure along its distribution place subpopulations at significant risk from overfishing. The individuals we recorded were juveniles, about 1 m total length, forming aggregations in a specific area of the island. These videos are the first scientific proof of the occurrence of this species on Easter Island. No other scientific survey had recorded them, even though, fishermen claimed to see them frequently. This result also confirms the effectiveness of BRUVS over other types of underwater visual census when it comes to studying top

predators. Future studies will focus on the population connectivity between Easter Island and Salas y Gomez Island, which is located 400 km east and supports a fish community with an abundance of Galapagos sharks.

0673 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Nickolas Moreno, Scott Glaberman, David Nelson, Ylenia Chiari

University of South Alabama, Mobile, Alabama, USA

A Multidisciplinary Approach to Evaluate the Conservation Status of the Alabama Red-Bellied Turtle (*Pseudemys alabamensis*)

Pseudemys alabamensis (Alabama red-bellied turtle) is an endemic that occurs only in the lower drainage systems of Alabama and Mississippi. It is classified as endangered by the U.S. Fish and Wildlife and on the IUCN Red List. *P. alabamensis* represents an ideal system for examining the impact of ecological stressors on endangered species and their habitat. The range for this species is narrow around Mobile Bay, Alabama, which is contains heavily urbanized areas with potential to have large amounts of chemical runoff. Furthermore, some chemicals that may be found in runoff at sites where this species occurs have the potential to be genotoxic (e.g., inducing DNA damage). Across its distribution range, human-made barriers (e.g., roads) and salt or brackish water bodies may impede free movements of individuals of this species and thus gene flow among populations. With little currently known about *P. alabamensis*, assessment of the genetic diversity and of the effects of urbanization across the species range will help identify genetically distinct populations as well as populations suffering from small population size, high DNA damage and to establish the effect that habitat quality has on these species characteristics. This will permit to develop management strategies and effective conservation actions, such as identifying areas requiring habitat restoration, as my results will be shared with state agencies and the US Fish & Wildlife. This integrated approach will serve as a model for future studies to identify priority areas for conservation within the Southeast US and species deserving highest conservation priority.

0314 Lightning Talks II, Glass Oaks, Friday 14 July 2017

Clark Morgan, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

A Survey of Shark Abundance on Northeast Florida Beaches

Long-term abundance surveys are necessary for identifying trends in the status of fish populations that are the target of commercial and/or recreational fisheries. This is especially the case for populations of certain fish like sharks and their relatives, which grow slowly and often take a long period of time to rebuild from fishery-associated

declines. In this presentation, we provide preliminary data on the species composition and abundance of shark populations that use nearshore waters on the northeast Florida coast from the initial years of a new survey focusing on shark abundance in coastal habitats. The overall goal of this survey is to examine long-term patterns in large and small coastal shark abundance on northeast Florida beaches along with conducting more comprehensive assessments of shark life history, especially reproduction, so that still-unclear questions about certain commercially- and/or recreationally-important shark species can be addressed. In particular, we are concerned about the current status of aggressively managed large and small coastal shark species that have traditionally made up a significant contribution of commercial or recreational shark landings.

0120 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Cynthia Morris, Matthew Lattanzio

Christopher Newport University, Newport News, Virginia, USA

Ecological and Physiological Factors Affecting the Escape Responses of Tree Lizards (*Urosaurus ornatus*)

For lizards, Optimal Escape Theory has been used to successfully describe the tradeoff between the costs of escape and the risks of predation, particularly with respect to variation in predator traits (e.g., approach angle or speed). In contrast, the effects of other ecological factors on a lizard's flight response, or their mode of escape, have received scant attention. We evaluated the effects of sex, macro- (site-level) and micro- (perch substrate) habitat use, body temperature, and perch temperatures (initial and final perch) on the flight-initiation and flight distances, and escape tactics (run or squirrel), of adult tree lizards (*Urosaurus ornatus*) at three sites differing in fire history within the Appleton-Whittell Research Ranch near Elgin, Arizona. Perch use shifted from a bias towards snags to trees moving from non-burned to burned sites for both sexes. Overall, flight-initiation distance was affected by site and body temperature only, with lizards from a frequently-burned habitat, and lizards with low body temperatures, fleeing sooner than other lizards. Lizard body temperature was also positively correlated with perch temperature, and those lizards initially on cooler perches tended to flee to warmer locations. We detected no effects of any of our predictors on flight distance. Finally, in terms of their escape tactics, all lizards preferred running over squirreling, regardless of sex, site, or perch use. Overall, our findings support that wariness in *U. ornatus* may be influenced by both ecological and physiological conditions, and that their escape responses may also provide a thermal benefit.

0652 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Hannah Morris¹, Juan D. Daza¹, Aaron M. Bauer²

¹Sam Houston State University, Huntsville, Texas, USA, ²Villanova University, Villanova, Pennsylvania, USA

On the Occurrence of the Stapedial Foramen in Geckos

The stapedial (internal carotid) artery has three possible paths in squamates, it may perforate the otostapes through the stapedial foramen, it might pass in front of or behind an imperforated otostapes. A perforated otostapes is a plesiomorphic feature among squamate reptiles, being recorded only in dibamids and gekkotans. The presence of a stapedial foramen is a common feature used to diagnose gecko groups, therefore the presence or absence of this structure could be useful for categorizing higher level groups of geckos, and possibly all squamates. The most extensive review of this trait in gekkotans was completed 30 years ago and included a survey of 46 gekkotan genera. Here we reviewed specimens from virtually all gekkotan genera using HRCT data, and surveyed the distribution of this feature in the light of recent molecular analyses. The foramen is absent in all pygopodoideans, and present among all eublepharids and sphaerodactylids. The stapedial foramen is present in half of the phyllodactylid genera, where it has been lost multiple times, and is present in the majority of the gekkonid genera (60%). Using the current molecular topology as a working hypothesis, the presence of the stapedial foramen is inferred as ambiguous on the crown group, although this structure is present in a 99-million-year old fossil from Myanmar that is kin to all geckos.

0223 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Megan Mosier, Lynda Miller

Christian Brothers University, Memphis, TN, USA

Population Variation in Two Species of Ambystomatid Salamanders

Variation in populations are frequently caused by restrictions in gene flow. Those restrictions can be caused by vicariant events such as mountain ranges or large rivers. We examined preserved specimens from two species of ambystomatid salamanders that were separated by the Mississippi River. Morphometric measurements of *Ambystoma opacum* and *A. texanum* populations from Arkansas and Tennessee were compared to determine if geographic separation had an effect on the body size or limb length. *Ambystoma opacum* from the Tennessee populations was significantly larger in both front limb and hind limb length than those collected in Arkansas. *Ambystoma texanum* was significantly larger in front limb and snout to vent length in Arkansas populations than those in Tennessee. Differences in morphometrics may be influenced by environmental pressures, competition in the larval stage, or differences in the microhabitats on either side of the river.

0297 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Jeanette Moss¹, Aumbriel Schwirian¹, Anna Jackson¹, Mark Welch¹, Glenn Gerber²

¹Mississippi State University, Mississippi State, MS, USA, ²San Diego Zoo Institute for Conservation Research, San Diego, CA, USA

Multiple-paternity in an insular lizard, the Sister Islands rock iguana (*Cyclura nubila caymanensis*)

Social behaviors that influence individual reproductive output can have important consequences for long-term population viability due to reductions in effective number of breeders and genetic deterioration. Female polyandry, a taxonomically widespread strategy that can result in multiple-paternity (MP) and reproductive skew, has been invoked as a mechanism for boosting individual reproductive output and enhancing offspring geometric mean fitness. While MP has been extensively studied in laboratory crosses and captive pedigrees, studies of wild populations are often limited by a lack of detailed pedigree information and small clutch sizes. However, molecular fingerprinting tools and the development of novel likelihood approaches have greatly expanded the applicability of parentage analyses to empirical datasets. In this study, molecular techniques are employed to investigate the prevalence of MP in an insular population of *Cyclura nubila caymanensis*, or the Sister Islands Rock Iguana (SIRI), a critically endangered taxon endemic to Little Cayman and Cayman Brac. A total of 50 clutches sampled on Little Cayman in the years 2015 and 2016 were genotyped at 14 microsatellite loci and evaluated for evidence of MP using the full-pedigree likelihood approach implemented in the program COLONY. Nearly half of all clutches were found to be multiply sired, suggesting that female polyandry is common in rock iguanas. Paternal contributions are skewed in most clutches, which may reflect assortative mating to avoid inbreeding. Depressed rates of MP and significant dominance of few males was observed at a high-density, human-supplemented site, suggesting that resource abundance and competition can impact effective number of breeders.

0300 SSAR SEIBERT ECOLOGY I, Glass Oaks, Thursday 13 July 2017

Jeanette Moss¹, Mark Welch¹, Glenn Gerber², Schwirian Aumbriel¹, Jackson Anna¹

¹Mississippi State University, Mississippi State, MS, USA, ²San Diego Zoo Institute for Conservation Research, San Diego, CA, USA

Behavioral ecology of the critically endangered Sister Islands rock iguana (*Cyclura nubila caymanensis*): ongoing investigations into patterns of mate choice, dispersal, and nesting

The West Indian rock iguanas (genus: *Cyclura*) comprise one of the most endangered groups of lizards in the world. Patterns of habitat use and gene flow among these large herbivores are structured by complex social systems and diverse life histories, an understanding of which is critical to predicting future responses to population reduction and fragmentation. For example, negative assortative mating and dispersal patterns that promote admixture may be important mechanisms for inbreeding avoidance in insular populations. We employ a combination of direct field observation and molecular fingerprinting to investigate patterns of female mate choice, nest site selection, and kin structuring in the Sister Islands rock iguana (*Cyclura nubila caymanensis*). With the pedigree data obtained through nest site monitoring and whole clutch genetic sampling, we make likelihood inferences of parentage and sibship, estimate rates of multiple-paternity, and assess patterns of assortative mating exhibited by females. To further investigate reproductive strategies, we employ nest excavation, mark-recapture, and radio telemetry approaches to identify intrinsic and environmental factors that influence female dispersal and maintain traditional communal sites. Finally, we examine the genetic relatedness among spatial aggregates of nesters to investigate the possible role for kin structuring and natal philopatry in shaping population genetic structure and nest distributions. The diversity of observed behaviors in this population suggests that reproductive success may be achieved through a broad range of strategies and that dispersal is largely random. However, home territory overlap and philopatry appear to largely guide female choice with regards to mates and nesting sites.

0118 AES GRUBER AWARD I, Wedgewood, Thursday 13 July 2017

Kat Mowle, Jim Gelsleichter

University of North Florida, Jacksonville, FL, USA

Characterization of vitellogenesis in the bonnethead shark *Sphyrna tiburo* in the Northwestern Atlantic Ocean

Vitellogenin (Vtg) is a precursor to yolk-proteins that is known to be produced in the liver under the control of the hormone estradiol (E2) in reproductively active females of most non-mammalian vertebrates. Previous studies have examined Vtg production in a wide variety of fishes, but no studies to date have done so in a placental viviparous elasmobranch. Therefore, the purpose of this study is to examine Vtg production in a viviparous shark species, the yolk-sac placental bonnethead shark *Sphyrna tiburo*. Specifically, this study focuses on determining where Vtg is produced in *S. tiburo*, how reproductive steroid hormones influence Vtg production, and what temporal patterns occur in Vtg levels throughout the species' reproductive cycle. To date, Vtg presence in the plasma has been assessed using immunoblotting; preliminary results have detected Vtg only in the plasma of mature females collected during the spring period of follicular development. Immunohistochemistry has also been conducted; these assays have confirmed the liver is the site of Vtg synthesis in *S. tiburo*. Preliminary evidence also suggests that E2 and progesterone (P4) play a role in regulating this process, with immunohistochemistry detecting the receptors for both hormones within the liver. To

further examine where Vtg is synthesized, in situ hybridization assays will be conducted for liver and ovarian tissues. The role that E2 and P4 play in regulating Vtg synthesis will also be further assessed by exposing cultures of liver slices to the hormones and measuring Vtg production.

0182 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Marta Moyano¹, Björn Illing², Lars Christiansen¹, Myron A. Peck¹

¹University of Hamburg, Hamburg, Germany, ²Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Australia

Linking Rates of Metabolism and Growth in Marine Fish Larvae

The intricate relationship between metabolism and growth is still largely unexplored in early life stages of fish. In the present study, we investigated the metabolic rates of Atlantic herring (*Clupea harengus*) larvae and their links to body size, growth and feeding environment. First, standard metabolic rate (SMR) was estimated at 5-15°C in larvae (10-24 mm body length) from two herring populations (North and Baltic Sea), and a temperature-dependent allometric equation was generated. Second, in two of three trials, SMR was downregulated (up to 30%) four days after larvae experienced sub-optimal feeding conditions. Inter-individual differences in SMR and recent nutritional condition (RNA-DNA ratio) in those larvae were unrelated. Third, the link between SMR and short- (otolith marginal increment width) and long-term growth (size-at-age, otolith diameter-at-age) was investigated. Inter-individual differences in SMR under ad libitum conditions were not explained by any of the recent or long-term growth indicators, but a negative relationship between SMR and otolith core (formed between hatching and first feeding) was observed. The present results are very valuable for exploring how food limitation may influence larval growth and survival in the sea, as well as for parameterizing bioenergetic models. Furthermore, they revisit the potential of otoliths and RNA-DNA ratio for combined field studies on growth and physiology to understanding fish performance under a future changing environment.

0239 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Marta Moyano, Joan Martorell, Katrin Engler, Myron A. Peck

University of Hamburg, Hamburg, Germany

Thermal Impacts on the Ontogeny of Routine Swimming and Foraging Behavior in Atlantic Herring Larvae

Understanding ontogenetic changes in swimming behavior can provide insight into the mechanisms impacting larval survival in the field. Well-developed swimming abilities can confer larvae with increased survival advantages in terms of a better foraging capacity (e.g. larger water volumes searched, faster attacks) and escape responses when

encountering predators. In this study, we measured routine swimming and foraging behavior in spring-spawned Atlantic herring (*Clupea harengus*) larvae reared at 7 and 13°C. Routine swimming was estimated throughout larval ontogeny (10 to 22 mm body length) by video image analysis of groups of 20 larvae (5-L tanks, 48-h duration). Foraging behavior (feeding strike frequency, pause duration, pause frequency) was estimated from those videos and on larvae within rearing tanks (90-L containers). Furthermore, one short-term experiment was performed to observe changes in foraging behavior during short-term starvation followed by a re-feeding period. These results expand our knowledge on the impact of prey shortage and on the magnitude of diel cycles in foraging behavior and routine swimming in marine temperate larvae. Such results are essential to parameterize individual, physiological-based models, which have proven to be very useful to explore factors affecting larval growth and survival in the field.

0280 ASIH STORER HERPETOLOGY; Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Andy Mueller, C.M. Gienger

Austin Peay State University, Clarksville, TN, USA

Comparative Thermal Ecology of *Agkistrodon contortrix* and *Agkistrodon piscivorus*

Body temperature is directly related to the physiology and behavior of ectotherms and the ability to thermoregulate is crucial for the survival and development of the organism. *Agkistrodon contortrix* (Copperhead snakes) and *Agkistrodon piscivorus* (Cottonmouth snakes) are relatively common, wide-ranging viperids, and their sit-and-wait ambush foraging strategy suggests that they are more likely to be passive thermoconformers within their thermal environment than active thermoregulators. Evaluating the thermal ecology of these species requires knowing the body temperature of the snakes (T_b), the operative temperatures available to snakes in their environment (T_e), and the preferred body temperature range of the species (T_{set}). We calculated effectiveness of thermoregulation (E) and thermal exploitation (Ex) to compare the degree to which snakes actively thermoregulate in their differing habitats. The T_{set} for both species is nearly identical at 24.9-27.8°C for copperheads and 24.9-27.9°C for cottonmouths. Cottonmouths have a significantly higher index for the months of May, June, and July indicating that they are more effective thermoregulators than copperheads during mid active season. Although it does appear that cottonmouths also have a higher Ex across the active season, they are not significantly different than copperheads.

0841 AES Symposium: Applications of Physiological Ecology in Elasmobranch Research, Wedgewood, Saturday 15 July 2017

Christopher Mull¹, Kara Yopak², Nicholas Dulvy¹

¹Simon Fraser University, Burnaby, BC, Canada, ²University of North Carolina, Wilmington, NC, USA

Can you spare some brain: how life history and ecology have shaped brain size evolution in sharks and rays

Brain size likely evolves through a combination of selection and constraints. Increased brain size has been associated with greater behavioral flexibility across vertebrates, yet comes at a high energetic cost due to the metabolic demand of development and maintenance of neural tissue. In sharks and rays, increased relative brain size has been documented in species that occupy spatially complex shallow water habitats, particularly in reef sharks and stingrays. Yet, we have also shown that increased maternal investment via matrotrophy, particularly via placentotrophy and lipid histotrophy, is also strongly associated with increased brain size. A key unknown is the cause and effect relationship underlying the correlation of habitat and life history with brain size. Did the evolution of live-bearing and matrotrophy help overcome the energetic constraints of increased brain size, or was it a result of selection from ecological lifestyle? We address these questions in two steps: First we test for the correlated evolution of relative brain size with reproductive mode, maternal investment, depth, and habitat. We predict that increasing brain size is correlated with the evolution of increased maternal investment through matrotrophy, and with the colonization of warm shallow habitats. Secondly, we attempt to tease apart the cause and effect relationships between brain size, body size, life history, and ecology using phylogenetically corrected path analysis.

0044 Lightning Talks I, Glass Oaks, Friday 14 July 2017

Bruce Mundy¹, Mackenzie Gerringer², Jørgen Nielsen³, Patricia Fryer⁴, Astrid Leitner²

¹NOAA NMFS Pacific Islands Fisheries Science Center, Honolulu, Hawaii, USA, ²Department of Oceanography, University of Hawaii, Honolulu, Hawaii, USA, ³Natural History Museum of Denmark, Copenhagen, Denmark, ⁴Hawaii Institute of Geophysics and Planetology, University of Hawaii, Honolulu, Hawaii, USA

First in situ observation of an aphyonid fish (Teleostei, Ophidiiformes, Bythitidae)

Aphyonids are poorly-known, live-bearing brotulas (Ophidiiformes, Bythitidae) that until recently were considered to be in a distinct family, Aphyonidae. A single, ca. 9.3 cm total length aphyonid observed during a remotely-operated vehicle survey in the Mariana Archipelago at 2504 m on Explorer Ridge (20.68152°N, 145.08750°E) is the first seen alive in its natural habitat. Collection to verify its identification was not possible, but based on observations it was a species of either *Barathronus* or *Nybelinella*. The fish swam 1-10 cm over sediment between rocks and small boulders on a 45° talus slope.

Swimming speeds were consistently slow, 0.33 ± 0.15 body lengths per second, and the fish appeared to be neutrally buoyant. Although there are few other records of aphyonid-clade fishes in the Pacific away from continental margins, this observation suggests that they will be found elsewhere in the basin when appropriate methods are used to detect these small fishes in the high-relief, rugose habitats of central Pacific oceanic islands and seamounts.

0502 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Kelly Murman, Thomas LaDuke

East Stroudsburg University, East Stroudsburg, PA, USA

A Comparative Dietary Analysis of Five Species in the Streamside Salamander Guild (Plethodontidae) in Eastern Pennsylvania

In this ongoing study, the diets of five species of streamside salamander (*Desmognathus fuscus*, *Desmognathus ochrophaeus*, *Eurycea bislineata*, *Gyrinophilus porphyriticus*, and *Pseudotriton ruber*) are being analyzed using a non-lethal stomach flushing technique. The gut contents are being compared to invertebrate samples collected from the environment to assess similarity and attempt to determine where these species forage for food and whether there is evidence for prey selectivity. This project is also examining whether or not the composition of the species assemblage affects the diet of the member species by sampling at multiple localities with different assemblages. Sampling occurs in spring, mid-summer, and fall in order to determine if there are any seasonal shifts in the diets of these species. To date, all stomach contents examined have revealed a mixture of aquatic and terrestrial prey items regardless of the habitat preferences of the salamanders. Analyses will compare the proportions of aquatic and terrestrial prey consumed among and between species and sites.

0681 Poster Session I, Rio Grande Exhibit Hall, Friday 14 July 2017

Shannon Murphy¹, Mark Erdmann², Joshua Drew¹

¹*Columbia University, New York, USA*, ²*Conservation International, Auckland, New Zealand*

Satellite Tracking Reef Manta Rays (*Manta alfredi*) in Papua New Guinea to Inform Conservation Management

The reef manta ray, *Manta alfredi*, is a charismatic species that has captured the attention of people all over the world. This species of ray is popular among divers and tourists because of its large size and habit of appearing in groups. Recently, there has been an increased demand in Asian fish markets for manta ray gill plates, thin cartilage filaments used by the ray to feed, due to cultural beliefs that gill plates have medicinal properties. Manta rays only produce one or two pups at a time, have slow maturation times, and

tend to aggregate in large groups. These factors make ray populations vulnerable to pressures from local fisheries. Gonubalabala is a remote island situated off of Milne Bay, Papua New Guinea, that is home to an under-studied aggregation of manta rays. My research objective is to characterize the movement of manta rays around Milne Bay using satellite telemetry to inform conservation management. Satellite tags will be able to provide real time GPS locations of each manta, as well as collect important habitat data such as temperature and depth. I hypothesize that there will be a clear spatial pattern of movement of this population of manta rays around Milne Bay. If there is a clear spatial pattern of movement, one or multiple community-based marine protected areas (MPAs) could be developed to specifically protect areas where mantas spend considerable amounts of time. The development of a MPA in the coastal waters of Gonubalabala can also promote ecotourism.

0393 LFC Multi-Stressor Effects, San Marcos, Friday 14 July 2017

Christopher Murray, Jacob Snyder, Hannes Baumann

University of Connecticut Department of Marine Sciences, Groton, CT, USA

A Multi-Factorial Evaluation of Temperature Dependent CO₂-Effects in a Coastal Forage Fish

How marine fish respond to ocean acidification will likely be influenced by temperature, yet multi-factorial studies remain rare. We conducted a fully-factorial, CO₂ × temperature experiment where offspring of wild Atlantic silversides (*Menidia menidia*) were reared at three CO₂ levels (control, ~400; high, ~2,000; and extreme, 4,000 μatm) crossed with three temperatures (17°, 20°, and 24°C). Offspring were reared from fertilization until reaching ~10 mm standard length. Survival to hatch was generally high and unaffected by CO₂ level across temperature treatments. At 20° and 24°, overall survival (fertilization to experiment termination) was similar across CO₂ levels. At 17°C overall survival (% mean survival ± SD) was significantly greater at high (53 ± 21 %) and extreme CO₂ (52 ± 10 %) compared to control conditions (30 ± 8%). A significant CO₂ × temperature interaction on hatch lengths was detected. At 24°, hatched larvae (mean ± SD) were significantly shorter in high (5.32 ± 0.22 mm) and extreme CO₂ (5.21 ± 0.27 mm) compared to control larvae (5.51 ± 0.28 mm). Similarly at 20° larvae from extreme CO₂ (5.40 ± 0.28 mm) were significantly shorter than control samples (5.54 ± 0.27). However, no such CO₂ effect was found at 17°. Post-hatch growth rates were significantly influenced by temperature but not CO₂ level. Our experiment demonstrated a significant CO₂ × temperature interaction on hatch lengths of an important forage fish, where elevated CO₂ reduces hatchling size at warmer temperatures. The increased offspring survival under elevated CO₂ at low temperature warrants further investigation.

0316 Lightning Talks II, Glass Oaks, Friday 14 July 2017

Erin Muths¹, Brad Lambert², Scott Schneider², Larissa Bailey³

¹U.S. Geological Survey, Fort Collins, CO, USA, ²Colorado Natural Heritage Program, Fort Collins, CO, USA, ³Colorado State University, Fort Collins, CO, USA

Survival and the probability of movement in boreal toads: Implications for conservation

The probability of persistence is a touchstone in assessing extinction risk and in formulating conservation strategies. Persistence of populations of animals depends on multiple, inter-related factors including demography and the probability of successful movements away from natal sites (e.g. colonization). Survival is one of those factors, but differences in survival rates within a year is seldom assessed. Movement is also recognized a critical factor in persistence and influences gene flow, adaptation, and individual fitness. Movement can be addressed quantitatively at different spatial scales and multiple time scales, and qualitatively from many different perspectives, but despite a rich body of literature focusing on amphibian movements, there has been little attention given to a more probabilistic approach to assessing frequency of movements; specifically, the probability of movements, by adults, among breeding sites within a metapopulation or the probability of dispersal movements by adults completely outside of a metapopulation. We present data from boreal toads (*Anaxyrus boreas*) in Colorado and relate how this information about survival and toad movement can inform conservation concerns such as the spread of disease.

0729 Herp Biogeography & Phylogeography I, Brazos, Sunday 16 July 2017

Edward Myers, Frank Burbrink

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

Does ecological divergence promote speciation across a biogeographic barrier?

Understanding the process of speciation is central to evolutionary biology. However, whether speciation is driven largely by neutral or adaptive processes remains unknown for most groups of organisms as well as across biogeographic barriers. Here we test hypotheses regarding the importance of ecological speciation across thirteen codistributed snake species pairs in the Chihuahuan and Sonoran Deserts. In order to do so we integrate coalescent modeling of subgenomic data, environmental niche models, and geometric morphometrics. We provide evidence that head shape, a surrogate for feeding ecology, co-varies with the rate of migration between sister species pairs. The association of these two metrics is such that as ecological differences increase, the strength of genetic isolation also increases. Ultimately, this demonstrates that ecologically mediated speciation is a widespread cause of species diversification across the arid southwest of North America.

**0708 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD:
CONSERVATION & MANAGEMENT; Poster Session I, Rio Grande Exhibit
Hall, Friday 14 July 2017**

Jason Myrand, Erika Nowak

Northern Arizona University, Flagstaff, Arizona, USA

Microhabitat Use of Northern Mexican Gartersnakes (*Thamnophis eques megalops*) in an Intermittent Stream near Central Arizona

Northern Mexican gartersnakes (*Thamnophis eques megalops*) are federally-listed as Threatened with proposed designation of critical habitat under the Endangered Species Act. Monitoring and understanding microhabitat use of *T. e. megalops* is imperative for developing a recovery plan for this species. We have conducted intensive visual encounter surveys, minnow trapping, and radio-telemetry for *T. e. megalops* at three sites along Lower Tonto Creek, Arizona, near the confluence with Roosevelt Lake since the fall of 2014. This section of the stream tends to be intermittent by drying up in the summer and is typically refilled through winter snowmelt, summer monsoonal flooding, and high precipitation events. We detected 66 *T. e. megalops* at our site between 2014 and 2016. Our overall catch per unit effort for visual encounter surveys was 0.03 snakes per person-hour, and catch per unit effort for minnow trapping was 0.03 snakes per person-hour. Our preliminary radio-telemetry results indicate that this species selects sites with high vegetative cover (74 - 95%) and typically close to water (an average distance to water was 56.89 m \pm 19.24). The four most common macrohabitats used were riparian woodland (22%), meadow (22%), aquatic edge (17%), and dry edge (15%). During the winter months, we documented snakes moving out of den sites in response to snowmelt flooding. We recommend investing in intensive search efforts during any presence/absence surveys for this cryptic species. Our results build on previous *T. eques megalops* studies that inform management decisions for recovery and conservation of this species in intermittent streams.

0152 ASIH STOYE CONSERVATION III, San Antonio, Friday 14 July 2017

Leah Nagel, James Gibbs

State University of New York-College of Environmental Science of Forestry, Syracuse, NY, USA

From Egg to Adult: Factors Influencing Amphibian Survival in Small, Isolated Wetlands

Vernal pools are small, temporary wetlands that support unique aquatic communities and provide important nursery habitat for a number of amphibians, including threatened and endangered species. Throughout the northeastern U.S., studies of pool-breeding amphibians have largely focused on breeding effort – egg mass counts – to both identify and characterize the quality of vernal pools. However, few studies track

amphibian survival. Failure to do so can potentially lead to skewed conclusions about habitat quality if oviposition does not accurately predict juvenile production. With this study, we assessed the effects of pool heterogeneity on the larval survival of two pool-breeding amphibians, spotted salamanders (*Ambystoma maculatum*) and wood frogs (*Lithobates sylvaticus*). A total of 74 pools in two sites in central New York were surveyed biweekly throughout the spring and summer to track pool volume and other abiotic factors. Amphibian survival was assessed with egg mass counts at peak oviposition, and a combination of visual encounter and stove pipe surveys to track larval occupancy throughout the sampling period. Out of the 74 pools sampled, spotted salamanders bred in 67 pools and wood frogs in 51; however, only 24 and 19 pools hosted salamander and frog larvae, respectively. Of 24 pools that dried during the sampling period, amphibian larvae were observed in just 6 – all of which dried before larvae metamorphosed. By better understanding the factors that drive amphibian survival in vernal pools, we can more accurately characterize habitat quality of vernal pools and better prioritize them for protection.

0750 HL/SSAR/ASIH Symposium - The Science, Management, and Policy of Amphibian Conservation: Extending the Legacy of Ray Semlitsch, Glass Oaks, Saturday 15 July 2017

Priya Nanjappa

Association of Fish & Wildlife Agencies, Washington, DC, USA

Science and the Real World: How Ray's Conservation Legacy has Influenced Management and Policy

Wetland conservation and protection practices and policies would not be what they are today without the work by Ray Semlitsch and his students. Ray was a founding member of Partners in Amphibian and Reptile Conservation (PARC). His work was instrumental in demonstrating the value, and need for protections, for small, isolated wetlands. He also led seminal research that provided management agencies with the concept of core habitat. State and federal management agencies benefited from his research by having better information to manage wetlands, forests, and timber production lands, and thus their amphibian and reptile inhabitants. His papers are often cited in habitat management guidance, critical habitat determinations for federally threatened and endangered species, and in species recovery planning. In this talk, I will provide some examples of how Ray's visionary thinking and approach to applied conservation has contributed to a legacy of real world, science-based conservation.

0466 AES Ecology I, Glass Oaks, Sunday 16 July 2017

Krupskaya Narváez¹, Filip Osaer¹

¹ElasmoCan, Asociación Canaria para la Investigación y Conservación de los Elasmobranquios, Las Palmas de Gran Canaria, Spain, ²Fundación Colombiana para la Investigación y Conservación de Tiburones y Rayas, SQUALUS, Cali, Colombia

ANGELSHARK-ID: Creating a baseline for long-term angelshark monitoring in the Canary Islands

ANGELSHARK-ID is a research action created for long-term monitoring of angelsharks *Squatina squatina* in the Canary Islands, employing photo-identification. The aim of the project is to generate scientific base knowledge that allows the development of effective species management, while minimizing research impacts to the studied populations. In the absence of local knowledge of *S. squatina* in the Canarian Archipelago, data and tissue samples were collected during visual underwater census in coastal areas since 2006. The use of body marks was evaluated for viability in individual identification and the detection of short, medium and long-term resightings. Our results indicate that the innovative way of implementing photo-identification for *S. squatina* is a technique that meets our objectives. More than 90% of the sightings could be characterized for individual identification, and resightings were detected in juveniles and in adults up to nine years after their first observation. This methodology allows the description of activities, behaviour, population structure, habitat use, growth and longevity, as well as to identify critical habitats and potential threats. Genetic (ongoing) and isotopic assessment of the tissue samples will further help to inform conservation management.

0505 Poster Session II, Rio Grande Exhibit Hall, Saturday 15 July 2017

Ann-Elizabeth Nash

University of Northern Colorado, Greeley, CO, USA

The Social Network and Evidence for Personality in the Spiny-Tailed Iguana, *Ctenosaura similis*

Animal personalities are defined as consistent differences among individuals in response to ecologically relevant stimuli. Groups or species may exhibit a behavioral syndrome through consistency in individual behavior across situations. Evolutionary theory predicts individuals within a population should adapt their behavior in response to the current environment. Evidence from diverse taxa suggests instead that behavior is constrained by behavioral syndromes or personalities. Recently, incorporating personality into a social network analysis (SNA) framework has been advocated, characterizing the role different personalities play. To relate personalities to aspects of social organization, presence of behavioral types was established in the Spiny-Tailed Iguana, *Ctenosaura similis*, and quantified through two assays. 24 lizards were captured and outfitted with proximity tags to record social interaction data. Additionally, each individual was assayed for activity and exploration in a 9 m² arena containing a raptor model as a predator proxy. Individuals were also assayed for boldness using flight initiation distance (FID). There was strong support for different personalities in FID, with some individuals fleeing at distances >20.0 m while others remained stationary

until <0.5 m. Exploration measures also substantiated different personalities, with skewed distributions of behavior. However, there is no evidence of a behavioral syndrome; bold animals were not predictably more exploratory or in close proximity to a predator model. Absence of a syndrome suggests behavioral flexibility in *C. similis*, avoiding, for example, mating aggression toward conspecifics carried over into inappropriate encounters with predators. Finally, personality may influence social structure, with bold individuals non-randomly distributed across the group.

0560 AES GRUBER AWARD I, Wedgewood, Thursday 13 July 2017

Cody Nash¹, Jill Hendon², Toby Daly-Engel¹

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Reproductive periodicity and the frequency of multiple paternity in the finetooth shark, *Carcharhinus isodon*, in the Northern Gulf of Mexico

The mating behaviors of sharks are poorly understood largely because of the obvious complications of direct observation. However, information about reproduction is essential for forming effective management plans for species that are impacted by human activity. Sharks reach sexual maturity relatively slowly, so can have difficulty recovering from heavy fishing pressure or other sources of population decline. It has recently become apparent through genetic studies that polyandry is prevalent among the elasmobranchs (sharks, skates, and rays). Polyandry has been shown to result in multiple paternity - or multiple sires in individual broods - in almost all species studied to date. However, the adaptive advantage of this behavior is not clear. We are using polymorphic microsatellite markers to determine the frequency of multiple paternity in a small coastal shark of the Northern Gulf of Mexico, the finetooth shark (*Carcharhinus isodon*). This species has shown evidence of co-occurring annual and biennial reproductive periodicities within this region. We will compare the frequency of multiple paternity between individuals with each periodicity in order to determine if paternity is impacted significantly by long-term sperm storage and/or mate encounter rate. Preliminary results indicate that at least some larger litters are multiply-sired. The final results of this study will allow us to compare *C. isodon* to other related species to help determine how life history characteristics can impact mating behavior.
