

480 Lightning Talks III, Highland B, Sunday 15 July 2018

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Public Engagement of Herpetologists: Attitudes and Scope

Scientists' public engagement (PE) is a popular topic in the greater science community due to general concerns about public scientific support, attitudes towards science, and changes in scientific funding requirements. Herpetofauna specifically stands to benefit from PE, as direct exposure can improve attitudes and conservation behavior of participants towards uncharismatic species. Despite potential advantages, little research has focused on herpetologists' PE. We plan to assess the current scope of herpetologists' PE activities, investigate factors associated with their participation in PE, and compare these factors with those in the broader scientific community. We expect that conservation-oriented herpetologists will share similar PE factors but will exhibit an additional factor related to their understanding of the public's role in conservation. Based on previous research, our theoretical framework will utilize an adapted version of the Theory of Planned Behavior, which states that an individual's attitudes about a behavior, social pressure to perform that behavior, and an individual's perceived control over that behavior, for example resources and ability, predict an individual's intention to participate in a behavior. We will conduct 25-minute semi-structured qualitative interviews with ~15 herpetologists expressing varying interest in PE. We will code and analyze transcripts using thematic analysis with expected and emergent codes. Results will be used to design a broader survey consisting primarily of closed-ended questions which will be distributed through herpetological organizations. Survey results will be analyzed with descriptive and inferential statistics. This study will help identify barriers to PE by herpetologists, ultimately improving conservation outcomes of herpetofauna.

514 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Kirsten Hecht^{1,2}, Lori Williams³, Stephen Nelson⁴, Thomas Floyd⁵, Shem Unger⁶ and Jeremiah Cronin²

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Common Mudpuppies (*Necturus maculosus*) Not Common in Southern Blue Ridge Streams.

While the Common Mudpuppy (*Necturus maculosus*) is considered common throughout most of its North American range there are relatively little data to support the claim, especially within Southern Appalachia. From 2000-2016, we sampled 163 streams in eastern Tennessee, northern Georgia, and western North Carolina using several methods to determine presence/absence of Common Mudpuppies in lotic systems as well as to collect information on basic life history traits and habitat use. During 5,697.5 survey hours and 2,998 trap nights, we located a total of 115 individuals (64 in TN, 51 in NC, and 0 in GA). While locally abundant in some drainages, *N. maculosus* was not detected in many waterways (especially in NC and GA), and we had low catch per unit effort (CPUE) and trapping success. Both immature and mature Mudpuppies were found, along with five nests. We had the most success using the snorkeling with rock turning method and found most animals under rocks in runs and pools. Overall our efforts demonstrate that *N. maculosus* is potentially not common in Southern Appalachia and further research on this species and its status is warranted. Specific research needs include, but are not limited to, continued distributional surveys, habitat use (specifically, micro-habitat and potential use impounded waters and deeper riverine pools), diet, density, and movement.

372 Herpetology Conservation III, Highland C, Sunday 15 July 2018

Brandon Hedrick¹, Samantha Cordero², Patrick O'Roark² and Edward Watt²

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How Did the Salamander Cross the Road? Improvements to Older Amphibian Culverts

Roads create barriers to wildlife migrations, leading to habitat segmentation and road mortality. Erecting barrier fences and wildlife tunnels has become a common way to address these problems. The first amphibian tunnels in the United States were installed in 1987 in Amherst, Massachusetts to aid in the annual migration of the spotted salamander, *Ambystoma maculatum*, across a busy road. The salamanders hibernate on the eastern side of the road and move to the marshy breeding area on the western side of the road in mass during rainy nights in early Spring. An initial assessment of the tunnels' functionality in 2016 suggested that only 11% of the salamanders were still using the tunnels successfully, while 45% were scaling the barrier fences and the remaining 44% were reaching the tunnels, but balking upon approach. We have designed a three-year study using these tunnels to determine if it is possible to retrofit older amphibian tunnels cheaply to increase salamander use without necessitating costly full-scale renovations. In 2017, we repaired the fencing and added a light to the far side of one of the tunnels to discourage balking (anecdotal evidence suggested that salamanders balked less when confronted with a light at the far side of the tunnel). Although fewer salamanders scaled the fencing, there was no significant difference in the percentage of salamanders that balked. For Spring 2018 we have constructed ramps leading down to the tunnels designed to raise the energetic cost of balking at tunnel entrances.

468 Herpetology Biogeography I, Highland B, Saturday 14 July 2018

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Evaluating Evidence for the Arid Corridor Hypothesis in Angola's Herpetofauna

The herpetofauna of Angola is unique in sub-Saharan Africa because it includes a complete faunal turnover from arid-adapted taxa in the south to tropical taxa in the north. Many of the "southern" taxa are more closely related to geographically distant species from East Africa rather than species from intervening parts of Central Africa. This pattern may have arisen from species dispersing across intermittent arid corridors across Central Africa beginning in the Miocene, or alternatively as a result of more circuitous connections among populations via southern Africa, where many of the same arid-adapted species also occur. Through recent field work in Angola, we have obtained genetic samples suitable for testing the viability of the arid corridor hypothesis in a number of widespread amphibian and reptile lineages. We performed phylogenetic and phylogeographic analyses for many of these widespread lineages including *Sclerophrys*, *Tomopterna*, *Acanthocercis*, *Agama*, *Boaedon*, *Chondrodactylus*, *Hemidactylus*, *Pachydactylus*, and *Trachylepis*. Our results suggest that arid-adapted taxa in Angola are typically, but not always, most closely related to congeners found further to the south and that the arid-adapted herpetofauna is dominated by taxa that colonized via a southern, not central, route.

356 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Patricia Hernandez¹, Stephanie Keer¹, Catherine May², Sarah McMenamin² and Karly Cohen¹

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Anatomical assessment of the adult skeleton of thyroid-ablated zebrafish, *Danio rerio*

Thyroid hormone is critical for the normal development and regulation of a variety of cellular and organismal processes, particularly those involving normal skeletogenesis. Mouse and rat models have been traditionally used to study thyroid hormone, but the fast generation time and ease of genomic manipulation of zebrafish makes them an excellent tool to investigate the effects of thyroid hormone disruption. Therefore, a thorough anatomical assessment of the differences in the adult hypo-, eu-, and hyperthyroid zebrafish is important for those who wish to use zebrafish as a model organism for thyroid research. We study the effects of thyroid alteration on skeletal development using both transgenic hypothyroid and mutant hyperthyroid lineages of *Danio rerio*. Our anatomical examination has shown that in hypothyroid zebrafish, developmental anomalies include the parietal and frontal bones failing to properly fuse, and the radials of the pectoral girdle undergoing improper ossification. In addition, hyperthyroid

zebrafish exhibit greatly enlarged neural spines, haemal spines, and dentaries. By thoroughly investigating and comparing the anatomy of hypo-, eu-, and hyperthyroid zebrafish, we are better able to understand the role of thyroid hormone in skeletal development in vertebrates in general.

535 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Melanie Herrera^{1,2}, Antony Harold¹, Carly Gramling¹ and Madison Martin¹

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Diversity and Abundance of Early Life History Stages of Fishes Associated with Algal Beds Dominated by *Gracilaria vermiculophylla*

Diversity and abundance of juvenile and sub-adult stages of estuarine fishes has been well studied overall, although that of earlier, post-metamorphic juveniles has not. Benthic microhabitats are thought to be important resources during early life history. These habitats in estuaries of the southeastern United States have become dominated by the invasive red alga *Gracilaria vermiculophylla*, with native species of algae reduced. In order to probe the effects of bottom coverage of benthic algae on diversity we compared two microhabitats that occur over sand/silt bottom in Charleston harbor, during June and July 2017: dense assemblages dominated by *G. vermiculophylla* ($\geq 80\%$ coverage) and sparse assemblages ($\leq 20\%$ coverage). A 15 foot long fine-meshed (1/16") beach seine was dragged along a transect 15 meters in length. All fishes captured were identified to the lowest taxonomic level possible and standard length recorded. A total of 3,305 fish specimens were caught, with 2944 (19 species total) of those from dense sites (top five in decreasing rank of abundance: *Menidia menidia*, *Anchoa mitchilli*, *Fundulus majalis*, *Syngnathus* sp., and *Bairdiella chrysoura*) and 361 (21 species) from sparse sites (decreasing rank: *A. mitchilli*, *Syngnathus* sp., *M. menidia*, *B. chrysoura*, and *Trachinotus carolinus*). Dense sites support much higher abundances in comparison to sparse but with much less living space available. It is yet to be determined whether the explanation for the high abundances in dense algal beds is related to structural complexity, abundance of food resources, predator avoidance, or some other factor.

544 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Jeremy Higgs, Jim Franks, Gary Gray, Patrick Graham and Nancy Brown-Peterson

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

Age and growth of recreationally caught Swordfish, *Xiphias gladius*, in the northern Gulf of Mexico

Swordfish, *Xiphias gladius*, is a circumglobal species that is commonly sought in recreational and commercial fisheries. Prior studies on Swordfish age and growth have primarily been associated with commercial longline fisheries in the South and North Atlantic Oceans,

Mediterranean Sea, and waters around Hawaii and Taiwan, but there is no information from the Gulf of Mexico (GOM). In the current study, biological samples were collected from Swordfish caught in the northern GOM by recreational anglers, primarily participating in the Mississippi Gulf Coast Billfish Classic ($n = 28$). Sizes ranged from 150.3-213 and 165.8-195 cm lower jaw fork length (LJFL) for females and males, respectively. Second anal spines were sectioned and used for age estimations by three independent readers. Age estimates for combined sexes ranged between 3-11 years. Back-calculations of age were conducted to model growth due to limited sample size. Four growth models (two- and three-parameter von Bertalanffy, Gompertz, and logistic) were fitted to the combined sex, size-at-age data and all showed a significant ($p < 0.05$) relationship between length and age. The three-parameter von Bertalanffy growth function provided the best fit and estimated $L_{\infty} = 214.3$ cm LJFL and $k = 0.20/\text{yr}$. Ongoing histological assessments will provide baseline data on length and age of maturity for Swordfish in the GOM. This opportunistic study represents the first age and growth investigation of Swordfish from the GOM.

464 Herpetology Biogeography II, Highland B, Saturday 14 July 2018

Paul Hime^{1,2}, Shem Unger³, Steven Price², Jeffrey Briggler⁴, Lori Williams⁵, Michael Freake⁶, Andrea Drayer², Amy McMillan⁷, Mary Foley^{8,2}, Emily McCallen⁹, Dale McGinnity¹⁰, John Groves¹¹, Emily Lemmon¹², Songlin Fei⁹, Rod Williams⁹ and David Weisrock²

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What the Hellbender?! Genomic Perspectives on the Evolutionary History of *Cryptobranchus*.

Identifying the demographic and historical forces which have shaped contemporary patterns of biodiversity is a primary aim of modern phylogeography. Central to these efforts, is the desire to objectively test hypotheses about lineage boundaries in dispersal-limited taxa. We investigate range-wide phylogenetic relationships and putative species boundaries in the imperiled North American hellbender salamander (genus *Cryptobranchus*), integrating comprehensive geographic sampling and dense sampling of the nuclear genome in a model-based statistical framework. Phylogenomic analyses of 194 individual hellbenders from 14 states have revealed extensive population genetic differentiation within and between major watersheds and suggest the presence of multiple, deeply divergent, reproductively isolated lineages of hellbenders. Our results suggest that *Cryptobranchus* contains as many as four cryptic lineages which are broadly aligned with the major continental watersheds of eastern North America. Do these different lineages of hellbenders actually represent distinct species? We demonstrate that rates of effective gene flow between these lineages are up to four orders of magnitude lower than rates of gene flow within lineages, and that these putative species exhibit genealogical exclusivity

across the genome. These findings have significant implications for delimiting species with genomic data, and imply that the current hypothesis of a single hellbender species may warrant reconsideration. This work also has applied conservation implications for hellbenders in that, regardless of the true number of hellbender species, given current trends, a model of zero *Cryptobranchus* species may be impossible to reject in the foreseeable future.

593 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION & BEHAVIOR, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Amanda Hipps and Jon Moore

Florida Atlantic University Honors College, Jupiter, Florida, USA

Filling in the Data Gaps: The Vertebrate and Invertebrate Gopher Tortoise Burrow Commensals in Southeast Florida

The gopher tortoise, *Gopherus polyphemus*, is a keystone species that digs extensive burrows providing a novel microhabitat also used by over 360 other vertebrate and invertebrate species. Limited information is available regarding gopher tortoise burrow commensal species in southeast Florida, especially regarding invertebrates. This study investigates the gopher tortoise burrow commensals at six sites in subtropical southeast Florida, consisting of three pine flatwoods and three scrub habitats with varying degrees of habitat management. Vertebrate commensal species are identified using a burrow scoping system and game cameras. Several methods are being employed to collect invertebrate species to aid in their identification, consisting of insect pitfall traps, baiting with gopher tortoise feces, burrow facade traps, UV light, mesh tents, and active searching at burrow entrances. This project is ongoing and preliminary results will be presented. The objective of this research is to compile an account of vertebrate and invertebrate species dependent on gopher tortoise burrows in this region, accumulate information on threatened, endangered, and invasive species, add to the distributional information on obligate invertebrate species, and to present information to land managers concerned with maintaining biodiversity.

630 Herpetology Genetics II, Highland D, Sunday 15 July 2018

Matthew Holding^{1,2}, Darin Rokyta¹, Mark Margres¹ and Lisle Gibbs²

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Assessing biotic and abiotic drivers of venom divergence among populations of the Northern Pacific rattlesnake (*Crotalus oreganus*).

Identifying the biotic and abiotic correlates of population divergence in functional traits can provide insights into the evolutionary mechanisms that generate local adaptation among populations. Venom is used by snakes to capture prey, and shows significant divergence among

populations of the same species in many taxa, yet the underlying causes of this general pattern remain unclear. Here, we assess patterns of population differentiation in venom protein expression in Northern Pacific rattlesnakes (*Crotalus oreganus*) from 13 locations across California. We then evaluate the relative importance of major biotic (prey species community composition), abiotic (temperature, precipitation, and elevation) and genetic (genetic distance based on RADseq loci) factors as correlates of population divergence in these venom phenotypes. Environmental and genetic data all explain a significant amount of population divergence in venom but vary in their relative importance. Surprisingly, genetic differentiation among populations was the best predictor of venom divergence accounting for 46% of overall variation, whereas differences in prey community composition and abiotic factors explained smaller amounts of variation (23% and 19%, respectively). The association between genetic differentiation and venom composition may reflect an isolation by environment effect where selection against recent migrants is strong, producing a correlation between neutral genetic differentiation and venom differentiation. Our analyses suggest that even coarse estimates of prey community composition can be useful in understanding the potential selection pressures acting on patterns of venom protein expression.

194 General Herpetology I, Highland B, Sunday 15 July 2018

Iris Holmes, Daniel Rabosky and Alison Davis Rabosky

University of Michigan Museum of Zoology, Ann Arbor, MI, USA

Relationship of host genetic diversity to microbiome diversity in squamate reptiles

Gut microbiomes are critical to the survival of multicellular animals. They help the host digest their food, resist invading pathogens, and synthesize critical nutrients. The gut microbiome of snakes and lizards is little studied relative to other vertebrates, but the physiological flexibility of squamates (for example clonal lineages and multiple evolutions of viviparity, among others) makes them an intriguing potential study system for host-microbiome interactions. The gut microbiome interacts with the host primarily by communicating with the host immune system, although many other host metabolic processes are also involved. Correlative evidence suggests that more diverse gut microbiomes improve host health, although the mechanism behind this effect are not fully understood. The diversity of mammal gut microbiomes show a slight correlation with increasing host genetic diversity. Squamates have a greater range of heterozygosity levels than are displayed in mammals, including several clonal lineages that should have near zero between-individual heterozygosity. I present a study of a community of squamates that includes two clonal lizards and ten sexually reproducing species that cover a four-fold range of average heterozygosity. We find no consistent effect of host heterozygosity on gut microbiome diversity.

253 Herpetology Conservation IV, Highland C, Sunday 15 July 2018

Chace Holzheuser¹, Bruce Means², Brooke Talley³ and Karen Lips¹

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Assessing Distribution and Abundance of the Southern Dusky Salamander (*Desmognathus auriculatus*) in Florida: Population Surveys, Habitat Analysis, and Disease Status.

Once considered an abundant salamander across its range in Georgia, Florida and Alabama, the Southern Dusky Salamander (*Desmognathus auriculatus*) cannot be found at many historic locations. In 2016 we calculated the historic distribution of this species in Florida from field notes and museum data, and conducted a statewide resurvey of historic localities to determine the current distribution, population abundances, and disease status. We swabbed 628 museum specimens and 50 wild caught individuals for amphibian chytrid (*Bd*), and analyzed historic versus current distribution with GIS. Analysis of capture effort at 7 sites in Florida between 1969-1977 shows a decline of 1.29 salamanders hr⁻¹ yr⁻¹ (p-value = 0.011), until reaching zero at all sites by 1977. From June 2016 - July 2017, we spent 155.75 hours searching 123 sites in 14 river basins. We encountered SDS in 7 sites (5.7%) within 3 habitat patches with a combined area of ~513 km², or <1% of its original distribution. Of the 50 field swabs we collected, 1 was *Bd+* (2%; 95% CI: 0-11.47%). We tested 142 museum swabs of this species but found only 1 *Bd+* (0.7% 95% CI: 0-4.28%). We show that declines began by at least the 1960s, although we are unable to identify a cause. Identifying the extent of losses and current distribution is critical for informing state agencies, IUCN and ESA on the species conservation status. Determining the timing, locations and patterns of population declines can help identify potential causes and possible recovery and mitigation actions.

344 SSAR SEIBERT CONSERVATION I, Highland B, Thursday 12 July 2018

Charlene Hopkins, Shawn Kuchta and Willem Roosenburg

Ohio University, Athens, Ohio, USA

How to Build a Better Ecopassage: Evaluating Amphibian Use and Preference of Various Ecopassage Designs

As roadways impact amphibian and reptile population sizes, disrupt connectivity, and degrade habitat, mitigation measures are increasingly being implemented. Barrier-ecopassage systems are a common strategy used to mitigate roadway impacts. Barriers limit access to roadways and may direct animals toward ecopassages, which are corridors designed to conduct animals safely over or under the roadway. We assessed use and preference of various ecopassage parameters by utilizing manipulative choice experiments and an observational choice experiment along a two-lane highway in southeastern Ohio. Using amphibians, and some reptiles, we tested preference for the aperture size of passages, levels of sky exposure in the passages, and

maintenance of ability to see across the passage. Testing animals throughout 2017, we found that amphibians prefer passages that are 100cm wide, provide 90% sky exposure, and maintain full sight across the passage. The results from the manipulative and observational experiments did not vary significantly, and our observational experiment was able to reduce mortality along the roadway stretch where it was in place. These findings have potential implications for the implementation of future barrier-ecopassage mitigation projects.

165 ASIH: If Salamanders Could Speak Symposium, Grand Lilac Ballroom North, Saturday 14 July 2018

Gareth Hopkins^{1,2}, Susannah French² and Edmund D. Brodie, Jr.²

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Interacting effects of salinity and temperature on amphibians: exploring the potential for adaptation in a changing world

To accurately predict the impact of environmental change, it is necessary to assay effects of key interacting stressors on vulnerable organisms such as amphibians, and the potential resiliency of their populations. Yet, for the most part, these critical data are missing. We examined the effects of two common abiotic stressors predicted to interact with climate change, salinity and temperature, on the embryonic survival and development of rough-skinned newts (*Taricha granulosa*) from populations differing in their history of exposure to these stressors. We found that salinity and temperature significantly interacted to affect newt embryonic survival and development, with the negative effects of salinity most pronounced at temperature extremes. We also found significant variation among, and especially within, populations, with different females varying in the performance of their eggs at different salinity-temperature combinations, possibly providing the raw material for future natural selection. Our results highlight the complex nature of predicting responses to climate change in space and time, and provide critical data towards that aim.

278 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center; part of ASIH symposium: If Salamanders Could Speak, Saturday 14 July 2018

Gareth Hopkins¹, Jasmine Maftai-Muirson², Seamus Doherty², Gina Mincham² and Craig Williams²

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Amphibian adaptability to global environmental change: salinity tolerance in the common Australian froglet *Crinia signifera*

Ecosystem disturbance through urbanisation and agriculture, coupled with anthropogenic climate change, poses a pervasive threat to ecosystem health. On face value, increasing salinisation of both soils and waterways has the potential to render habitats unsuitable for amphibians. However, some species are known to exist in brackish and saline habitats, which suggests the capacity to adapt to salinisation. To assess this adaptability, we examined current brackish habitat utilisation by a common Australian froglet, *Crinia signifera*, and determined the tolerance of eggs and tadpoles of this species to acute and chronic exposure to brackish water. *C. signifera* were found to lay eggs in brackish water, and through laboratory experiments we determined that short term survival in water up to 7.5 ppt salinity is common. Chronic exposure experiments demonstrated that *C. signifera* can successfully complete larval development to metamorphosis in brackish water (up to 5.0 ppt) and that there is some initial evidence of growth and development trade-offs for salinity tolerance.

280 Herpetology Behavior, Grand Lilac Ballroom South, Friday 13 July 2018

Christopher Howey¹ and Erika Snyder²

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Substrate type affects scent-trailing behavior of timber rattlesnakes

Animals can obtain social information from monitoring chemical cues within their environment left behind by conspecifics, competitors, predators, or prey. Whereas many studies have addressed the ability for snakes to trail scents within a laboratory along a homogenous substrate (butcher paper), our objective was to determine if the scent-trailing behavior of a snake was affected by changes in substrate type. We brought 5 gravid timber rattlesnakes (*Crotalus horridus*) into the laboratory where each gave birth to an average 9 neonates. After each neonate shed, we conducted Y-maze trials. For each trial, the Y-maze floor was covered in either paper, sand, leaf litter, or burnt leaf litter. The scent of the mother was applied down one arm of the Y-maze. Prior to each trial, we replaced the substrate and scent. Each neonate was tested on each substrate. Neonates non-randomly chose the arm with the mother's scent 87% of the time when tested on paper ($P < 0.001$) and 73% of the time when tested on sand ($P < 0.011$). When tested on leaf litter and burnt leaf litter, neonates chose the arm with the mother's scent 67% and 53% of the time ($P < 0.068$ and $P < 0.715$ respectively). Substrate affects the ability for neonates to scent trail their mother. In a natural setting, the rocky substrate coupled with leaf litter near den sites may facilitate this scent-trailing behavior. However, as prescribed fire becomes a more popular forest management tool, care should be taken in where this tool is applied.

259 Amphibian Disease Ecology, Highland E, Thursday 12 July 2018

Jessica Hua and George Meindl

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Effect of Different Cold-temperature Regimes on Compensatory Larval Growth, Development, and Susceptibility to Road Salt and Parasites in *Lithobates sylvaticus*.

Environmental conditions early in development can alter amphibian fitness or performance later in life. For example, during embryonic stages, early spring-breeding amphibians can be exposed to a diversity of cold-temperature regimes (pulse vs. press) that may differentially affect growth and development. Amphibians can counteract the negative effects of poor embryonic conditions by accelerating larval growth and development. However, these compensatory responses may lead to costs that hinder the ability for amphibians to respond to other stressors. We investigated how different embryonic thermal regimes affect compensatory larval growth and development and larval responses to contaminant and parasitic stressors. Towards this goal, we exposed *Lithobates sylvaticus* embryos to three thermal regimes: Control (20C), press-of-cold (4C), and pulses-of-cold (4C/20C). We then conducted three tolerance assays by exposing tadpoles from each thermal regime to NaCl (3d and 17d post-hatching) and an amphibian parasite (echinostomes-24d post hatching). We found: (1) No evidence of compensatory growth- tadpoles reared in 4C and 4C/20C were consistently smaller than tadpoles reared in 20C. (2) Evidence of compensatory development in tadpoles exposed to the 4C/20C treatment, but not in the 4C treatment. (3) Tadpoles reared in the 4C treatment were initially more susceptible to NaCl, but this effect disappeared by 17d. (4) The reduction in mass caused by the 4C and 4C/20C treatments indirectly facilitated tadpoles by making them less susceptible to parasites. These results demonstrate that variation in cold-temperature regimes can lead to unique direct and indirect effects on larval growth, development, and performance.

586 Poster Session I, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Sarah Huber¹, Katherine Maslenikov², Andrew Williston³, Eric Hilton¹, Adam Summers² and David Blackburn⁴

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oVert Deep Dive: Ontogenetic Series of Fishes

The non-destructive nature of CT-scanning makes it appealing for studying ontogeny in groups for which early developmental material is rare, and it has been successfully used for studying the ontogeny of many vertebrates that have relatively gradual developmental shifts, including

mammals and birds. Many groups of vertebrates that have not been the focus of this type of imaging (e.g., fishes and amphibians) undergo major ontogenetic changes during development. For many taxa in these groups it is not possible to capture the morphological diversity of a particular species by scanning a single adult specimen. Within the framework of the oVert Thematic Collections Network, we will identify taxa, with input from the ichthyological community, for which it would be advantageous to CT larval or juvenile material to capture otherwise unobtainable anatomical data from rare specimens (legacy scans), to produce anatomical data for key taxa (basal ray-finned fishes) or to highlight the radical ontogenetic transformations that occur in fishes. We will leverage the excellent collections of marine and freshwater larval fishes at VIMS, UW and MCZ to provision the oVert database with ontogenetic data. Based on preliminary collection surveys, we have identified over 250 taxa for which ontogenetic material is available. Traditional CT scanning methods are sufficient for examining early development in highly ossified taxa, and we will explore contrast enhanced scanning for less ossified specimens. We expect that resulting scans will become a remarkable educational tool for showcasing the radical metamorphoses that occur in many vertebrates. Supported by NSF DBI-1701714.

230 Ichthyology Systematics I, Grand Lilac Ballroom South, Saturday 14 July 2018

Lily C. Hughes

George Washington University, Washington, DC, USA

Comprehensive phylogeny of ray-finned fishes (Actinopterygii) based on transcriptomic and genomic data

Our understanding of phylogenetic relationships among bony fishes – half of all living vertebrates – has been transformed by analysis of a small number of genes, calling into question many traditional groupings based on morphology, but uncertainty remains around critical nodes. Additionally, fish molecular phylogenies are particularly prone to biases due to undetected paralogy, given the history of whole-genome duplications at the base of the vertebrate and teleost fish radiations. We leveraged 144 genomes and 159 transcriptomes (130 newly sequenced) to investigate fish evolution with an unparalleled scale of data: >0.5 Mb from 1,105 exon sequences from 303 species, representing 66 out of 72 ray-finned fish orders. This set of exon markers was filtered against paralogy based on explicit tests to detect whole-genome duplications among vertebrates, eliminating many loci initially identified as single-copy based on a few genomes. Our results further consolidated the backbone of the ray-finned fish phylogeny with genome-wide data, and gene genealogy interrogation settled some long-standing uncertainties, such as the branching order at the base of the teleosts, among early euteleosts, and the massive percomorph radiation in a hypothesis testing framework that accounts for gene tree error.

**485 ASIH STOYE GENERAL ICHTHYOLOGY I, Grand Lilac Ballroom South,
Thursday 12 July 2018**

Elizabeth Hunt¹, Stuart Willis², Kevin Conway³ and David Portnoy¹

¹Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA. ²California Academy of Sciences, San Francisco, California, USA. ³Texas A&M University, College Station, Texas, USA

Phylogenomics of pufferfish in the genus *Sphoeroides* (Tetraodontiformes, Tetraodontidae)

Species-level phylogenies are critical for studying mechanisms of diversification, but challenges to accurate inference abound, some of which can be addressed with genomic methods. While there have been previous investigations into the phylogenetic relationships of fishes in the family Tetraodontidae, a diverse group of derived percomorph fishes, there has yet to be an extensive investigation into the relationships within the genus *Sphoeroides*. The diversity of *Sphoeroides* is primarily within the western Atlantic and eastern Pacific in shallow waters, with the exception of *S. pachygaster* which is found circumglobally in deeper water of the continental shelf. In order to better understand mechanisms driving speciation in this group we generated data from ultraconserved DNA elements (UCE) using hybrid enrichment. We targeted 500 loci in order to assess the phylogenetic relationships among 13 of the 23 currently recognized species of *Sphoeroides*, with a special focus on putative sister species from the Gulf of Mexico that are distributed on either side of an apparent biogeographic break.

100 ASIH STOYE CONSERVATION, Highland D, Friday 13 July 2018

Nicholas A. Huron, S. Blair Hedges and Matthew R. Helmus

Temple University, Philadelphia, PA, USA

Extinctions Point to Different Levels of Morphological and Functional Role Diversity Loss in a Genus of Island Lizards

Functional diversity (FD) loss is a central concern under the current mass extinction. FD reflects unique roles species with different traits play in ecosystems. Because traits mediate ecological interactions, if organisms with uncommon traits go extinct, loss of unique interactions could follow. For example, large-bodied species are extinction-prone, and their loss catalyzes cascading effects on ecosystems. Here, we estimated past, present, and future FD loss for an imperiled Caribbean lizard clade, *Leiocephalus* (curly-tailed lizards). We first asked how *Leiocephalus* morphological FD evolved in the past. We measured external traits for extinct/extant species, constructed a phylogeny, and fit models of adaptive trait evolution to these data. Second, we estimated the change from past to present-day morphological FD and from present to future FD if all threatened species go extinct. Finally, we built an interaction database from mined literature and asked if unique interactions are lost due to extinction. All *Leiocephalus* are ground-foraging and xeric-adapted species, and morphological FD evolution was explained by weak

stabilizing selection toward a single adaptive optima. However, significant interspecific variation exists in morphological FD, and this diversity is being lost. Extinct species were larger than extant species, and if threatened species go extinct, ca. 53% more morphological FD will be lost, mostly on Hispaniola. By contrast, we estimate that few unique interactions will disappear. This discrepancy between morphological FD erosion with minimal loss of species interactions emphasizes the importance of evaluating biodiversity across several dimensions to prioritize conservation efforts and avoid irreversible changes to sensitive ecosystems.

330 ASIH STOYE GENERAL HERPETOLOGY, Highland C, Friday 13 July 2018

Carl Hutter and Rafe Brown

University of Kansas, Lawrence, KS, USA

A new and freely available exome sequence capture probe set of 10,000 loci for all frogs

The widespread use of high-throughput sequencing technologies has led to new challenges for biodiversity researchers in designing projects and deciding which method to use to sequence reduced portions of the genome. Targeted sequence capture is one method shown to work well across divergent taxa at a lower cost; however, this requires a specifically designed probe set for the focal taxon, which is largely unavailable for frogs. Herein, we introduce and demonstrate the utility of a new and publicly available sequence capture probe set and data analysis pipeline for all frogs. We provide a modular, large, and flexible set of probes for ~13,000 loci that unifies all previous sequencing work on frogs by including legacy loci previously used in phylogenetic studies in frogs (e.g. Sanger Loci, AHE, UCEs). The probe set is designed to be modular, such that subset of the loci can be selected and used based on the type of research question and taxonomic scale being addressed. Finally, we evaluate our sequence capture results using multiple phylogenetic scales, evaluating the number of loci captured per taxa, the sensitivity and specificity of the sequence capture, assess percentage completeness across different values, and demonstrate the utility of exon and intron sequence across these phylogenetic scales.

199 SSAR SEIBERT ECOLOGY II, Highland A, Friday 13 July 2018

Saidee Hyder¹, Jon Davenport¹ and Josh Ennen²

¹*Southeast Missouri State University, Cape Girardeau, Missouri, USA.* ²*Tennessee Aquarium, Chattanooga, Tennessee, USA*

Preliminary assessment of movement ecology in a West Tennessee population of Alligator Snapping Turtles (*Macrochelys temminckii*)

Alligator snapping turtles (*Macrochelys temminckii*) are experiencing population declines throughout their range; this decline is primarily due to habitat fragmentation and overexploitation. Currently, one of the only known populations in West Tennessee is being monitored in order to understand the habitat preferences and spatial use of *Macrochelys temminckii*. This population is composed of subadult turtles that were previously released and monitored as hatchlings. Currently, little data is available for the subadult life stage of *Macrochelys temminckii* in comparison to hatchling and adult life stages. We hypothesized that the home range size will have increased since estimates taken from hatchlings and that turtles will select warmer microhabitats with a high percentage of tree cover. Preliminary data shows that the mean home range size for this first field season is 0.38 +/- 0.16 hectares. The mean distance moved per day by a turtle is 2.37 +/- 0.85 meters with trends showing differences in microhabitat. There also appears to be a correlation between the distance moved and water temperatures, with longer distances and more movements associated with warmer water temperatures. Continued monitoring of the habitat preferences and spatial use of this population will aid in future reintroductions and management protocols within West Tennessee. This study will also provide updated data for the IUCN in a state with currently little information available on *Macrochelys temminckii*.

444 Ichthyology Genetics, Reproduction, and Development, Highland E., Friday 13 July 2018

Atsushi Ishimatsu¹, Van Hieu¹ and Karen Martin²

¹Nagasaki University, Nagasaki, Japan. ²Pepperdine University, Malibu, CA, USA

Patterns of Fish Reproduction at the Air-Water Interface

Although fishes by nature are aquatic, many species expose their embryos to air during incubation. We examine the ecological context of reproduction by fishes at the air-water interface, whether or not the adults breathe air. Seven modes are described, with examples from taxa of teleost and primitive species from fresh water, estuaries and sea water. Mode 1 is the most common type of reproduction by fishes at the air-water interface, marine teleosts that spawn in water onto a substrate surface, on vegetation, or other objects that will later be exposed to air tidally. In Mode 2, some fishes emerge from water to oviposit beneath a substrate or on vegetation above the water line. Mode 3 is annual fishes that bury eggs in temporary pools that evaporate seasonally. Mode 4 fishes spawn buoyant eggs on a water surface surrounded by vegetation. Mode 5 fishes construct foam nests on hypoxic water. Mode 6 mudskippers excavate burrows and store air in a subterranean chamber. Mode 7 combines Modes 5 and 6, placing demersal eggs on foams inside a nesting burrow. The widespread, variable nature of fish reproduction at the air-water interface across a broad taxonomic spectrum indicates repeated independent evolutionary events and strong selection pressure for fishes to protect their propagules from hypoxic waters or aquatic predators. Air-breathing by adult fishes appears to be de-coupled from air exposure of developing embryos, and no primitive fishes are known to place their propagules where they will be exposed to air.

336 ASIH STORER HERPETOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Kathleen Ivey and Emily Taylor

California Polytechnic State University, San Luis Obispo, California, USA

Turn Up The Heat: Thermal Ecology of the Endangered Blunt-nosed Leopard Lizard (*Gambelia sila*)

Recognizing how climate change will impact populations can aid researchers and managers in making decisions about how they will approach conservation of endangered species. By projecting how the accelerated rate of anthropogenic climate change will interact with a species' thermal ecology, we can predict the likelihood of extirpation of endangered populations and identify methods for mitigating the effects of climate change. The Blunt-nosed Leopard Lizard (*Gambelia sila*) is a federally endangered lizard found in the arid grasslands of the San Joaquin Valley and Carrizo Plain. It has been extirpated from most of its range due to habitat destruction and alteration. We collected data on the field-active body temperatures of *G. sila*, combined with operative temperatures, preferred body temperatures, and thermal tolerance data for the population, that allows us to (1) calculate the number of hours that lizards are currently thermally constrained, (2) project how this number will change in the future as ambient temperatures rise, and (3) assess the importance of shade-providing shrubs in the current and projected future thermal ecology of *G. sila*. I will be presenting preliminary data on the thermal ecology of the blunt-nosed leopard lizard.

94 ASIH STOYE ECOLOGY & ETHOLOGY I, Highland C, Thursday 12 July 2018

Carl Jacobsen¹, William Flint² and Donald Brown¹

¹*West Virginia University, Morgantown, WV, USA.* ²*James Madison University, Harrisonburg, VA, USA*

Projected Current and Future Habitat for the Cow Knob Salamander (*Plethodon punctatus*).

The Cow Knob Salamander (*Plethodon punctatus*) has a narrow distribution at the high elevations of Shenandoah and Great North Mountain. Given their small distribution and specialized habitat requirements, *P. punctatus* is considered a species of special concern in both Virginia and West Virginia. Previous studies have predicted that the climatic niche for this species will be eliminated by 2050 due to climate change. We sought to expand on these studies by using a species-specific approach and a robust occurrence data set to identify habitat variables that are the strongest predictors of the environmental niche for *P. punctatus*.

Additionally, we created a habitat suitability model that can be used to facilitate the discovery of new populations. We used a maximum likelihood approach (package maxlike) to model the structural and climatic niche for this species. We explored the effects of climate change using an ensemble of 37 global climate models produced for the IPCC 5th assessment report and statistically downscaled using SimClim. Our results indicate that elevation, aspect, and hill shade are the best predictors for structural niche, while mean annual temperature and mean precipitation in the warmest quarter are the best predictors of climatic niche. Further, our climatic niche model predicts a drastic reduction in suitable habitat for this species by 2050 due to warmer annual temperatures.

584 ASIH STOYE GENERAL ICHTHYOLOGY IV, Highland E., Friday 13 July 2018

Francesco Janzen¹, William Crampton², Mark Sabaj-Pérez³, Javier Maldonado-Ocampo⁴ and Nathan Lovejoy⁵

¹University of Ottawa, Ottawa, Ontario, Canada. ²University of Central Florida, Orlando, Florida, USA. ³The Academy of Natural Sciences of Drexel University, Philadelphia, Pennsylvania, USA. ⁴Pontificia Universidad Javeriana, Bogotá, Capital District Cundinamarca, Colombia. ⁵University of Toronto Scarborough, Toronto, Ontario, Canada

Molecular Phylogeny of the Weakly-electric Knifefishes of Central and South America (Gymnotiformes, Actinopterygii)

The Neotropical knifefish order Gymnotiformes, comprises 200+ species divided into five families. These fishes have a distribution that includes Central and South America, and inhabit a variety of freshwater habitats. Gymnotiforms are capable of producing and detecting species-specific electrical signals using specialized electric organs and electroreceptors. For these reasons, knifefishes are excellent models for studying biogeography, speciation, and the evolution of communication. However, these studies rely on a clear understanding of gymnotiform phylogeny. To date, attempts at resolving the internal relationships of the Gymnotiformes have yet to produce an unambiguous, well-supported species-level phylogeny. In order to resolve the phylogeny of Gymnotiformes, we used 197 species representatives from nearly all recognized clades and combined molecular data for seven nuclear and two mitochondrial genes. We performed maximum likelihood and Bayesian analyses to produce phylogenies of the order. We found support for the monophyly of all families within Gymnotiformes. Of note was the prevalence of paraphyly and polyphyly of the genera and recognized major clades found within the Apterontidae. *Sternarchogiton* is polyphyletic as *Sternarchogiton preto* is sister to all other species of Navajini. *Porotergus* and *Apteronotus* are also polyphyletic, indicating a need for some *Apteronotus* species to be reclassified as *Porotergus*. The genera *Sternarchorhynchus* and *Adontosternarchus* were strongly supported as monophyletic. We propose two new major clades within Apterontidae based on our results: a Leptorhynchini clade containing *Apteronotus leptorhynchus* and close relatives, and a *Platyurosternarchus* clade. Our study provides a robust phylogenetic framework for future evolutionary and ecological investigations of gymnotiform fishes.

228 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Rebecca Jasulevicz and Aaron Bauer

Villanova University, Villanova, PA, USA

A Bolder Shoulder: Pectoral Girdle Morphology in Geckos

Geckos utilize a variety of substrates and have developed morphological adaptations to facilitate effective locomotion across them. Morphology of the pectoral girdle reflects these adaptations. The pectoral girdle articulates the forelimbs with the axial skeleton, plays a role in defining locomotor capabilities, and provides attachment points for musculature associated with locomotion, ventilation, and feeding. Micro-CT data was used to assess morphological variations in the pectoral girdles of arboreal, terrestrial, and rock-dwelling gecko species across the six limbed families within Gekkota. Reduced interclavicles are more common in arboreal geckos, whereas terrestrial and rock-dwelling geckos more often possess wider transverse processes on these elements. The scapulocoracoid complex is variable across the families, but distal ossification of the epicoracoid is more often seen in arboreal species, and the suprascapula is more heavily ossified in terrestrial and rock-dwelling species. The shape of the clavicles is also highly variable, although with some evidence of phylogenetic signal.

137 ASIH STORER HERPETOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Kyle Jaynes¹, David Blackburn², Raffael Ernst³, Matthew Fujita⁴, Eli Greenbaum⁵, Vaclav Gvozdk⁶, Greg Jongsma², Adam Leaché⁷, Patrick McLaughlin⁸, Daniel Portik⁹, Mark-Oliver Rödel¹⁰, Bryan Stuart¹¹, Ange Ghislain Zassi-Boulou¹² and Rayna Bell¹

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²*University of Florida, Gainesville, Florida, USA.* ³*Senckenberg Natural History Collections, Dresden, Germany.* ⁴*University of Texas at Arlington, Arlington, Texas, USA.* ⁵*University of Texas at El Paso, El Paso, Texas, USA.* ⁶*Institute of Vertebrate Biology, Czech Academy of Sciences, Brno, Czech Republic.* ⁷*University of Washington, Seattle, Washington, USA.* ⁸*Drexel University, Philadelphia, Pennsylvania, USA.* ⁹*University of Arizona, Tucson, Arizona, USA.* ¹⁰*Museum für Naturkunde Berlin, Berlin, Germany.* ¹¹*North Carolina Museum of Natural Sciences, Raleigh, North Carolina, USA.* ¹²*Institut National de Recherche en Sciences Exactes et Naturelles, Brazzaville, Congo*

Diversification of Giant Treefrogs (Arthroleptidae: *Leptopelis*) in West and Central Africa

The Guineo-Congolian rainforests of West and Central Africa and the Gulf of Guinea Archipelago host immense biodiversity. Previous research has revealed important insights into the biogeography of this biodiversity hotspot; yet our incomplete understanding of phylogenetic relationships for most taxonomic groups in this region has hindered our understanding of the speciation mechanisms that fostered this diversity. The genus *Leptopelis* is a radiation of Afrobatrachian treefrogs that have a complicated taxonomic history and reputation for their elusive phylogeny. Three species of “giant” treefrogs in the genus form a species complex distributed across West (*L. macrotis*) and Central (*L. millsoni* and *L. rufus*) Africa, as well as on the land-bridge island Bioko (*L. rufus*). Here, we combine phylogeographic and morphological datasets to assess patterns of genetic structure and morphological divergence in the *Leptopelis* species complex across the Guineo-Congolian rainforests. To assess phylogeographic structure in the species complex we collected mitochondrial sequence (16s) and genome-wide SNP (ddRADseq) data from more than 160 specimens across 34 localities. To characterize morphological divergence among these closely related species, we collected 14 standardized measurements from over 90 museum specimens. We recovered pronounced genetic structure across the species complex corresponding to Upper Guinean, Lower Guinean, and Bioko Island lineages. Our morphological analyses revealed phenotypic divergence among these lineages, including differentiation in tympanum size. Our work resolves long-standing taxonomic issues in this group and sets the stage for future work investigating population divergence and speciation in this charismatic group of frogs.

179 Herpetology Physiology, Highland C, Saturday 14 July 2018

Benjamin Johnson, Jeremy Searle and Jed Sparks

Cornell University, Ithaca, NY, USA

Morphological Drivers of Physiological Performance in Lungless Salamanders

Water balance is the dominant constraint on amphibian life histories. Understanding how amphibians resist water loss thus offers mechanistic insight into critical water balance adaptation. Water balance is highly constrained in the Plethodontidae, whose obligate cutaneous respiration mandates that the skin remain moist and permeable at all times to maintain gas exchange. In this group, water transport performance is driven by considerable variation in performance-related morphology: Cutaneous gas and water conductance is determined by diffusive surface area relative to body volume (determined by body size and shape) and barrier thickness (determined by cell size and arrangement within the dermis), each subject to selection independently. Here we examine how variation in these traits impacts physiological performance under different environmental conditions. We measured cutaneous respiration and water transport in nine species of *Plethodon* and *Eurycea* at four temperature x humidity treatments, coupled with morphological measurements for body mass, volume,

genome size, cell size, and skin thickness. We used trait probability densities and a mixed modeling framework to assess the influence of whole-organism, integument, and cell-level morphology on individual and species-level physiological performance. Preliminary results indicate strong effects of body size on both respiration and water transport, with effects of genome size dependent on environmental conditions. These results demonstrate how different morphological means interact with environmental conditions to meet a common functional performance end.

204 Ichthyology Genetics, Reproduction, and Development, Highland E., Friday 13 July 2018

Kendall Johnson¹, Chenhong Li², Luke Tornabene³ and Frank Pezold¹

¹Texas A&M University - Corpus Christi, Corpus Christi, TX, USA. ²Shanghai Ocean University, Shanghai, China. ³University of Washington, Seattle, WA, USA

Finding Evolutionary Links and Genes in Adaptive Radiations of Reef Gobies (Gobiidae) by Targeted Gene Capture

Gobies (Gobiidae+Oxudercidae) are one of the most diverse and complicated groups of teleosts. Phylogenetic studies of gobies using traditional genetic markers or morphology have revealed a deep divide between saltwater, reef-dwelling gobies (Gobiidae) and freshwater or brackish gobies (Oxudercidae), but have not yet been able to resolve many intergeneric relationships within the Gobiidae. The lack of resolution is due to an early period of rapid diversification, which led to the evolution of a remarkable variety of ecologies and morphologies. This diversity makes them ideal subjects for the study of many topics of ecology and evolution, including the evolution of behavior and life history traits, ecological and morphological adaptation, and species diversification. The phylogenetic structure of the gobiids must be resolved to investigate the mechanisms behind such events, and a new gene-capture method can accomplish this. By examination of a suite of functional, protein-coding genes across a broad range of taxa both the evolutionary links among rapidly evolved taxa and the gene suites responsible for adaptations in gobiids will be determined. A high number of markers shall resolve the dense phylogenetic relationships, while the use of functional genes allows the investigation of signatures of selection in genes potentially associated with physiological and morphological adaptations. The ability to combine the identification of loci under selection with the resolution of difficult relationships via gene capture offers unprecedented opportunity understand of adaptive radiations and speciation in general.

653 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Kiyomi Johnson, Marina Carbi and Edward Myers

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

Speciation and Phylogeography of *Anolis opalinus* on Jamaica

Anole lizards are common through the Caribbean and Neotropics and have been well studied because they represent a textbook case of adaptive radiation. However, even in well studied groups, like anoles, there are undescribed species. *Anolis opalinus* is widely distributed across the island of Jamaica and previous work on the systematics of the *grahami* series of *Anolis* lizards suggests that this species is non-monophyletic in a mtDNA gene tree. Here we generate a multi-locus phylogeographic data set for *A. opalinus* to test for cryptic speciation between these divergent mtDNA clades. With this multi-locus data set we also reassess the relationships of the Jamaican anole lizards and estimate divergence times among these species.

118 Herpetology Morphology II, Highland D, Sunday 15 July 2018

Hugo Juarez and Domenic D'Amore

Daemen College, Amherst, NY, USA

Tooth morphology and function in the snake tribe *Thamnophini*.

Although diet is well understood in numerous species of snakes, there have been very few studies that quantify snake tooth morphology to correlate with diet. Teeth from snakes belonging to the tribe *Thamnophini* were surveyed from dry skeletons in the American Museum of Natural History. The goal of the study was to determine if tooth size and shape correlates with diet. 956 maxillary and dentary teeth from dry skeletons of 16 specimens were photographed from the labial perspective. The margins of the teeth were outlined using TpsDig2.6, and converted into equidistant semilandmarks. A generalized least squares Procrustes superimposition was carried out, and centroid size was calculated. Dietary data was taken from existing literature. Discriminant function showed maxillary teeth to be generally more distally curved than dentary, which may correlate to inertial feeding methods unique to snakes. Most snakes species had significantly different Procrustes shape distances from one another, with dentary teeth separating more than maxillary. Canonical variants showed the majority of shape variance represented how narrow/wide the tooth was. Several species, including *Clonophis kirtlandii* and *Regina alleni*, had smaller-sized, wide teeth, which may correlate to a diet relying heavily on aquatic crustaceans. *Storeria dekayi* and *Thamnophis melanogaster* prey preferentially on soft-bodied invertebrates, and have average-to-large sized, thin teeth that do not taper. This condition was shared with larger generalists such as *Thamnophis sirtalis* and *Natrix natrix*. Future work will investigate the degree of heterodonty in these species, as well as the influence of allometry on tooth form.

643 Amphibian Disease Ecology, Highland E, Thursday 12 July 2018

James Julian¹, Gavin Glenney² and Jerod Skebo³

¹*Pennsylvania State University, Altoona College, Julian, Pennsylvania, USA.* ²*Northeast Fisheries Center, U.S. Fish and Wildlife Service, Lamar, Pennsylvania, USA.* ³*Pennsylvania State University, State College, Pennsylvania, USA*

Disease Outbreaks in Wood Frog (*Lithobates sylvaticus*) Populations and the use of

Environmental DNA to Detect Pathogens

High conservation value is often placed on diverse amphibian communities, but these assemblages can be at high risk for the occurrence of pathogens, and the outbreak of disease. Since 2014, we conducted amphibian inventories at breeding ponds in Stone Valley Forest (Petersberg, PA), as well as pathogen screenings using larval swab samples, larval tissue samples, and environmental DNA (eDNA) samples. Swab sampling suggests that each additional species within a pond nearly doubles the probability that wood frog (*Lithobates sylvaticus*) populations will be infected with the chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*). Furthermore, the presence of green frogs (*Lithobates clamitans melanota*), red-spotted newts (*Notophthalmus viridescens viridescens*), and spring peepers (*Pseudacris crucifer*) were positively associated with *Bd* presence. In 2015, populations of wood frogs experienced mass mortality events associated with *Ranavirus* sp. outbreaks. These outbreaks were weakly associated with amphibian species richness, and outbreaks re-occurred at a subset of these ponds in 2017. In 2017, filtered water samples were taken from all wood frog populations to screen for the eDNA of pathogens. We will discuss pathogen screening results which compare investigator vs volunteer-collected eDNA samples, as well as *Ranavirus* detection before, concurrent with, and several weeks after the mortality events of 2017.

**582 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, Highland D,
Friday 13 July 2018**

Allison Julien, Andrew Kouba, Scott Willard and Carrie Vance

Mississippi State University, Starkville, MS, USA

Efficacy of Administrating Luteinizing Hormone Releasing Hormone Analog (LHRHa) Nasally to Elicit Sperm Production in Fowler's Toads (*Anaxyrus fowleri*)

Declining amphibian populations around the world necessitate the need for artificial reproductive techniques, such as exogenous hormone therapy. Methods of hormone administration involve intraperitoneal injections, which can be considered invasive and potentially stressful. The purpose of this study was to determine the efficacy of administering a luteinizing hormone releasing hormone analog (LHRHa) intranasally to decrease potential stress yet maintain sperm production. Male *Anaxyrus fowleri* (n=15/trt) were nasally given 5 different hormone treatments (control, 1 μ g, 5 μ g, 10 μ g, and 20 μ g LHRHa) and subsequently assessed for sperm production. Spermic urine was collected from animals over an 8-hour period and evaluated for spermiation latency, sperm motility, and concentration. Nasal administration of LHRHa resulted in spermiation in 60%, 93%, and 80% of males in 5 μ g, 10 μ g, and 20 μ g treatments, respectively. Treatments of 1 μ g of LHRHa and the control did not elicit sperm production. On average, 5 μ g treatments of LHRHa resulted in spermiation within 2.3 hours, while 10 μ g and 20 μ g treatments of LHRHa resulted in spermiation within 2.8 hours and 1.5 hours, respectively. Sperm motilities averaged 70%, 63%, and 52% across the 5 μ g, 10 μ g, and 20 μ g treatment groups. The highest sperm motility resulted from the 5 μ g treatment. Moreover, males administered 10 μ g of LHRHa produced significantly higher sperm concentrations than males administered 5 μ g or 20 μ g of LHRHa. We found that nasal administration of small volumes of LHRHa provides a successful, minimally-invasive method for sperm production, which could be utilized by captive breeding programs for threatened species of anurans.

418 SSAR SEIBERT CONSERVATION II, Highland B, Thursday 12 July 2018

Michael Jungen¹, Shane Welch¹, John Holloway², Ernie Wiggers³ and Jayme Waldron¹

¹Marshall University, Huntington, West Virginia, USA. ²Marine Recruit Depot, Parris Island, South Carolina, USA. ³Nemours Wildlife Foundation, Yemassee, South Carolina, USA

Long-distance Translocation of Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*)

The eastern diamondback rattlesnake (*Crotalus adamanteus*; EDB) is a long-lived, large-bodied pit viper endemic to southeastern pine savannas and woodlands. The EDB is declining, and conservation efforts, including long-distance translocation, are being undertaken to aid in the species' recovery. Long-distance translocation to re-establish or supplement populations of viperids has yielded mixed results, with survival averaging less than 50%. We translocated EDBs (N = 21) from a sea island population to a pine savanna restoration area located on private property in South Carolina, 2016-2017, and estimated post-translocation survival probability. We ran various known-fate models in MARK to analyze covariates affecting survival probability. Our top model had time since egress as the most important survival covariate, and survival averaged 48%. This study will further our understanding of the efficacy of translocation as a conservation tool for EDB restoration.

67 Herpetology Morphology II, Highland D, Sunday 15 July 2018

Derek Jurestovsky and Henry Astley

University of Akron, Akron, OH, USA

Effects of the Zygosphene/Zygantrum Joint on the Range of Motion in Snake Vertebrae

Joint articulations can limit range of motion (ROM) and stabilize movement. Snakes have a relatively unique zygosphene/zygantrum joint in their vertebrae (either reduced or absent in all other vertebrates), but the role of this joint is poorly understood, with the majority of studies focusing on taxonomic identification within snakes. To experimentally determine the role of the zygosphene/zygantrum in the range of motion in snake vertebrae, two sequential mid-body vertebrae of a corn snake (*Pantherophis guttatus*) were CT-scanned, segmented out, and 3D printed (14x size). Motion capture cameras were used to record the angular ROM in yaw (lateral bending), pitch (dorsoventral bending), and roll (axial torsion) as the joint was manually manipulated. Two copies of the posterior vertebrae were printed, one unaltered and one with the zygosphene digitally removed. Preliminary results show substantial differences in ROM in yaw and roll. Yaw ROM in the unaltered vertebra was +/- 20 degrees vs +/-30 degrees without the zygosphene, while dorsal pitch ROM was unaffected. In the unaltered vertebra, roll ROM

was only 3 degrees for all combinations of pitch and yaw, whereas in the altered vertebra roll ROM was unconstrained at yaw angles where the pre- and post-zygapophyses were no longer articulated. The zygosphen limits vertebral ROM in snakes, particularly the vertebral roll ROM at high yaw angles. The zygosphen-zygantrum joint may allow snakes a greater range of motion without being constrained by the need to maintain pre- and postzygapophysal articulation.

178 Herpetology Conservation I, Grand Lilac Ballroom South, Friday 13 July 2018

Nancy Karraker¹, Mirza Kusrini², Ryan Healey¹ and Jessica Atutubo¹

¹University of Rhode Island, Kingston, RI, USA. ²Agricultural Institute of Bogor, Bogor, Indonesia

Population Demography of Southeast Asian Box Turtles (*Cuora amboinensis*) in Protected and Disturbed Habitats in Indonesia

The Southeast Asian box turtle (*Cuora amboinensis*) is considered the most heavily traded turtle in the world and is numerically the most important turtle exported from Indonesia. Targeted for food and traditional medicine trades largely in China and pet trade in the U.S. and Europe, as with many other turtles, delayed sexual maturity and small clutch sizes limit the capacity of populations to recover from impacts. Using mark-recapture methods, we compared abundance and demography of two protected populations (forested swamp and savanna ponds) inside a national park and two disturbed populations (fish aquaculture ponds and dam-created wetlands) outside the national park in Sulawesi, Indonesia. Turtle densities were >3x higher in forested swamp and >10x higher in savanna ponds in the national park than in the dam-influenced wetlands outside of the national park. No turtles were captured in the fish aquaculture ponds. Sex ratio (M:F) was close to 1:1 in savanna ponds in the national park, and was nearly 2:1 in forested swamp in the national park and in dam-influenced wetlands outside of the park. Juveniles made up about 40% of each population in the national park, and about 70% of the population outside of the park. Mean carapace length of adults was about 10% smaller in turtles outside of the park. Informal discussions with local fishermen suggest there is currently little harvesting of *C. amboinensis*, but land use change from forested swamp and savanna to rice paddy and other agricultural/aquacultural production appears to be impacting turtle populations.

177 ASIH STORER ICHTHYOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Jerry Kattawar and Kyle Piller

Southeastern Louisiana University, Hammond, LA, USA

Comparative population genetics of the Relict Darter and Guardian Darter in western Kentucky.

The Relict Darter, *Etheostoma chienense*, is endemic to the Bayou du Chien drainage of western Kentucky. It is listed as a federally endangered species due to its limited distribution, and lack of suitable spawning habitat, as well as habitat fragmentation and historically poor land-use practices. A previous five year status review suggested that information on the levels of genetic exchange among populations within the basin was needed. Therefore, this study was undertaken to gather this relevant information. We obtained tissue samples from multiple populations of the Relict Darter from the Bayou du Chien drainage, as well as samples from another closely related congener, the Guardian Darter (*Etheostoma oophylax*) from the Clarks River. Examining genetic variation in a comparative context will give us insight on how to properly manage and protect this species. We amplified a fragment from the mitochondrially encoded cytochrome b gene and developed haplotype networks to compare genetic diversity within each species. Results suggest that there is a greater amount of genetic variation (168 individuals, 10 haplotypes) in the Guardian Darter in comparison to the Relict Darter population (149 individuals, 3 haplotypes). The conservation implications of these results will be discussed.

406 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Shannon Keating¹, Aaron Griffing¹, Stuart Nielsen¹, Daniel Scantlebury² and Tony Gamble¹

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Identification of ZZ/ZW Sex Chromosomes in two *Aristelliger* Geckos.

Sex determination in vertebrates is accomplished by two different mechanisms: environmental sex determination where sex is determined by an environmental factor during embryogenesis, or genetic sex determination (GSD) in which the sex chromosome complement controls an organism's sex with either XX/XY or ZZ/ZW sex chromosomes. Squamates (lizards and snakes), and geckos in particular, exhibit all of these. Both forms of GSD, male heterogametic XY and female heterogametic ZW systems, have evolved multiple independent times in geckos. This makes geckos an ideal system to study sex chromosome evolution, and new studies often reveal novel GSD turnover events. *Aristelliger expectatus*, a sphaerodactylid gecko, has previously been shown to have ZZ/ZW sex chromosomes. Here, we examined the sex chromosome of two additional *Aristelliger* species, *A. lar* and *A. praesignis*, to test for sex chromosome conservation within the genus. RADseq was used to identify female-specific markers in *A. lar* and *A. praesignis*, confirming that all three studied *Aristelliger* species have a ZZ/ZW system. These new results suggest conservation of a ZZ/ZW sex chromosome system across the *Aristelliger* genus, which can further our understanding of sex chromosome evolution in geckos.

158 Herpetology Morphology I, Highland D, Sunday 15 July 2018

Rachel Keeffe and David Blackburn

University of Florida, Gainesville, FL, USA

Comparative Morphology of the Forelimb and Pectoral Girdle in Forward-Burrowing Frogs

Anuran locomotor strategies are diverse and include saltation, swimming, walking, climbing, and burrowing. Burrowing has many benefits for frogs: predator avoidance, exploitation of novel food stores, and (especially for desert-dwelling frogs) access to a moist and cool environment. This behavioral strategy is widely convergent across the anuran tree – from basal groups like Rhinophrynidae to higher groups like Hemisotidae. Within burrowing frogs, there are two main burrowing strategies: head-first burrowing and feet-first burrowing. The majority (95%) of burrowing anurans dig feet-first, such as *Scaphiopus*, *Breviceps*, and *Pelobates*. While front-first burrowing is less common, it has evolved independently at least seven times across Anura. These forward-burrowers tend to be more specialized for life underground. Some of their adaptations include a reinforced rostrum, ossified sternum, enlarged forelimb retractor muscles, and robust forelimb and pectoral girdle bones. Using CT data generated through the oVert Thematic Collections Network, this project will (1) quantify shape variation in the humerus, coracoid, and scapula of burrowing taxa with 3D morphometrics, (2) measure the integration between these bone elements, and (3) identify potential front-first burrowing species based on their pectoral anatomy. This also provides a framework for predicting locomotor modes in taxa for which the natural history is poorly known.

128 Amphibian Ecology I, Grand Lilac Ballroom North, Friday 13 July 2018

Crystal Kelehear^{1,2}, Kristin Saltonstall¹ and Mark Torchin¹

¹Smithsonian Tropical Research Institute, Panama City, Panama, Panama. ²Sul Ross State University, Alpine, TX, USA

Testing the Enemy Release Hypothesis: The Global Spread of Cane Toads as an Accidental Experiment.

Invasive species are the second greatest threat to biodiversity, yet we know little about what drives their success. The “enemy release hypothesis” posits that release from native competitors, predators, and parasites facilitates invader success in a new environment. The cane toad, *Rhinella marina*, is a toxic amphibian native to South America that has been widely introduced. It has reached pest status in many new ranges, poisoning domestic pets and native wildlife. Because of its extensive invasion history and unparalleled documentation of introductions, the cane toad provides an ideal “natural” experiment to test the potential influence of enemy loss on invasion success. We traced the geographical pathway of toad

introductions back to their native origins to investigate whether the enemy release hypothesis explains the cane toad's prosperity as an invasive species. First, to determine if cane toads exhibit features consistent with increased population success in invasive ranges we compared two proxies for fitness (body condition, reproductive output) in replicate invaded and native toad populations. Second, to investigate whether fitness is a function of enemy release, we compared diversity and intensity of parasitic infections in invasive vs native toad populations. The results of our study are discussed.

150 SSAR SEIBERT ECOLOGY II, Highland A, Friday 13 July 2018

Steven Kell¹, Ronald J. Brooks² and Jacqueline Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada. ²University of Guelph, Guelph, Ontario, Canada

Nesting in Close Quarters: Causes and Benefits of High Density Nesting in Painted Turtles

Nesting is a costly time for female turtles, both energetically and from threat of predation. Although predation rates of eggs and juveniles are often high, ensuring maximum survival of offspring is crucial for population stability and individual fitness. Past observations from our long-term study site in Algonquin Park, Ontario indicate that female Painted Turtles (*Chrysemys picta*) may be nesting together, suggesting this clumping may have a benefit to themselves or offspring. Our goals were to determine if females are choosing to nest at high nest densities, what cues they use to locate nest sites, and what benefits the offspring might accrue from incubating at high nest densities. Using ArcGIS, we found that females nested in clusters, the location of clusters varied among years, and that nest site selection was not strongly determined by abiotic characteristics (overstory density, slope, soil temperature). Female turtle models were placed on the nesting embankment in three different densities and rotated among three locations, and we found that females nested most often with the highest density of models. In ~20% of cases, nests were so clustered that eggs were deposited directly into existing nests or directly beside existing nests. Survivorship of clustered nests (49%) was higher than solitary nests (39%). These lines of observational and experimental evidence strongly suggest that female Painted Turtles choose to nest in close proximity to conspecifics, and that this clustering results in a fitness benefit through increased nest survival.

151 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Steven Kell¹, Ronald J. Brooks² and Jacqueline Litzgus¹

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Quantifying Road Effects on Painted and Snapping Turtle Population Demographics in Algonquin Park, Canada

Road mortality is a significant threat to turtle populations and has contributed to potentially deleterious changes in population demography. Road mortality can occur during annual nesting migrations of females, dispersal of juveniles, movements to escape unfavorable habitat conditions, or to find suitable habitat and mates. Although studies have investigated mortality rates of turtles caused by vehicle collisions, our study is unique because it examines effects of road mortality on population characteristics that may cause population instability. We hypothesize that proximity to roads will decrease the health and fitness of turtle populations due to an increase in mortality from vehicle collisions, leading to changes in demography. We surveyed turtle populations in 8 impact sites (wetlands along the major highway corridor) and 8 non-impact sites (wetlands >4 km from roads) in Algonquin Park. We will compare body sizes and conditions, injury rates, population density, population age structure and sex ratio between impacted and non-impacted sites. We predict that non-impact sites will contain populations with larger body sizes, fewer injuries, older aged individuals, and an equal sex ratio. Snapping Turtles and Painted Turtles from wetlands will be captured in spring by canoe and dip net, and in late summer by trapping. From the 16 wetlands, 148 Painted Turtles and 94 Snapping Turtles were captured. Preliminary analyses indicate that non-impact sites have, on average, larger body sizes and more female-biased sex ratios. Roads cause direct mortality of turtles; our study will quantitatively determine whether roads negatively influence turtle populations in more subtle indirect ways.

457 Herpetology Genetics I, Highland D, Sunday 15 July 2018

Audrey Kelly¹, Amanda Pierce^{1,2} and Karin Pfennig¹

¹University of North Carolina, Chapel Hill, NC, USA. ²US Environmental Protection Agency, Washington, DC, USA

Transfer via Hybridization of an Allele Associated with Rapid Development Time in Spadefoot Toads

Hybridization between species, and the gene flow (introgression) that can result, has been implicated in many aspects of evolution, including speciation, extinction, the generation of new traits, and the transfer of adaptations (termed adaptive introgression). In particular, the transfer of locally adapted alleles via hybridization may help the recipient species expand into novel environments. We investigated naturally hybridizing populations of the spadefoot toads *Spea bombifrons* and *S. multiplicata* and identified a microsatellite allele that shows evidence of having originated in *S. multiplicata* populations and was transferred to *S. bombifrons* via hybridization in the Texas panhandle. This allele subsequently spread into *S. bombifrons* populations in New

Mexico and Arizona, following the same path as the species' range expansion into the area. Crucially, we discovered that this allele is associated with more rapid development times of *S. bombifrons* tadpoles, conferring a survival advantage in the rapidly drying ephemeral desert ponds where both species breed and develop. We also identified two genes positioned adjacent to this microsatellite in the *S. multiplicata* genome, and we are analyzing them for connections to development time and signatures of selection. This potential case of adaptive introgression facilitating range expansion has implications for how species might evolve in the face of changes to their environments brought about by climate change - hybridization may actually help species to adapt to their changing environments. This is particularly important because of the increased potential for hybridization that is also predicted to occur with continued climate change.

348 Ichthyology Systematics II, Grand Lilac Ballroom South, Sunday 15 July 2018

Christopher Kenaley and Peter Jordan

Boston College, Chestnut Hill, Massachusetts, USA

Body-Size Evolution in Ray-finned Fishes (Actinopterygii): Tempo, Mode, and Ecological Correlates

Body size features prominently in nearly every aspect of an organism's biology, including several fitness-related parameters such as fecundity, mating success, energy budget, and life span. Thus, explorations of macroevolutionary trends associated with the tempo and mode of size-evolution are important in understanding the diversity of size in ray-finned fishes. Here we use body length data from 1,400 species of extant actinopterygians and the most current and expansive multi-locus phylogeny for the group to evaluate a multitude of models of log-transformed body-length evolution. We found that the tempo of size evolution in ray-finned fishes is explained best by an Ornstein-Uhlenbeck (OU) process, thereby suggesting that size evolves toward a phenotypic optimal value. In addition, to assess which ecological parameters may contribute to size diversity, we gathered distribution and habitat data for all of our included species. Using phylogenetic generalized least squares analysis under both OU and Brownian motion error models, we found that depth and ecoregion explain 60% of the variation in body length. Together, these results suggest that the evolution of body size is influenced by the ecophysiological constraints of habitat preference.

610 ASIH STOYE GENERAL HERPETOLOGY, Highland C, Friday 13 July 2018

Ethan Kessler¹, John Crawford², Andrew Kuhns¹ and Christopher Phillips¹

¹*Illinois Natural History Survey, Champaign, IL, USA.* ²*National Great Rivers Research and Education Center, East Alton, IL, USA*

Local and Landscape Drivers of Amphibian Community Composition across Illinois

Amphibian community composition is influenced by habitat at both local and landscape levels, making identification of factors driving amphibian diversity difficult. Additionally, the difficulties in collecting accurate community and habitat data and the inherent correlation within and among community and habitat factors complicates analyses and the interpretation of results. To determine the major drivers of amphibian assemblages in Illinois, our study utilized an occupancy and detectability sampling scheme for larval and adult amphibian presence at 252 ponds throughout the state to address primary local and landscape features driving amphibian communities across the state. For each pond, local habitat variables (e.g. presence of fish) were measured in situ and landscape scale variables (e.g. percent forest within a buffer) were determined using lidar derivatives and aerial photography (both from public sources). We used a multivariate approach to determine what factors had the greatest effect on amphibian community makeup and identify the species affected. After controlling for geographic location (latitude and longitude), the percentage of canopy cover within a buffer, the presence of fish, the number of ponds within a buffer, and slope of a wetland had the greatest effects on statewide amphibian communities. Ultimately, our results provide quantitative evidence of the factors shaping amphibian communities across the landscape and identified the species most affected.

**277 ASIH STOYE GENERAL ICHTHYOLOGY II, Grand Lilac Ballroom South,
Thursday 12 July 2018**

Daemin Kim¹, Bruce Bauer² and Thomas Near¹

¹*Yale University, New Haven, Connecticut, USA.* ²*University of Tennessee, Knoxville, Tennessee, USA*

Species Delimitation and Phylogeography of the Longear Sunfish, *Lepomis megalotis* (Centrarchidae)

Lepomis megalotis, the Longear Sunfish, is a freshwater fish that inhabits various habitats across North America east of the Rocky Mountains. Species delineation within *Lepomis megalotis sensu lato* and its sister-group (*L. marginatus*) has been controversial for almost a century. Phylogenetic analyses derived from nuclear genomic (ddRAD-seq) data suggest that 1) *L. peltastes* makes *L. megalotis* paraphyletic, 2) there are several highly distinct lineages within *L. megalotis s.l.* and 3) these distinct lineages have geographic ranges that are consistent with several species in other groups of fishes (e.g., Cyprinidae and Percidae). Based on the multiple lines of evidence derived from molecular and morphological data, we propose the recognition of species that represent the distinct lineages identified within *L. megalotis s.l.*

636 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Saki Kimura and Yoshihiro Natsuhara

Nagoya University, Nagoya, Aichi, Japan

Influence of different farming methods on the trophic ecology of various tadpoles in paddy fields in Japan

Paddy fields provide not only rice production for food, but also diverse multiple functions and are increasingly considered as important surrogates for natural wetlands for conserving biodiversity. Many Japanese frog species have adapted to evolve in such habitats. In recent years, however, due to agricultural modernization, frog population declines and extinction have been reported in various regions in Japan. Frogs and their tadpoles occupy critical positions in the food webs as important prey and predators, and are thought to be crucial in maintaining biodiversity in water systems and in the surrounding ecosystems. Tadpoles often represent one of the largest animal biomass in Japanese paddy fields and are expected to play critical roles in these ecosystems, but we know very little about the potential effects of different farming methods on their trophic ecology. We combined gut content and stable carbon and nitrogen isotope analyses to examine the trophic ecology of the tadpoles of four Japanese frog species (*Hyla japonica*, *Fejervarya kawamurai*, *Rhacophorus schlegelii* and *Pelophylax nigromaculatus*) between conventional (with middle flesh) and organic paddy fields (without intermediate flesh, winter flooding) in Toyota city, Aichi. The four species overlap in their breeding seasons and their tadpoles can co-occur within the same habitat. We sampled tadpoles at different life stages from mid-May to late July 2017. We predicted that the tadpoles would differ in their gut contents and isotope trophic spaces along ontogeny, between species and between habitats.

332 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Katie King, Hayley Crowell, Heather Liwanag and Emily Taylor

California Polytechnic State University, San Luis Obispo, CA, USA

The Metabolic Rates of *Crotalus oreganus* Determined via Respirometry

The metabolic rates of squamates are directly influenced by ambient environmental temperature. In a time when environmental temperatures are rising at unprecedented rates, it is imperative that we understand the possible physiological pressures these changes will exert on organisms. The Pacific rattlesnake (*Crotalus oreganus*) is the most common rattlesnake in Central California, and can be found in a variety of ecosystems encompassing a wide range of thermal habitats. However, the metabolic rates of this species have not been well studied and therefore

little is known about the energy use and requirements of this particular species. Rattlesnakes from four study sites across central coastal California were collected, brought back to the laboratory, and metabolic rates were calculated using respirometry. We also used body temperature data from free-ranging snakes to estimate field resting metabolism. We will present findings comparing the metabolic rates and resting energy expenditure of snakes from mild, coastal populations to those of hot, inland populations. The preliminary results suggest that snakes from inland sites have a higher metabolic rate than coastal sites due to their larger body size. These data can be used to estimate the energetic requirements of various populations based on temperature, and to project possible changes in the amount of food needed to sustain life as climates continue to warm.

506 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Lauren Kircher¹, Ariana Green¹, Matthew Bristol¹, Jessica Noble¹, Joy Young² and John Baldwin¹

¹Florida Atlantic University, Davie, FL, USA. ²Florida Fish and Wildlife Conservation Commission, Tequesta, FL, USA

The Potential Impact of High Discharge Events on Snook Movement Patterns in the St. Lucie Estuary

Southern Florida's water drainage has been altered from shallow, slow-moving sheets of water flowing south to channelized canals that flow east to Caloosahatchee estuary and west to St. Lucie estuary. Water managers use canals to prevent flooding, alleviate drought, and supply water for recreational, personal, and agricultural uses. Before a storm, water is flushed out to the estuaries in a short period of time, forming a pulse of freshwater. These high discharge events can introduce osmoregulatory stress to the organisms and die-offs of seagrasses and oysters have occurred. This study utilizes Harbor Branch Oceanographic Institute's Indian River Lagoon Observatory Network of LOBO data loggers in St. Lucie to examine extent and duration of changes due to high discharge events and their potential impact on snook movement patterns. Fish movement can be cued by the environment. Although tolerant to a wide range of salinities, snook experience an osmoregulatory cost when moving through different salinities that may reduce fitness and success. We will compare changes in hydrologic parameters (salinity, flow, and temperature) surrounding high discharge events. Movement tracks will be plotted in ArcGIS from passive acoustic telemetry. Passive acoustic telemetry involves a transmitter implanted in the body cavity of the target organism and a stationary receiver in the environment that records unique ID codes as fish move. Understanding the effect of management on waterways, can enhance interpretation of animal responses to discharges. Future research will fully model the influences of hydrologic variables on movement to quantify their relationships and further inform management.

496 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Sophie Kocheff¹, Adriana Jeckel², Taran Grant² and Ralph Saporito¹

¹John Carroll University, University Heights, Ohio, USA. ²University of São Paulo, São Paulo, Brazil

Differences in palatability of various Central and South American dendrobatid poison frogs

Dendrobatid poison frogs are aposematic, sequester defensive alkaloids from dietary arthropods, and exhibit tremendous alkaloid variation by population, age, sex, size, and between species. Alkaloid variation in the dendrobatid frog *O. pumilio* has recently been correlated with differences in palatability to arthropods, which represent a group of natural predators upon frogs; however, differences in arthropod palatability among other poison frogs have yet to be examined. The goal of the present study was to compare how arthropods might respond to variable alkaloid defenses among different species of dendrobatid poison frogs in Central and South America. Alkaloid defenses were extracted from 54 individual frogs, representing seven species from nine different geographic locations throughout Central and South America. Alkaloid extracts were used in palatability assays using the fruit fly *Drosophila melanogaster* as a model arthropod. Our results demonstrate that fruit flies feed significantly less on solutions containing alkaloids as compared to controls, suggesting that all frog alkaloids are unpalatable. Furthermore, there are differences in palatability between species and among populations of the same species. Collectively, our results further suggest that alkaloid variation among dendrobatid poison frogs translate into differences in palatability, which could lead to differences in natural predation.

603 Ichthyology Morphology/Collections/Fisheries, Grand Lilac Ballroom South, Sunday 15 July 2018

Matthew Kolmann¹, Karly Cohen¹, Kate Bemis², Patricia Hernandez¹ and Adam Summers³

¹George Washington University, Washington DC, District of Columbia, USA. ²Virginia Institute of Marine Science, Gloucester, VA, USA. ³Friday Harbor Laboratories, Friday Harbor, WA, USA

Tooth and consequences: heterodonty and tooth replacement in piranhas and pacus

Complex, heterodont dentitions are frequently associated with limited tooth replacement in amniotes, while non-amniotes are generally thought of as having homodont, continuously-replaced dentitions. These complex dentitions have been cited as key innovations, allowing mammals to process myriad prey or stubborn prey materials, by creating a division of labor among different teeth. Piranhas and pacus have curious dentitions for non-amniotes, as many species show some degree of heterodonty attributed to adaptations for either carnivorous or herbivorous diets, respectively. While tooth replacement mode in pacus is unknown, in

piranhas all the teeth on one side of the head are lost as a unit and then replaced simultaneously. We used CT scanning and histological staining to examine tooth replacement and heterodonty in piranhas, and examine the evolution of these modalities using a published molecular phylogeny. While investigating tooth replacement across piranhas and pacus, we found that all serrasalmids are heterodonts. Most of these species are both monognathic and dignathic heterodonts, with teeth differing in shape between the upper and lower jaws, as well as within the jaws themselves. Additionally, all serrasalmids (with one notable exception) share a unilateral tooth replacement pattern, which casts doubt on whether this mode is an adaptation strictly for hypercarnivory. These patterns are found to be consistent over ontogeny in size series of *Pygocentrus* and *Metynnis*, using both histological and tomographic scanning methods. We propose that heterodonty begets simultaneous replacement, and ensures that division of labor among teeth is not interrupted, as might occur with polyphyodont dentitions.

552 Lightning Talks II, Highland A, Saturday 14 July 2018

Michelle Koo¹, Carol Spencer¹, David Blackburn², David Cannatella³, Alessandro Catenazzi⁴, Ann Chang¹, Joyce Gross⁵, Deanna Olson⁶, Vance Vredenburg⁷ and David Wake¹

¹Museum of Vertebrate Zoology, Berkeley, CA, USA. ²Florida Museum of Natural History, University of Florida, Gainesville, FL, USA. ³University of Texas at Austin, Austin, TX, USA. ⁴Florida International University, Miami, FL, USA. ⁵Berkeley Natural History Museums, Berkeley, CA, USA. ⁶US Forest Service, Corvallis, OR, USA. ⁷San Francisco State University, San Francisco, CA, USA

AmphibiaWeb Updates and Innovations to Address the Global Crisis in Amphibians

Amphibians comprise the most endangered group of vertebrates; about one-third of the world's amphibian species are under threat of extinction. Emerging infectious diseases such as chytridiomycosis are especially devastating. Many amphibian species are susceptible to disease caused by chytrid fungi (*Batrachochytrium dendrobatidis*, or Bd, and *Batrachochytrium salamandrivorans*, or Bsal). AmphibiaWeb was founded to directly address the urgent needs to facilitate research in amphibian biodiversity and emerging infectious disease. These include a central repository that provides primary information on amphibian biology, taxonomy, and conservation by integrating data from VertNet, producing species accounts, tracking and mapping new species and more. By harnessing informatics tools and networks, we aim to facilitate collaborative efforts nationally and internationally. In collaboration with the US Forest Service in 2016, we launched the AmphibiaWeb disease portal which tracks Bd and Bsal data collected around the world (<https://amphibiandisease.org>). The portal enables users to visualize archived datasets in publications, as well as to easily download and reuse datasets from previous research in order to integrate multiple studies. Using this portal, researchers can coordinate and collaborate in efforts to understand disease impacts on amphibian biodiversity, including private data sharing for projects prior to publication.

416 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT, Empire Hall South – JF Rochester Riverside Convention Center, Friday 13 July 2018

Cory Kozmik and Jacqueline D Litzgus

Laurentian University, Sudbury, Ontario, Canada

Using Spatial Ecology and Circuit Theory to Inform Age-class Appropriate Road Mortality Mitigation for Turtles

Habitat fragmentation, destruction, and degradation of wetland systems that provide Critical Habitat are key threats that contribute to declines in Species At Risk (SAR) reptile populations. Magnetawan First Nation (MFN) in Eastern Georgian Bay, Ontario is home to several SAR reptile species and fragmented by linear anthropogenic features consisting of two highways, including Trans-Canada Hwy 69 planned to expand within MFN and the surrounding area. This relatively pristine landscape includes contiguous wetland matrices consisting of upland habitat, marsh, swamp, fen, bog, and peatlands, many occur adjacent to Hwy 69, a documented mortality “hotspot” for reptiles. The general focus of road ecology studies has been adult turtles; however, alive and dead sub-adult and juvenile turtles have also been documented on the 6 km stretch of Hwy 69 throughout MFN. Knowledge gaps remain regarding dispersal patterns of younger age-classes in relation to highway infrastructure, and the impacts of highways on recruitment. Our goal is to predict the best locations for connectivity corridors allowing access to habitats adjacent to Hwy 69, and to ensure mitigations for future highway development are conducive to spatial movements of all age classes. We will use radio-telemetry, mark-recapture and road demographic data to quantify the spatial ecology of juvenile turtles around the highway. We will use circuit theory to model age-class connectivity patterns and requirements. Our research will fill knowledge gaps about impacts of anthropogenic linear features on vulnerable reptile communities and associated critical habitats, providing data to inform cost effective mitigation design in other locations.

361 Ichthyology Genetics, Reproduction, and Development, Highland E., Friday 13 July 2018

Trevor Krabbenhoft¹ and Thomas Dowling²

¹*University at Buffalo, Buffalo, NY, USA.* ²*Wayne State University, Detroit, MI, USA*

Sex Determination in an Allotetraploid Fish (Cypriniformes: Catostomidae): On the Importance of Understanding Genetic and Epigenetic variation in Captive Breeding Programs

Genetic and environmental factors can play a role in sex determination, with significant variation in their relative importance across the tree of life. In some cases, epigenetic modifications can play an important role in developmental programming to allow organisms to respond appropriately to environmental variation. Here, we present the serendipitous discovery of previously unknown variation in mechanisms of sex determination in an allopolyploid fish. We identified two groups of males: those with and without a suite of male-specific genetic loci. We assess whether the two groups of males represent genetically- versus environmentally-determined sex, respectively. Preliminary evidence suggests that these two types of males have significantly different rates of reproductive success in a captive breeding program, underscoring the critical importance of understanding mechanisms of sex determination and epigenetic variation in such programs. We examine genetic and epigenetic

(DNA methylation) variation within and between these two groups of male fish and explore possible mechanisms of sex determination in this allopolyploid species. To our knowledge, this is the first study describing potential mechanisms of sex determination in the Catostomidae. Our results demonstrate the value of understanding both genetic and epigenetic variation in captive breeding programs and in the wild.

183 ASIH STORER ICHTHYOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Aaron Krolow and Kyle Piller

Southeastern Louisiana University, Hammond, Louisiana, USA

Environmental DNA (eDNA) Assessment of Fish Communities Occurring at or around Artificial Reefs along the Louisiana Coast

Worldwide, artificial reefs have been deployed to improve fisheries by providing hard substrate in an otherwise desolate environment. These structures allow for the colonization of a diverse invertebrate community that, in turn, attract an array of fish species. The success of artificial reefs in attracting fish has proven difficult, as sampling with traditional gear has been challenging. In addition, high turbidity has limited the effectiveness of remote operated vehicles (ROVs), and SCUBA to assess fish community structure on these reefs. Therefore, this study was undertaken to assess the fish community on artificial reefs using an alternative approach, environmental DNA (metabarcoding), a non-invasive monitoring technique. We gathered water samples, filtered, sequenced, and analyzed samples collected from multiple reef and control sites along the coast of Louisiana. Results, although preliminary, suggest that this is a viable approach that will allow us to monitor ray-finned fishes that utilize these reef structures. Preliminary results from our first season of sampling will be presented.

83 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Brian Kron and Scott McRobert

St. Joseph's University, Philadelphia, PA, USA

The Effects of Salinity on Growth and Calcium Retention in Young Diamondback Terrapins

The diamondback terrapin (*Malaclemys terrapin*), is a species of turtle living in brackish water coastal environments ranging from Texas to Massachusetts. This species is listed as 'endangered' in Rhode Island, 'threatened' in Massachusetts, and 'near threatened' by the IUCN. Life in brackish water estuaries involves regular fluctuations in salinity, which could

potentially affect young terrapins. In this study we compare growth and calcium retention in thirty-six terrapins, hatched from eggs collected at North Sedge Island, New Jersey in September 2017. One half of the turtles (18) were maintained in low saline water (LS=10ppt), and half (18) were maintained in higher salinity water (HS=25ppt). Between January and June 2018, each terrapin was measured weekly for weight, carapace and plastron length, and a marginal scute was removed from each terrapin at the beginning and end of the study to assess (by ACP-OES) calcium retention. Percent growth rate was determined for each growth measure. Mean weight for LS terrapins (60.14% +/- 6.83%) was not significantly different than mean weight for HS terrapins (59.75% +/- 4.54%). Mean carapace length was not significantly different between LS and HS terrapins (17.09% +/- 4.59%; 15.69% +/- 1.96%, respectively). Mean plastron length for LS terrapins (8.24% +/- 1.79%) approached significant difference from mean plastron length for HS terrapins (6.07% +/- 2.06%). In June, all terrapins will be released at the site of collection. We hope this work will add information on the effects of salinity on young terrapins and aid in conservation efforts for this species.

263 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT, Empire Hall South – JF Rochester Riverside Convention Center, Friday 13 July 2018

Chelsea Kross and John D. Willson

University of Arkansas, Fayetteville, AR, USA

The Effects of Prescribed Fire on the Development of Larval Crawfish Frogs (*Lithobates areolatus*)

Prescribed fire is a common technique used in restored and managed prairies to reduce the abundance of non-native vegetation and prevent succession. Seasonal prairie wetlands can be affected by prescribed fire through a reduction in vegetative biomass, which serves as an important nutrient base, or through the deposition of ash from surrounding terrestrial habitat. Terrestrial amphibians have been shown to experience increased mortality due to the loss of habitat heterogeneity and cover as a result of prescribed fire. However, few studies have assessed the effects of reduced biomass or ash input on larval amphibians. We used a mesocosm approach to investigate the effects of prescribed fire on larval amphibian development. We had treatments representing three scenarios: (1) Control – unburned prairie vegetation, (2) Ash Addition – unburned prairie vegetation, with added ash to simulate deposition from surrounding terrestrial habitat, and (3) Reduced Biomass – 50% of vegetation burned, with ash retained. We compared average time to metamorphosis, snout-vent-length, mass, and survival of larval *Lithobates areolatus* among treatments. Larval survival was lowest in the reduced biomass treatment, but other developmental metrics were similar among treatments. Our results suggest that prescribed fire has negligible effects on the development of aquatic amphibian larvae but might result in reduced survival if burning occurs prior to wetlands filling.

126 Amphibian Disease Ecology, Highland E, Thursday 12 July 2018

Ariel Kruger

Rutgers University, New Brunswick, NJ, USA

Pine Barrens Treefrog Skin Bacteria Inhibit Growth of the Chytrid Fungus, *Batrachochytrium dendrobatidis*

Probiotic therapy is currently being explored for ameliorating disease in wildlife. In the amphibian-chytrid fungus (*Batrachochytrium dendrobatidis*, hereafter *Bd*) system, identifying anti-*Bd* bacteria has been a promising avenue of conservation research. However, many studies searching for anti-*Bd* bacteria neglect the ecological interactions that may occur when *Bd* infects amphibian skin. In this study, I attempted to take a more holistic approach to determining whether individual amphibians may be protected from *Bd* based on their skin bacterial communities. I swabbed the skin of Pine Barrens Treefrogs (n=10) and grew bacterial communities on agar. After three days of growth, ten unique bacterial isolates were identified across all individuals, with an average of four isolates on each individual. To mimic natural interactions that may occur on frog skin, I set up co-culture assays where bacteria and *Bd* were grown together in liquid media in the community combinations found on each individual frog. After three days of growth, cell-free supernatants from co-cultures were used in inhibition assays to determine which bacterial isolates (singly and in naturally occurring combinations) successfully inhibited *Bd* growth. When grown together, all 10 frog's naturally occurring skin bacterial communities showed complete inhibition of *Bd*. However, when grown singly, only 5/10 bacterial isolates successfully inhibited *Bd* growth. These results suggest that probiotic therapy should be studied in a community context when assessing anti-*Bd* function. To my knowledge, this is the first study to take a community-level approach to determining individual amphibian susceptibility to *Bd* based on skin bacterial communities.

602 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY II, Highland C, Friday 13 July 2018

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Developmental Osteology of the Channel Catfish, *Ictalurus punctatus* (Teleostei:Ictaluridae)

The skeleton of catfishes (Siluriformes) is characterized by several autapomorphies, including extreme modifications of certain elements (i.e. pectoral-fin spine) and the presence of several

bones that are currently presumed to be the result of fusion (i.e. the parieto-supraoccipital). Despite the vast number of anatomical investigations of the adult skeleton in catfishes, comprehensive information on early development remains scarce. This is surprising given the number of species currently being reared for aquaculture or the aquarium trade. In order to further our understanding of the siluriform skeletal system, we document the development of the entire skeleton in the economically important Channel Catfish, *Ictalurus punctatus*. Our investigation is based on approximately 125 cleared and double stained individuals (8.1-36.2 mm NL/SL) and 50 specimens (8.6-21.2 mm NL/SL) cleared and stained with alizarin red S only. We examined and scored each individual for the presence/absence of 136 skeletal elements and generated a sequence of ossification for the entire skeleton. We compare the ossification sequence generated for *I. punctatus* to that of another ictalurid (*Noturus gyrinus*) and other otophysans (*Barbus holotaenia* and *Salminus brasiliensis*) to determine which heterochronic changes in skeletal development characterize siluriforms.

488 Poster Session I, Empire Hall South – JF Rochester Riverside Convention Center, Friday 13 July 2018

Bernie Kuhajda¹, Sarah Sweat¹, George Gavrielides¹, Anna George¹, Joe Powell², Mack Lunn² and Ryan Brown²

¹Tennessee Aquarium Conservation Institute, Chattanooga, Tennessee, USA. ²Tennessee Technological University iCube, Cookeville, Tennessee, USA

Freshwater Information Network (FIN): Merging Natural History and Living Museums to Reflect Fish Distributions in the Southeastern United States

The Southeastern United States is a global biodiversity hotspot for freshwater aquatic organisms. Unfortunately, the Southeast also harbors some of the most imperiled aquatic species in the world. Thus the need for collaborative conservation efforts for southeastern aquatic organisms is more important now than ever. However, distributional and status data for these organisms are stored in a variety of platforms, including spreadsheets, museum records and databases, unpublished reports, and field notes. This can be exceptionally problematic for endangered species where recent sightings cannot be vouchered and accessed by others. The Freshwater Information Network (FIN) aims to combine all of these data sources into a single user friendly “living” database containing georeferenced locations and voucher photographs. We collected museum, institutional, and field note data and georeferenced records. Currently FIN includes 402 species of fishes within the Tennessee, Mobile, and Cumberland river drainages. This interactive website allows users to submit new locality data and field photograph vouchers through a configurable application made with ArcGIS Solutions. Distribution maps, photo voucher galleries, a brief description of life history, and literature cited for each species will allow for a one stop webpage on information on all the species for both scientists and the public. Future additions to FIN will include other aquatic taxonomic groups in these drainages. With new addition of data from experts and citizen scientists, conservation efforts in the Southeast can become a focused collaborative effort.

387 Lightning Talks II, Highland A, Saturday 14 July 2018

Arianna Kuhn^{1,2}, Sara Ruane³, Chris Raxworthy¹ and Frank Burbrink¹

¹American Museum of Natural History, New York, NY, USA. ²City University of New York: Graduate Center, New York, NY, USA. ³Department of Biological Sciences Rutgers-Newark, Newark, NJ, USA

Spatially Explicit Historical Demography of Widespread Malagasy Gemsnakes

The accurate estimation of demographic and genetic population parameters often relies on the resistance or connectivity of landscape features. Although such dynamic population models are spatially explicit, population-level inferences frequently use aspatial models to estimate spatially-dependent parameters. We utilize an approach for investigating the diversification of Malagasy gemsnakes using species distribution models (SDMs) as estimates of historical landscape permeability and forest connectivity under various past-projection scenarios. Demographic parameters and SDM projections were used to simulate spatial population models to better understand how historical climatic change shaped structure and genetic diversity in widespread gemsnake populations, ultimately contributing to the elevated endemism seen across the island. This work will not only help resolve the controversy over Madagascar's historical landscape but also provide a platform for future investigations of the generation and maintenance of diversity in a shrinking and endangered global biodiversity hotspot.

255 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Elizabeth Kull¹, James Titus-McQuillan², Edward L. Stanley³, Matthew P. Heinicke⁴, Aaron M. Bauer⁵ and Juan D Daza¹

¹Sam Houston State University, Huntsville, Texas, USA. ²University of Texas at Arlington, Arlington, Texas, USA. ³Florida Museum of Natural History, Gainesville, Florida, USA. ⁴University of Michigan-Dearborn, Dearborn, Michigan, USA. ⁵Villanova University, Villanova, Pennsylvania, USA

Variation in the cranial osteology of the genus *Prosymna* (Lamprophiidae: Serpentes)

The Sub-Saharan lamprophiid genus *Prosymna* includes 16 recognized species of small sized snakes. Although external morphology of these snakes is similar, study of their skull has revealed tremendous phenotypic variation. We obtained high resolution computer tomographies for voucher specimens from eight species. We used a multigene phylogeny of 11 species as a molecular scaffold to map seven conspicuous variable cranial osteological features.

According to our results, the genus has undergone two independent losses of the postorbital bone. Although these snakes have a characteristic shovel-snout morphology, this trait is accentuated in a clade including *P. ruspoli*, *P. greigerti*, and *P. meleagris* which possess a bony premaxillary rostral shelf. In some *Prosymna* (*P. visseri*, *P. sundevalli*, *P. bivittata* and *P. lineata*) there is a marked trend towards consolidation of the skull, fusion of parietals with the braincase (especially the supraoccipital). In some members of this clade (*P. sundevalli*, *P. bivittata* and *P. lineata*) the premaxilla and the maxilla approach or contact each other, perhaps reinforcing the snout. Fusion of the skull is extreme in *P. visseri* in which not only the parietals and the braincase are fused, but the frontals and the nasals are integrated into a single continuous bony covering for their entire brain. *Prosymna visseri* also develops other adaptations in the skull, a diamond shaped prefrontal, and a hammer shaped maxilla. This species lives in cracks in rocky formations and is seem to be specialized on hard shelled gecko eggs, which may explain their divergent morphology.

424 Poster Session II, Empire Hall South – JF Rochester Riverside Convention Center, Saturday 14 July 2018

Shannon L Kuznar, Jack M Craig and James S Albert

University of Louisiana at Lafayette, Lafayette, Louisiana, USA

**Diversity of tooth morphology in the oral jaws of the Banded electric fishes
Gymnotus (Gymnotidae: Gymnotiformes)**

Tooth morphology is widely associated with trophic position and life history traits in fishes. Previous studies of dental morphology in *Gymnotus* have revealed characteristic features of subclades and species, including the presence and number of dentary and premaxillary teeth with conical, needle, or arrowhead shapes. For example, arrowhead-shaped teeth, anteroposteriorly compressed triangular teeth in the anterior portion of the dentary differ among species groups, ranging from 0-5 in members of the *G. carapo* group. Identifying dental traits among *Gymnotus* species contributes to understanding of the evolution of trophic position, as needle-shaped teeth are associated with insectivorous habits and arrowhead-shaped teeth with piscivorous habits. Here we use meristic and morphometric measurements of tooth shape along the dentary arcade to document diversity of oral teeth in *Gymnotus* species representing each of five major subclades, i.e. species groups. Species of the *G. carapo* group exhibit a common curve of tooth width to length ratios, in which anterior teeth are more anteroposteriorly compressed (all have a positive slope). Highly compressed anterior teeth can be achieved either by a lower y-intercept (all teeth more compressed) or a steeper slope (greater variance in tooth compression along dentary margin). Species also differ in total number of dentary teeth, irrespective of tooth shape. Species of the other species groups do not exhibit high variance in tooth compression along the dentary margin. These are the first results to quantify tooth shape within and among *Gymnotus* species, and demonstrate morphological specializations that are consistent with known interspecific trophic differences.

617 SSAR SEIBERT ECOLOGY I, Highland A, Friday 13 July 2018

Brandon LaBumbar, Molly Bletz, Kelly Barnhart and Douglas Woodhams

University of Massachusetts Boston, Boston, MA, USA

Community Structure and Function of Amphibian Microbiomes Relating to Pathogen Defense

The skin microbial community plays a vital role in the defense against pathogens, yet it can vary temporally and between hosts. The amphibian skin microbiome can provide resistance to chytridiomycosis, caused by *Batrachochytrium dendrobatidis* (*Bd*). By determining which bacteria offer pathogen defense, when they are present, and relatively how abundant they are, we can better understand pathogen dynamics and develop more effective strategies for combating disease. We investigated the skin bacterial communities using 16S ribosomal RNA amplicon sequencing of the amphibian community in Colchester, VT to address seasonal and community patterns related to *Bd* presence or absence. We see that the overall composition appears to be stable over time but that the relative abundance shifts seasonally for two species of amphibian. We also used an amphibian skin bacteria database to determine the proportion of the sequenced microbiome with potentially *Bd*-inhibitory microbes to determine if protective function is maintained and if it differs among species.

27 HL GRADUATE RESEARCH AWARD, Highland A, Friday 13 July 2018

Max Lambert

Yale University, New Haven, CT, USA

Sex reversal is widespread in wild green frogs

Sex in amphibians is typically believed to be strictly determined by genetics. Environmental effects on sexual development are therefore considered aberrant responses to anthropogenic contaminants or extreme temperatures. As such sex reversal, where tadpoles develop a phenotypic sex opposite their genotypic sex, is widely viewed as an unnatural process in wild frog populations. Using novel sex-linked genetic markers for the common and wide-ranging North American green frog (*Rana clamitans*), we show that sex reversal is common within and across populations, bidirectional, and independent of land use or contamination. Our work also illustrates that natural temperature variation experienced in the wild may be a dominant driver of sex reversal. Specifically, we found that cooler pond temperatures are associated with higher rates of female-to-male sex reversal and hotter temperatures are associated with higher rates of male-to-female sex reversal. Additionally, we also found intersex males (i.e., males with egg-like cells in their testes) in most populations and found no association between intersex and

either sex reversal frequencies or human land use. Combined, our results do not align with common perceptions of how sex is determined in amphibians and suggest a larger natural role for the environment in shaping the sexual fate of wild frogs. These findings suggest we begin to reconsider the relative natural and anthropogenic contributions to sexual development, sex reversal, and “sexual abnormalities” in amphibians.

115 Amphibian Disease Ecology, Highland E, Thursday 12 July 2018

Gabriel Langford, Triantofilos Iakovidis and Michael Politis

Florida Southern College, Lakeland, Florida, USA

Impact of Multiple Host Invasions on Native Parasite Assemblages: What Happens When Three Non-native Anurans Invade a Florida Frog Pond?

While much attention and resources have been given to the impact of free-living invasive species on native flora and fauna, few studies have focused on the impact invasive species have on native parasite assemblages. Florida is well-known for its invasive species, including an increasing number of anurans, many of which have already been surveyed for parasites. Our long-term survey of anurans from central Florida aims to compare a native parasite assemblage pre and post-invasion of 3 non-native anurans. We also aim to record any parasites introduced from the non-native species. From September 2010 – April 2018, we sampled adult anurans from a permanent, shallow wetland adjacent to the Florida Southern College campus. All anurans collected in 2010 – 2011 were species native to central Florida: *Anaxyrus terrestris*, *Acris gryllus*, *Hyla cineria*, *Rana grylio*, and *Rana utricularia*, which hosted diverse parasite assemblages that included native parasites, such as *Cosmocercella* sp., *Cosmocercoides* sp., *Rhabdias* spp., *Haematoloechus* spp., *Mesocoelium* sp., and *Lawrencarus* sp. Invasive anurans first appeared in our wetland in spring 2012 with non-native *Rana catesbiana*, which was followed by exotic *Rhinella marina* (spring 2013) and *Osteopilus septentrionalis* (fall 2016). Besides the introduction of these non-native anurans, no obvious changes occurred to the wetland environment. In 2018, the anuran community consists of 4 native and 3 non-native species, which varies markedly from the original community of 5 native host species. We found many native parasite species were still present in the wetland’s anurans, however some parasite species have apparently become locally extirpated.

353 Herpetology Habitat & Environment, Highland A, Saturday 14 July 2018

Tracy Langkilde¹, Thomas Adams¹, Julian Avery¹ and Robin Warne²

¹*Pennsylvania State University, University Park, PA, USA.* ²*Southern Illinois University, Carbondale, IL, USA*

Effects of anthropogenic noise on wood frog tadpoles

Anthropogenic noise permeates most of the world's habitats. There is increasing evidence that novel noise has effects on resident species, including on physiology and vocal communication. We have found that adult wood frogs (*Lithobates sylvaticus*) have difficulty locating calling males and exhibit elevated physiological signatures of stress in the presence of road noise. We wanted to test whether larval amphibians, which may be buffered by their aquatic habitat, are similarly affected by anthropogenic noise. We raised wood frogs from eggs to pre-metamorphic tadpoles in the presence or absence of noise from compressors associated with the transport of natural gas following extraction from the Marcellus Shale Play. We found that during the initial stages of development, noise and associated vibration reduced tadpole size and, when this stress was coupled with physical disturbance, caused significant tadpole mortality. These effects of noise were not observed later in tadpole development after noise levels had been reduced, and there were also no associated significant effects on physiological stress (corticosterone) levels. Overall, our results suggest that anthropogenic noise may affect larval amphibians, and could be another factor affecting overall anuran decline, particularly when experienced with additional stressors.

311 Herpetology Conservation II, Highland C, Sunday 15 July 2018

Julia Laterza Barbosa and James Watling

John Carroll University, University Heights, OH, USA

Using Experimental Translocations of Reptiles and Amphibians to Evaluate Faunal Rescue in the Brazilian Amazon

Faunal rescue is a form of mitigation-driven animal translocation that is mandated by law in Brazil as part of the environmental licensing of large-scale construction projects, such as hydroelectric dams. Faunal rescue consists of moving animals from construction sites and releasing them in protected areas. This practice results in the translocation of thousands of animals from construction sites every year, most of which are reptiles and amphibians. Although commonly used as a mitigation measure, the monitoring in faunal rescues is insufficient to determine even the most basic measures of success, such as survival and settlement in release areas. Therefore, I conducted a field-based mark-recapture study to evaluate if leaf litter frogs and lizards settle in release sites, and if translocation influences density of animals in release areas. I found that lizards settled in release plots, although translocation did not increase densities significantly. Settlement of amphibians was not analyzed due to low recapture rates; densities were lower on the post-translocation phase but did not differ between control and release plots. These results suggest that lizards settle in release areas and amphibian settlement might be influenced by seasonality. Finally, I propose including mark-recapture methods in faunal-rescue monitoring transects and in release areas. This addition is a cost-effective way of improving evaluation of translocation success to determine if faunal rescue is an effective conservation tool for reptiles and amphibians.

152 Poster Session I, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Melissa Lech^{1,2}, Tracey Tuberville² and Melissa Pilgirm^{1,2}

¹USC Upstate, Spartanburg, SC, USA. ²Savannah River Ecology Laboratory, Aiken, SC, USA

Investigating Biomagnification of Hg and ¹³⁷Cs in *Nerodia floridana* using Stable Isotopes

Previous studies have shown that some contaminants bioaccumulate in organisms and biomagnify through food webs. Stable isotope techniques provide a non-lethal approach for evaluating trophic transfer of contaminants. In this study, we used the nitrogen isotopic composition ($\delta^{15}\text{N}$) of 74 *Nerodia floridana* (Florida Green Watersnakes) collected from three former nuclear cooling reservoirs (i.e., Par Pond, Pond B and Pond 2) to examine potential biomagnification of two contaminants - mercury (Hg) and radiocesium (¹³⁷Cs). We found a significant positive relationship between $\delta^{15}\text{N}$ and Hg concentrations ($r^2=0.29$, $df=73$, $p < 0.001$). We found a significant positive relationship between $\delta^{15}\text{N}$ and ¹³⁷Cs for individuals collected at Par Pond ($r^2=0.85$, $df=9$, $p < 0.001$) but not for individuals collected at Pond B or Pond 2. In addition, $\delta^{15}\text{N}$ values ranged from 5.6 to 9.3. Our results support that biomagnification of contaminants is occurring in our study systems.

378 ASIH STOYE ECOLOGY & ETHOLOGY I, Highland C, Thursday 12 July 2018

Brenna Levine¹, Marlis Douglas¹, Julie Savidge², Bjorn Lardner², Robert Reed³, Amy Yackel Adams³ and Michael Douglas¹

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

Genomic Pedigree Reconstruction Provides Novel Insight into the Reproductive Ecology of the Invasive Brown Treesnake (*Boiga irregularis*) on Guam

Important to the control of an invasive species is an understanding of the manner by which its persistence is mediated by its reproductive ecology. Persistence of the highly invasive brown treesnake (*Boiga irregularis*; BTS) on Guam has been well documented since its introduction circa 1949. However, its mating and reproductive ecology are less well understood, and their relationships to population persistence over time have yet to be quantified. We examined the reproductive ecology of BTS by reconstructing a multigenerational pedigree for a closed population established on Guam in 2004 (N = 469). Pedigree reconstruction was accomplished by analyzing 506 independent, highly informative SNPs (= single nucleotide polymorphisms; minor allele frequency cutoff ≥ 0.25 , $H_e = 0.24$) produced by filtering 6,180 loci derived from double-digest Restriction-site Associated DNA (ddRAD). Our preliminary pedigree analysis assigned 57 known males as the sires of 289 individuals in the population, and 67 known females as the dams of 179 individuals. Offspring per sire ($\mu = 5.1$) exceeded that per dam ($\mu = 2.7$), and relative variance in reproductive output among sires was significantly greater than

among dams (F -ratio test; $P < 0.05$). We also found evidence of multiple mating and promiscuity in both sexes. Our results provide novel insight into the cryptic mating and reproductive ecology of the invasive brown treesnake and have implications for population persistence over time. As such, these results have the potential to promote the development of effective invasive species control.

355 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Highland D, Thursday 12 July 2018

Nicholas Levis, Andrew Isdaner and David Pfennig

University of North Carolina, Chapel Hill, NC, USA

Carnivore tadpoles shed light on phenotypic plasticity's role in evolutionary innovation

Plasticity-first evolution ('PFE') posits that novel features arise when selection refines pre-existing phenotypic plasticity into an adaptive phenotype. However, PFE is controversial because few tests have been conducted in natural populations. Here we present evidence that PFE fostered the origin of an evolutionary novelty that allowed certain amphibians to invade a new niche--a distinctive carnivore morph. We compared morphology, gene expression, and growth of three species of spadefoot toad tadpoles when reared on alternative diets: *Scaphiopus holbrookii*, which (like most frogs) never produce carnivores; *Spea multiplicata*, which sometimes produce carnivores, but only through diet-induced plasticity; and *Spea bombifrons*, which produce carnivores regardless of diet. Consistent with PFE, we found pre-existing, diet-induced plasticity--in morphology and gene expression--in *Sc. holbrookii*, adaptive refinement of this plasticity in *Sp. multiplicata*, and further refinement of the carnivore phenotype in *Sp. bombifrons*. Generally, phenotypic plasticity might play a significant, if underappreciated, role in evolutionary innovation.

299 Poster Session I, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Peiwen Li, Rute Clemente-Carvalho, Peter van Coeverden de Groot and Stephen Loughheed

Queen's University, Kingston, ON, Canada

Comparing Methods for SNP Calling and Implications for Estimation of Population Parameters: An Empirical Study from a Tetraploid Arctic Fish

High-throughput DNA sequencing methods can facilitate population genomic analysis by providing access to panels of Single Nucleotide Polymorphism (SNP) from across the genome of nonmodel species. For such nonmodel species typically no reference genome is available, and SNP calling is usually accomplished *de novo*, or by aligning reads to a closely-related species' reference genome. However, empirical studies evaluating the effects of the two different SNP calling methods are still scarce, especially when confident SNP calling remains challenging for

nonmodel, polyploid species as is the focus of our study. In this study, we use Double Digest Restriction Associated DNA sequencing (ddRADseq) to obtain millions of DNA reads for Arctic char (*Salvelinus alpinus*), a nonmodel, tetraploid arctic fish species for which no reference genome is yet available. We then perform SNP *de novo* calling using multiple pipelines, and also by aligning the genome to another salmonid species, the rainbow trout (*Oncorhynchus mykiss*). We compare the number of SNPs obtained using both approaches, plus pairwise F_{ST} , F_{IS} , and observed and expected heterozygosity. Preliminary results show that our *de novo* calling yielded about twice as many SNPs as the reference-based method, but we found no significant differences in pairwise F_{ST} values. Our study provides insights into the optimization of analytical design in population genomics for nonmodel, polyploid organisms, and presents a means for evaluating the impacts of different calling methods for analyses of population structure in wild species.

58 SSAR: Coloration in Fish, Amphibians, & Reptiles Symposium, Grand Lilac Ballroom North, Sunday 15 July 2018

Russell Ligon

Cornell University, Ithaca, NY, USA. Arizona State University, Tempe, AZ, USA

Colorful language: Investigating the complex chromatic communication of chameleons

Sexual and social signals have long been thought to play an important role in speciation and diversity; hence, investigations of intraspecific communication may lead to novel insights regarding key processes of evolution. Communication, for example, can reduce the costs of conflict, and understanding how animals mediate conflict over different timescales can provide understanding of the factors guiding the evolution of contest strategies. To answer longstanding questions regarding how animals use dynamic signals to mediate conflict, I employed novel methods to measure the color changes used by male veiled chameleons *Chamaeleo calypttratus* during agonistic encounters. I discovered that rapid brightening serves as a signal of aggression and rapid darkening as a signal of submission. Interestingly, the honesty of these dynamic color signals of strategy appears to be maintained by social costs – dishonestly signaling chameleons receive more aggression than their honestly signaling counterparts. Among brightening chameleons, there is additional information encoded in particular elements of display coloration, for example the timing of maximum skin brightness is a strong predictor of maximum bite force. Together, these results indicated the utility of dynamic color signals which can communicate information about contest strategy, physiology, and physical performance.

117 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Shi Lin

Museum of Vertebrate Zoology, Berkeley, CA, USA

Taxonomic Review of *Trachemys scripta troostii*: A Clarification of the *elegans-troostii* Problem

The Cumberland slider, *Trachemys scripta troostii* (Holbrook, 1836), is the most poorly studied subspecies of the pond slider (*Trachemys scripta*). This highland taxon has a long and nebulous taxonomic history. In early literature, the usage of the name “*troostii*” and “*elegans*” are confusing. The name *troostii* was initially used to describe melanistic male individuals while *elegans* are non-melanistic ones. Herein I addressed the complicated *elegans-troostii* problem, giving a summary of the taxonomic history and clarifying issues that overlooked by previous authors. Implications for future research are also discussed.

243 Herpetology Physiology, Highland C, Saturday 14 July 2018

Craig Lind¹, Ignacio Moore² and Terence Farrell³

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³Stetson University, DeLand, FL, USA

Interactions between steroid hormones and snake fungal disease indicate potential sublethal effects on fitness in Pygmy Rattlesnakes, *Sistrurus miliarius*.

Snake fungal disease (SFD) has been identified as a proximate threat to snake biodiversity, however little is known regarding the physiological consequences of infection and their potential to impact populations. In cryptic species, direct effects of infection on fitness are not easily determined on timescales that facilitate timely conservation initiatives. In such contexts, physiological proxies for individual fitness are valuable in identifying the scope of the threat that SFD may represent to populations. The steroids testosterone and estradiol directly mediate reproductive investment in snakes, and adrenal glucocorticoids may play a role in mediating the tradeoff between immunocompetence and reproduction. To test the hypothesis that infection is associated with a physiological stress response that suppresses gonadal steroid production (i.e. the cort-fitness hypothesis), we estimated SFD severity by visual clinical signs and measured testosterone, estradiol, and corticosterone in a field-active population of Pygmy Rattlesnakes. We predicted a positive association between infection and corticosterone and a negative association between infection and testosterone (males) and estradiol (females), and that these relationships would be strongest during seasonal bouts of reproductive investment. Individuals with SFD exhibited increased corticosterone levels across seasons and sexes. Infected males had lower testosterone during summer spermatogenesis and during the fall mating season. Infected females were less likely to have elevated estradiol during the fall mating season and during spring vitellogenesis. Results are consistent with the cort-fitness hypothesis and suggest that seasonal energetic tradeoffs mediated by corticosterone may result in a decrease in reproductive success in afflicted individuals.

316 SSAR SEIBERT CONSERVATION I, Highland B, Thursday 12 July 2018

Luke Linhoff¹, Francesca McGrath², William Symes³ and Maureen Donnelly¹

¹Florida International University, Miami, Florida, USA. ²University of Michigan, Ann Arbor, Michigan, USA. ³National University of Singapore, Singapore, Singapore

Dramatic Increases in the Values of Traded U.S. Amphibians Indicates Higher Risk of Overexploitation

The collection of wild amphibians for human consumption and the pet trade may directly reduce populations through overexploitation. Additionally, human mediated movement of amphibians facilitates the spread of wildlife diseases and invasive species. Market fluctuations in the amphibian trade may directly impact conservation goals with potential global consequences. We examined changes in the market values of 52 species of amphibians in the United States in a 28-year time period by carrying out systematic surveys of U.S. based sellers of live amphibians. All but two species had increased in price dramatically during the study period. The mean percentage adjusted market price of U.S. amphibians rose 822%. The mean price for anuran species increased from US\$4.26 to US\$15.56 and caudates from US\$5.32 to US\$33.60. We found the market value is significantly higher for caudates with declining populations than other groups. We also found price increase to be positively correlated to range size from IUCN maps, indicating these maps may be insensitive to underlying range changes. Additionally, there was no influence on the prices of U.S. caudate species that were recently affected by a contentious 2016 emergency trade ban. The results provide valuable information on price trends of commonly traded North American amphibian species. We urge increased monitoring of amphibian market pressures and price dynamics to ensure the pet trade is sustainable.

47 ASIH STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, Highland D, Friday 13 July 2018

Allison Litmer and Christopher Murray

Tennessee Technological University, Cookeville, TN, USA

Neutrophil: Lymphocyte Ratios as a Measure of Chronic Stress in Populations of the Hellbender (*Cryptobranchus alleganiensis*) Across a Habitat Quality Gradient

Amphibians are currently facing widespread population declines, primarily due to the introduction of anthropogenic stressors. Anthropogenic stressors have the potential to alter ecosystem dynamics and elicit long-term physiological responses that could hinder population viability. Current metrics of population viability rely heavily on demographics, population fluctuation, and degree of isolation. Physiological parameters, such as stress-response proxies, offer a new scale for population assessment, providing an explanation of the mechanism causing population declines. Implicating a method of assessing chronic stress, such as white blood cell counts, specifically neutrophil:lymphocyte (N:L) ratios, may provide a metric that can be rapidly assessed and related back to microhabitat characteristics for management purposes. As a long-lived, specialist facing population declines, the hellbender (*Cryptobranchus*

alleganiensis) is a good candidate species for applying N:L ratios to assess population viability. This study used N:L ratios in relation to microhabitat variables to assess chronic stress among populations, determine environmental variables correlated with stress, and assess the implication of N:L ratios, among wild hellbender populations. Of the microhabitat variables assessed, low- dissolved oxygen and canopy cover, and high- pH and turbidity, correlated with elevated N:L ratios. Additionally, N:L ratios significantly differed among hellbender populations, suggesting that varying habitat condition and environmental stressors influencing population viability are reflected by N:L ratios. Specifically, N:L ratio indicated populations of management concern that traditional methods failed to suggest. Viability assessments incorporating physiological parameters provide evidence of declining viability earlier than traditional methods, and suggest specific variables contributing to stress, allowing for better management strategy.

197 Ichthyology Systematics II, Grand Lilac Ballroom South, Sunday 15 July 2018

Juan Liu

SUNY University at Buffalo, Buffalo, NY, USA

You are how you look: body shape analysis of Eocene cypriniform fishes

The oldest skeleton-based fossil cypriniforms (Teleost: Ostariophysi: Cypriniformes) were recently recovered from Eocene sediments of North America and East and South Asia. These fossils belong to three families, Cyprinidae, Catostomidae, and Jianghanichthyidae, and represent the principal sources for understanding the early diversity and divergence of the Cypriniformes. However, low morphological disparity among Eocene cypriniforms is a major problem for confident taxonomic assignment even at the family level. To better understand the early morphological disparity of cypriniforms, I conducted geometric morphometric shape analysis on all available Eocene cypriniform specimens following a systematic taxonomic review. Complete and undeformed two-dimensional specimens preserved laterally on slabs were selected for image capture using a surface scanner. Fourteen homologous anatomical loci which represented body shape were digitized. A sample of 86 specimens from three families, four genera, and 9 species were studied, consisting of 54 individuals of catostomids, 29 jianghanichthyids, and 3 cyprinids. Regressions of shape versus size suggest allometry plays an important role on the body shape changes through ontogeny and body shape variations among groups of Eocene cypriniforms. Moreover, discriminant function analysis on Eocene catostomids vs. cyprinids suggests significant difference between these two groups in body shape ($p < 0.00001$). In addition, although only 3 observations are currently available from Cyprinidae, they are distinct from catostomids and jianghanichthyids in a body shape morphospace (PC1+2, 63% of variance). The next step of this research will be to collect more data from Eocene cyprinids and applying phylogenetic comparative methods to better understand evolutionary trajectory and patterns of Cypriniformes.

490 ASIH STORER ICHTHYOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Tobit Liyandja^{1,2} and Jonathan Armbruster¹

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Geometric morphometric and molecular phylogeny provide new insights about convergent evolution, distribution and diversity within the African carp: *Labeo parvus*.

Labeo is the third most diverse African Cyprinoid genus and is widely distributed. *Labeo parvus*, a small species originally described from the Congo basin, seems to be the only species of the Reid's forskalii-group to be distributed in four different African ichthyo-provinces (Nilo-Sudan, Upper and Lower-Guinea, and the Congo). Several nominal species have been synonymized with *L. parvus* despite Reid's proposition to restrict the occurrence of that species to the Congo basin and the distinction between *L. parvus* and close relatives remains problematic. We used geometric morphometrics and molecular phylogenetics to assess the biological diversity within *L. parvus* and reevaluate its distribution. Our phylogenetic analysis strongly supports a non-sister relationship between the West Africa (Nilo-Sudan and Upper Guinea ichthyo-provinces) and the central Africa (Congo ichthyo-province) *Labeo parvus* lineages. Permutation tests for Procrustes and Mahalanobis distances, applied on the overall body shape dataset, reveal a significant difference (P-value < 0.0001, PD= 0.0267 and MD= 4.1437) between the West Africa and Congolese *L. parvus* lineages. Because phylogenetic reconstruction is corroborated by geometric morphometric analysis, we conclude that *L. parvus* is an endemic species of the Congo basin and does not occur in West Africa where it is replaced by *L. ogunensis* as suggested by Reid. Additionally, our analyses suggested that both *L. parvus* and *L. ogunensis* are species complexes. We discuss our findings in term of convergent evolution by mapping the phylogeny into the morphospace and testing for phylogenetic signal.

195 Reptile Ecology I, Highland A, Sunday 15 July 2018

Oliver Ljustina

Southeastern Louisiana University, Hammond, LA, USA

Using Species Traits to Predict Habitat Partitioning in a Suburban Watersnake (Genus: *Nerodia*) Assemblage

Organisms which persist in urbanized areas often possess particular traits; for example, they tend to be generalist species with smaller body sizes. In this study, I used visual encounter surveys to examine a system of suburban drainage canals in southeastern Louisiana to determine if habitat use among watersnakes could be predicted by life history traits of

individual species. I selected transects along three canal types (shallow/narrow, intermediate, deep/wide) which potentially exemplified habitat preferences of the four species of watersnake typically found in freshwater ecosystems in southeastern Louisiana. I hypothesized that 1.) generally piscivorous and more aquatic species (i.e. *Nerodia cyclopion* and *Nerodia rhombifer*) would be primarily found in deeper canals and would generally be the most abundant species, and 2.) that more terrestrial species which preferentially feed on anurans (i.e. *Nerodia erythrogaster* and *Nerodia fasciata*) would be restricted to shallower canals and be would be generally less abundant. Individuals of *Nerodia cyclopion* were found mostly in intermediate canals and were the most abundant snakes, while individuals of *Nerodia rhombifer* were found primarily in shallower canals and were the least abundant snakes. Individuals of *Nerodia erythrogaster* were found primarily in shallower canals and were the second most abundant snake. I encountered no individuals of *Nerodia fasciata*. Life history traits were effective in predicting habitat use in this system for some watersnake species, and less so for others. Urban systems provide the opportunity to examine factors influencing ecological community structure by stratifying habitat preferences among species.

570 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Jeremy J Lomax¹ and Stephanie Crofts²

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Tooth Arrangement's Effect on Durophagous Predation

Durophagous organisms, like pacus and drums, consume hard prey items using teeth that are to some degree 'molariform' and arranged in semi-continuous crushing surface. This contrasts the tooth morphologies and arrangement of other organisms, who are either less specialized or specialized on prey without hard shells. Studies have made progress explaining this diversity in the context of a single tooth's relative crushing performance, but understanding crushing ability is complicated by the interspecific variation seen in the arrangement of teeth. To understand the effects tooth pattern has on a predator's crushing ability, we tested four tooth arrangement patterns roughly based on natural design, with teeth in: a) a single row; b) an off-set line; c) a square; d) a concentrated crushing surface. To test the interaction between tooth arrangement and tooth shape, we made milled aluminum tooth plate models reflecting our four patterns, and varying tooth morphologies, and used these to determine the force necessary to crush representative prey items using a material testing system. While preliminary data suggest a trend in linear arrangements requiring less force to fracture, these results were non-significant and potentially the result of highly variable testing material. Using 3D printed replicas of the intertidal snail *Nucella lamellosa* we created functionally identical prey items for testing, essentially reducing the effects of variation. We discuss here the relationship between crushing ability, tooth morphology, and general patterns of tooth arrangement focusing on tooth plates

demonstrating a linear organization compared to those that coalesce teeth into a crushing surface.

252 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

John Loomis and Jennifer Deitloff

Lock Haven University of Pennsylvania, Lock Haven, Pennsylvania, USA

Comparison of Foot Morphology in *Plethodon ventralis* and *Plethodon websteri* using Geometric Morphometrics

Morphological features of species are often related to environmental conditions or resource use. *Plethodon websteri* and *P. ventralis* have overlapping ecological requirements, and the two species are very similar in appearance. When found in allopatric locations *P. ventralis* and *P. websteri* both show color polymorphism with the presence or absence of a red stripe along the dorsal side. When found in sympatry, they diverge in this characteristic with *P. ventralis* displaying the unstriped morph and *P. websteri* with the red striped morph. We hypothesized that foot shape would differ between species and would diverge in sympatry. We used geometric morphometrics with homologous landmarks on images of the front and hind feet to capture foot morphology. We used a multivariate analysis of variance (MANOVA) to assess the differences in feet shape, and a principle components analyses (PCA) to graphically demonstrate differences in foot morphology between the two species. We also used warp grids to show the divergence of each species from the overall average. We found support for our hypothesis that *P. ventralis* and *P. websteri* differed in front and hind foot morphology. Further research could be conducted to determine if foot shape is adaptive for each species in their natural environments.

463 Herpetology Morphology I, Highland D, Sunday 15 July 2018

Jorge Alejandro Lopez Torres

LANGEBIO, Irapuato, Guanajuato, Mexico

Ecomorphology of Neotropical Salamanders

Ecomorphology is the branch of ecology study of the relationship between body shape and function of organisms, as well as the response of these to environmental pressures. In a phylogenetic context, ecomorphology can link the diversification of species with the use of environmental resources or microhabitat. In systems such as *Anolis* lizards, the combination of ecomorphological and phylogenetic studies has enriched our knowledge of the ecological and evolutionary factors that impacted the diversification and richness of species. The Neotropical plethodontid salamanders (tribe Bolitoglossini) include 40% of the global salamander species diversity and have diversified into arboreal, cave, terrestrial

and even fossorial microhabitats. Some cases of morphological homoplasy associated with the use of the same microhabitat have been identified, suggesting that there are different ecomorphs within the group. Previous studies of morphology of this lineage have focused on variation in size and shape or osteological analyses, but a formal analysis of ecomorphology has not yet been done. In this study, we use body measurements likely related to microhabitat use from preserved museum specimens and phylogeny, to identify convergent morphological regimes, and relate these morphological regimes to microhabitat use to test for the presence of ecomorphs within the Neotropical salamanders. Identifying convergent morphological regimes in Neotropical salamanders will contribute to a better understanding of the relationship between morphology and the microhabitat use, taking into account evolutionary processes that contributed to the diversification of this salamander lineage.

132 Ichthyology Biogeography, Grand Lilac Ballroom South, Saturday 14 July 2018

Hernán López-Fernández¹, Stephanie Blain² and Viviana Astudillo-Clavijo³

¹University of Michigan, Ann Arbor, Michigan, USA. ²University of British Columbia, Vancouver, British Columbia, Canada. ³University of Toronto, Toronto, Ontario, Canada

Increased phylogenomic resolution of Neotropical cichlids allows dating of Guiana Shield biogeographic events within the genus *Geophagus*

The genus *Geophagus* sensu stricto (ss., Cichlidae: Geophagini) is widespread in the Amazon, Orinoco and Guiana Shield basins but its diversity, phylogenetic relationships and biogeographic history remain poorly understood. *Geophagus* ss. is part of a monophyletic but unclearly resolved clade comprising *Gymnogeophagus* and the “*Geophagus*” *steindachneri* clade. We analyzed sequences from 742 exons using concatenated and summary coalescent methods to clarify relationships within the clade. Addition of “*G.*” *pellegrini* to the *steindachneri* clade unambiguously resolved relationships among the three genera. We used the newly resolved relationships, the Eocene fossil *Gymnogeophagus eocenicus* and a literature-based secondary root calibration to date the divergence of *Geophagus* ss. from throughout its range, with emphasis on Guiana Shield populations. Our analyses revealed complex relationships among Amazonian and Orinoco lineages, as well as a monophyletic clade of *Geophagus* comprised of a “Rio Negro clade” as sister to a “Guiana Shield clade” that included lineages from the Rio Branco and Rupununi basins, and a “Coastal Clade” of drainage-specific populations in each basin between the Essequibo and Marowijne river basins. Divergence between the Rio Negro lineage and the Guiana Shield clade appears to have occurred 4-10 Ma and the Coastal Clade was dated to 2.83-7.15 Ma (mean 5.1 Ma). The latter spans a late Miocene to a mid-Late Pliocene age that could be consistent with the breakup of the Proto-Berbice paleo drainage and the establishment of a connection between the greater Amazon basin and the coastal drainages of the Guiana Shield.

**599 CHS: Effects of Climate Change Symposium, Grand Lilac Ballroom North,
Friday 13 July 2018**

Stephen Lougheed

Queen's University, Kingston, Ontario, Canada

**Using the Past to Explore the Future. Lessons from Landscape Genetics and
Phylogeography of North America Herpetofauna**

Predicting how organisms might be impacted by future climates and landscapes is fraught with challenges. Our research on phylogeography of frogs and snakes, including investigations of secondary contact zones, provides insights on how historical climate and habitat shifts shaped past species distributions and evolutionary trajectories, and thus how organisms might respond in the future. Our investigations of gene flow, across hierarchical spatial scales, help us to understand how landscape features modulate dispersal, and how human-induced environmental changes may affect this. Newer work on frog emergence and breeding time and variation in some mating system traits show how changing spring temperatures may affect phenology and fitness.

564 Herpetology Conservation II, Highland C, Sunday 15 July 2018

Robert Lovich¹ and Christopher Petersen²

¹Naval Facilities Engineering Command Southwest, San Diego, CA, USA. ²Naval Facilities Engineering Command Atlantic, Norfolk, VA, USA

Amphibians and Reptiles of United States Department of Defense Installations

The United States (U.S.) Department of Defense (DoD) occupies approximately 25 million acres of land within the U.S., spanning most ecosystems contained therein. To date, no comprehensive inventory or analysis of amphibian and reptile diversity has been conducted on military lands. This study updated and developed herpetofauna species lists for 415 DoD installations/sites within the continental U.S., and analyzed species diversity on DoD sites. The herpetofauna species confirmed present on DoD sites represent 63 percent of the total native herpetofauna species documented in the continental U.S. Of the Military Services, Army sites have the greatest number of confirmed species, followed by the Air Force, Navy, and Marine Corps, respectively. Those military installations with the greatest amphibian and reptile biodiversity are located in the southeastern U.S. DoD lands are home to many species of Federally-listed, State-listed, and at-risk herpetofauna. In general, the number of non-native and native transplant herpetofauna species/subspecies on DoD sites is relatively low. Lastly, our analysis has verified that that approximately half of the military sites evaluated in this study have at least one venomous snake species confirmed present. The results of this investigation directly assist in ongoing management and conservation of herpetofauna species on DoD lands.

**125 CHS: Effects of Climate Change Symposium, Grand Lilac Ballroom North,
Friday 13 July 2018**

Leslie Anthony Lowcock¹ and Purnima Govindarajulu²

¹N/A, Whistler, BC, Canada. ²BC Ministry of Environment, Victoria, BC, Canada

Potential climate change effects on introduced and invasive herpetofauna in Canada: a review.

With the world's second-largest land area but relatively low herpetofaunal diversity, Canada seems an unlikely place for introduced reptiles and amphibians unadapted to northern climates to gain foothold, let alone become problematic. And yet, not only has this occurred, but it has involved both transplanted native and non-native forms. Warmer areas of the country such as southern British Columbia and southwestern Ontario – both of which are experiencing shorter winters and earlier springs – would be most vulnerable to alien species introduced from warmer climates, as the establishment/naturalization of exotic red-eared slider in both locations, and a burgeoning invasion of European wall lizard on Vancouver Island illustrate. Yet native species have also been successfully introduced to previously uninhabited areas of the country: Pacific chorus frog and red-legged frog in the Haida Gwaii archipelago; American bullfrog and northern green frog in the lower B.C. mainland and on Vancouver Island; mink frog on Anticosti Island in the Gulf of St. Lawrence; and American toad, mink frog, northern green frog, wood frog and Maritime gartersnake on Newfoundland. With invasive species second only to habitat loss as a force of extinction in the Anthropocene, we review successful introductions and current problems, using existing information for various introduced taxa from Canada and other jurisdictions to consider whether climate warming might catalyze further invasiveness of introduced herpetofauna in this country.

188 ASIH STOYE GENERAL ICHTHYOLOGY I, Grand Lilac Ballroom South, Thursday 12 July 2018

William Ludt¹, Moises Bernal², Erica Kenworthy¹, Eva Salas³ and Prosanta Chakrabarty¹

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Investigating species limits of surgeonfishes in the Eastern Pacific (Acanthuridae: *Prionurus*)

Many sister species can only be distinguished by slight color variation. However, coloration is a labile character that can be misleading, and molecular analyses have demonstrated that these patterns do not always accurately reflect the distinct evolutionary histories between closely related groups. In the present study, we analyze the evolutionary history of sister species of *Prionurus* in the Tropical Eastern Pacific (TEP), which are mainly distinguished by the presence or absence of dark spots on their body. We examined the species limits in this system using comparative specimen-based approaches, a mitochondrial gene (COI), more than 800 nuclear loci (Ultraconserved Elements), and abiotic niche comparisons. The results indicate there is a complete overlap of meristic counts and morphometric measurements between the two species, with only modal differences in pectoral and dorsal fin-rays. Further, we detected multiple individuals with intermediate spotting patterns suggesting that this trait is not diagnostic. Mitochondrial data recovered a single main haplotype shared between the species and all

locations resulting in a complete lack of structure ($\Phi_{ST} = 0$). Genomic analyses corroborate this lack of genetic differentiation ($F_{ST} = 0.013$), and no alternatively fixed SNPs were detected between the two species. Furthermore, niche comparisons could not reject niche equivalency or similarity between the species. Together, these results suggest that these two phenotypes are conspecific and widely distributed in the TEP. The underlying causes of this phenotypic plasticity are unknown. However, this system gives insight into general evolutionary dynamics within the TEP.

80 Poster Session II, Empire Hall South – JF Rochester Riverside Convention Center, Saturday 14 July 2018

Marvin M. F. Lutnesky¹, Kenwyn R. Cradock² and James B. Reynolds³

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Estimation of Electroshock Immobilization Threshold and Effective Conductivity of Two Small Fishes

Electrofishing (EF) is commonly used for fish capture. The threshold power density (D_t , $\mu\text{W}/\text{cm}^3$) transferred from water to fish for immobilization is dependent on the conductivity of the water (σ_w) and the fish (σ_f). While EF is generally safe for fish, improper settings may cause injuries, including mortality, or more subtle damage to physiology, or delayed reproduction. EF is usually applied to a fish community, so we need to understand variation in σ_f to understand variation in D_t . Minimum threshold power density (D_m) is transferred to a fish when σ_w and σ_f are equal, i.e. in a matched condition. For unmatched conditions, more power density must be applied to the water to achieve the same transfer of power density as in the matched condition. At any water conductivity, D_t must be estimated by experimentation. Over a range of water conductivities, assuming the σ_f is bracketed, D_t as a function of σ_w will form a U-shaped curve and the nadir provides an estimate of D_m and σ_f . What we know about σ_f comes primarily from studies of game fishes. However, we estimated D_m and σ_f for a small cyprinid (*Cyprinella lutrensis*) and a poeciliid (*Gambusia affinis*). Using 73 *C. lutrensis*, and 23 *G. affinis*, we found D_m and σ_f values to be 120 $\mu\text{W}/\text{cm}^3$ and 23 $\mu\text{S}/\text{cm}$, and 142 $\mu\text{W}/\text{cm}^3$ and 23 $\mu\text{S}/\text{cm}$, respectively. These values of σ_f are less than half of previously known values, demonstrating the need to consider such variation in EF sampling.

174 ASIH STOYE GENERAL ICHTHYOLOGY II, Grand Lilac Ballroom South, Thursday 12 July 2018

Daniel MacGuigan¹ and Thomas Near^{1,2}

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Genomic Data Clarify the Evolutionary History of Two Widespread Species of Darter, *Etheostoma nigrum* and *E. olmstedii*

The prevalence of geographic isolation as a speciation mechanism is exemplified by darters, a clade of ~250 freshwater fishes. Nearly all darter sister species pairs are isolated in different river drainages, precluding the possibility of gene flow. One exception is *Etheostoma nigrum* and *E. olmstedii*, a widespread sister species pair with three separate areas of range overlap. These species have a complicated taxonomic history, fluctuating between one and four recognized species and between two and twelve recognized subspecies. To understand the evolutionary history of *E. nigrum* and *E. olmstedii*, we ask the following questions: 1) how many species are there within *E. nigrum* and *E. olmstedii*, 2) does genetic variation correspond to river basin arrangement or to geographic proximity, and 3) what is the nature of introgressive hybridization between *E. nigrum* and *E. olmstedii*? We used ddRADseq to collect thousands of SNPs for ~500 individuals from across the ranges of *E. olmstedii* and *E. nigrum*. Our data supported the recognition of two contested and highly localized species, *E. perlongum* and *E. susanae*, while also concluding that *E. olmstedii* consists of two species. We uncovered several surprising patterns of genetic variation, including two previously unrecognized peripheral and ancient evolutionary lineages within *E. nigrum*. Finally, our results revealed a complex history of introgression across two hybrid zones in New York and Virginia. Our study highlights the utility of genomic data for addressing complex taxonomic situations while simultaneously providing a window into the speciation process.

538 SSAR SEIBERT ECOLOGY I, Highland A, Friday 13 July 2018

Andrew MacLaren¹, Paul Crump¹, Andy Royle² and Michael Forstner¹

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Observer free experimental evaluation of habitat and distance effects on the detection of anuran and bird vocalizations

For vocalizing animals, acoustic surveys are often used to determine density, distribution, and diversity. Surveys are traditionally performed by humans, but automated recording devices (ARD) are becoming increasingly popular. Sound attenuates as it travels, and habitat types may differentially increase attenuation further. These effects are unaccounted for in acoustic monitoring programs where equal detection among species and habitats is assumed. We evaluated 3 playback devices and 3 ARDs using vocalizations of 6 anurans, 6 birds, and 4 pure-tones. Using the optimal devices, we then broadcast and recorded vocalizations in five habitats along 1000m transects. We used generalized linear mixed models to test for effects of habitat, distance, species, environmental, and landscape variables. Finally, we predicted effective

detection distances (EDR; $p=0.5$) for all vocalizations. Among the devices tested, only one playback device simulated vocalizations consistently, and the most modern ARD outperformed its predecessors in sensitivity. We found differences in detectability between open and closed canopy habitats, and heterogeneity in EDR among species. Humidity positively influenced detectability, but where topography impeded sound transmission detectability decreased. Surprisingly, ~10% of the variability within the data occurs among sites, thus, optimizing survey designs to account for these issues may require pilot measurements. Our results refute the assumption of equal probability among species and habitats as distance increases, and suggest that researchers should model the effects of habitat and distance among species when calculating detection probabilities.

555 Reptile Ecology I, Highland A, Sunday 15 July 2018

Kirsty MacLeod, Michael Sheriff, David Ensminger, Dustin Owen and Tracy Langkilde

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Stress kills: maternal glucocorticoid treatment during gestation reduces female survival, reproductive success, and post-gestational competitiveness, in eastern fence lizards.

Organisms continuously encounter stressors within their environment, such as predators, food shortage, or anthropogenic disturbance. The activation of the hypothalamic-pituitary-adrenal (stress) axis and subsequent release of glucocorticoid hormones is an important process allowing animals to cope with such encounters. Fundamental to understanding the impacts of stress and the role of the physiological stress response in ecological processes is determining the fitness effects, if any, of repeated acute glucocorticoid elevations. However, our understanding of the consequences of elevated glucocorticoids at ecologically relevant levels is largely lacking, particularly in wild animals. We subjected gravid eastern fence lizards (*Sceloporus undulatus*) to a daily topical glucocorticoid treatment, designed to emulate the physiological effects of an ecologically relevant low-level environmental stressor, until laying. Gravid females treated with a low dose of glucocorticoids suffered a greater loss of body condition and experienced higher gestational mortality than control females. The eggs laid by physiologically stressed females were also less likely to hatch. We also found that effects of elevated glucocorticoids during gestation on female metabolic rate and competitive behaviour in the post-gestational period, suggesting longer-term impacts of gestational stress than have been previously estimated. This is the first study to show that ecologically-relevant levels of glucocorticoids alone can reduce both survival and reproduction in a wild animal. These findings suggest that the fitness consequences of glucocorticoid increases in response to other non-lethal stressors may be underestimated.

30 SSAR SEIBERT CONSERVATION I, Highland B, Thursday 12 July 2018

Thomas Maignret¹, John Cox² and Jian Yang²

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Persistent Geophysical Effects of Mining Threaten Ridgetop-Associated Herpetofauna of Appalachian Forests

Surface coal mining can permanently alter the rugged topography of Appalachia, which plays an important role in creating and maintaining the structure, composition, and diversity of the region's ecological communities. We used remote-sensing datasets to characterize the past and future topographic impacts of surface coal mining on the mixed-mesophytic forests of eastern Kentucky. To provide context, we examined the consequences of widespread topographic rearrangement for an imperiled ridgetop-associated predator, the timber rattlesnake (*Crotalus horridus*). We found that surface mining disproportionately impacts ridgetop habitats, causing large reductions in the suitable habitat for *C. horridus* and likely other ridgetop-dependent biota. Land permitted for surface mining is also concentrated in high topographic positions, thus patterns of habitat loss are likely to remain concentrated in these ecosystems into the future. These permanent topographic shifts complicate restoration of preexisting microhabitats, creating homogenized landscapes, threatening long-term ecosystem health, and charting a new course towards less diverse ecological communities.

472 ASIH STORER ICHTHYOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Alex Maile and Matthew Davis

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Changes in Body Shape Across Habitat Transitions in Lizardfishes (Aulopiformes)

This study focuses on the morphologically diverse and species-rich (~282 species) marine lineage of lizardfishes (Aulopiformes). Aulopiform species possess a breadth of variation in body shape across their radiation, ranging from cigar-shaped to elongated. No study has ever investigated the evolutionary pattern of body shape changes in this lineage of fishes, and we further compare the evolution of body shape to habitat distributions of lizardfishes.

Evolutionary changes in the body shape of lizardfishes is quantified with a landmark-based geometric morphometric approach based on digitized specimens representing all of the major lineages of aulopiform fishes.

492 ASIH STORER ICHTHYOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Rachel Manning¹, Luke Tornabene² and Carole Baldwin³

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²*School of Aquatic and Fishery Sciences, Burke Museum of Natural History and Culture, University of Washington, Seattle, Washington, USA.* ³*Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA*

A New Genus of Caribbean Deep Reef Gobies (Teleostei: Gobiidae) of the *Priolepis* Lineage with Descriptions of Six New Species

Tropical mesophotic and deeper coral reefs (< 50 m) have been largely understudied to date; preliminary studies suggest that approximately one third of fishes on these reefs are still undescribed. Efforts to begin rigorously exploring mesophotic and deeper reef biodiversity have been conducted from 2011 to present by both the Smithsonian Institution's *Deep Reef Observation Project* and more recently, the University of Washington Burke Museum, across 5 Caribbean locations via two manned submersibles, *Curasub* and *Idabel*. As a result, Tornabene et al. (2016) identified a putative new Gobiid genus comprising three species, though additional sampling and phylogenetic analysis indicate a total of six undescribed species. Herein we present phylogenetic data from four molecular markers and morphological data for 57 specimens of the new genus. We discuss the interspecific relationships and some potentially diagnostic characters within the genus. Lastly, we provide a cursory osteological comparison of the genus to other closely related genera, including *Trimma*, *Lythrypnus*, *Priolepis*, *Paratrimma*, and *Feia*.

415 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Zachary Marcou¹, Allison McElroy¹, Josh Pierce², Craig Rudolph² and Stephen Mullin¹

¹*Stephen F. Austin State University, Nacogdoches, Texas, USA.* ²*Southern Research Station, U.S. Forest Service, Nacogdoches, Texas, USA*

Detecting Turtles (Emydidae: *Terrapene*) Using Wildlife Cameras

As expected for ectothermic species, the activity patterns of Box Turtles (*Terrapene carolina*) vary with changes in the temperature of their surroundings. In turn, changes in the turtles' levels of activity can affect the ability of researchers to detect individuals in the field. We used camera trap arrays to photograph turtles in the Angelina National Forest (eastern Texas) during two consecutive field seasons. Images were recorded every 30 sec at the intersection of 20 drift fence arrays and, for each turtle detected, we recorded the date, time, and temperature, and amount of precipitation. We examined whether or not turtle detections were influenced by these abiotic variables. Some turtles (~7 %) having a unique pattern of shell damage were positively identified as individuals moving through the same array on different days. We discuss our

findings as they pertain to understanding the activity patterns of Box Turtles via remote detections.

386 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION & BEHAVIOR, Empire Hall South – JF Rochester Riverside Convention Center, Friday 13 July 2018

Zachary Marcou¹, Josh Pierce², Craig Rudolph² and Stephen Mullin¹

¹*Stephen F. Austin State Univ., Nacogdoches, Texas, USA.* ²*Southern Research Station, U.S. Forest Service, Nacogdoches, Texas, USA*

Remote Photography Reveals the Diel Activity Cycle of a New World Elapid

Knowledge of the activity patterns for a given species can be used to make predictions about its ecological role in the environment. Information reported about the diel activity cycles of snakes belonging to the genus *Micrurus* (Squamata: Elapidae) is predominantly based on anecdotal evidence. Reported observations of surface activity of *Micrurus* are not exclusive to any particular portion of a day, having occurred at any time within a 24-hr period. We used 20 remote photography arrays (RPA) to detect snakes during two consecutive activity seasons in the Angelina National Forest (eastern Texas). Cameras recorded images at 30-sec intervals, and automatically logged the date, time, and temperature for all images. RPA detected a total of 1094 individual snakes. Of these, we examined the data for the 174 images of *Micrurus tener* (Texas Coralsnakes) to determine if there were any temporal patterns for the activity of this species. In a given day, Texas Coralsnakes exhibited two peaks in activity that coincided with twilight. We interpret our findings as they relate anecdotal claims about the activity patterns of *M. tener*, the species' ecology, and the utility of RPA in future research that examines the natural histories of snake species that are challenging to detect in the field.

615 Herpetology Physiology, Highland C, Saturday 14 July 2018

Jacob Marlay¹, Elizabeth Everman² and Paul Klawinski¹

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Adaptation and Acclimation in an Introduced Gecko (*Hemidactylus turcicus*) Encountering Novel Thermal Environments during Range Expansion.

During a species' range expansion, range expansion may be limited to environments similar to the species' native range, but may include areas that pose novel environments. In this case, the species can cope with those new environments by either adapting to the new environments,

relying on phenotypic plasticity, or a combination of both. We studied the thermal biology of the introduced gecko, *Hemidactylus turcicus*, in Galveston, TX, and Oklahoma City, OK, to examine how the species is coping with the colder environments it is encountering as it experiences a northward range expansion. We collected geckos during the winter of 2018 and the summer of 2017 and recorded field body temperatures and ambient temperatures as well as preferred temperatures of both populations. In addition, we raced geckos down a liner racetrack at 10 C, 15 C, 20 C, 25 C, 30 C, and 35 C after being lab acclimated at both seasons' field collected temperatures. Winter geckos in Oklahoma City were active on walls during the winter at temperatures significantly below their preferred temperatures but the same was not true for Galveston geckos. Both populations exhibited similar field body temperatures during the summer months demonstrating that Oklahoma City does pose a potential thermal challenge. Both winter and summer collected geckos were able to run at temperatures below their previously reported critical thermal minimum. Patterns of performance across temperatures indicated that this species may be coping with a novel, cooler environment through a combination of both adaptive response and acclimation.

346 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Mariana Marques^{1,2}, Luis Ceríaco^{3,2}, Suzana Bandeira^{3,4}, Ishan Agarwal⁵, Nuno Ferrand de Almeida⁶ and Aaron Bauer⁵

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Serra da Neve: Herpetofauna Diversity of southwest Africa's least known Inselberg

Serra da Neve is an Inselberg in the northern limit of Namibe Province, Southwestern Angola, and is the second highest peak (2489 m) in Angola. Until very recently this mountain has remained completely unexplored in terms of its biodiversity, although, given its isolation, area (approx. 5000 km²) and biogeographic patterns of the surrounding areas, it has always been considered a place of special biogeographic interest. In 2016 we conducted the first herpetological survey of the Serra da Neve Inselberg, and the preliminary results suggest the presence of a diverse and rich diversity of amphibians and reptiles, including new species to science and various lineages of species occurring in the surrounding areas. The herpetofauna of the mountain includes both taxa that are typically found in the higher elevation areas of the Angolan plateau, as well as those that are more xeric, lower elevation and commonly found in the Pro-Namib region of both Angola and Namibia. This poster presents some of these novelties

and gives a preliminary overview of the biogeographic significance and context of Serra da Neve Inselberg and the surrounding areas of Southwestern Angola.

369 ASIH STOYE GENETICS, DEVELOPMENT, & MORPHOLOGY I, Highland D, Thursday 12 July 2018

Roberto Márquez¹, Tyler Linderoth², Daniel Mejía-Vargas³, Pablo Palacios³, Rasmus Nielsen², Adolfo Amézquita³ and Marcus Kronforst¹

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Divergence, Gene Flow and Convergent Origins of Aposematic Phenotypes in *Phylllobates* Poison-dart Frogs

Understanding the evolutionary genetic processes that generate phenotypic diversity is among the main goals of evolutionary biology. Studying the spatial distribution of phenotypic and genotypic variation present within a lineage can provide valuable insight on the role that different evolutionary processes, (e.g. adaptation, isolation, gene flow) have played in shaping its phenotypic diversity. The genus *Phylllobates* is composed of five nominal species that have independently evolved aposematic coloration at least twice. Aiming to understand the evolutionary genetic processes underlying this case of convergent evolution, we study survey genetic and morphological, and colour-pattern variation in Colombian populations of this genus, where coloration has evolved rapidly. We focus on the upper/mid San Juan River drainage, where there is ample and seemingly continuous variation in coloration among geographically close populations. Based on phylogenetic, population genetic, and cline analyses we find 1. dynamic and correlated evolution of morphology, coloration, and toxin concentration and 2. evidence for gene flow and local adaptation as the forces shaping variation in aposematic phenotypes along the San Juan drainage.

454 SSAR SEIBERT SYSTEMATICS & EVOLUTION I, Highland B, Friday 13 July 2018

Thomas Marshall^{1,2}, Thomas Jenkinson³ and David Rodriguez¹

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Population Genomics of Amphibian Chytrids in Texas: Understanding Pathogen Dynamics in Understudied Regions

Chytridiomycosis, an emerging infectious disease caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), has had a devastating impact on many amphibian populations worldwide over the last forty years. However, mortalities have not been distributed equally across species or geographic regions. Notable declines have occurred in Australia, the Neotropics, and the western United States, while populations in Asia and the eastern and central U.S. have been largely unscathed, despite the presence of *Bd* in these regions. 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. Here, we isolated, cultured, and used next-generation sequencing to characterize strains of *Bd* in central Texas, a region not known for major chytridiomycosis-associated declines. We then performed genetic clustering analyses with 28 Texas isolates and a panel of globally distributed strains from previous studies. Our results indicate that the isolates cultured here belong to the pervasive global panzootic lineage (GPL), and that they cluster with other strains from North America. We also found evidence of genetic structure within *Bd*-GPL across continents, as well as possible admixture between strains from different clusters. By turning our attention to understudied regions, we seek to gain a more complete evolutionary picture of *Bd* and a better understanding of the conditions that contribute to variable disease outcomes in different areas.

196 SSAR SEIBERT CONSERVATION I, Highland B, Thursday 12 July 2018

Amanda Martin and Karen Root

Bowling Green State University, Bowling Green, Ohio, USA

Detecting Spatial Patterns of Herpetofauna Biodiversity in Northwest Ohio

The Oak Openings is a regional biodiversity hotspot with a multitude of endangered, threatened and potentially threatened species, including vulnerable herpetofauna. The bioregion has many protected areas that consist of oak forests and savannas, wet and dry prairies, and barrens that lie within a human-dominated landscape. Given the lack of holistic studies of herpetofauna diversity, this study fills in gaps in our knowledge of herpetofauna diversity, richness and abundance while providing a foundational spatial dataset. Herpetofauna were detected using visual encounter surveys within the Oak Openings Preserve, the largest protected area in the bioregion. Spatial patterns were examined using GPS coordinates for each individual detected. We observed 21 species encompassing 1345 individuals. Twelve expected species were not detected within the geographical area and amphibians accounted for 96% of our detections. We found that Caudata were widely distributed across the landscape, and all herpetofauna groups, except for squamates, had significant spatial clustering. Finally, we found that Anura and Caudata were found in forests significantly more than expected. Species distribution patterns vary over time and space and whether these changes occur from anthropogenic or natural factors, it is critical that we monitor changes to inform conservation efforts. Therefore, we have created a spatial representation of herpetofauna biodiversity to document current abundances and distributions. We developed a

simple, reduced labor and cost-effective survey method for future monitoring. Furthermore, since Oak Openings Preserve is a representative park we would expect that herpetofauna diversity would follow similar patterns in other protected areas.

**189 ASIH STOYE GENERAL ICHTHYOLOGY II, Grand Lilac Ballroom South,
Thursday 12 July 2018**

Rene Martin

University of Kansas, Lawrence, KS, USA

**The Role of Phylogeny in the Evolution of Body Shape of Lanternfishes
(Myctophiformes)**

Lanternfishes are an abundant and comparatively species-rich group of small mesopelagic fishes. The 257 species of myctophids share a relatively similar body plan, but many lineages show patterns of variation in their body shape. Some of this variation includes slimming of the caudal peduncle, body truncation, and body elongation. Little work has been done to explain the evolution of these observed patterns. To address questions of potential body shape convergence or adaptation across lineages, we use geometric morphometric methods to describe the body shape of over 700 lanternfish specimens including at least one representative of every genus of myctophiform. We examine patterns of body shape arrangement in a principal component-based morphospace and investigate the potential influence of phylogeny on body shape using a recent phylogeny of lanternfishes.

**50 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY,
NATURAL HISTORY, DISTRIBUTION & BEHAVIOR, Empire Hall South - JF
Rochester Riverside Convention Center, Friday 13 July 2018**

Kristen Martinet, Leyna Stemle and Gabriel Langford

Florida Southern College, Lakeland, Florida, USA

**A Comparative Analysis of the Commensal Diversity of Two Gopher Tortoise
(*Gopherus polyphemus*) Populations in Central Florida**

Gopher tortoises (*Gopherus polyphemus*) are extremely important to Florida's environments and have been called a keystone species because their burrows serve as shelter and foraging space for commensals. Burrow commensal diversity varies based on location and the age of the gopher tortoise community. However, no studies have accessed how commensal communities respond to gopher tortoise reintroductions. To determine the difference in commensal diversity between gopher tortoise populations, this study surveyed the commensals present in two

Environmental Lands Program properties in central Florida: Circle B Bar Reserve (CBR), which has a relocated gopher tortoise population, and Lakeland Highland Scrubs (LHS), which has a natural, undisturbed population. Pit fall traps, motion-activated field cameras, and a burrow camera were used to survey the commensals that live among the gopher tortoises in both sites. Over 200 individual commensals spanning over 30 different species were found at each site during an eight-week sampling period. The distribution of these species at each site was analyzed using Shannon's Diversity Index. The two sites ultimately did not have statistically significantly different commensal diversity, even though their gopher tortoise populations were present in their environments for very different lengths of time. The similarity of commensal populations could be attributed to the similarity of plants around the burrows, as well as the existence of other burrow-dwelling species such as pocket gophers at CBR that allowed burrow commensals to live at CBR without gopher tortoises.

379 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Wilfredo Matamoros¹, Sara Domínguez-Cisneros¹, Ernesto Velázquez-Velázquez¹ and Caleb McMahan²

¹Universidad de Ciencias y Artes de Chiapas, Tuxtla Gutiérrez, Chiapas, Mexico. ²The Field Museum of Natural History, Chicago, IL, USA

A New Species of Killifish of the Genus *Profundulus* (Cyprinodontiformes: Profundulidae) from the Mexican state of Oaxaca

The Middle American killifish genus *Profundulus* occurs in most Pacific and Atlantic drainages from the Mexican state of Guerrero to the Río Chamelecón in Honduras, with highest species diversity in southeastern Mexico. In this study we document a new member of the genus from the Mexican state of Oaxaca. It is distinguished from closely related congeners by combinations of pigmentation patterns, meristic data, and osteological characters. Based on phylogenetic analysis of molecular sequence data, the new species is recovered as the sister taxon to *Profundulus balsanus*, recently re-elevated and re-described. The discovery of this new lineage in southeastern Mexico raises the number of species from this region to five and suggests that this area has been an important center for diversification within this clade of killifishes.

413 Lightning Talks III, Highland B, Sunday 15 July 2018

Laurie Mauger¹, Frank Mazzotti² and James Spotila³

¹Southern Utah University, Cedar City, UT, USA. ²University of Florida Fort Lauderdale Research and Education Center, Davie, FL, USA. ³Drexel University, Philadelphia, PA, USA

Landscape Genetics of *Crocodylus acutus* in Pacific Costa Rica

The American crocodile, *Crocodylus acutus*, is a wide-ranging species that is endangered throughout much of its range. We investigated the influence of geographic features on gene flow between 11 *C. acutus* localities in Pacific Costa Rica. We utilized nine microsatellite loci to study the landscape genetics of 183 individuals. We identified three main population clusters using STRUCTURE, (1) Parque Marino Nacional (Las Baulas), (2) Parque Nacional Santa Rosa, Parque Nacional Palo Verde, and Rio Tarcoles and (3) Osa Conservation Area. Bayesian clustering analysis (Geneland) gave a somewhat different distribution, but rates of migration calculated by BayesAss+1.3 supported the results of STRUCTURE. Parque Marino Nacional (Las Baulas) was isolated from other populations with little migration occurring from or to this population. Parque Nacional Santa Rosa received a large number of migrants (approximately 30% of the population) from Parque Nacional Palo Verde, which contained a major source of crocodiles for the coast. There was no isolation by distance along streams with a cost distance analysis using GIS framework. These distances only explained up to 11% of the genetic differentiation observed between population pairs. The crocodile population in Las Baulas is of particular concern because of its isolation. A central management plan is needed including all Pacific Conservation Areas of Sistema Nacional de Areas de Conservacion (SINAC) to account for the effective dispersal observed between population clusters.

471 ASIH STORER ICHTHYOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Zachary May and Matthew Davis

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

Evolution of Body Shape in the Deep-Sea Hatchetfishes (Sternoptychidae)

Stomiiformes (dragonfishes and their allies) are a species-rich order of fishes (~438 species) that are primarily found throughout the meso-bathypelagic zone of the world's oceans. The bodies of stomiiforms are covered in an array of bioluminescent photophores that produce light in their near-dark to dark environment. In contrast to the more elongated body plan of most stomiiforms, fishes of the family Sternoptychidae (hatchetfishes, ~79 species) have evolved a hatchet-like body shape. Few studies have investigated the evolution of body shape among stomiiform fishes, a lineage that has evolved exclusively in a pelagic deep-sea environment. In this study we use landmark-based geometric morphometrics to examine the differences in body morphology across Stomiiformes with a focus on the family Sternoptychidae. We also explore the evolution of body shape among hatchetfishes in the context of their evolutionary relationships inferred from a synthesis of genome-scale sequencing with ultraconserved elements (UCEs) and protein-coding gene fragments.

288 General Herpetology III, Highland B, Sunday 15 July 2018

Jacob McCartney¹, Emma Bode¹, Josephine Reinhardt¹ and Nancy Stevens²

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New fossils from the Oligocene of Tanzania reveal early origin of modern African snake fauna

The origins of modern snake faunas extend back to the Miocene with the sudden increase in importance of colubroid snakes following a period of low snake diversity. This evolutionary history is well documented in North America and Europe, but comparatively little is known about the appearance and evolution of snakes in the southern continents. Ongoing fieldwork in the late Oligocene Rukwa Rift Basin of southwest Tanzania has yielded new snake fossils that begin to address this faunal transition. Previously described material reveals that although two booid species occur, the fossils are majority colubroid, suggesting the timing of colubroid expansion may differ in Africa with respect to northern continents. Newly recovered material includes the earliest known definitive Lamprophiidae, extending their fossil record by more than 25 million years and providing the first fossil calibration point for the family. Using this new calibration point, we calibrated a molecular clock model using sequences of four mitochondrial loci from 104 species with mcmctree. Preliminary results suggest an origin for Lamprophiidae at about 50 million years ago, a date near the upper range of previously estimated origin times. The earlier divergence of Lamprophiidae indicates a nearly 25 million year gap in the fossil record, and demonstrates the importance of continued fieldwork in Africa and elsewhere. The extensive ghost lineage may be partly a result of the small size of the animals, and the lack of distinct morphologies in most species permitting differentiation of different snake families.

427 ASIH STORER HERPETOLOGY, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Sara McClelland and Sarah Woodley

Duquesne University, Pittsburgh, PA, USA

Ecologically Relevant Levels of an Organophosphorous Pesticide Causes Changes in Stress Levels and Brain Structures in Amphibians

The organophosphorous pesticide chlorpyrifos is the most applied insecticide in the United States. Like other pesticides, chlorpyrifos is found in surface waters throughout the US, most commonly at concentrations less than 10 ppb (though higher values have been reported). While chlorpyrifos has been shown to cause neurological and behavioral problems in vertebrates that are exposed to high doses, the effects of low dose exposures are still not well understood. This study aimed to better understand the effects of these low level exposures. We exposed a vertebrate model, the Northern Leopard Frog (*Lithobates pipiens*), to 0, 1, or 10 ppb chlorpyrifos during development in a controlled laboratory study. We measured levels of the stress hormone corticosterone and body and brain shape. Exposure to chlorpyrifos resulted in increased levels of corticosterone as well as changes in brain mass and alterations in brain shape. Specifically,

tadpoles that were exposed to CPF during development had wider and longer telencephala and longer olfactory bulbs. This study provides evidence that exposure to low, ecologically relevant doses of organophosphorous pesticides causes neurological effects and increased stress levels. Our results indicate that amphibian physiology is being impacted by chlorpyrifos at the concentrations that are found contaminating natural habitats.

458 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Eric McCluskey¹, H. Lisle Gibbs², Scott Martin² and Jennifer Moore¹

¹Grand Valley State University, Allendale, Michigan, USA. ²Ohio State University, Columbus, Ohio, USA

Does habitat area influence genetic diversity? A case study with the Eastern Massasauga

The loss of genetic diversity in fragmented landscapes is a major concern for threatened and endangered species. Reductions in patch size and connectivity are expected to further erode genetic diversity for populations that do not receive immigrants. Most conservation efforts are focused on ameliorating the connectivity issue via corridor creation to promote gene flow. Addressing the potential loss of genetic diversity from a habitat perspective is less straightforward because the relationship between habitat area and genetic diversity has not been thoroughly investigated across taxa in the field of landscape genetics. We examined this relationship for a federally threatened species, Eastern Massasauga Rattlesnake (*Sistrurus catenatus*) that is largely restricted to isolated populations making loss of genetic diversity a pertinent management issue. We obtained genetic diversity data from populations across the range that varied in habitat amount and level of connectivity. We evaluated the relationship between these habitat attributes and genetic diversity using multiple habitat metrics. Our preliminary results indicate that genetic diversity does not appear to be directly related to habitat patch area when defined by patch borders delineated using aerial imagery. Variation in habitat type, microhabitat availability, and land use histories may also be important factors when considering the influence of habitat on genetic diversity.

256 Poster Session I, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Frank McCormick¹, Jackson Leonard² and Benerito Martinez³

¹US Forest Service, Fort Collins, CO, USA. ²US Forest Service, Flagstaff, AZ, USA. ³US Forest Service, Durango, CO, USA

A risk assessment of aquatic resources based on fish assemblages in the upper Animas River, Colorado, USA.

In 2015, a bulkhead failure at the Gold King Mine spilled an estimated 3 million gallons (11M L) of mine drainage into Cement Creek, a tributary of the upper Animas River in Southwestern Colorado, USA. In 2017, USEPA designated the Bonita Peak Mining District, encompassing the upper Animas River basin and its tributaries as a Superfund site. The site is affected by surface and groundwater discharge from abandoned mine lands including 48 National Priority List sites. Remediation and restoration is complicated by the fact that the basin lies within the Silverton - San Juan caldera complex in the western San Juan Mountains. Hydrothermally altered bedrock naturally weathers to contribute significant loadings of iron, aluminum and other heavy and trace metals to surface and groundwater. We used historical records and recent collections to assess the structure and condition of the fish assemblage of the upper Animas River. Wherever possible, fish collections were linked with chemistry sampling that had been conducted either at the same time or in the same reach to develop associations between chemical stressor and biological response indicators. When fish were present, collections were dominated by non-native Brook Trout and other non-indigenous species. Native fish were either rare or absent. Where native species did occur, their abundance was low. Native fish presence was associated with lower metal concentrations.

25 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Highland A, Thursday 12 July 2018

Ciera McCoy, Christopher Lupfer and Brian Greene

Missouri State University, Springfield, MO, USA

Survey of Arboviruses in Free-ranging Cottonmouths (*Agkistrodon piscivorus*) in Southern Missouri

Four arboviruses, Eastern equine encephalitis (EEEV), Western equine encephalitis (WEEV), Saint Louis equine encephalitis (SLEEV), and West Nile Virus (WNV), normally infect avian hosts but can be transmitted to various other organisms through mosquito vectors. Although infection risks are low, each virus is capable of causing significant central nervous system disease in humans, with mortality rates approaching 75%. Cottonmouths (*Agkistrodon piscivorus*) may serve as important EEEV reservoirs because of their high population densities and primary association with wetlands, where EEEV prevalence is highest. Because cottonmouths occur in a variety of aquatic systems, we hypothesized that the proportion of infected snakes may be population-specific and correlated with mosquito density. To determine if habitat type influences the likelihood of arbovirus infection, we examined arbovirus prevalence in free-ranging cottonmouths from contrasting habitats with different mosquito densities: an upland landscape and a lowland floodplain. We predicted that the individuals sampled from the swampy habitat would have the highest prevalence of arboviruses. Blood samples were taken from free-ranging cottonmouths in the spring and fall and analyzed for all four arboviruses using qualitative PCR. Preliminary results indicate that cottonmouths from a lowland floodplain habitat exhibit higher levels of arboviruses when compared to cottonmouths from an upland landscape habitat.

**556 ASIH STOYE GENERAL ICHTHYOLOGY I, Grand Lilac Ballroom South,
Thursday 12 July 2018**

Tyler McCraney¹, Michael Alfaro¹, Janet Buckner¹, Brant Faircloth² and Christine Thacker³

¹University of California, Los Angeles, Los Angeles, CA, USA. ²Louisiana State University, Baton Rouge, LA, USA. ³Natural History Museum, Los Angeles, CA, USA

Phylogenomic Systematics of Gobiiformes: Small Fishes Show Some Backbone

Gobiiformes comprise a global radiation of small, mostly marine fishes characterized by extraordinary species richness and ecological diversity. Molecular phylogenetics has been crucial to advancing gobiiform systematics, but classification remains unsettled due to disagreements on clade relationships and poor bootstrap support; especially along the backbone of the tree subtending lineages of goby families Gobionellidae and Gobiidae. Here we use a phylogenomic approach to infer gobiiform phylogeny from 851 ultraconserved element loci sequenced on a broadly sampled set of 50 taxa. Consistent with early mitochondrial work and recent phylogenomic studies, our results support successive sister group relationships of families Kurtidae, Apogonidae, Odontobutidae, Eleotridae, Butidae, Gobionellidae and Gobiidae. We also recover monophyly of all goby lineages sampled with complete bootstrap support. These results support the classification of Gobiiformes inclusive of Kurtiformes (Kurtidae and Apogonidae), provide improved resolution along the gobioid backbone, and advance systematics of goby lineages.

652 Herpetology Conservation IV, Highland C, Sunday 15 July 2018

Michael McFadden^{1,2}, Deon Gilbert³, Philip Byrne², Peter Harlow¹ and David Hunter⁴

¹Taronga Conservation Society Australia, Sydney, NSW, Australia. ²University of Wollongong, Wollongong, NSW, Australia. ³Zoos Victoria, Melbourne, Victoria, Australia. ⁴NSW Office of Environment and Heritage, Albury, NSW, Australia

**Recovery Efforts for the Critically Endangered Southern Corroboree Frog
(*Pseudophryne corroboree*)**

The Southern Corroboree Frog (*Pseudophryne corroboree*) is a small myobatrachid frog restricted to Kosciuszko National Park, in south-eastern Australia, that has rapidly declined in recent decades largely due to disease, caused by infection with *Batrachochytrium dendrobatidis*.

Population numbers are critically low with the species now only occurring at translocation sites. Immediate management objectives for this species include establishing robust insurance colonies, maintaining populations in the wild via translocation, and developing efficient captive breeding and translocation methods to increase the longer term capacity and resilience of the program. Ex-situ insurance colonies have now been established at Taronga Zoo, Zoos Victoria and the Amphibian Research Centre. The insurance population has a genetically-diverse founder base established from wild-collected eggs over many years. Despite initial difficulties, reliably high captive breeding results have been achieved in recent years permitting the use of offspring for reintroduction and research. Experimental

translocations currently include the translocation of eggs into artificial pools at four natural sites, natural pools at two sites and artificial pools at three sites with reduced threat of the disease, due to the absence of suitable breeding habitat for a sympatric, reservoir host species. An additional management action currently being trialled involves releasing frogs into enclosures within their range that restrict vectors for the chytrid fungus.

337 Poster Session II, Empire Hall South - JF Rochester Riverside Convention Center, Saturday 14 July 2018

Emily P. McFarland¹, Carole C. Baldwin² and Luke Tornabene¹

¹University of Washington, Seattle, WA, USA. ²Smithsonian Institution, Washington, DC, USA

Trophic Structure of Deep-reef Fishes off Bonaire and Curaçao, Southern Caribbean

Tropical deep reefs (>50 m), which include mesophotic coral ecosystems, are too deep for SCUBA divers to explore for extended periods of time and too shallow for costly deep-diving submarines to study on their way down to the deep sea. These reefs, which contain both light-dependent and -independent species, are just recently beginning to be recognized for their importance and distinctiveness from shallow reefs. In particular, recent explorations of Caribbean deep-reef fishes have shown several taxonomically and ecologically distinct communities along the deep reef slope from 50-300 m. This study analyzed the distribution of trophic groups of deep-reef fishes across the deep-reef slope off the coast of two Caribbean islands, Bonaire and Curaçao, using data from manned submersible dives. Counts of species and their depth distributions were made from visual surveys and targeted collections (>10000 total observations) aboard the *Curasub* submersible, and the trophic guild of each species was determined from the literature. We then compared depth distributions for the different trophic guilds for both within- and between-site comparisons. The analysis showed significant differences between three different groups of trophic types: (i) strict carnivores, (ii) planktivores and planktivore/carnivores, and (iii) herbivores and omnivores. These results establish preliminary data that will serve as a robust foundation for making inferences about deep-reef ecology at Caribbean-wide or global scales.

143 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION & BEHAVIOR, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Rhiannon McGlone, Jennifer Deitloff and David Savage

Lock Haven University, Lock Haven, Pennsylvania, USA

Territorial Behavior in *Plethodon cinereus* (Red-Backed Salamander) in Seven Populations from Pennsylvania

Species that have wide geographic ranges can diverge in characteristics such as morphology, resource use, or behavior due to adaptation to local environmental conditions. *Plethodon cinereus* is widely distributed throughout the northeastern United States. For many populations of *P. cinereus*, intraspecific competition for resources may occur, resulting in territorial behavior. However, some populations of *P. cinereus* do not display territorial behavior. Furthermore, the extent to which males and females display territoriality can differ among populations. We tested the hypothesis that populations and sexes of *P. cinereus* differ in territorial behavior by comparing behavioral responses among seven different populations across Pennsylvania. We found that populations differ in four of the behaviors that we recorded: all trunk raised, edging (walking along edge of experimental chamber), nose taps, and bites. Other behaviors, such as body flattening and touching between salamanders, do not differ among populations. None of these behaviors significantly differed between sexes. We concluded that differences in behavior among populations is due to variation in resource abundance at these different locations. The study of territorial behavior in *P. cinereus* could be extended to determine how territoriality differs throughout the entire geographic range. Furthermore, determining levels of resource availability for different populations is a key factor that can influence population size, habitat, and behavior.

285 SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION & BEHAVIOR, Empire Hall South - JF Rochester Riverside Convention Center, Friday 13 July 2018

Sarah McGrath, David McLeod and Morgan Steffen

James Madison University, Harrisonburg, VA, USA

Exploring the Microbiome: Diversity of the Microbial Community of Three Foam Nesting Frogs, Genus: *Polypedates*, Across a Developmental Gradient

Characterization of microbial biodiversity, including that of the amphibian skin-associated microbiome, is a burgeoning frontier of research recently made accessible through advances in sequencing technology. The interaction between microbe and host has been shown to have profound influences on host health across a wide range of macroscopic organisms. Amphibians are currently one of the fastest disappearing vertebrate groups on the planet, due in part to skin-associated diseases caused by pathogenic microbes. Therefore, it is particularly important to characterize the amphibian skin-associated microbiome and to delineate the host-microbe relationships that may influence host health. In determining the microbial community of amphibian skin, it is important to consider how microbial communities are established. One of the fundamental questions related to the microbiome of amphibians and other organisms is: To what extent are skin microbes being passed down from parent to offspring (vertical transmission) or obtained from the environment? This study will focus on characterizing the cutaneous microbial diversity of three species of Southeast Asian tree frogs (family Rhacophoridae) that reproduce via the specialized breeding strategy of building a foam nest. Microbes associated with reproducing adults, foam nests (a reproductive specialization),

tadpoles, and the surrounding environment will be compared. Delineating these ecological relationships (between host, microbe, and environment) is important because it adds a missing piece to our knowledge of the natural world and can broadly inform conservation efforts for amphibians worldwide.

595 SSAR SEIBERT SYSTEMATICS & EVOLUTION II, Highland B, Friday 13 July 2018

Sean Mchugh and Kelly Zamudio

Cornell University, Latham, NY, USA

Evolution of Body Size and Sexual Size Dimorphism in Tortoises

Sexual size dimorphism (SSD) varies in terrestrial vertebrates from male biased to female biased. In tortoises, SSD and body size vary widely across the family while following Rensch's rule, an allometric trend in which the intensity of male biased SSD increases and female biased SSD decreases as average body size increases. The ubiquitous male combat found within the family is theorized as driving a progressive male biased trend in SSD in the clade from a female biased ancestor. Using phylogenetic comparative methods, we found that while tortoises follow Rensch's rule, clades within the family do not. We found that South African tortoises followed isometry, and tortoises of the genera *Manouria* and *Gopherus* exhibited a qualitative pattern reverse of Rensch's rule. Furthermore, evolutionary rates for male and female body size varied from clade to clade. Males rates were higher in three clades, female rates were higher in one clade, and rates were the same for each sex in another clade. We also found that the evolution of body size followed a similar pattern in males and females and only diverged near the tips, with males becoming larger than females in some lineages. The evolution of male biased SSD was correlated with egg mass. Our results indicate that the evolution of SSD in tortoises is not uniform, and that current distribution of SSD biases is the result of recent divergences in body size driven by multiple selective mechanisms.
