

ABSTRACTS – 2008

JOINT MEETING OF ICHTHYOLOGISTS & HERPETOLOGISTS
COMPILED BY M.A. DONNELLY (underlined name = presenter)

Roberts to Zawadzki

0706 Poster Session III, Sunday July 27, 2008

Mixed Stock Analysis of Adult Male Loggerhead Sea turtles (*Caretta caretta*) from Cape Canaveral, Florida, USA

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Relatively little is known about male sea turtles compared to their female counterparts. While genetic studies have shown that males are not restricted to mating only with females from their natal beach, freeing them from the geographic constraints such a restriction might place on their movements, it is still unclear where males spend the majority of their lives. Unlike females, whose nesting activity makes them easily observable, males are seldom seen. Loggerhead sea turtles (*Caretta caretta*) in the North Atlantic are well studied, with genetically identifiable nesting populations. Using this information, several studies have been conducted to determine the natal origins of mixed aggregates of subadult loggerheads, particularly in the south eastern United States. However, analyses of this type are typically incapable of detecting differences between males and females. Given previously published genetic studies describing different mating strategies for the two sexes, as well as temperature dependent sex determination allowing for different sex ratios on thermally dissimilar beaches, an understanding of the sex-specific composition of mixed aggregates is important information to consider in conservation management decisions. Here, 39 identifiable males and 27 undifferentiated subadults from a mixed feeding assemblage at Cape Canaveral, Florida - a known biogeographic "break" in sea turtles - are analyzed to determine potential natal beach contributions. This unique data set provides further insight into male loggerhead sea turtle life histories.

0761 General Herpetology II, Jarry/Joyce, Monday July 28, 2008

Reptile and Amphibian Responses to Large-Scale Wildfires in Southern California

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In 2003, southern California experienced several large fires that burned thousands of hectares of wildlife habitats and conserved lands. In order to investigate the effects of the fires on reptile and amphibian communities, we compared the results from pre-fire sampling to those from the second and third years post-fire among 38 burned and 17 unburned plots. The sampling plots were spread over four vegetation types and four open space areas within San Diego County. Our capture results indicate

that burned chaparral and coastal scrub lost herpetofaunal species diversity post-fire and displayed a significant shift in community structure. In these vegetation types, the average shrub and tree cover after the fires decreased by 55% in chaparral and 76% in coastal scrub. Post-burn herpetofauna community structure was more similar to unburned grassland. We found no differences in herpetofaunal species diversity or community composition in grasslands or woodland/riparian vegetation where shrub and tree cover did not change. At the individual species level, *Sceloporus occidentalis* was the most abundant reptile both before and after the fires. We saw increased net capture rates for *Aspidoscelis tigris*, *Phrynosoma coronatum*, and *Uta stansburiana* in burned chaparral and *Aspidoscelis hyperythra* and *Uta stansburiana* in burned coastal scrub. The toad, *Bufo boreas*, was detected at significantly fewer burned plots in chaparral after the fires. Additionally, we documented decreases in the area occupied by *Elgaria multicarinata*, *Batrachoseps major*, *Coluber constrictor*, *Lampropeltis getula*, *Pituophis catenifer*, and *Masticophis lateralis* in coastal scrub and chaparral. We discuss these individual species results as they relate to specific life history traits, such as susceptibility to initial mortality and post-fire changes in habitat suitability and prey availability. We foresee that a continued unnatural fire regime for southern California will result in a simplification of the southern California reptile and amphibian communities.

0147 General Herpetology I, Salon 4&5, Sunday July 27, 2008

Diet of Burmese Pythons in South Florida

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Burmese pythons (*Python molurus bivittatus*) are native to southeast Asia, but are an invasive, non-native species that has become established in the Southern Everglades, and potentially other conservation areas in south Florida on both the mainland and the Florida Keys. They are generalist predators that consume a wide variety of mammal and bird species, as well as reptiles, amphibians, and fish. Our purpose is to understand the diet of Burmese pythons in order to assess their impact on native fauna and to predict what species are at risk. Prey species in the digestive tracts of Burmese pythons were identified by examining hair, bone, and teeth. Fourteen species of mammals, five species of birds, and one species of reptile have been found in the digestive tracts of pythons collected and examined in Florida, including several federally endangered Key Largo woodrats (*Neotoma floridana smalli*); one threatened species, the American alligator (*Alligator mississippiensis*); and two species of special concern, the limpkin (*Aramus guarana*) and the white ibis (*Endocernis albus*). We have also found the remains of a bobcat (*Lynx rufus*), and white-tailed deer (*Odocoileus virginianus*). Given the diverse dietary habits of the Burmese python, it is possible that other federally endangered or threatened species in Florida may be at risk as prey. In addition to the Key Largo woodrat, protected species believed to be at risk include the Florida panther (*Puma concolor coryi*), mangrove fox squirrel (*Sciurus niger avicennia*), Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*), wood stork (*Mycteria Americana*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), and American crocodile (*Crocodylus acutus*).

0089 Biodiversity & Agriculture I, Drummond, Friday July 25, 2008

Agrochemicals Increase Trematode Infections in a Declining Amphibian Species

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Global amphibian declines have often been attributed to disease, but ignorance of the relative importance and mode of action of potential drivers of infection has made it difficult to develop effective remediation. In our field study, the widely used herbicide, atrazine, at measured concentrations less than 1 µg/L, was the best of over 240 plausible predictors of the abundance of larval trematodes (parasitic flatworms) in the declining northern leopard frog, *Rana pipiens*, and the effects of atrazine were consistent across trematode taxa. The combination of atrazine and phosphate, major agrochemicals in global corn and sorghum production, accounted for 74% of the variation in the abundance of these often debilitating larval trematodes. Path analysis of the field data and mesocosm experiments support a causal mechanism whereby these agrochemicals increase exposure and susceptibility to larval trematodes by augmenting intermediate hosts and suppressing amphibian immunity. These results raise concerns about the role of atrazine and phosphate in amphibian declines and illustrate the value of quantifying the relative importance of multiple plausible drivers and mechanisms of disease risk.

0055 General Ichthyology II, Salon 6&7, Saturday July 26, 2008; STOYE
GENERAL ICHTHYOLOGY

Phylogenetic Systematics of the Flatfish Family Pleuronectidae (Percomorpha: Pleuronectiformes)

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The pleuronectiform family Pleuronectidae contains 60 species of primarily dextral flatfishes, in 23 genera. They occupy mostly benthic marine habitats and maintain a broad distribution, inhabiting all oceans of the Northern Hemisphere. Previous phylogenetic analyses, utilizing characters of adult osteology and external morphology, recovered four major lineages of the Pleuronectidae. To test monophyly of these lineages, and to determine intergeneric relationships, DNA sequences (totalling approximately 2300 bp) from the nuclear recombination activating gene 2 (RAG 2), and the mitochondrial genes, NADH dehydrogenase subunit 1 (ND1) and NADH dehydrogenase subunit 2 (ND2), were obtained for 20 pleuronectid genera. Sequence data were analyzed using parsimony and Bayesian methods, and the reconstructed phylogenies are presented. General trends in, and

the phylogenetic significance of, external larval morphology of the Pleuronectidae are also discussed. Larval characters are presented as an additional line of evidence to support the phylogenetic position of genera within the Pleuronectidae.

0022 Poster Session III, Sunday July 27, 2008

The Conservation Status of the Southern Cavefish *Typhlichthys subterraneus* in Arkansas

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We investigated the status of the southern cavefish (*Typhlichthys subterraneus*) in Arkansas. Its presence in the state represents the western-southern limits of its distribution. Three localities have been confirmed that contain individuals of this species: Richardson Cave (Fulton County), Alexander Cave/ Clark Spring (Stone County) and Ennis Cave (Stone County). A fourth locality has been cited as a well in Randolph County, but because the exact location is unknown, its presence has not been confirmed. There are also a number of unconfirmed localities for "cavefishes" in the region. Populations of this species in Arkansas seem to be small (less than 100 individuals) which is common among populations of hypogean amblyopsids elsewhere. All the confirmed localities are in areas either under controlled access by the private owners or by the federal government. No immediate threat to these populations was found by either overcollecting or other anthropogenic causes. Yet long-term monitoring of the recharge zones is recommended since pollution of these areas has been the major ecological problem for this and other hypogean amblyopsids species elsewhere. Current work suggests that the populations in Arkansas may represent a new species of *Typhlichthys*.

0187 General Ichthyology I, Drummond, Saturday July 26, 2008

The Hypogean Fishes of China

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China has 91 species of hypogean (cave and artesian) fishes described so far. That is nearly one third of all the hypogean species that have been described in the world (298). That figure places China as then country with the largest proportion of those kinds of fishes. Of all Chinese hypogean fishes 55 species show troglomorphisms, i.e., adaptations that have been correlated to the hypogean environment such as reduction and/or loss of eyes, pigmentation, and the swim bladder. Additionally, two other characters seem to be unique to some of the hypogean species of China: presence of a horn-like structure and hyperdevelopment of the dorsal area similar to a humpback. Despite the fact that the first written account of a cave fish took place in China in 1540, almost all the new descriptions occurred in the last 20 years mostly in papers written in Chinese and/or in journals of difficult access outside China. We summarize all the basic knowledge about the hypogean fishes of China and put them in context regarding all the hypogean fishes in the world.

0271 Sustainable Harvest Symposium, Drummond, Monday July 28, 2008

Comparison of Feasible Demography and MSY Models and Their Predictions for Terrapin Management

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We analyzed a twenty-year mark recapture data set of the diamondback terrapin, *Malaclemys terrapin* using both a feasible demography and a maximum sustainable yield (MSY) approach. The terrapin is a species with delayed maturity, low reproductive rates, and low juvenile survivorship. The feasible demography technique uses a life table approach to determine how variation in survivorship in different age classes affects population stability. The MSY technique evaluates the effects of removal (harvest) on population size and recruitment potential. Both approaches indicate that removal of 2-3% of the adults per year from this population would result in population decline, indicated as a net reproductive rate of less than 1 for the feasible demography approach and a reduction in brood stock and recruitment potential by the MSY approach. Thus, terrapin populations cannot sustain a viable commercial harvest. A key component of the success of the MSY technique was the availability of a long-term mark-recapture data set to estimate the parameters incorporated into the model. Although the Maryland legislature closed the terrapin fishery through legislative process in 2007, the regulatory agency was prepared to establish a moratorium on the fishery based on the outcome of the MSY approach in case the legislation failed. Our results suggest that MSY models can have similar predictions to the feasible demography approach. However, both rely on the availability of accurate, long-term data sets to ensure accurate parameters are included into the models.

0417 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

Widespread Occurrence of *Batrachochytrium dendrobatidis* in the Southeastern United States

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The chytridiomycete fungus, *Batrachochytrium dendrobatidis* (BD), has been associated with amphibian population declines in other areas but its prevalence and host taxonomic associations in the southeastern United States are unclear. From 1999 to 2006, we sampled >1,000 amphibians for this fungal pathogen at 27 sites in 9 states of the southeastern U.S. Using histological techniques or PCR assays, we detected BD infection in 10 species of aquatic-breeding amphibians in 6 states. The prevalence of BD infection was 17.8% for samples of postmetamorphic amphibians examined using

skin swab-PCR assays ($n = 202$ samples from 12 species at 4 sites). In this subset of samples, anurans had a much higher prevalence of infection than caudates (39.2% and 5.5%, respectively). Mean prevalence in ranid frogs was 40.7%. The only infected salamanders were *Notophthalmus viridescens* at 3 sites in 3 states. The results of our study indicate that the taxonomic breadth of species known to be infected with BD in this region is broader than was previously understood. We found infected amphibians from late winter through late spring and in 1 autumn sample. Despite the ubiquity of BD infection, we confirmed only 8 cases of probable chytridiomycosis involving individuals found dead or exhibiting clinical signs of disease. Although we observed other mortality events at 6 sites, the die-offs were not attributed to BD. In general, we observed a pattern of widespread and apparently subclinical infections. However, because most of the sites in our study were visited only once, we cannot dismiss the possibility that chytridiomycosis is adversely affecting some populations.

0508 Poster Session II, Saturday July 26, 2008

No Evidence for Sex-Biased Dispersal in Eastern Foxsnakes (*Elaphe gloydi*) within Two Disjunct Regional Populations in Ontario

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Dispersal is a key life history attribute of animals and has a direct impact on the genetic structure and persistence of populations within a species. New molecular techniques have allowed for quantification of dispersal and gene flow across spatial scales, and also permit the estimation of sex-biased dispersal. Sex biased dispersal can result in differential genetic structure for males and females and has been widely studied in mammals and birds. In striking contrast, there are few estimates for reptiles. Our study, one of the first for snakes, assesses whether sex biased dispersal exists within two regional populations of eastern foxsnakes (*Elaphe gloydi*) using eleven high resolution DNA microsatellites developed for the eastern foxsnake. Using comparisons of mean A_{IC}, variance in A_{IC}, F_{ST} and F_{IS} between males and females, we found no evidence for sex-biased dispersal in either regional population. This may be due to dispersal (and concomitantly gene flow, which is evident among sites within regions) occurring during the juvenile stage of the snakes' life history, before dispersal decisions based on sex are typically made. Alternatively, this species of snake may not be strongly influenced by the factors promoting sex-biased dispersal for other taxa.

0672 Poster Session II, Saturday July 26, 2008

Daily Movements and Activity of Stinkpot Turtles (*Sternotherus odoratus*) in a Southwestern Michigan Lake

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Studies of activity, habitat use, and home range size can lend insights into foraging behavior and limitations on energy acquisition. We used radiotelemetry to study

movements of Stinkpot Turtles (*Sternotherus odoratus*) in a small southwestern Michigan lake over two summers. *Sternotherus odoratus* moved mainly within the littoral zone but one individual used a stream and its adjacent terrestrial habitat. Turtles moved greater distances during the late morning and late afternoon hours when compared to early morning and mid-day hours indicating some degree of crepuscular activity. Daily distances moved averaged less than 100 m d⁻¹ and there were no significant effects of weather conditions or sex on mean total daily distance moved. Shell surface temperatures more closely paralleled water temperature at the littoral zone bottom (ca. 50 cm) than at the water's surface (ca. 2 cm) suggesting that turtles spent much of their time on the bottom. Mean total daily distances moved were positively correlated with mean daily air and water temperatures indicating some temperature limitations on movement. Minimum convex polygon home range size estimates for turtles in the lake averaged less than 2.5 ha and did not vary between sexes.

**0042 Conservation in Canada, Salon 4&5, Saturday July 26, 2008;
CARCNET/RÉCCAR**

Genetic and Morphologic Analysis of a Hybrid Zone in Toads, *Bufo americanus* and *B. hemiophrys*, in Southeastern Manitoba

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Hybrid zones (narrow regions where genetically distinct populations may interbreed to produce hybrids) are good "natural laboratories" to study processes involved in evolution, the creation of new species and the maintenance of genetic barriers. The present study aims to investigate a hybrid zone in southeastern Manitoba using mitochondrial DNA markers, nuclear DNA markers and morphometric analysis. Two species of toads, *Bufo americanus* and *B. hemiophrys*, interbreed in this region and produce fertile hybrids. Previous studies of this hybrid zone described its general location and form using morphological characters and data from isozyme electrophoresis, but the level of concordance between characters encoded by nuclear genes with each other and with mtDNA haplotypes is unknown. Mitochondria are known to spread through populations across hybrid zones between species. Because mitochondrial genes are routinely used to study species-level evolution and taxonomy, using DNA barcoding for example, it is important to understand how well mitochondrial and nuclear genomes actually match each other. This project allow us to better understand the dynamics of this hybrid zone, leading to further research on specific isolating mechanisms, and eventually help us understanding more general processes as speciation through hybridization and species boundaries.

0351 General Herpetology II, Jarry/Joyce, Monday July 28, 2008

Phylogeographic and Demographic History of the Milk Snake, *Lampropeltis triangulum*: The Impact of Glacial Cycles on a Pan-tropical and Temperate Vertebrate

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The milk snake (*Lampropeltis triangulum*) is one of the most widely distributed squamates in the New World, ranging from the northeastern U.S. and southern Canada, across the U.S. and into northern South America. Thus, they are a prime candidate to investigate phylogeographic structure and demographic responses to glacial cycles. We identify several major lineages of milk snake found in specific geographic areas using inferences from the cytochrome b gene. Additionally, relaxed phylogenetic divergence dating and coalescent information revealed that fluctuations in population size might be tied to glacial cycles. Finally, to corroborate these results, we have produced an anonymous loci library of independently evolving nuclear genes.

0318 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008

Dive Characteristics and Movement Patterns of Acoustic and Satellite-Tagged Manta Rays (*Manta birostris*) in the Revillagigedo Islands of Mexico

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Individual manta rays (*Manta birostris*) were tagged with either PAT or coded acoustic tags for a period of 12 days at two separate Islands (San Benedicto and Roca Partida). Three subsurface recorders were placed around San Benedicto and continuous movements of animals were monitored around the island and between the islands and the Baja California peninsula. Analysis of recorded data indicated that the animals are within range of the fixed recorders less than two percent of the total time and that attendance appears to be primarily between 0100 hrs and 1300 hrs. Animals fitted with PAT tags travelled between the attachment sites and areas adjacent to the Baja California peninsula. Travel routes to and from the peninsula were similar in both animals. Total travel distances were 2249 and 1063 km., at calculated average speeds of 8.8 and 2.5 km/hr. respectively. Initial analysis show that both mantas move in sinusoidal cycles from the surface and between 72 and 80 meters during the period of travel. Hours of sunlight were spent at shallower depth than those during the night, where animals appear to be following the lower boundary of the thermocline. Several descents exceeded 200 meters, with a maximum of 450 meters, ranging between surface temperatures of 28 C to 10 C at depth.

0714 Poster Session I, Friday July 25, 2008

Photo-Identification of the Manta Ray, *Manta birostris*, in the Revillagigedos Islands, Mexico

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Photographic samples have been obtained for a population of manta rays for the past three decades. Based on differences in color and marking pattern we have established the presence of two forms, referenced here as chevron and black morphs. Chevron and black animals compose 70.2% and 29.8% respectively of the known population and do not differ significantly in either size or sex ratio. Dissimilar individual markings occur in both morphs and do not appear to change over time. The use of a four-point grid matching technique of the ventral surfaces has allowed us to recognize 225 individuals to date. Seventy-one (32.5%) of the animals have been resighted and one individual has been seen 13 times. Three are known for a period of fifteen years. Females represent 55.9% and males 44.1% of the sexed individuals (n= 111). Known populations of manta rays in the Pacific and Indian Oceans appear to lack the black morph. Chevron individuals in these populations show recognizably different markings on both the surfaces which appear to be regionally specific. They are also of smaller body size and seem to reach reproductive maturity at sizes well below those of this population. These differences may suggest ecotypes as a function of differences in food availability or character displacement as well as the absence of gene flow.

0609 Poster Session II, Saturday July 26, 2008

Multiple Estimates of Terrapin Clutch Size at Gateway National Recreation Area, New York and New Jersey: What is the "real" average?

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One-year studies are often used to assess clutch size parameters in turtle populations. However, can a single year of data provide a good estimate of the "real" average clutch size? How large must samples be to provide reliable estimates? At Gateway National Recreation Area in New York and New Jersey, diamondback terrapin (*Malaclemys terrapin*) clutch size data were collected 1998-2001, 2004-5, and 2007. A total of 400 nests were counted from the main island, Rulers Bar Hassock (average 12.5 eggs/clutch). Clutches from another 29 nests were collected from two islands (Little Egg Marsh and Ruffle Bar) in Jamaica Bay; they had an overall average of 12.9 eggs/clutch. The overall average size was 12.6 eggs/clutch. Clutch size on these islands was not significantly larger than on Rulers Bar Hassock. We also examined 169 clutches from Sandy Hook, the southern section of GNRA and potentially a different breeding population, where the average clutch size was 10.5 eggs. This was significantly smaller than that of the Jamaica Bay population. We conducted a series of tests to determine which year we achieved a good estimate of clutch size, and found that the data from 1999, 2000, 2001, 2005, and 2007 were not statistically different from the overall average. In one case, a sample size as small as 13 nests was very close to the overall average. However, in 2004, when data were collected from 142 nests, the average was significantly different from the overall average. This suggests that in some cases 142 nests may not be enough to determine the average clutch size of a population. Given that clutch size data are not usually

normally distributed, simulation experiments will be needed to estimate the number of nest samples needed in order to obtain a robust estimate of average clutch size.

0549 AES Physiology/Conservation, Kafka/LeMaratine, Sunday July 27, 2008

Acquisition, Husbandry and Release Techniques for the Giant Manta Ray (*Manta birostris*) At Atlantis Resort, Bahamas

Keisha Russell

Atlantis Resort, Nassau, Bahamas

Over the past 7 years the Atlantis Resort has successfully displayed 8 Giant Manta Rays (*Manta birostris*) with 3 of them currently on exhibit in a 2.3 million gallon lagoon that also features other tropical marine species. As the only aquarium facility in the Western Hemisphere displaying Giant Manta Rays, we have been afforded the unique opportunity to observe how mantas behave, feed and interact with each other, each displaying distinguishing characteristics and different personalities. Recent tracking programs using satellite tags has provided further insight to some of the natural habits of this species.

0610 Poster Session III, Sunday July 27, 2008

Predicting Suitable Habitat for the Northern Prairie Skink (*Plestiodon septentrionalis*) in Manitoba

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The northern prairie skink (*Plestiodon septentrionalis*) is the only lizard found in Manitoba, Canada and is currently listed as endangered, in part, due to its limited Canadian distribution. The prairie skink's range appears to be limited to the sandy habitats in the southwestern portion of the province in several disjunct populations roughly 150 kilometres from the nearest southern population. In this study, we used coarse-scale environmental features (soil characteristics, temperature and land-use patterns) to predict habitat suitability for *Plestiodon septentrionalis*. We identified suitable habitat using the locations from historical captures provided by the Manitoba Conservation Data Centre, locations of our own field captures from 2006, and literature reports on the habitat requirements of this species. Using a Geographic Information System (GIS) and data available from the Manitoba Land Initiative (MLI), three qualitative habitat suitability indices (low, moderate, high) were derived from specific combinations of soils, climate and land use criteria. Our model identified suitable habitat centred around the Carberry and Lauder Sandhills; both areas are within the known distribution for this species. In addition, the model predicted suitable habitat in the Portage Sandhills and in the southeastern portion of Manitoba, neither of which have known prairie skink populations. We used field captures from summer 2007 to test the accuracy of the habitat suitability model. This habitat suitability model will aid in defining critical habitat for this endangered Canadian species.

0732 Fish Systematics IV, Salon A&B, Monday July 28, 2008

A Preliminary Molecular Phylogeny of Syngnathid Fishes

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Syngnathid fishes are a diverse, unique, and charismatic group that include over 50 genera and at least 278 valid species of pipefishes, seahorses, sea dragons, and pipehorses. Many syngnathids are heavily exploited for traditional Chinese medicines and the aquarium trade, and they occur in some of the ocean's most threatened habitats. Management of syngnathids is undermined by their challenging alpha taxonomy, and systematic relationships are unresolved at multiple levels. Many genera are monotypic, yet no study has measured the degree of evolutionary uniqueness of these lineages. Here, we present comparative nucleic acid sequence data derived from mitochondrial CO1, 12S, 16S and nuclear intron RP-1 of ribosomal gene S7. Fifty-two species from 36 genera were sequenced for a total multi-gene aligned sequence length of 4260 base pairs. Phylogenetic relationships were reconstructed using parsimony and Bayesian methods, with node support calculated through full heuristic bootstrap resampling. Caudal fin and brood pouch morphology, two characters previously applied to morphological phylogenies, were mapped onto the resulting phylogenetic hypotheses. The results do not support division of this group into the Hippocampinae (seahorses) and Syngnathinae (all other syngnathid lineages). Syngnathids exhibiting the tail brooding strategy (Urophori) do not form a monophyletic clade, with the abdominal brooding strategy (Gastrophori) sister to one clade of Urophori. While a suite of well supported clades suggest diversification patterns among some species and genera, including (Micrognathus + Syngnathus), (Filicampus + Trachyrhamphus), ((Kaupus + Pugnaso) + (Histiogamphelus) + (Vanacampus) + (Hypselognathus)), and (Doryrhamphus + Maroubra)), the relationships among these clades are unresolved. The weedy and leafy sea dragons form a monophyletic clade, but Haliichthys, the ribboned "sea dragon", is only distantly related. The 'pipehorse' genera Solegnathus, Syngnathoides, Acentronura, and Idiotropiscis are particularly problematic. Additional nuclear markers and thorough taxon sampling are needed to produce a molecular phylogeny sufficiently robust to support syngnathid taxonomy, systematics, biogeography, and conservation.

0015 General Ichthyology I, Drummond, Saturday July 26, 2008

Piscatorial Travelogue of the 2006 Expedition to Mongolia

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In August 2006 the All Catfish Species Inventory and Cypriniform Tree of Life Project sponsored a joint expedition to northeastern Mongolia to collect fishes and aquatic invertebrates. A total of 16 sites in four major drainages was sampled: Selenge, Kerulen, Onon and Halhin/Buyr Lake. The expedition yielded 12,308 fish specimens (12,302 formalin fixed plus 6 preserved for skeletons) representing approximately 35 species in 29 genera and 12 families. Tissue samples were preserved for approximately 300 specimens representing nearly all taxa from multiple drainages. The expedition website

(<http://silurus.acnatsci.org/ACSI/field/Mongolia2006>) displays 115 images of live and preserved fishes plus additional images of collecting sites and habitats. The Amur catfish, *Silurus asotus*, was found in the Kerulen and Onon basins and Buyr Lake. Where sampled Buyr Lake was devoid of large adult fishes, apparently as a result of severe over-fishing. Two species found in the lake are newly reported for Mongolia and appear to have been recently introduced: *Abbottina rivularis* (Chinese false gudgeon; Family Cyprinidae) and *Rhinogobius* cf. *lindbergi* (Amur goby; Gobiidae). Highlights of the fish, fluvial and lacustral diversity of eastern Mongolia will be presented.

0014 Fish Systematics I, Salon A&B, Friday July 25, 2008

Revision of Recent *Doras* Lacepède, 1803 (Siluriformes: Doradidae) with Descriptions of Three New Species

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Recent *Doras* are newly diagnosed among Doradidae by the unique combination of maxillary barbel long and fimbriate; mesethmoid with rostral lateral margins converging towards pointed tip; single cranial fontanel anterior to epiphyseal bar and contained largely within frontals and anteriorly by mesethmoid; anterior nuchal plate wide, pentagonal to hexagonal, sharing distinct lateral suture with epioccipital and isolating supraoccipital from middle nuchal plate; nuchal foramina absent; coracoid process short, posterior tip finishing well short of that of postcleithral process; dentaries with acicular teeth; and skin ventral to postcleithral process perforated with conspicuous pores. One fossil species, †*D. dioneae*, and two nominal recent species, *D. carinatus* and *D. micropoeus*, are recognized as valid. Three additional recent species, *D. "phlyzakion"*, *D. "higuchii"* and *D. "zuanoni"*, are newly described from the middle Amazon and tributaries, lower Amazon tributaries, and rio Araguaia (Tocantins drainage), respectively. *Doras* "phlyzakion" and *D. "zuanoni"* form a monophyletic group that is found in lowland, lentic habitats, and is characterized by numerous pores in skin on breast and abdomen, a trait unique among doradids and perhaps among all catfishes. The remaining recent species, *D. carinatus*, *D. "higuchii"* and *D. micropoeus*, with uncertain relationships, are found in upland, lotic habitats. The occurrence of *D. carinatus* in the Orinoco basin suggests a historical link between right-bank tributaries of the lower Orinoco (e.g., Caroní) draining the western Guiana Shield and more eastern rivers (e.g., Cuyuní-Essequibo) that drain the Shield directly into the Atlantic Ocean.

0493 General Herpetology I, Salon 4&5, Sunday July 27, 2008

Developmental and Ecological Impacts of European Buckthorn Invasion on Amphibians

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Emodin, a metabolic compound found throughout tissues of the invasive shrub European buckthorn, has been demonstrated to cause endocrine disruption in mammals. Given the aggressive growth of buckthorn around amphibian breeding

ponds, effects of emodin on amphibian development are of great interest. We used FETAX (Frog Embryo Teratogenesis Assay-*Xenopus*) to determine if emodin affects development of amphibian embryos. The FETAX had 5 treatments; a negative control (Ringer's solution), a positive control (6-animonicotinamide), and emodin treatments of 1, 10, and 100 ppm. The negative control resulted in 18% mortality with 29% of surviving embryos exhibiting minor axial malformations. The positive control resulted in 42% mortality with 86% of surviving embryos exhibiting severe gut, tail, and notochord malformations. Emodin treatments of 1, 10, and 100 ppm resulted in 30%, 45%, and 100% mortality, respectively. In the 1 ppm emodin treatment, 90% of surviving embryos exhibited gut, tail, notochord, and eye deformities. In the 10 ppm emodin treatment, 100% of surviving embryos exhibited severe notochord and tail malformation, stunted growth, abdominal edema, and severe eye malformations. Development was too abbreviated in the 100 ppm emodin treatment to score malformations. To determine ecologically-relevant concentrations of emodin entering the ecosystem, High Power Liquid Chromatography was applied to European buckthorn leaves, fruit, and soil extracts. Soil samples from buckthorn-infested sites had emodin concentrations ≥ 2 ppm. Future work will include quantifying emodin in pond water. However, results presented here suggest emodin contamination resulting from invasive European buckthorn may represent an unrecognized threat to pond-breeding amphibians.

0731 Poster Session II, Saturday July 26, 2008

Histopathology of the Gills of *Astyanax fasciatus* and *Pimelodus maculatus* of Reservoir from Dam of Furnas, Brazil

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Fishes are often exposed to polluted water by industrial, agricultural and urban discharges. The gills play multiple functions such as respiration, nitrogen excretion wastes and ion- and osmoregulation and are the first organs contacting the external environmental. Histological studies focus on the cell structures and the severity of lesions to evaluate the organ function provides a useful tool to check pollution, sub-lethal and chronic effects and may be considered as a bioindicator. To evaluate the integrity of gills, fish (*A. fasciatus* and *P. maculatus*), water and sediment were sampled on six sites in the Furnas Power Plant reservoir, MG, Brazil, in July and December. The histopathologies were classified as hypertrophy and hyperplasia of gill epithelia, changes in mucous and chloride cells, blood vessels and necrosis. *A. fasciatus* shows hypertrophy of gill epithelia, lamellar epithelial lifting and rupture, hypertrophy and hyperplasia of chloride cells and rare focus of necrosis, while *P. maculatus* shows hypertrophy and hyperplasia of gill epithelia and chloride cells, complete fusion of several lamellae, lamellar epithelial lifting, aneurysms and focal necrosis. The presence of organochlorides and heavy metal on the water and sediment may be related to histopathological tissue damage in these species. Financial support: Furnas Centrais Elétricas S.A., FAPESP, CNPq, CAPES

0189 Biodiversity & Agriculture I, Drummond, Friday July 25, 2008

Historical and Emergent Stressors Acting on Amphibian Populations on Agricultural Landscapes: Assessing Risks, Effects, and Conservation Programs

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Based upon the results of an international workshop in St. Louis, Missouri, in 2007, intensive agricultural land use continues to cause dramatic changes to ecosystems worldwide. These changes occur primarily due to habitat loss and fragmentation, hydrologic alterations, and applications of pesticides and fertilizers. More recently, production of crops for biofuels, the use of genetically engineered organisms, and emergent diseases have become agents for further change to the ecological structure within agricultural landscapes. It also is clear that direct, indirect, and interactive effects of historical and emergent stressors must be considered within the context of climate change. Given overlap between amphibian species richness, land-use changes within existing agricultural landscapes, and new conversions of native habitat to agricultural production, we need integrated assessments of the ecological effects agricultural practices cause in concert with other stressors and the effectiveness of conservation programs to mitigate them. In the midwestern United States, we are using geospatial and hydrologic analyses and modeling, linked to sampling *in situ*, to study risks and effects from these stressors for amphibian populations. We also are studying outcomes of the U.S. Department of Agriculture's Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP) for amphibian populations. Results thus far suggest varying combinations of agricultural and non-agricultural stressors pose differential risks to amphibian populations across the Midwest. Populations persist, but trends in relation to stressors generally are unknown and continued reductions in the quantity and quality of habitat are likely. Consequently, conservation programs such as the CRP and WRP are critically important. While these programs have helped conserve and restore terrestrial and wetland habitats in heavily farmed landscapes, and we are working to evaluate resultant benefits for amphibian populations, placement of these sites might need to be considered more strategically from an ecological perspective.

0168 Poster Session I, Friday July 25, 2008

Interrelationships and Historical Biogeography of Cypriniform Fishes (Actinopterygii: Ostariophysii): Evidences from Mitochondrial Genomics Placed Familial/Subfamilial Branching and Intercontinental Exchanges Older Than Fossil Records

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Order Cypriniformes (Actinopterygii: Ostariophysii) comprises more than 3400 species placed in five to eight families and restricted almost entirely to freshwaters. Our previous study comparing whole mitochondrial genomes from 53 taxa, with rooting from six outgroup taxa, resolved many of the interrelationships among families and subfamilies. The present study includes seven additional mitochondrial genomes of *Gila conspersa* and *Mylocheilus caurinus* from Western North America, *Pseudogobio esocinus* from East Asia, *Paralauca typus* from South Asia, *Raiamas senegalensis* from Africa, *Labeo boga* from South Asia, *Ictiobus bubalus* from Eastern North America and re-sequenced *Crossostoma lacustre* from South Asia. Addition of these taxa makes our taxon sampling more geographically representative with at least one taxon sampled for subfamilies or tribes with intercontinental ranges. Unambiguously aligned concatenated sequences (14,594 bp) were divided into seven partitions (first, second and third codon positions of protein-coding genes, stem and loop regions of rRNA and tRNA genes). Partitioned maximum likelihood analysis with RY coding for third codon positions of protein-coding genes strongly reconfirmed the framework of our previous Bayesian analysis. Lower bootstrap support for the ML tree and higher probabilities for alternative topologies indicated branches with low reliabilities and indicated problems to be solved in the future. Bayesian divergence time analysis based on the amino acid sequences with the sarcopterygian-actinopterygian split as a calibration point (4.19-4.72MA) revealed most branching nodes in Cypriniformes were much older than known fossil records. Dispersal-vicariance (DIVA), a parsimonious and gain-loss ratio analyses of historical taxon biogeography at the subfamilial level indicated the initial geographic range of the Cypriniformes was in south-eastern Laurasia (present-day South Asia).

0036 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008;
GRUBER

Diet and Trophic Position of *Mobula thurstoni* and *Mobula japonica* as Inferred from Stable Isotopes of Nitrogen and Carbon

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Mobula thurstoni and *Mobula japonica* are two of the five mobulid species present in the Gulf of California. They have been an important component of the artisanal elamosbranch fishery of Mexico, but are presently protected as their populations are vulnerable to over-exploitation. Stable isotopes of nitrogen and carbon were used to infer the diet and trophic position of *M. thurstoni* and *M. japonica* in the SW Gulf of California. A total of 32 *M. thurstoni* and 6 *M. japonica* muscle samples were obtained from May 2006 to January 2007. Eleven monthly diurnal and nocturnal plankton tows were carried out from March to November 2006. We analyzed stable isotopes of *Nyctiphanes simplex* (a euphausiid, and the mobulid's most probable prey) as well as of herbivorous, carnivorous and omnivorous zooplankton. Based on isotopic fractionation between mobulids and their potential prey, we conclude that both mobulid species fed on *N. simplex* and not on other zooplankton groups analyzed. We calculated a trophic level of 3.43 for *M. thurstoni* and 3.48 for *M. japonica*. The isotopic signal of zooplankton varied with oceanographic conditions, with lower $\delta^{15}\text{N}$ values in times of higher productivity.

0468 Poster Session II, Saturday July 26, 2008

Biological Aspects of Some Sciaenid Species from the Marine Area Along the Via Parque Isla De Salamanca, Colombian Caribbean

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Monthly samples of fish captures using a chinchorro (dragging net) were carried out in the Caribbean marine shore of the Via Parque Isla Salamanca (departamento de Magdalena, Colombia). The sampling period covered two climatic seasons: rainy (September-November, 2006) and dry (February-April, 2007). The sciaenid species registered were *Larimus breviceps*, *Micropogonias furnieri*, *Stellifer venezuelae*, *Paralonchurus brasiliensis*, *Umbrina coroides*, and *Menticirrhus littoralis*. Some biological aspects, such as length-weight correlation, size structure, sex ratio, and maturity states, of the three more abundant species [shorthead drum (*L. breviceps*), whitemouth croaker (*M. furnieri*), and Venezuelan stardrum (*S. venezuelae*)] were studied. Size-weight regressions estimated for shorthead drum (n=67), whitemouth croaker (n=39), and Venezuelan stardrum (n=44) were $w = 0.0041 L^{3.4027}$, $w = 0.0057 L^{3.205}$, and $w = 0.0017 L^{3.7255}$, respectively; all species showed allometric growth. For shorthead drum a size structure ranging between 9 and 21.9 cm and a sex ratio of 2.94 females for each male were established. Gonad states were variable for this species: juveniles were found from February to March, and states II to IV were present along the whole study period. For whitemouth croaker the most abundant sizes were 17-23.9 cm and a sex ratio of 1.05 males: 1 female was found; gonad states were variable for this species: juveniles, maturing, and mature specimens were found

in all months, but spent individuals appeared only in September and October. Most Venezuelan stardrum were captured between 13-14.9 cm, with sizes ranging from 8 to 16.9 cm, male-female ratio was 0.62:1. Specimens in states I, II, III, and IV were found between September and October and spent individuals appeared only in October.

0334 Poster Session I, Friday July 25, 2008

Age and Growth of the Silky Shark, *Carcharhinus falciformis*, on the West Coast of Baja California Sur, Mexico

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The age and growth of the silky shark, *Carcharhinus falciformis*, caught from August 2000 to October 2002 on the west coast of Baja California Sur, Mexico, are described. In total 252 sharks were registered, mainly between June and November. The ages of 145 organisms were estimated using vertebra growth marks. The females were between 88 and 230 cm total length (TL), and the males between 142 and 260 cm TL. The relationship of vertebra radius to TL showed a rectilinear tendency with a coefficient of determination $r^2 = 0.94$, indicating that vertebrae are useful for age estimates and description of growth in this species. It was assumed that growth marks have annual periodicity and that the opaque band is formed during summer and fall. The estimated age for females was between 2 and 16 years, and for males between 3 and 14 years. No significant difference between sexes in size or age was detected. The estimated parameters for the growth model of von Bertalanffy for combined sexes were $L_{\infty} = 240$ cm TL, $k = 0.138$ year⁻¹ and $t_0 = -2.98$ years. According to the growth model, the silky shark averages 20 cm growth in the first year of life; 16 cm/year between 2 and 4 years; 10 cm/year from 5 to 7 years; 6 cm/year in the next 4 years and 3 cm/year or less after 11 years of age. It was determined that females and males reach sexual maturity between 7 and 8 years of age.

0689 Fish Systematics IV, Salon A&B, Monday July 28, 2008

A Molecular Phylogeny of the Grunts (Perciformes: Haemulidae) Inferred from the Nuclear RAG1 and COI Gene Sequences

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We infer a phylogeny of the haemulid genera using approximately 1386 base pairs of the nuclear Recombination Activation Gene-1 (RAG1) from 35 haemulid species representing 13 genera, one species of the closely related Inermiidae, and two species of the outgroup Sparidae. This analysis is corroborated using approximately 650 base pairs of the mitochondrial Cytochrome Oxidase I (COI) gene and RAG1-COI combined gene analyses. Results show strong support for a monophyletic Haemulidae. However, the placement of Inermiidae within the proposed superfamily Haemuloidea remains unresolved. The subfamilies Haemulinae and Plectorhinchinae are recovered from both maximum parsimony and maximum likelihood analyses using RAG1, COI, and RAG1-COI genes combined. The RAG1 gene phylogeny combined with distribution data also revealed a biogeographic pattern that suggests a specific radiation of haemulids. There was strong support for

a basal paraphyletic Old World (coastal Eurasia, Africa, Australia, and western central Pacific) group, a derived monophyletic New World (coastal Americas) group, and an intermediate Old World-New World group, which can be accounted for by the closing of the Tethys Sea and widening of the Atlantic Ocean. In addition, molecular data using RAG1 and COI genes highlighted potential problems regarding the validity of several haemulid genera and suggest a re-evaluation of these genera. Finally, this study indicates that the nuclear RAG1 gene is useful for inferring phylogeny at the intrafamilial level for this percoid family of fishes.

0643 Poster Session I, Friday July 25, 2008

Histology of Lateral Line in Embryos of *Potamotrygon motoro* (Chondrichthyes: Potamotrygonidae)

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Potamotrygon motoro is a stingray restrict to freshwater environment. It exhibit benthonic habits, unrelated with morphological findings of neuromast pore channel distribution on the lateral line. The purpose of this study was examined by light and scanning electron microscopy the lateral-line sense organs in the embryos skin of freshwater stingray *Potamotrygon motoro* in four different stages of embrionary development. The neuromast is composed by a sensory hair cell, surrounded by support cell, mantle cell, and a jelly cupula. Some degenerated sensory cell was presented, and this fact is related with cell turnover. As the animals develop toward later embryo stages, the epidermis surface becomes thickened and the number of neuromasts higher. The neuromast morphology is similar in stage 3 and 4 of embrionary development.

0252 Reptile Ecology, Salon 6&7, Friday July 25, 2008

Variation in Bufadienolide-Based Chemical Defenses of the Natricine Snake, *Rhabdophis tigrinus*, in Japan

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Recent studies have documented that the Asian natricine snake *Rhabdophis tigrinus* sequesters its chemical defenses from a dietary source. The defensive nuchal glands of *R. tigrinus* contain a variety of bufadienolide toxins that ultimately are derived from toads consumed as prey. Recent studies have identified 17 bufadienolides from nuchal glands of *R. tigrinus* and have revealed modest variation among snakes in bufadienolide composition (a measure of the type, number, and quantity of bufadienolides present). The observed variation in toxins of *R. tigrinus* may reflect patterns of chemical variation in their bufonid prey and likely has important implications for the efficacy of chemical defense in these snakes. In this study, we

further examine variation in bufadienolide composition of *R. tigrinus* by comparing samples from 42 locations within Japan. We describe patterns of variation in composition between sexes, among syntopic individuals, and among individuals from different locations. We use multidimensional scaling (MDS) as a graphical tool for the visualization of differences in bufadienolide composition, and analysis of similarity (ANOSIM) to detect statistical differences in composition. This study reveals considerable variation in bufadienolide composition among individuals of *R. tigrinus*. We identified more than 35 bufadienolides, including more than 20 new bufadienolides from *R. tigrinus* that will require further characterization. This variation may result from differences in the composition of ingested bufadienolides (perhaps reflecting regional variation among populations of toads) and/or modification of bufadienolides by the snakes. Whether the widely varying combinations of compounds observed among *R. tigrinus* differ in their effectiveness as defensive chemicals remains to be determined.

0674 Herp Systematics, Drummond, Friday July 25, 2008; STOYE GENETICS, DEVELOPMENT & MORPHOLOGY

A Time-Calibrated Phylogeny for *Anolis*

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The origins of terrestrial Caribbean fauna remain mysterious and competing hypotheses may be grouped into those proposing vicariance or dispersal. The lizard genus *Anolis* is notably diverse and ubiquitous on Caribbean islands, as well as being spread throughout neighboring continental regions. Our goal is to generate a time-calibrated molecular phylogeny for the anole radiation and to use this phylogeny to evaluate competing biogeographic hypotheses for the origin of the West Indian biota. Our phylogeny results from analysis of multiple nuclear genes and a 1,200 bp fragment of mitochondrial DNA. Although only one meaningful calibration for this phylogeny can be obtained from the fossil record, a growing number of biogeographic calibrations are becoming available. Use of these dates has the advantage of including a broad spectrum of calibration dates scattered across the phylogeny. Additionally, the diversity of anole lineages often permits calibration of multiple nodes with the same biogeographic event. Thus, whole-tree validation procedures allow for a thorough evaluation of individual calibrations and individual dating events.

0191 Herp Conservation, Salon 4&5, Sunday July 27, 2008

Permanently Aquatic Salamander Dispersal Capabilities; Implications For Wetland Connectivity

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Amphibians inhabiting isolated wetlands rely on terrestrial landscape connectivity between wetlands for long-term population persistence. Research focusing on the role of landscape connectivity for amphibians has been restricted to species with a

terrestrial life-stage component. Although permanently aquatic salamanders are commonly encountered in isolated wetlands, their movement ecology has yet to be conclusively determined. For these salamander species, temporary waterways formed during heavy rains may provide transient dispersal opportunities between otherwise isolated wetland patches. We assessed the vagility of two obligate aquatic salamanders, greater siren (*Siren lacertina*) and two-toed amphiuma (*Amphiuma means*), by running them on a Living Stream track under three simulated environmental conditions: terrestrial dispersal (damp but no standing water), shallow standing water (one centimeter of water), and complete submergence (approximately five centimeters of water). Both species demonstrated a trend towards exhaustion in the 0cm and 1cm treatments, and failed to move more than 8m in either treatment. As expected, animals in the fully submerged treatment were the most vagile and showed little to no tendency to exhaust. Physical characteristics (body length, mass, and condition) did not affect dispersal ability. An aquatic corridor in which these salamanders are completely submerged is the likely method of movement. Therefore, maintaining the surrounding landscape to allow formation of temporary waterways is important for successful inter-wetland movement. Human activities that alter flooding events and watershed connectivity, such as flood control regimes and roads, may have important implications for wetland connectivity, and thus metapopulation viability of permanently aquatic salamanders.

0203 Poster Session III, Sunday July 27, 2008

Patterns of Fish Diversification in the Lower Congo River Rapids Region of West Central Africa

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The Congo River forms one of the largest biogeographical barriers in Africa – yet we know remarkably little about the history of the system. Geologists estimate that perhaps as recently as 400,000 years ago the Congo was a large lake with no outflow to the Atlantic. At some point the Congo breached the Batéke Plateau in the region of present day Malebo Pool (ex-Stanley Pool), most of the lake was drained and a “new” river cascaded down through gorges of the Crystal Mountain region, dropping 280m over 350km to reach the Atlantic Ocean. Today, some of the most spectacular rapids on Earth and a rich endemic fish fauna are found in the lower Congo River between Pool Malebo and the Atlantic. Its peculiar hydrology, with a linear array of variously sized rapids, pools and runs represents a biohydrologic model system for exploring patterns of species richness and endemism in the region. In this study, molecular and morphological differentiation is examined in endemic species from three genera of small cichlids, *Teleogramma*, *Lamprologus*, and *Thoracochromis*, and in the cyprinid, *Garra congoensis*, all of which are distributed throughout the lower Congo rapids region. For the morphological component, landmark based geometric morphometric studies were conducted, focusing on both whole-body external shape and cranial anatomy. Principal Components Analysis (PCA) revealed separation among many geographical populations, but with some overlap. In contrast, molecular analyses using mitochondrial CO1, ND2, and cyt-*b* revealed a marked separation between populations on opposite banks of the Congo, separated by an intervening rapid, at some localities; microsatellite data are now being assimilated to further elucidate these patterns. This hidden molecular diversity poses challenges to current taxonomy and illuminates patterns of differentiation across geographic axes, potentially elucidating mechanisms driving speciation in the lower Congo River.

0059 Poster Session III, Sunday July 27, 2008

Detection of Wood Frog Egg Masses and Implications for Monitoring Amphibian Populations

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Annual counts of egg masses have been promoted as an appropriate state variable for monitoring populations of some amphibian species. However, if some egg masses are not detected and detectability changes over time, the use of egg mass counts is unreliable. Variation in counts of egg masses may be indicative of variation in actual abundance or variation in detectability. We used closed capture-recapture models to estimate detection probability and evaluate potential sources of variation in the detectability of Wood Frog (*Rana sylvatica*) egg masses in a pond in Rocky Mountain National Park in 2003 and 2004. Model selection results and model-averaged estimates provided evidence that detection probability varied between years. However, we found no evidence of variation between observers within each year. The results of this study provide additional evidence that detection probability needs to be accounted for if egg mass counts are to be used to infer abundance and population trends in amphibian populations.

0471 Fish Systematics I, Salon A&B, Friday July 25, 2008

Molecular Systematics and Morphological Variation in Mountain Catfishes (Amphiliidae, *Amphilius*) in Guinea, West Africa

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A morphometric and molecular analysis was performed on specimens identified as *Amphilius* from Guinea, West Africa. Specimens and tissue samples of *Amphilius atesuensis*, *Amphilius rheophilus*, and *Amphilius platyichir* were collected in the streams of the Fouta Djallon, Zone Forestière, and coastal drainages during expeditions in 2003. A geometric morphometric (GM) analysis showed significant morphometric variation within the *A. platyichir* complex. The GM analysis also showed significant morphometric variation within the *A. rheophilus* complex. Phylogenetic analysis of partial sequences of mitochondrial cytochrome *b* gene revealed three distinct clades corresponding to *A. platyichir*, *A. atesuensis*, and *A. rheophilus*. Within the *A. platyichir* clade well supported deep divergence was observed between specimens from the Fataala River and those from the Konkouré, Gambie, and Senegal River basins. The *A. rheophilus* clade displayed well supported divergence between specimens from the Rio Corubal basin and those from the Senegal River basin. This divergence corresponds to the significant morphometric variation observed with the GM analysis.

0033 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008;
STOYE GENETICS, DEVELOPMENT & MORPHOLOGY

Occipito-Vertebral Gap: The Complex Structure of the Anterior Part of the Vertebral Column in Barbeled Dragonfishes (Stomiidae, Teleostei) and its Phylogenetic Implications

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The Stomiidae were traditionally placed in six separate families. Fink (1984, 1985), reanalysed stomiid intrarelationships, based primarily on osteological characters and parts of the soft anatomy, and presented evidence for uniting the six stomioid families into one. Today these families are designated as subfamilies within the Stomiidae (Nelson, 2006), but there is a high degree of homoplasy in the datasets, and existing morphological data suggest that most subfamilies are not monophyletic. In most stomiid genera there is a huge gap between the skull and the first fully ossified vertebra, within which only the flexible notochord persists. Several morphological studies in the early 20th century revealed that 15 stomiid genera have one to ten of the anteriormost vertebrae reduced or absent. However the restructuring of the anterior portion of the vertebral column has never been included as a character in phylogenetic analyses, because it is poorly understood. Comparative study of the insertion of the anteriormost myosepta in all 28 genera provides new insight into the morphology of the anterior part of the vertebral column. Counting the spino-occipital nerves provides an additional source of information about the number of reduced vertebral centra, and investigation of larval morphology sheds light on how the absence of vertebral centra arises through ontogeny. With this new approach a revision of the previously reported number of reduced or absent vertebrae shows that only in two stomiid genera (*Chauliodus* and *Eustomias*) are vertebral centra indeed lost, with their respective neural arches and parapophyses persisting. In all other genera the extensive occipito-vertebral gap is not a consequence of reduced vertebrae, but of an elongation of the notochord. The complex structure and ontogeny of the anterior part of the vertebral column appears to offer valuable information for the elucidation of stomiid phylogeny.

0660 Poster Session I, Friday July 25, 2008

A Preliminary Revision of the *Dionda Episcopa* Complex

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Accurately defining species is critical to protecting biodiversity because species are usually the biological units that receive legal protection and are the elements of comparative studies. Several species concepts have been proposed in the literature and were grouped into four categories by Johnson *et al.*, 2004: 1) phylogenetic species concept; 2) similarity species concept; 3) ecological species concept; and 4) biological species concept. The diversity of *Dionda* inhabiting the Rio Grande Basin has had a confused taxonomic and systematic history, mostly due to the overall morphological similarity and the lack of a comprehensive study of the complex. This group of small North American cyprinids represents the currently restricted genus *Dionda sensu stricto*, separate from a new genus containing other species formerly in *Dionda* in

Mexico (Schonhuh *et al.*, in press). Among all the species of *Dionda*, only *D. diaboli* has remained taxonomically stable since its original description, while the other nine described forms (*D. melanops*, *D. argentosa*, *D. serena*, *D. nigrotaeniata*, *D. couchi*, *D. texensis*, *D. papalis*, *D. flavipinnis*, *D. punctifer*) have been considered synonyms or subspecies of *D. episcopa* (Miller, 1991; Mayden *et al.*, 1992). *Dionda* currently includes at least six recognized and described species, but their boundaries, delimitation and characterization have never been satisfactorily addressed. In this study, we undertook a genetic survey (2 mitochondrial and 2 nuclear genes), to test species boundaries. These data reveal 12 species that currently comprise the genus *Dionda* and we propose some junior synonyms to be elevated to full species.

0348 Herp Genetics, Salon A&B, Sunday July 27, 2008

Genetic Population Structure of the Sand Skink (*Plestiodon reynoldsi*) within Scrubs in Florida

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The sand skink, *Plestiodon reynoldsi*, is a fossorial lizard that is restricted to scrub habitat on the central ridges of peninsular Florida. The sand skink is threatened throughout its range. Urban and agricultural development of its naturally fragmented habitat poses a conservation threat. As a result of natural fragmentation, barriers to gene flow may already exist at a fine-scale, and further development may have a negative impact on the genetic diversity of *P. reynoldsi*. Previous research finds genetic structure among discrete geographic samples across the range of *P. reynoldsi*. The goal of this study is to conduct a more fine-scale examination of the extent of gene flow within and between scrub patches using multiple microsatellite DNA loci. We screened multiple microsatellite loci in individuals ($n > 300$) from the scrub surrounding the Archbold Biological Station near Lake Placid, Florida. The Archbold region has patches of unsuitable wetland habitat, which may serve as barriers to gene flow, as well as regions of more homogeneous scrub habitat. We also screened individuals ($n = 10 - 50$) from multiple samples of a less fragmented scrub habitat and additional discrete geographic samples from central Florida. Individual-based assignment testing, estimates of genetic differentiation, and spatial genetic analyses will be used to investigate population structure among all individuals sampled. The Archbold sample (highly fragmented) will be compared to the other samples (less fragmented) to investigate the effect of fine-scale fragmentation on the genetic diversity of sand skink populations. Additionally, we will investigate possible effects of a managed burn regime on sand skink population structure within the Archbold samples.

0755 Poster Session II, Saturday July 26, 2008; STORER HERPETOLOGY

Effects of Hurricane Disturbances on Herpetofaunal Communities in Southeastern Louisiana

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Reptile and amphibian community dynamics are understudied in Southeastern Louisiana even though major habitat changes and climatic events have occurred over the last several decades. Standard transect field surveys were conducted in levee and marsh habitats of the Manchac Wildlife Management Area and in a nearby swamp habitat, diurnally and nocturnally once a month from October 2002 to November 2004 and again in March 2005 to November 2006 to identify herpetofaunal communities. During the course of this study three hurricanes (Ivan, Katrina, and Rita) caused extensive flooding in the survey sites, which allowed us to compare species richness, diversity, community assemblage, and abundance before and after hurricane events. We observed the highest herpetofaunal species richness in the swamp habitat (23 species), followed by levee (21 species) and marsh (15 species) habitats. Herpetofaunal diversity was greatest in marsh habitat ($H' = 2.082$), however the swamp habitat harbored the highest number of unique species. Overall, herpetofaunal diversity decreased and evenness increased in each habitat following hurricanes Ivan and Katrina. Most species showed a decline in abundance throughout the study, however species were differentially affected causing shifts in dominant species. Significant saltwater input was recorded in marsh and levee habitats, but not in the swamp. Changes seen in herpetofaunal diversity and abundance may amount to long-term effects to community structure and ecosystem dynamics of the study area.

0612 Herp Systematics, Drummond, Friday July 25, 2008

Phylogenetic Analysis of South American Liolaemini Lizards Using Nuclear and Mitochondrial DNA

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Phylogenetic relationships among over 90 species of Liolaemini lizards are examined using combined and separate analysis of mitochondrial and nuclear DNA sequence data. All major lineages within *Liolaemus* and *Phymaturus* are included. Over 3200 base pairs of nuclear DNA encoding TLR7 and GJA1 are analyzed using parsimony, maximum likelihood, and reversible jump Bayesian methods and subsequently combined with approximately 1750 base pairs of mitochondrial data from the region spanning ND1-COI. Phylogenetic hypotheses generated from both nuclear DNA regions are congruent with those derived from mtDNA data alone. Combined analyses provide robust support for relationships among most major clades of Liolaemini lizards. The utility of TLR7 and GJA1 as informative nuclear markers for herpetological systematics will be discussed.

0451 Reptile Ecology, Salon 6&7, Friday July 25, 2008

Stability, Fragility and Resilience: Demography and Life History of Mt. Chappell Island Tiger Snakes

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In populations, stability can refer to the persistence of demographic structure when challenged by unpredictable change. One such change, loss of individuals of a particular age group, could imbalance this stability unless other ecological factors

lead to recovery. This recovery is a collective variable known as resilience, an understanding of which may demonstrate the overall behaviour of the system. Mt. Chappell Is. in the Furneaux Group in Bass Strait, near Tasmania, with an area of about 300 hectares, supports a single species of snake, the tiger snake (*Notechis scutatus*: Elapidae), with the largest average adult body sizes of any conspecific population on islands or mainland areas. The great size of these adult snakes appears related to their sole prey, hatchlings of the short-tailed shearwater, or muttonbird (*Puffinus tenuirostris*). A quarter million shearwaters breed annually on Mt. Chappell Is. and chicks are available as prey for the snakes for only about five weeks. Seasonal sampling and metabolism of radioactive isotopes determined that adults must starve between feeding periods. Mark-release-recapture studies over 10 consecutive years of field work show that yearly adult population sizes average 2701 ± 568 and survivability estimates average 0.98 ± 0.21 . Growth models suggest 10 years for neonates to reach maturity. Adult male and female numbers are nearly equal and only half of the females are reproductively active each year. Nevertheless, annual reproductive potential is 11,250 neonates, with little apparent recruitment of juveniles into the adult population. Historical records show that in the 1950's 500+ adult snakes (18.5%) were removed from the island, most in only a few days. The mechanism of recovery in the current population is unknown. As a possible scenario, if juvenile mortality is due to starvation from intense intraspecific competition for small lizards and the inability of larger juveniles to catch small lizards, loss of adult females could reduce the number of young snakes born each year and raise the per capita availability of lizard prey. Greater juvenile survival to a size capable of swallowing a muttonbird chick could restore the adult populations to previous levels. This apparent resilience, speculative but believable, suggests that the adult population size may regulate the K-levels of juveniles.

0637 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

Insights from Imperfect Data: Climate Change, Disease, and Amphibian Declines

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We review the evidence for the role of climate change in triggering disease outbreaks of chytridiomycosis, an emerging infectious disease of amphibians. Both climatic anomalies and disease-related extirpations are recent phenomena, and effects of both are especially noticeable at high elevations in tropical areas, making it difficult to determine whether they are operating separately or synergistically. Reports of amphibian declines from Lower Central America and Andean South America were compiled to create maps and construct statistical models to test our hypothesis of spatiotemporal spread of the pathogen *Batrachochytrium dendrobatidis* (*Bd*), and to update the elevational patterns of decline in frogs belonging to the genus *Atelopus*. Claims of climate change influencing the spread of *Bd* were evaluated by including error into estimates of the relationship between air temperature and last year observed. Similarly, we evaluated spatiotemporal patterns of pathogenic spread by incorporating error into estimates of dates of decline. Available data support the hypothesis of multiple introductions of this invasive pathogen into South America and subsequent spread along the primary Andean cordilleras. Additional analyses found no evidence to support the hypothesis that climate change has been driving outbreaks of amphibian chytridiomycosis, as has been posited in the climate-linked epidemic hypothesis. Future studies should increase retrospective surveys of

museum specimens from throughout the Andes and should study the landscape genetics of *Bd* to map fine-scale patterns of geographic spread to identify transmission routes and processes.

0013 Sustainable Harvest Symposium, Drummond, Monday July 28, 2008

Commercial Harvesting of Turtles: A Possible Disconnect Between Theory, Empirical Data, and the "Real World"?

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Historically, many freshwater turtle populations in North America have been harvested heavily for food and the pet trade. However, a series of recent field and simulation studies indicate that, for many (if not most) species of turtles, commercial harvests cannot be considered sustainable. Despite these studies, commercial harvests for turtles continue in many states and federal lands and other states have implemented restrictions only in the past few years. In addition, some resource agencies have declined to restrict harvesting on the basis of lack of evidence. In this paper we (a) review the available literature on the impacts of harvesting on turtle populations, (b) review a series of case studies where turtle harvesting regulations have been proposed and either adopted or rejected, and (c) discuss why there appears to be a "disconnect" between field data and population models on the one hand, and actual practices by management agencies on the other.

0692 Poster Session I, Friday July 25, 2008

Evolutionary Relationships of the Frog Genus *Callulops* (Anura, Microhylidae)

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Papua New Guinea remains an area of high biodiversity, this is particularly true regarding amphibian richness. The frog amphibian communities are part of this high diversity and many species remain undescribed. Understanding alpha diversity is important and preliminary step to assess phylogenetic relationships for any group of organism. Among frogs, the family Microhylidae is represented in New Guinea by the subfamily Asterophryinae and these are among the frogs for which we have the least amount of data. Herein, we present preliminary data on the diversity and relationships of the genus *Callulops*. The genera *Xenobatrachus*, *Hylophorbus*, *Oreophryne*, *Austrochaperina*, and *Cophixalus* are used as outgroups. We sequenced a fragment of about 900 basepairs the 12S mitochondrial ribosomal.

0254 Fish Ecology II, Salon A&B, Monday July 28, 2008

What Happened to Small Scales? The Balance between Spatial scales in the Distribution and Co-occurrence of Stream Fish Communities

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Contemporary ecology is greatly interested in understanding processes that take place at broad or regional scales, emphasizing spatial organization and dispersal of individuals as important agents linking and structuring aquatic systems. Although important, this view is compelling ecologists to focus in increasingly larger scales, neglecting variation at very small scales that perhaps are deemed no longer important. Given their physical constraints, stream systems are ideal to understand how different spatial scales influence community structure, species distributions and patterns of co-occurrence among fish species. Streams are often organized as a sequence of pools, riffles and runs. This organization allows replicated conditions at different spatial scales regarding habitat type (micro and macrohabitat) and environmental heterogeneity (within and across sites). In this study, we present the results of a field survey of several streams that aimed at assessing the links between habitat variation and fish distribution at the microhabitat, reach and catchment scales. Our results indicate that a great proportion of the variation in fish distribution and co-occurrence occurs at the microhabitat scale, demonstrating the need of considering ecological patterns also at very small scales. In addition to describing these results, we will also discuss an analytical framework for determining the levels of variation in fish distribution and fish community-environment relationships at multiple scales.

0304 Poster Session II, Saturday July 26, 2008; STORER HERPETOLOGY

Diet of the Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, along the Upper Texas Coast

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All life stages of the critically-endangered Kemp's ridley sea turtle, *Lepidochelys kempii*, seasonally inhabit the northwestern Gulf of Mexico. An ontogenetic shift occurs at about age two, when juveniles leave pelagic *Sargassum* mats for coastal areas, where they forage on benthic invertebrates. Diet characterization, therefore, can be utilized to determine life history stage, as well as important prey types. Fecal samples were collected from 17 immature ridleys (18.6-41.2 cm straight carapace length [SCL], mean=32.3 cm, SD=5.5 cm) encountered in Galveston County, Texas as recreational hook-and-line captures (n=15) or strandings (n=2) during 2005-2007. Samples were also collected from a subadult (58.2 cm SCL) that stranded in Matagorda County and an adult female (62.8 cm SCL) captured offshore Jefferson County. Over half of the samples (53%) contained blue crab (*Callinectes sapidus*) or *Callinectes* spp., and other common prey included calico crab (*Hepatus ephiliticus*), hermit crabs, and worm tubes. *Sargassum* was found in 53% of samples, whereas 58% contained shell hash and/or rocks. Five ridleys (26.1-41.2 cm SCL) had consumed both *Sargassum* and bottom material, indicating the upper Texas coast serves as

habitat for new recruits transitioning from the pelagic stage. In addition to providing foraging opportunities, this geographical region puts ridleys at risk for interactions with human activities, as evidenced by samples containing a candy wrapper (n=1), aluminum (n=1), and mullet (*Mugil* sp.), a common bait (n=1). The impacts of anthropogenic factors such as competition with commercial fisheries for prey, interactions with recreational fishing, and debris ingestion within this developmental habitat should be reviewed by managers to ensure the species' recovery. Future research will include sample collection during 2008 and subsequent analysis of 2005-2008 data. Staff at the NOAA Sea Turtle Facility assisted with turtle response, care, and sample collection. EES is supported by a Texas A&M University Tom Slick Graduate Fellowship.

0242 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008

Reproduction of Three Species from the Mobulidae Family in the SW Gulf of California, Mexico

Javier Serrano-Lopez, Felipe Galvan-Magaña, Rosa Ochoa-Baez, John O'Sullivan

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The highest mobulid catches in Mexico occur in the southwest Gulf of California. There is, however, a lack of information about the general biology and reproduction of the dominant species in the catch. During two years (2002 and 2004) we collected 358 mobulid samples in the fishing camp of Punta Arena de la Ventana. The most abundant species was *Mobula japanica* (37%), which we established that sexual maturity was reached at 200cm DW using the length and calcification of claspers in males from different sizes, and oocytes development and oviduct condition in females. We suggest that *M. japanica* gives birth during May and June, and mating occurred during July to August. The second most abundant species was *Mobula munkiana* (36%). There was size segregation and sex segregation depending on the time of year. *Mobula munkiana* individuals attained sexual maturity at 100 cm DW; we suggest that they give birth in May and June and mate in July and August. The least abundant species was *Mobula thurstoni* (27%). For this species the sexual maturity was attained at 150 cm DW. This species gave birth in July and August and mating occurred in September and October. We found that mobulid species analyzed, had functional only the left ovary and oviduct, and only one pup by reproductive cycle. The mating season happen during summer and fall; however the mating months were different in each mobulid species.

0615 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT SYSTEMATICS/EVOLUTION

An Introduction to FISH-BOL, the Fish Barcode of Life Initiative

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Indonesia is home to several hotspots of global biodiversity. One of them – Wallacea

– includes the island of Sulawesi, the Moluccas, and the Lesser Sunda Islands. We have used DNA barcoding and also nuclear loci to test for areas of genetic endemism (AGEs) in the largest and second largest islands of the Wallacea hotspot, Sulawesi and Halmahera. On Halmahera, our results from 14 sympatric species of herpetofauna indicate that there is very little genetic between populations on different peninsulas, although these Halmahera species do appear distinct from those on surrounding islands. This story is contradictory in our findings in the neighboring island of Sulawesi. Our work on one group of *Limnonectes* frogs showed genetic structure distributed congruently to paleo-island boundaries. For our future work, we will further use phylogenetic and population genetic approaches on other islands thus allowing for inter-island analysis in this complex region. We want to discover how species became distributed and their migration routes between these islands. Our studies can be used as background towards conservation management policies, especially concerning the connectivity between islands. So far our studies show on Halmahera and Sulawesi show a sharp contrast, which shows that for within island policies, these two islands must be treated differently.

0642 Biodiversity & Agriculture II, Drummond, Saturday July 26, 2008

Managing Amphibian and Reptile Biodiversity in California's Great Central Valley

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The Great Central Valley of California is one of the richest, most productive, and most intensively utilized agricultural landscapes in North America. It is also an area rich in both plant and metazoan biodiversity, with extremely high levels of endemism. The separation of the Great Central Valley from adjacent landscapes in southern California has been identified as one of the most significant phylogeographic barriers in western North America, and virtually every species of amphibian or reptile that has been examined shows a significant, potentially species-level divergence across the Tehachapi range in southern California. In addition, most species of amphibians and reptiles that inhabit the Valley have either been extirpated, restricted to marginal habitat at the periphery of their range, or are extremely rare, primarily because of agricultural activities and habitat degradation. Our recent work on the California Tiger Salamander, *Ambystoma californiense*, suggests that the species is deeply subdivided genetically across its Central Valley distribution, and that it is threatened or endangered across its range. Our multi-year landscape ecological study of the species demonstrates that individuals move several kilometres from their breeding sites in search of underground retreats, resulting in a requirement of 1000-2000 hectares of upland habitat to maintain a healthy population. Meshing this life history with intensive agricultural land use practices poses a very serious challenge to managers, and we suggest some innovative strategies that may help to maintain the species on some agricultural landscapes. Finally, we use both Ecological Niche Models and a novel Least Cost landscape genetic analysis to better predict how the species utilizes specific landscapes, and thus how to best protect the most critical landscape elements.

0317 Poster Session I, Friday July 25, 2008

Comparative Study of Prey Capture Mechanisms in Freshwater and Marine Stingrays

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The feeding behavior in elasmobranchs has been well documented for shark species; however, the knowledge for batoids still remains scarce. The aim of this study is to provide a comparison of feeding mechanisms between freshwater and marine stingrays under captive conditions. Specimens of *Potamotrygon motoro* (Potamotrygonidae) and *Dasyatis akajei* (Dasyatidae) were maintained in two acrylic aquariums. Video recordings were made using two high-speed cameras at 250 field s⁻¹ positioned at the side and under the aquarium. Twenty-eight video sequences were obtained (13 for *P. motoro* and 15 for *D. akajei*). Ram, bite manipulation, suction capture and suction transport composed the feeding behavior of both species; however, each species adopted somewhat distinct feeding tactics. After capturing the prey by suction or jaw protrusion, *P. motoro* manipulated the prey by expelling and engulfing it two or three times before suction transport. For *D. akajei*, the feeding behavior included prey capture by jaw protrusion and suction transport, usually without the expelling and suctioning phase. Apparently the manipulation phase occurred only for large preys. Anatomical details (e.g. relative mouth size and oral musculature) may explain the differences observed in prey manipulation by the stingray species.

0119 Fish Systematics II, Salon A&B, Friday July 25, 2008

Tempo and Mode of Morphological Diversification in the Anostomoidea (Characiformes): A Phylomorphospace Approach

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Understanding how and why certain clades on the tree of life diversify greatly in morphology while others do not remains a major theme in evolutionary biology. Within the South American fish superfamily Anostomoidea, the families Anostomidae and Chilodontidae demonstrate a remarkable range of skull morphologies and trophic ecologies, while their sister clade formed by the Curimatidae and Prochilodontidae are universally detritivorous and exhibit only two major skull types. This unequal morphological diversification could have been caused by a difference in tempo (the magnitude of morphological change expected per branch of the phylogeny or per unit time) or by a difference in mode (the relative ability of each clade to generate novel morphologies given similar rates of raw change). These two scenarios can be distinguished by projecting families of phylogenies into multivariate morphospaces and reconstructing ancestral morphologies. The resulting phylomorphospaces can be used to infer the magnitude of morphological change along the branches of each possible phylogeny and the density of lineages within morphospace. In the case of the Anostomoidea, unequal morphological diversification resulted not from the morphologically diverse clade changing more on each of its phylogenetic branches, but from that clade distributing

an equal amount of change more widely through morphospace and innovating continually throughout its history. While substantial morphological evolution occurred throughout the history of the less diverse clade, most of that clade's expansion in morphospace occurred in the most basal branches and more derived portions of that radiation typically oscillated within previously explored morphological limits. Comparing the observed phylomorphospaces with simulations revealed that it is very easy to generate two clades with the observed difference in mean morphometric branch lengths under a null Brownian model of evolution, but there is no more than a 5% probability of generating two clades that differ so greatly in the density of lineages. Thus, at least one of the two clades probably evolved under an alternate model of evolution, such as constrained change or adaptive radiation. The unequal morphological diversification of the Anostomoidea likely resulted from a difference in evolution's mode, not its tempo.

0003 Poster Session III, Sunday July 27, 2008

Adhesive Glands in *Gastrophryne carolinensis*

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The histology, histochemistry and ultrastructure of the adhesive breeding glands of male *Gastrophryne carolinensis* are described. Adhesive glands are multicellular exocrine glands in the dermis of the sternum and forearm that cause the male to adhere to the female during amplexus. The epithelial cells have distinct plasma membranes, and the product consists of electron-dense secretory granules that fill the cytoplasm and are released intact by an apocrine process. We support one previous study and contradict another report by finding that adhesive glands react positively for neutral carbohydrates and negatively for glycosaminoglycans and proteins. The ultrastructural results, the first on these organs, confirm that adhesive glands are derived from mucous glands and not serous glands.

0186 Poster Session III, Sunday July 27, 2008

Histology of the Paired-fin Adhesive Pads of Ostariophysan Fishes (Teleostei: Ostariophysi)

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The paired fins of benthic and rheophilic ostariophysan fishes frequently exhibit thickened pads of skin along the ventral surface of the anteriormost rays. These thickened regions of the epidermis, commonly referred to as adhesive pads, are often coated in a layer of unculi and are suggested to be involved in maintaining substrate contact in fast-flowing water. Paired-fin adhesive pads have been documented to date in members of the orders Goniorhynchiformes, Cypriniformes and Characiformes. The microsurface of paired-fin adhesive pads have been investigated extensively using SEM. Less frequently have the paired-fin adhesive pads of ostariophysan fishes been investigated using histological techniques. The histology

of the paired fins of benthic rheophilic ostariophysan taxa from 14 families (representing four orders) was investigated. Histology confirms that the paired-fin adhesive pads in all taxa examined are formed by a thickening of the epidermis on the ventral surface of the anteriormost unbranched and branched rays. A collagenous cushion, deep to the epidermis and ventral to the lepidotrichia, was observed in members of the Balitoridae, Cyprinidae and Psilorhynchidae. Unculi were only observed on the ventral surface of the paired fins in members of the Balitoridae, Characidae, Cyprinidae and Psilorhynchidae. However, non-unculiferous keratinization of the ventral surface was observed in members of the Gyrinocheilidae and Catostomidae. Keratinization, associated with tubercle formation, was observed only in certain members of the Cyprinidae and Balitoridae. Paired-fin adhesive pads were not observed in the siluriform taxa examined. In addition, all taxa exhibited free neuromasts, mucocytes, and saccular secretory cells in the epidermis encompassing each lepidotrichia.

0016 Cottonmouth Symposium, Salon 4&5, Monday July 28, 2008

Reproductive Biology of *Agkistrodon piscivorus*

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Aspects of the reproductive biology of *Agkistrodon piscivorus* from the western portion of their range are described using histological techniques and reviewed and compared with historical data on *A. piscivorus*. The initiation of the reproductive season in these westerly snakes begins with mating in late summer/early fall, concurrent with a peak in renal sexual segment (RSS) hypertrophy in males, and the presence of sperm in the posterior oviduct of females. During this time the oviduct in females synthesizes and stores abundant secretory material in the glandular uterus and the sperm storage region of the posterior infundibulum (SSTs). Sperm reaches the SSTs in females by late fall and remains present in this location through hibernation. Subsequent to hibernation, a similar pattern observed in the late summer/early fall occurs in the spring. This includes mating, as evidenced by sperm in the posterior oviduct and RSS hypertrophy in males. The uterine glands begin releasing the stored secretory material synthesized in the fall during the spring. By late May, mating has subsided, sperm in the posterior oviduct of females degrades (resulting in sperm presence only in the SSTs), and ovulation occurs. The uterine glands remain highly secretory and sperm persists in the SSTs, even though secretory granule synthesis has ceased, through gravidity. Post-partum females (fall to subsequent late summer/early fall) have little or no secretory activity occurring in the uterus or posterior infundibulum, however, sperm can remain in the SSTs until the summer of the next year. Spermatogenesis in male *A. piscivorus* from the western part their range occurs in late spring/early summer followed by another spike in spermatogenic activity in the late summer/early fall. Analysis of previous studies shows that some variation in the timing of male reproductive events may occur when moving west to east through the range of *A. piscivorus*. From our data on the cottonmouth, we propose that when looking at the reproductive biology of populations that inhabit a large range, multiple populations be used in the study to investigate geographic variation within a species. Data from Florida populations of *A. piscivorus* are desired.

0053 AES Management, Jarry/Joyce, Sunday July 27, 2008

Application of a Bayesian Hierarchical Meta-analysis in the Assessment of Pelagic Sharks: A Case Study Using the Night Shark, *Carcharhinus signatus*

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Night sharks, *Carcharhinus signatus*, are an oceanic species generally occurring in outer continental shelf waters in the western North Atlantic Ocean including the Caribbean Sea and Gulf of Mexico. Although information from some fisheries has shown a decline in catches of night sharks, it is unclear whether this decline is due to changes in fishing tactics, market conditions, or species identification. Despite the uncertainty in the decline, the night shark is currently listed as a species of concern due to alleged declines in abundance resulting from fishing effort, i.e. overutilization. A previous study concluded that the night shark did not qualify as a species of concern but the uncertainty in the trends in relative abundance precluded any determination of changes in stock status. Further, the “data-poor” situation precluded the application any typical stock assessment models. While some modeling-based frameworks (e.g. catch-free model) for estimating stock status in situations where catch data are poor have been utilized, the highly uncertain nature of the data for night shark also prevented application of these models. Previous standardized catch rates using a two-part generalized linear model gave conflicting results, with one series showing a decline, two series showing an increase and one series showing constant abundance. To address this uncertainty, we used a hierarchical meta-analysis in a Bayesian framework to estimate changes in relative abundance from fishery dependent and independent catch rate series. Prior probability distributions of the estimated parameters were developed using knowledge of data source and collection method. The final model was fit using R and estimates of trends were based on Markov chain Monte Carlo posteriors. The meta-analytic estimate indicated little decline overall suggesting night sharks have not suffered significant declines in abundance.

0333 AES Habitat & Movement I, Jarry/Joyce, Saturday July 26, 2008

Life in a Macrotidal World: Movements of the Dwarf Sawfish (*Pristis clavata*) in Northern Western Australia

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The short-term movements of adult dwarf sawfish (*Pristis clavata*) were studied using active acoustic telemetry in northern Western Australia. The semi-diurnal tidal variation in this region is extremely large, with a range over 10 m during spring tides. Individual sawfish were tracked for up to four days in shallow coastal waters using small boats. The tracks of five individuals showed very similar movement patterns. For approximately 100 minutes either side of high tide individuals rested in inundated mangrove forests. As the tide fell sawfish moved out of the mangroves and moved to remain in depths from 0-2 m. Individuals moved distances of 3-10 km

during each tidal cycle before returning to the mangrove forest on the next high tide. High tide resting locations for individuals were often within 50 m from the previous tide. The macrotidal environment was concluded to be the dominant factor controlling the movement of dwarf sawfish in this region.

0479 Poster Session II, Saturday July 26, 2008

Factors Affecting Anuran Community Structure within Delmarva Bays: Implications for Conservation and Management

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Many factors across multiple scales affect anuran community structure; understanding these factors is crucial to creating effective management strategies. Land use adjacent to breeding ponds can drastically change anuran community structure. Recent results indicate that alterations in land use may also have indirect effects through modifications to pond pH. Compared to factors such as hydroperiod, pH has received less attention as a major determinant influencing amphibian use of breeding ponds. We selected 55 ponds across a forest buffer gradient (ranging in size from <1 to 3 hectares) using aerial photos and geospatial software. We are presently conducting calling surveys, larval surveys and egg mass counts at each pond. An information-theoretic approach to modeling the probability of calling males at wetlands as a function of hydroperiod and pH suggests hydroperiod plays a predominate role in determining calling, while pH plays a secondary role. *Pseudacris crucifer* and *Rana utricularia* were not modeled as they are heard calling at the majority of wetlands (> 96%). Hydroperiod had a positive effect on the probability of calling for *R. clamitans*, *R. catesbeiana*, and *R. virgatipes*, while other species were most common at wetlands with intermediate hydroperiods. *Pseudacris kalmi* and *R. virgatipes* are less likely to call at wetlands with higher pH, while other species display the opposite trend. Our results suggest pH does play a role in mediating pond-breeding amphibian community structure. Ongoing efforts are investigating links between adjacent land use, hydrology and pH, and incorporating larval surveys.

0496 AES Habitat & Movement I, Jarry/Joyce, Saturday July 26, 2008

Habitat Utilization and Movement Patterns of Juvenile Porbeagle Sharks (*Lamna nasus*) in the Western North Atlantic

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The porbeagle (*Lamna nasus*) is a large, highly migratory endothermic shark broadly distributed in the higher latitudes of the Atlantic, South Pacific, and Indian Oceans. In the North Atlantic, the porbeagle has a long history of fisheries exploitation and recent assessments indicate that this stock is severely overfished. Although much is known of the life history of this species, there is little fisheries-independent information about habitat preferences and ecology. To examine migratory routes,

potential nursery areas, swimming behavior, and environmental associations in the western North Atlantic, we deployed pop-up satellite archival tags on 20 juvenile porbeagles in late November, 2006. The sharks, ten males and ten females ranging from 128-154 cm fork length, were tagged and released from a commercial longliner on the northwestern edge of Georges Bank, about 150 km east of Cape Cod, MA. The tags were programmed to release in March (n=7), July (n=7), and November (n=6) of 2007 and 17 (85%) successfully reported. Based on known and derived geopositions, the porbeagles exhibited broad seasonally-dependent horizontal and vertical movements ranging from 77-870 km and from the surface to 1300m, respectively. All of the sharks remained in the western North Atlantic from the Gulf of St. Lawrence and the coast of Nova Scotia to Georges Bank and oceanic and shelf waters south to North Carolina. In general, the population appears to contract during the summer and fall with more expansive radiation in the winter and spring. Although sharks moved through temperatures ranging from 2-26°C, the bulk of their time (77%) was spent in water ranging from 8-16°C. In the spring and summer months, the sharks remained epipelagic in the upper 200m of the water column. In the late fall and winter months, some of the porbeagles (n=10) moved to mesopelagic depths (200-1000m). Temperature records indicate that these fish were likely associated with the Gulf Stream.

0215 Biodiversity & Agriculture II, Drummond, Saturday July 26, 2008

Effects of Conservation Practices on Fishes, Amphibians, and Reptiles within Agricultural Streams and Wetlands

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Conservation practices have been traditionally used to manage soil and water resources to improve agricultural production, and now include methods to reduce the environmental impacts of agriculture on streams and wetlands. These practices have been regularly implemented within agricultural watersheds in the United States without documentation of their impacts. The goal of the ARS Conservation Effects Assessment Project Watershed Assessment Study is to quantify the effect of conservation practices within 14 agricultural watersheds within United States. All watersheds are evaluating water chemistry and hydrological responses, and ecological responses are being examined in two midwestern watersheds and one southeastern watershed by the CEAP Ecology Working Group. However, we have conducted research on the effects of conservation practices on aquatic biota since the early 1990's. Our objective is to synthesize the results of our past and current research involving fish, amphibian, and reptiles within agricultural streams and wetlands. Research within channelized streams focused on fishes through a combination of field studies evaluating community responses and laboratory studies measuring acute toxicity of Pimephales promelas. Riparian wetland research consisted of field experiments that assessed fish, amphibian, and reptile population and community responses. Our key findings suggest that within agricultural landscapes: 1) a combination of reach-scale habitat structures and watershed scale practices will be needed to positively influence fish communities within channelized streams; 2) conservation practices that only reduce loadings of agricultural chemicals within channelized headwater streams may have a limited short term influence on fish communities, but may reduce the prevalence of sublethal effects; 3) the creation

of differently sized riparian wetlands adjacent to channelized streams will benefit riparian fish, amphibian, and reptile communities; and 4) conservation practices that alter the management of agricultural fields may provide greater benefits for fishes within riverine wetlands than edge-of-the-field conservation practices.

0629 Fish Systematics IV, Salon A&B, Monday July 28, 2008

Relationships of the Stonefishes and Scorpionfishes (Teleostei: Scorpaenoidei)

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Recent molecular studies have suggested that the stonefishes do not form a clade with the traditional scorpionfishes and rockfishes (Scorpaenoidei). This hypothesis was examined using both anatomical and DNA sequence data. Preliminary results find strong support for the monophyly of the stonefishes and corroborate this clade's separation from the Scorpaenoidei. Morphological support for the monophyly and relationships of the stonefishes will be presented in the framework of the combined analysis.

0699 General Ichthyology II, Salon 6&7, Saturday July 26, 2008

The Northern-Most Cave Adapted Fish in the World: Discovery and Population Genetics

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The Pennsylvaniaian grotto sculpin (*Cottus*: Cottidae: Teleostei) was described in 2003 with specimens collected in a small cave in the Nippenose Valley, 15 km SW of Williamsport, PA. The specimens are not strikingly troglomorphic. They still have some pigment, eyes, and response to visual stimuli. The purpose of this study was to establish if the Pennsylvaniaian grotto sculpin is genetically distinct from its surface counterparts. Phylogenetic analysis of mitochondrial (16S rRNA) and nuclear (28S rRNA) haplotypes have surprisingly identified two distinct lineages within the same population of Pennsylvaniaian grotto sculpins. Within a single cave population, individuals have sequence divergence with a range of substitutions similar to those found among different species. However, despite the dramatically divergent DNA, individuals in the cave population reproduce with each other. The two cave lineages are related to either *Cottus bairdi* or to *C. cognatus*, both of which are found in nearby surface creeks. This suggests that the grotto sculpins are derived from a successful hybridization between two surface sculpin species, which were then able to survive in the cavernicole niche. In other sites in this area of Pennsylvania where hybridization occurs between *Cottus bairdi* and *C. cognatus*, hybrids do not successfully reproduce in surface populations, and their gene pools remain separate. The cave environment appears to allow for the hybrid offspring to survive. The cave lineages include haplotypes not found in either of the two surface species, which implies that the Pennsylvaniaian grotto sculpin has followed an independent evolutionary path from the surface species for an extended period of time. The restriction in gene flow allowed the cave sculpins to become troglobitic. These fish also hold the honor of being the northern-most cave adapted fish in the world.

0756 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

Areas of Endemism of New World Freshwater Fishes

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Concentrations of restricted-range species can be used to guide conservation efforts because they offer the opportunity to achieve high species conservation payoffs in a relatively small portion of the earth's surface. To date, this approach has been applied mainly to terrestrial biodiversity (i.e., Biodiversity Hotspots and High Biodiversity Wildernesses). As species mapping efforts advance, it will become possible to base priority areas on explicit range maps for large numbers of species. However, it is urgent to set freshwater priorities before such comprehensive datasets will be available. In order to identify initial priority areas for freshwater fishes, we geo-referenced the type localities for valid species based on stated type localities in Eschmeyer's Catalogue of Fishes, using the standards of the Biogeomancer Project. When the type localities were too vague to map, we substituted a mappable locality near the center of the species range. For the purpose of mapping species concentrations at the continental scale, we reasoned that most freshwater fish ranges are so small relative to potential priority areas that using a single locality per species was as effective as mapping the whole range. We tested this assumption by comparing results based on whole species ranges of Mexican fishes with results based on one locality per species. We also made comparisons with previous analyses of species density in the USA. Both tests showed the method to be effective. We explored various thresh-holds for delineating concentrations of restricted-range species, and this revealed peaks of endemism in southeastern United States, the Mesa Central of Mexico, Meso-America, flanks of the northern Andes, Guyana Shield, several parts of the Amazon Basin, Cerrado-Pantanal, and coast of South America from the Atlantic forest to the Pampas. We are continuing the approach to cover freshwater fishes globally, and parallel studies of dragonflies, damselflies, and freshwater turtles are underway.

0447 Poster Session III, Sunday July 27, 2008

Intraspecific Phylogeography of *Graptemys ouachitensis*

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Geological changes throughout history have had a profound effect on the phylogeography of biota. Contemporary spatial relationships of species are a result of both active and passive changes in their geographic distribution. Although the phylogeographic patterns of ichthyofauna in large river habitats is becoming better understood, little is known about the evolutionary life history of reptiles. The Ouachita Map Turtle, *Graptemys ouachitensis*, is an aquatic, large river turtle species native to the Mississippi River Basin. There are two disjunct populations of this species in the Scioto River, Ohio and the Kanawha River, West Virginia. By sequencing mtDNA control region of *G. ouachitensis*, the phylogenetic patterns of this species were hypothesized. A minimum spanning network of 15 haplotypes from 14 populations uncovered three haplotype groups. All haplotype groups had low levels of sequence polymorphism within groups. This genetic differentiation between the haplotype groups is indicative of a vicariant event occurring within the population.

One haplotype group has a localized distribution, while two haplotype groups are widespread throughout the species range. The lack of genetic differentiation within the haplotype groups as well as their widespread distribution across the species range could be evidence for a dispersal event following the Pleistocene glaciation.

0114 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

CO1 DNA Barcoding Amphibians: Successes and Failures

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A mitochondrial DNA barcode has been shown to be of great utility for species identification and discovery in an increasing number of diverse taxa, however caution has been urged with its application to one of the most taxonomically diverse vertebrate groups – the amphibians. We tested three of the perceived shortcomings of a CO1 DNA barcode's utility with a group of Holarctic amphibians: primer fit, sequence variability and overlapping intra and interspecific variability. We found that although the CO1 DNA barcode priming regions were variable, we were able to reliably amplify a CO1 fragment from degenerate primers and primers with G-C residues at the 3' end. Any overlap between intra and inter specific variation in our taxonomic sampling was due to introgressive hybridization (*Bufo*), complex genetics (*Ambystoma*) or incomplete taxonomy (*Triturus*). Rates of hybridisation and species discovery are not expected to be greater for amphibians than for other vertebrate groups, and thus problems with the utility of using a single mitochondrial gene for species identification will not be specific to amphibians. Therefore, we conclude that there is greater potential for a CO1 barcode's use with amphibians than has been reported to date. In the end, although there will undoubtedly be difficulties, this data set suggests that on the class level, we should not approach this group with an *a priori* expectation that they will be larger or more serious, than for any other taxonomic group of animals. Furthermore, these difficulties will expose questions for further scientific inquiry. It is our conclusion that it is far more advantageous that amphibians be included in a global effort to utilize a standardized gene region for species recognition than to exclude them because we wish for more evidence.

0441 Poster Session I, Friday July 25, 2008

Mineralization of Meckel's Cartilage in the Shark, *Squalus acanthias*: Histological Observations and the Role of Mechanical Stress

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The chondrichthyan (sharks, skates, rays and chimaeras) skeleton is composed of hyaline cartilage surrounded by peripheral units of mineralization known as tesserae which provide strength while allowing for flexibility. Previous observations of *Squalus acanthias* skeletal tissue have shown differences in the development and localization of tesserae across a single cartilage element. We hypothesize that mechanical force and the resultant stresses imparted upon the cartilage may be one factor that influences their formation. To test this hypothesis two groups of sharks

were fed different diets for 12 – 13 weeks, to impart high versus low stress levels on the jaw cartilage during feeding. The first group was fed whole mackerel to stimulate active bite feeding, which requires greater use of the adductor mandibulae complex for an extended period of time. The second group was fed small pieces of chopped mackerel to promote suction feeding and invoke less adductor mandibulae use. Calcein, a fluorescent marker, was injected intramuscularly at the beginning of the study to trace newly mineralized cartilage. A stress-strain gauge affixed to the Meckel's cartilage near the insertion of the quadratomandibularis ventral (QMV) muscle was used to measure the magnitude of jaw cartilage stress imparted by muscles during feeding using. Electromyography provided simultaneous quantification of muscle activity. Demineralized and non-demineralized samples of Meckel's cartilage, individually stained with Alizarin Red S, Verhoeff's, Villanueva Osteochrome and for ALP/TRAP activity, were evaluated for the structure and distribution of tessellate mineralizations and evidence of cellular activity. Fluorescence microscopy revealed new mineralization in the cap and base of the body using calcein and Alizarin Red S for both treatment groups. Other features of jaw mineralization are presented for sharks subjected to the different feeding regimes. Collective histological observations support previous reports of different mechanisms of mineralization in the cap versus body zone of the tessera.

0573 Poster Session I, Friday July 25, 2008

HerpNet: A Global Virtual Museum of Geospatial Data for Herpetological Collections

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HerpNet began in 2003 with 36 North American institutions that shared a common goal of providing a single interface for searching geospatial data for all herpetological collections. Since then, participation has grown to 59 institutions representing 12 countries, with 48 institutions available online. Our major goals for this network were to: 1) advance the development of scalable, interoperable technologies for distributed databases; 2) train the next generation of scientists in biodiversity informatics; and 3) make these locality and specimen data available globally and publicly to allow repatriation to their country of origin. By August 2008, 80% of the unique localities for 3.7 million specimens will be georeferenced and available online for the original 36 institutions. An additional 276,035 georeferenced localities are available from eight non-North American collections. Georeferenced distributed data are the basis for much research in biodiversity and species distributional modeling. Museum data available on this scale are invaluable to studying historic distributions of species and specimen data from areas that are currently too politically sensitive to collect. Spatially accessible specimen records are useful for collection management and conservation. With more "eyes" on the data, data quality improves through time as HerpNet georeferencing provided the "first pass" and the procedures to quantify error. HerpNet also collaborated with AmphibiaWeb to allow dynamic mapping of museum specimen data and expert-opinion maps, and developed a cache to provide faster data access. Additionally, HerpNet staff hosted 10 georeferencing workshops in four countries; these workshops provided a rare opportunity for museum curators and staff to meet to discuss use and challenges of geospatial data and to educate museum staff in data

standards. Future implementations will seek funding to add more institutions, especially large, historically important collections, and to improve the data portal.

0673 Herp Genetics, Development & Morphology, Drummond, Saturday July 26, 2008

Geometric Morphometric Analysis of Head and Horn Morphology of the Coast Horned Lizard Species Complex, *Phrynosoma coronatum*

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The coast horned lizard (*Phrynosoma coronatum*) is distributed over 2,200 kilometers from the Cape Region of Baja California to northern California. A considerable degree of variation in scalation, cranial horn morphology, and coloration is found throughout its range. At least 20 attempts to partition this geographic variation into discrete taxonomic units have resulted in a turbulent taxonomic history. A recent morphological study used standard morphometric measurements to establish new species boundaries within the group. Geometric morphometric techniques offer a novel approach for morphological analysis and are particularly useful for quantifying differences in the shapes, sizes, and orientations of structures. The cranial horns of *Phrynosoma coronatum* are geographically variable and are a perfect candidate for a geometric morphometric analysis. We quantified variation in head and horn shapes from lizards collected throughout the range from northern California to southern Baja California to test alternative species boundaries based on morphology and genetic data. The geometric morphometric methods incorporated digitized scans of the dorsal surface of the head and horns. We digitally placed twenty positional landmarks on homologous locations on the head and horns, and used statistical methods (CVA and PCA) to compare differences among geographic groups. Thus far, we have scanned 628 adult male and female heads of specimens from 3 natural history collections. Preliminary analyses of adult horn and head morphology separate populations into two groups that are concordant with geography, and the break is located in southern Baja California, north of La Paz. There is no apparent separation statistically between California and Northern and Central Baja California groups. Components that represent horn and head shape were negatively correlated with latitude, with larger, more laterally curving occipital horns in southern lizards. This result is concordant with the previous morphological study, phylogenetic analyses of nuclear loci, and ecological niche modeling

0726 Sustainable Harvest Symposium, Drummond, Monday July 28, 2008

Sustainable Harvest of Sea Turtles: Myth and Reality

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Sea turtles are long-lived vertebrates that have high reproductive potential but low survivorship of hatchlings and juveniles. More than 40 years ago Archie Carr described the considerable commercial value of sea turtles in an article in National Geographic magazine. However, he quickly became skeptical of the value of both sea turtle farming and harvesting of sea turtles in the wild. He was convinced that the demands of the market would overwhelm the ability of sea turtles to reproduce and

would drive natural populations to extinction. There are continued calls by some for market driven exploitation of sea turtles as a mechanism of conservation. Here we explore the relationship between the life history characteristics of sea turtles and the effects of harvesting adults, juveniles and eggs on their populations. Our analyses demonstrate that sea turtle populations cannot withstand more than a small harvest of eggs, juveniles or adults or they will be driven to extinction. For example, harvesting even 25% of eggs will lead to a long term decline in sea turtle populations. Adult mortalities above natural rates of 5 to 10% will also drive a sea turtle population to extinction. These models are similar to those for fresh water turtles and apply to all sea turtle species. Examples from the past and present support these mathematical models of population biology of sea turtles and indicate that it is not possible to sustain a commercial harvest of sea turtles.

**0442 Fish Development/Reproduction, Salon 6&7, Sunday July 27, 2008;
STOYE GENETICS, DEVELOPMENT & MORPHOLOGY**

The Development of Kinethmoid Mediated Premaxillary Protrusion in the Zebrafish: What Can the Ontogeny of a Complex Trait Tell Us about Its Evolution?

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Cypriniform fishes effect premaxillary protrusion via a unique mechanism which includes the kinethmoid, a novel ossification within the rostral skeleton. Members of the Cypriniformes alone possess a kinethmoid which is situated behind the ascending processes of the premaxillae. This median bone is completely suspended by a complex bridge of ligaments uniting it to the premaxillae, neurocranium, maxillae, and palatines. Mouth opening and subsequent rotation of the maxillae (generated by contraction of jaw adductors) causes the kinethmoid to rotate and protrude the premaxillae. While the morphology and mechanics of such an innovative mechanism are inherently interesting to functional morphologists, the evolutionary origin of this novel trait makes it of special interest to evolutionary biologists. We investigated the development of this feeding mechanism in order to elucidate embryological processes on which selection could have acted to produce a novel trait. Using techniques available to developmental biologists, we examined how a complex system comprised of multiple elements (from disparate embryological origins) develops to form one functional unit in the zebrafish. Firstly, there is a novel ossification, the kinethmoid, which first develops as a cartilaginous anlagen within the ligament uniting the paired maxillae. While the kinethmoid arises early in development, it is not until the juvenile stage that significant premaxillary protrusion is seen. This may be due to the fact that kinethmoid-mediated premaxillary protrusion requires a change to the adductor mandibulae muscles. The adductor mandibulae, the primary lower jaw closing muscle arises early in development as a single unit but later differentiates into divisions essential for protrusion. Finally, a complex bridge of ligaments suspending the kinethmoid and allowing protrusion must develop properly before protrusion can occur. These developmental data along with outgroup comparison have allowed us to develop evolutionary hypotheses concerning the origin, assimilation, and diversification of this novel feeding mechanism.

0234 Biodiversity & Agriculture I, Drummond, Friday July 25, 2008

Fish Assemblage and Water Chemistry Responses across a Gradient of Headwater Stream Enclosures

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In intensively farmed areas, headwater streams are often enclosed to increase the efficiency of farming and reduce soil erosion. Enclosures involve burying open first or second order streams and replacing them with drain tiles installed below the soil surface. This is also referred to as tiling over or burying streams. We wish to relate the degree of enclosedness of headwater streams in cultivated fields to the downstream ecosystem's structure and function in the Ausable River basin (ARB) in southwestern Ontario. Ten watercourses in the ARB with varying degrees of upstream enclosedness, but with similar natural variation, were selected for this study. Fish and benthic macroinvertebrate assemblages were characterized using standardized sampling protocols in July and November 2007 and May 2008. Water samples were collected monthly from July – November 2007 and March-July 2008 and analyzed for ammonia, nitrate and major ions (P^{3-} , Ca^{2+} , Mg^{2+} , K^+ , Na^+). Data from this field sampling enable us to test the hypothesis that enclosedness affects, among other ecosystem attributes, the diversity and composition of the downstream fish and benthic invertebrate community. Our findings will aid managers in Ontario in setting scientifically defensible regulations regarding stream enclosures and will significantly further our knowledge of the importance of headwater streams to downstream ecosystems.

0123 General Ichthyology I, Drummond, Saturday July 26, 2008; STOYE GENERAL ICHTHYOLOGY

How Fins Contribute to Stability and Manoeuvrability in Fishes

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Most fish have two sets of paired fins and three median fins. Fish must balance torques around their centre of mass to control their body position and they appear to use their fins to do this. Recent kinematic and hydrodynamic studies on trout median fins show that dorsal and anal fins in trout appear to produce forces that balance rolling torques during swimming. Dorsal and anal fins oscillate with a large phase lag, yet the lateral jets produced by the fins have a small phase lag. This means dorsal fins release jets after they reach maximum excursion and anal fins before maximum excursion. Differences in incident flow experienced by each fin may contribute to different jet release timings between fins. Trout paired fins are located upstream of the median fins. The ventral location of paired fins means that the wake they produce could influence the flow surrounding the ventral anal fin. To date the kinematic or hydrodynamic function of the posterior paired pelvic fins has not been described. In this study I use particle imaging velocimetry and high-speed cameras to visualize the wake structures and kinematics of the pelvic fins in rainbow trout (*Oncorhynchus mykiss*). I use a horizontal light sheet to visualize the entire fish belly and describe how the pelvic fin wake interacts with the anal fin during swimming. Trout move their pelvic fins in a contralateral oscillation; one fin abducting while the other adducts. The contralateral oscillation of the pelvic fins produces distinct lateral

jets that appear to influence and contribute to the anal fin wake structure, possibly enhancing anal fin hydrodynamic function.

0205 Fish Systematics III, Drummond, Saturday July 26, 2008

Pseudotropheus elegans: A Junior Synonym of *Pseudotropheus livingstonii*

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Boulenger described *Tilapia livingstonii* from the Shire River, Mala_i in 1899. Subsequently this species was placed in the genus *Pseudotropheus* and later was moved to *Metriaclima*. Subsequent to the original description, Trewavas described *Pseudotropheus elegans* in 1935 and again this species was moved to *Metriaclima*. A detailed examination of the holotypes using computed tomography (CT) scan provided data to show that *P. elegans* is a junior synonym of *P. livingstonii*. Furthermore, this species does not possess the synapomorphies of *Metriaclima* (e.g. a moderately sloped ethmo-vomerine block and a swollen rostral tip). The ethmo-vomerine block of *Metriaclima zebra*, the type species of *Metriaclima* is positioned in the skull at a 48.7° angle, while that of *P. livingstonii* is positioned at a 64.5° angle.

0431 Herp Behavior, Salon A&B, Thursday July 24, 2008

Emydid Turtles Modulate Their Feeding Behavior in Response to Prey Type and Feeding Environment

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Plasticity of feeding behavior is an important component of phenotypic plasticity, allowing organisms to feed in multiple environments and on a variety of different prey items. Such plasticity can promote species dispersal into multiple environments or evolutionary diversification into new niches. Here, I present the results of two studies investigating plasticity of feeding behavior in emydid turtles. In the first study, *Chrysemys picta* and *Trachemys scripta* individuals were filmed feeding on 3 food types of varying physical properties. Aspects of feeding behavior were quantified, and variation in feeding behavior among species and food types was calculated. *T. scripta* individuals showed a greater ability than *C. picta* to modulate their feeding behavior in response to novel food items. We suggest that this greater flexibility may partially explain the greater success of *T. scripta* in invading new habitats. In the second study, aquatic and terrestrial feeding events were filmed for individuals of *C. picta*, *T. scripta*, *Graptemys pseudogeographica*, *Glyptemys insculpta*, *Deirochelys reticularia*, and *Malaclemys terrapin*. Of these species, only *G. insculpta* is known to regularly feed terrestrially in the wild. Aspects of the feeding kinematics of these species were quantified and aquatic and terrestrial bites were compared for each species. Although some species showed a greater difference between bites in the two environments, most species showed a consistent pattern of changes in bite kinematics between the two environments. Some of the patterns observed (e.g., less hyoid depression during terrestrial feedings) are consistent with those shown by *Terrapene carolina*, a turtle that regularly feeds in both environments. We suggest that the differing viscosities of water and air impose consistent changes on the feeding

behavior of emydid turtles, and that these changes can be selected upon in those aquatic turtle species that adopt a terrestrial or semi-terrestrial lifestyle.

0270 AES Food & Feeding, Kafka/LeMaratine, Saturday July 26, 2008

The Diet and Feeding Ecology of Sympatric Orectolobiform Sharks: An Example of Resource Partitioning

Joanna Stead, Michael Bennett

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Dietary studies are vital for determining a species' role within an ecosystem. It is recognised that elasmobranches play an integral role in the transfer of energy within marine ecosystems. However, studies of elasmobranch feeding ecology lag behind those on other vertebrates and knowledge remains limited, despite the global trend in declining elasmobranch numbers. Resource partitioning is an important mechanism that allows species to co-exist within an assemblage but there have been few investigations comparing the diets of sympatric elasmobranch species. The diet and feeding biology of three sympatric benthic shark species (*Chiloscyllium punctatum*, *Orectolobus maculatus*, and *Orectolobus ornatus*) were examined. Specimens were collected by commercial fishermen from the sub-tropical waters of Moreton Bay, off south eastern Queensland, Australia. The Index of Relative Importance (IRI) indicated that *C. punctatum* are generalist feeders, which prey on benthic invertebrates (polychaetes, 33.58%IRI; crustaceans, 33.80%IRI, predominantly carid shrimps and brachyuran crabs; cephalopod molluscs, 4.18%IRI) and demersal vertebrates (teleost fishes, 28.33%IRI). An ontogenetic shift was evident with teleosts more prominent in the diets of larger individuals. The wobbegong sharks (*O. ornatus* and *O. maculatus*) were predominantly piscivorous, with 96.98%IRI and 99.85%IRI for teleosts respectively. The diets of the wobbegongs were not significantly different at the prey taxonomic level of Order, but were significantly different ($P < 2.9\%$) at the Family level, with *O. maculatus* ingesting predominantly pelagic and soft substrate associated species and *O. ornatus* reef associated species. Teleosts ingested by *C. punctatum* and both wobbegong species were significantly different ($P < 0.1\%$), revealing that all three are targeting different teleost species. The dietary composition of the bamboo shark, *C. punctatum* complemented findings from acoustic tracking, which indicated that this species commonly feeds over inter-tidal mudflats adjacent to mangroves. It is proposed that spatial resource partitioning allows these benthic shark species to co-exist within Moreton Bay without inter-species competition.

0382 Poster Session III, Sunday July 27, 2008

Developing Predictive Models of Anuran Calling Activity: Optimization of Amphibian Monitoring Programs

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Recent declines in amphibian populations have been dramatic and alarming, and most declines have been documented in anuran populations. In response, programs have been established to monitor anuran populations, and many of these rely on

calling surveys. Understanding how the environment influences calling variation can be used to optimize such surveys. In an effort to understand how environmental variation affects anuran-calling activity, we measured calling activity at an ephemeral wetland in the western Piedmont of North Carolina using an automated recording system. We determined which environmental variables significantly affected the calling activity of *Pseudacris crucifer*, *Pseudacris feriarum*, and *Rana sphenoccephala*. Models developed using logistic regression showed that for *P. crucifer*, day of year, time, precipitation and water temperature positively influenced calling and air temperature negatively influenced calling; for *P. feriarum*, time, precipitation, air temperature and water temperature positively influenced calling, and day of year negatively influenced calling; for *R. sphenoccephala*, day of year, time, precipitation and air temperature positively influenced calling, and higher water temperature negatively influenced calling. Using these results, we developed models predicting the best conditions under which to conduct anuran-calling surveys. The models were tested using previously collected data from calling surveys performed in the same region of North Carolina. Models accurately predicted calling activity approximately 70% of the time.

**0361 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008;
STOYE ECOLOGY & ETHOLOGY**

Light Habitat Influences Dewlap Conspicuousness of Male and Female Brown Anoles (*Norops sagrei*)

John Steffen

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Signal theory hypothesizes that visual signals should evolve conspicuousness sufficient to allow for detection in some light environments at the cost of conspicuousness in other light environments. We quantified the spectral variation of male and female dewlaps from a population of Brown Anoles, *Norops sagrei* that inhabited a semi-disturbed habitat in central Florida, using a UV-sensitive spectrometer. *Norops sagrei* display dewlaps that, to the human eye appear to have a yellow or white midline dewlap region flanked by a pinkish-red lateral region. We applied these spectral data to a visual model that integrated information about *Norops sagrei* visual physiology and coloration of background vegetation to estimate the conspicuousness of male and female dewlaps in four classic light habitats. The chromatic aspects of dewlap reflectance of *Norops sagrei* were most conspicuous in light conditions typical of woodland shade, and were slightly less conspicuous in light conditions typical of large and small gaps. Green backgrounds generally rendered dewlap color more conspicuous than brown backgrounds. Sexes could be discriminated based on differences in their dewlap color and brightness, in woodland shade only. Of *Norops sagrei*'s four photoreceptor types, conspicuousness of the dewlap is primarily driven by the UV sensitive cone. The sexes, however, differ in the degree to which the medium and long wavelength cone stimulation explains conspicuousness in most light environments. We discuss how these results may influence social behavior of Brown Anoles.

0574 Poster Session I, Friday July 25, 2008

Phylogenetic Analysis of the Iguaninae

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The subfamily Iguaninae is a particularly interesting group because of its ancient Cenozoic origin, broad distribution across multiple geographical boundaries, and high degree of regional and island endemism. Prior molecular and morphological studies of this group have relied upon incomplete taxonomic sampling and limited data, resulting in unresolved or conflicting nodes within and between genera. Thus, the evolutionary history of the group and taxonomic status of several lineages remain unclear. In order to generate a robust phylogeny, we build upon prior studies with a more thorough sampling of the subfamily, taxonomically and geographically, as well as through the analysis of multiple independent data sets. Data presented are the result of sequencing between 71-55 individuals at 4 loci (nDNA: Cmos, NT3; mtDNA: ND4, CytB). These loci have varying rates of evolution and we are able to resolve most nodes throughout the tree with strong support (using MP, MLE, & Bayesian analyses). Results of phylogenetic analyses are compared to prior studies and examined in terms of biogeographic history and current taxonomy.

0510 Poster Session II, Saturday July 26, 2008

Testing the Sensory Exploitation Hypothesis in a Lizard, *Sceloporus minor*

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The sensory exploitation hypothesis states that male sexual signals evolve to stimulate a pre-existing female preference for such traits (Ryan and Rand 1993). This idea has received significant theoretical and empirical support in studies of mating preferences, but few studies have examined whether male aggressive signals could evolve similarly. In phrynosomatid lizards, male reproductive success is often predicted more strongly by male resource holding potential (RHP) than by female choice (e.g., Hews 1990). Consequently, members of this taxon might be expected to exhibit behavioral patterns consistent with male sensory exploitation, if variation in male intrasexual signals strongly predicts male fitness. *Sceloporus minor* is a Mexican phrynosomatid that exhibits striking variation both within and among populations in dorsal coloration. Sexual dimorphism of dorsal color is relatively weak in ancestral populations near the city of San Luis Potosí (SLP), each sex typically dull brown or orange. Conversely, in the derived population at Parque Nacional Los Mármoles (PNLM), only males exhibit bright blue dorsal color, often with overlying orange patches; females lack these additional color features. I predicted that if the sensory exploitation hypothesis best explains the observed pattern of between-population dorsal coloration in *S. minor*, then males at SLP painted to resemble the derived phenotype (blue) should receive less aggression than males painted to resemble the local phenotype (orange) or green (novel stimulus control). Resident males (n=24) were captured on their territories, marked, and released. Intruder males (n=24) were captured at separate sites, and painted dorsally with one of three paint treatments. All lizards were measured for morphometric and color variables that might influence contest outcome. Intruders were introduced to residents by tether, and allowed to interact for up to 20 min in videotaped trials; each resident and intruder lizard was

used in only one trial. Preliminary analysis does not support the sensory exploitation hypothesis. These findings are discussed in the context of sexual selection theory.

0182 Poster Session III, Sunday July 27, 2008

Evaluating Patterns of Riparian Disturbance and their Influence on Aquatic Turtles in the Lower Flint River Basin, Georgia

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Agriculture has been a major part of the economy in southwest Georgia, but this large-scale land use has also had many negative effects on terrestrial and aquatic habitats. Although limited data exist, some known effects include sedimentation, chemical leaching, edge effects and most notably habitat conversion. Freshwater turtle communities are among many groups of wildlife that may be impacted by agricultural disturbance to riparian habitats. Sedimentation and pollution from agriculture may negatively impact riverine turtles by reducing the abundance of invertebrate prey, and the clearing or thinning of forests near rivers may reduce the availability of logs needed for shelter and basking. The objective of this study will be to assess species richness and abundance of freshwater turtles in both unimpacted or restored and agriculturally-impacted tributaries of the Lower Flint River Basin (LFRB). Aerial photography and random site selection has been used to choose appropriate sites for sampling. Two methods of capture, aquatic hoop traps and effort-managed snorkel surveys, will be employed to sample all known species. During the summer of 2007, we made 349 captures of 301 individuals representing eight turtle species along 3.5 kilometers of Ichawaynochaway Creek. Preliminary results of seven sampled reaches have shown differences in capture abundances of yellow-bellied slider (*Trachemys scripta*) and Barbour's map turtle (*Graptemys barbouri*) when considering the amount of riparian disturbance. This research will add to knowledge of the influences of landscape scale disturbances on turtle community ecology and conservation.

0319 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008

Reproductive Behaviour, Mating and Male Competition in Manta Rays (*Manta birostris*) in the Indian Ocean

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Underwater observations and photographic capture of reproductive behaviours, including copulation and male/male competition for mates were obtained for continuous mating seasons (2005-2008) at North Male Atoll, in the Republic of the Maldives. Two types of male/female interactions have been documented. Males swimming in a linear pattern (mating "trains") consisting of 1 to 21 males following and chasing single, fast swimming females were well defined during October and November. A second association consists of males in smaller numbers (1 to 4), "shadowing" rather than chasing, slower swimming individual females. The former pattern appears to temporally follow the latter. Male group size appears to increase

through time, reach a peak number and decline until only a few males remain and compete for access to a given female. During copulation the few remaining males attempt to dislodge the successful male from his attachment to the female by head ramming. Of the known resident females, 41 of 65 (63%) were pregnant in 2008 while only one was visibly pregnant in 2007. Some females involved in mating trains one season were pregnant the following year and shortly after giving birth, were observed bearing fresh pectoral fin mating scars. These data seem to suggest a biennial mating cycle as the norm and an annual reproductive cycle for some individuals.

0553 Poster Session I, Friday July 25, 2008

Clarification of the *Lycodes diapterus* Species Complex (Perciformes: Zoarcidae), with Comments on the Subgenus *Furcimanus*

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Lycodes diapterus, the type species of *Furcimanus* Jordan et Evermann, has been divided into as many as three subspecies (*L. diapterus diapterus*, *L. d. beringi*, and *L. d. nakamurae*). Although *L. d. nakamurae* has been broadly recognized as a distinct species by recent authors, the status of *L. d. beringi* is unresolved, and several authors have noted the need for a comprehensive morphological study of *L. diapterus*. Based on an examination of nearly 500 specimens collected from Kamchatka to California, we recognize *Lycodes beringi* as a valid species distinguished from *L. diapterus* by meristics and squamation. *Lycodes beringi* is distributed from southeastern Kamchatka through the Bering Sea, Commander and Aleutian Islands, Gulf of Alaska, and south along the North American west coast to Puget Sound, while *L. diapterus* ranges from the Pacific coast of Vancouver Island south along the U.S. west coast to southern California. In this report we document the morphological variation present in *L. diapterus* and *L. beringi*, provide distribution information for both forms, and clarify the status of the subgenus *Furcimanus*.

0650 Poster Session III, Sunday July 27, 2008; STORER ICHTHYOLOGY

The Evolution and Design of a Unique Feeding Mechanism: Asymmetry in Lake Tanganyika Scale Eating Cichlids

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Perissodus microlepis and *Perissodus straeleni* are cichlid fishes native to Lake Tanganyika in central Africa that forage through lepidophagy, or scale-feeding. Both species are laterally asymmetrical, their heads tending towards either the left or right side of the sagittal plane. The nature of this asymmetry, whether the result of one dramatically altered craniofacial structure or an integration of many differences between the left and the right side, remains unclear. Analyses focused on the bones of the head that constitute the feeding apparatus. Geometric morphometric shape analysis was performed as a means of phenotypic characterization. Landmarks were selected on the basis of being functionally significant pivot points and lever arms, and were used to test simple-lever and four-bar linkage models of the feeding system from which calculations of force and motion could be obtained. Initial results

indicate that scale eating cichlids show discrete, sided differences in jaw shape, and that these differences predict lateralization in the force and speed of jaw rotation. Nature is replete with examples of craniofacial asymmetries (i.e., narwals, owls, flatfish), and many human birth defects are characterized by asymmetric craniofacial malformations (hemifacial microsomia, Treacher-Collins syndrome, hemihypertrophy). Unfortunately, the development of lateral asymmetries in superficially paired structures is poorly understood, both genetically and evolutionarily. Studying the evolution of laterality in *Perissodus* and ultimately identifying the genetic factors that contribute to the asymmetric development of skeletal structures will shed light on the evolutionary and clinical consequences of vertebrate laterality.

0631 Fish Systematics III, Drummond, Saturday July 26, 2008

A Morphometric Analysis of Guyanese *Arapaima* and Status of *Arapaima arapaima*

Donald Stewart, L. Cynthia Watson

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Valenciennes (in Cuvier and Valenciennes 1847) described *Arapaima arapaima* based on descriptive information and an illustration from Schomburgk's (1841) monograph on fishes of British Guiana. This taxon has been considered a synonym of *Arapaima gigas* (Schinz, in Cuvier 1822) since 1868 when Günther published an opinion to that effect. A re-evaluation of the status of *A. arapaima* has been hindered by presumed absence of type materials as well as a lack of fresh *Arapaima* materials from the areas where Schomburgk collected. Review of materials in BMNH, London, and MNHN, Paris, led to the discovery of three specimens that could be considered syntypes of *A. arapaima* under international rules; but one of those is now lost and another is a skeleton in poor condition. Designation of the remaining entire specimen as Lectotype will provide a basis for evaluating status of *A. arapaima*. We have collected a complete size-range of *Arapaima* from the Essequibo River basin in Guyana over the past two years, and they provide a framework for evaluation of morphometric variation and allometry. We conclude that *A. arapaima* is a valid species whose distribution may extend from southwestern Guyana to central Brazil (i.e., Rio Negro and lower Rio Xingu).

0512 Poster Session III, Sunday July 27, 2008

Morphological And Call Divergence, And Contact Zone Dynamics Of Cryptic Lineages Of The Spring Peeper (*Pseudacris crucifer*)

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Phylogeography has played a major role in our current understanding of how historical processes shape contemporary species distribution. For many taxa, these data reveal striking range-wide genetic structure with well supported, geographically restricted clades that may both reflect historical refugial dynamics and the initiation of divergence. Despite over six decades of research however, a

complete understanding of how such historical range fragmentation can contribute to the origins of new species diversity and an explicit link between phylogeography and the evolution of reproductive isolation remains elusive. In spring peepers (*Pseudacris crucifer*) mtDNA phylogeographic studies have revealed a dynamic history of isolation in Pleistocene refugia followed by post-glacial recolonization and many zones of secondary contact between deeply diverged lineages. Our analyses show that, within SW Ontario, where two such lineages are in secondary contact, males differ significantly in acoustic properties of their advertisement call (frequency and temporal attributes) and in morphology. This raises the possibility that females exhibit preference for their male calls of their natal lineage, a hypothesis we hope to assess this spring using phonotaxis experiments, with consequences for the evolution of reproductive isolation.

0373 Fish Development/Reproduction, Salon 6&7, Sunday July 27, 2008

Developmental Mechanisms of Dentition Reduction in Cypriniform Fishes

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Reduction of the number of teeth and tooth-bearing locations is considered a general trend in the evolution of vertebrate dentition. This trend could be explained either by the frequent adaptive superiority of reduced dentition or by biases in the generation of variation in tooth number and location. We are attempting to distinguish between these possibilities through comparative developmental genetic studies focused on the zebrafish, *Danio rerio*. As in other members of the order Cypriniformes, teeth in *D. rerio* are restricted to the fifth ceratobranchials of the pharyngeal skeleton. In contrast to this extreme reduction of tooth-bearing locations, *D. rerio* retains what is thought to be the primitive number of teeth for the family Cyprinidae, despite a trend toward tooth number reduction in this taxon. Our previous comparisons of gene expression and function in *D. rerio* and the characiform *Astyanax mexicanus*, which retains oral and pharyngeal dentition, suggested loss of signalling through the Fibroblast growth factor (Fgf) pathway as a potential cause of oral tooth loss in cypriniforms. Specifically, application of a pharmacological inhibitor of Fgf signalling to *A. mexicanus* larvae resulted in loss of oral teeth and appearance of a gene expression profile in the oral region resembling that of *D. rerio*. To determine whether activation of Fgf signalling can restore oral tooth development in *D. rerio*, we used transgenic methods to ectopically express Fgf ligands. Such treatments resulted in the induction of supernumerary teeth in the pharyngeal, but not the oral region of *D. rerio*. This finding is consistent with a greater bias against expanding the number of tooth-bearing locations than increasing tooth number within a location.

0193 Northern Herps Symposium, Salon 6&7, Friday July 25, 2008

Frozen and Alive: Canadian Herps in Winter

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Natural freeze tolerance is key to winter survival for a selection of amphibians and reptiles and my laboratory has extensively studied the biochemical adaptations that

support freezing survival using two Canadian species: wood frogs (*Rana sylvatica*) that winter on the forest floor and painted turtle hatchlings (*Chrysemys picta*) that spend their first winter in natal nests. For example, wood frogs can survive for weeks with 65-70% of total body water frozen in extracellular ice masses. Well-known components of freeze tolerance across phylogeny typically include the use of nucleating agents and high concentrations of carbohydrate cryoprotectants (e.g. glucose in frogs). However, advances in genomic and proteomic technologies have now allowed us to identify many genes/proteins (and their cellular functions) that have never before been associated with natural freezing survival. We now know that coordinated regulation of many aspects of metabolism is required to reorganize priorities for energy use in the frozen state, implement many metabolic or gene responses that deal with the stresses imposed by freezing (e.g. anoxia, tissue dehydration, physical damage by ice), and maintain long term cell viability in the frozen state. Recent work in my lab using cDNA array screening and Western blotting has documented the freeze responsive up-regulation of genes/proteins involved in multiple cell functions including ischemia protection, antioxidant defense, cell volume regulation, membrane transporters, signal transduction cascades (protein kinases and phosphatases, transcription factors), chaperone proteins, cell cycle versus apoptosis regulators, protease inhibitors and metabolic arrest mechanisms. Wood frogs also express three novel genes with unique freeze-responsive patterns of expression (organ, time, response to second messenger signals); their cryoprotective actions are as yet unknown but over-expression in insect cell lines strongly improves cell freezing survival in vitro. Freeze tolerance is not only an amazing example of biochemical adaptation but the molecular mechanisms that support natural freezing survival highlight key targets for the improvement of medical cryopreservation technology. Funded by NSERC Canada; for more information visit www.carleton.ca/~kbstorey.

0690 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

Phylogenetic Relationships and Genetic Integrity of Native-Strain Walleye (*Sander sp. cf. vitreus*) from the Central Highlands

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Native populations of the walleye (*Sander vitreus*) persist in the Central Highlands despite the widespread destruction of their spawning sites and the introduction of exogenous fish from the Great Lakes. Although a few relictual spawning groups of Highlands walleye are known, neither their relationships with other walleyepopulations nor their genetic integrity have been rigorously investigated. We used a combination of mitochondrial and nuclear markers to assess the phylogenetic relationships of Highlands walleye in general, and the genetic integrity of putative native strain populations in particular. Phylogenetic analysis of mitochondrial cytochrome *b* and nuclear Rh2 sequences revealed that native-strain walleye in the Cumberland River (KY), Big South Fork (TN), New River, (VA), upper Ohio River (OH) and Black River (MO) represent an Evolutionarily Significant Unit (ESU) distinct from ESUs that natively occurred in drainages of the Great Lakes and Gulf Coast. Analysis of microsatellite variation revealed a historical relationship between spawning groups from the Appalachian and Ozark regions. The combined mtDNA and nuclear data set supports the hypothesis that native-strain walleye from the Central Highlands are phylogenetically distinct and represent an imperiled species. The distribution of the Highlands walleye is consistent with historical records for "*Stizostedion salmoneum*" and may warrant recognition pending a taxonomic revision of the genus.

0577 AES Conservation, Kafka/LeMaratine, Sunday July 27, 2008

Advances in Shark Repellent Research Using Highly Electropositive Metals

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Recent studies conducted by the National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NOAA – Fisheries) suggest that electropositive metals hold promise as shark bycatch reduction devices. To understand the underlying electrochemical processes, voltammetry was performed with flowing seawater electrolyte and moveable fritted glass half-cells. Voltage and current were monitored as the distance was increased between half-cells. Voltammetric measurements indicate that shark skin is more electronegative than the electropositive lanthanide metals and mischmetals. We hypothesize that a galvanic cell, created by an electropositive metal in seawater, spontaneously produces trivalent cations in solution. These cations are attracted to the electronegative shark skin, resulting in a net positive charge on the shark skin, which is measured by the electrode. Further research is required to understand the mechanism by which the accumulation of a positive charge is detected by the ampullae of Lorenzini. In practical fishery terms, because of the limited detection range of the ampullary organs, it is desirable to place electropositive metals as close to the hook as possible without interfering with capture. A simple hook modification has been developed which can be applied to multiple hook types. The modification utilizes thin ribbons of electropositive metal wrapped around a steel circle hook. Galvanometric analysis was utilized to confirm that the hook corrosion rate is not increased by the presence of the electropositive metal ribbon, thus ensuring that the structural integrity of the circle hook is not compromised during fishing.

0752 Poster Session I, Friday July 25, 2008

Applying an Individual-Based Modeling Approach to Address Potential Impacts of Habitat Loss in a Lemon Shark Nursery

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Mangroves provide critical habitat for many species, often during juvenile life stages. In Bimini, Bahamas, the mangrove-fringed lagoon between the two main islands comprises several important parturition sites and nursery areas for lemon sharks (*Negaprion brevirostris*). Within the North Sound nursery, juvenile lemon sharks are afforded abundant prey, as well as protection from larger predators. A significant volume of research exists concerning the life history, physiology, feeding and diet, bioenergetics, growth and behavioral ecology of lemon sharks in Bimini, as well as numerous studies on the ecosystem itself. The growing field of individual-based modeling has helped researchers begin to understand complex ecological patterns that develop from individuals' behaviors and interactions with each other and their environment. In an individual-based computer model, "agents" representing individuals are assigned rules that dictate their behaviors and influence interactions with other agents and the environment. This type of model can be a powerful heuristic tool to explain ecosystem complexity. After multiple iterations of the model, population- and ecosystem-level patterns may emerge from interactions of

independently-acting agents. The goal is to develop the model such that emergent patterns reflect patterns of interest observed in the field. This study will utilize over twenty years of data to create an individual-based model that combines the behavior and bioenergetics of juvenile lemon sharks with that of the sharks' prey and predators as they interact within the North Sound ecosystem. The field-validated model will ultimately be used to address actual and potential ecological impacts of mangrove removal in the nursery area. In addition, the model will help elucidate the roles of this high-level predator in a mangrove-fringed lagoon ecosystem, as well as the potential consequences of a decline or loss of this predator. Supported by grants from NSF, Hoover Foundation, CPB Environmental Foundation and the Bimini Biological Field Station.

0347 AES Habitat & Movement I, Jarry/Joyce, Saturday July 26, 2008

The Potential Use of Pop-up Archival Transmitting (PAT) Tags to Examine Habitat Use and Migration Patterns of Spiny Dogfish (*Squalus acanthias*) in the Western Gulf of Maine

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Central to any successful fishery management plan is the availability of accurate, detailed and updated life history information on the species. Pop-up satellite archival tags (PAT) offer an innovative tool for examining the movement patterns, temperature, and depth preferences of many marine species. In the past, this technology has been too large or cumbersome for use in sharks less than 100cm in fork length. However, with the advent of the relatively small X-Tag by Microwave Telemetry, the value of using satellite technology on smaller shark species was tested on the spiny dogfish, *Squalus acanthias*, within the Gulf of Maine. Between October 31st and November 7th, 2007, a total of three X-Tags were attached to dogfish captured 6 miles off the coast of Southern Maine. Although two of the three tags prematurely released from the animal (expected "pop off" date was set at May 31st 2008), the data that was recovered (approximately 3 months worth) offered information that goes against many current paradigms for this species in the western Atlantic. This includes north-south movement ranges that are much wider and more active in scope than previously described for this shark. Moreover, deeper more constant depth profiles were also observed for this species. We anticipate the third tag will reveal similarly unique findings.

0694 Fish Morphology & Histology II, Salon 6&7, Saturday July 26, 2008

Ontogeny of the Fine-scale Morphology of the Tessellated Skeleton of Cartilaginous fishes

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The majority of the skeleton of elasmobranch fishes is characterized by a tessellated design in which uncalcified cartilage is overlain by a rind of mineralized and abutting hexagonal blocks (tesserae). This poses an interesting problem in that although the skeleton cannot exhibit significant remodeling, it must be able to grow in size while maintaining a continuous and integral calcified surface. We employ a diversity of imaging techniques and ontogenetic tissue series to investigate the development and ultra-scale morphology of the tessellated skeleton in a species of stingray (*Urobatis halleri*). Tesserae formation and growth is characterized by distinct changes in cell morphology and orientation. The skeletons of yolk sac embryos are not yet tessellated and chondrocytes orient randomly relative to the perichondrium. In the histotroph stage, chondrocytes flatten at the tissue periphery and are engulfed by forming tesserae, creating cell-rich laminae in the mineralized blocks with communicating passageways between entombed cell lacunae. Alignment of peripheral chondrocytes relative to tesserae is pronounced only as tesserae are forming, then becomes more random with age. Chondrocytes and tesserae continue to grow in size through adulthood, with cell density and the number of chondrocyte twins (an indirect indicator of cell division) decreasing sharply following tesseral formation. Oxytetracycline injection indicates that tesserae grow from mineral accreted on all surfaces (perichondral, chondral and intertesseral) resulting in tesserae widening and deepening by up to 5 times in adults relative to the histotroph stage. Skeletal elements are therefore growing by matrix deposition in uncalcified regions and accommodating enlargement of tesserae. Although our results show some parallels with endochondral ossification (e.g., chondrocytes decreasing in size and density with age), cells do not hypertrophy and die as in tetrapods.

0273 Fish Ecology II, Salon A&B, Monday July 28, 2008

Deep-Pelagic Fishes And The Mid-Atlantic Ridge: Interactions And Vectoring Of Gelatinous Carbon To Higher Trophic Levels?

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The assemblage structure and vertical distribution of deep-pelagic fishes relative to a mid-ocean ridge system is described from an acoustic and discrete-depth trawling survey conducted as part of the international Census of Marine Life field project MAR-ECO. A survey along the Mid-Atlantic Ridge (MAR), covering the full depth range (0 to >3000 m) with a combination of gear types, was conducted to understand the role of the pelagic fauna in ecosystem dynamics. A total of 205 fish species were

collected by midwater sampling. Depth was by far the primary assemblage composition determinant, with ridge section secondary. The dominant ichthyofaunal component was a widespread assemblage of fishes between 750-3000 m, from Iceland to the Azores. Some zonation was apparent in the northern and southern ends of this large depth stratum, with six smaller assemblages of fishes exhibiting limited distributions. Biomass per volume reached a water column maximum in the bathypelagic zone between 1500-2300 m. This stands in stark contrast to the general "open ocean" paradigm that biomass decreases exponentially from the surface downwards. As much of the summit of the MAR extends into this depth layer, a likely explanation for this midwater maximum is ridge association. Fish density within the benthic boundary layer (within 200 m of the ridge) was nearly double that of the water column and biomass was approximately 50% higher. Of the 'ridge-associating' species, two species known to consume gelata, *Bathylagus euryops* and *Scopelogadus beanii*, contributed over half of the fish biomass of this layer. These data suggest that a pelagic fish-gelata trophic linkage may be a key element of benthic-pelagic coupling over mid-ocean ridges, thus supporting enhanced nekton biomass over ridges in the absence of terrigenous nutrient input. Ongoing research to better understand this trophic linkage will be presented.

0141 Poster Session III, Sunday July 27, 2008

Developmental Morphology of the Skeleton of the Barbel, *Barbus barbus* (Linnaeus, 1758) (Ostariophysi, Cyprinidae)

Jolanta Szlachciak, Alicja Boron, Roman Kujawa

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The development of the skeleton of laboratory – reared cyprinid fish *Barbus barbus* from the six stages was observed. Larvae were first sampled at 7 days after hatching, and then every four days till 29 days after hatching. They were cleared and differentially stained for cartilage and bone using a modified version of Dingerkus and Uhler (1977). In the first stage the anterior tip of the notochord did not start to ossify yet and vertebral centra did not appear. In the neurocranium the otic capsules were developing. The taeniae marginales fused medially between the eyes to form the trabecula communis. Anteromedially the trabeculae crani fused to one another and chondrified laterally to form the ethmoid plate. In the splanchnocranium the cartilaginous and ventral elements of the mandibular and hyoid arch were present. All hyoid parts were fused to form a single cartilaginous piece. Most of the bony ossifications of the splanchnocranium were present in the third stage, 20 days after hatching. The fifth ceratobranchials developed later than first four, but ossified earlier. Two separate centres of development were found in the axial skeleton, Weberian apparatus and caudal fin. In the 16th day old larvae the anterior tip of the notochord started to ossify. The first vertebrae as well as the all structures of the Weberian apparatus were present. In the last stage analyzed, 29 days after hatching the skeleton of caudal fin was fully developed. Among the paired fins, as first developed the pectoral ones, while the pelvic fins were visible in the second stage, without any elements of the girdle. The dorsal fin developed first than the anal one. Lepidotrichia started to ossify 20 days after hatching. First ossification of the anal fin started late, in the sixth stage of development.

0140 Fish Development/Reproduction, Salon 6&7, Sunday July 27, 2008

Development of the Skeleton of the Spined Loach, *Cobitis taenia* (Pisces, Cobitidae)

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The development of the skeleton of the spined loach *Cobitis taenia* from hatching to 23 days was studied, from cleared and stained material. No elements of the skeleton were present during the first day. In the next day the major part of the skull base was formed. The trabecular bars were separated from each other. The posterior otic cartilage was distinguished. The cartilaginous dorsal and ventral elements of the mandibular and hyoid arch were present. The notochord had begun to flex during the second day after hatching. Beneath its posterior portion, a condensation of hypural 2 was visible. At this stage the pectoral fins were present as an endoskeletal disc and fin fold. Three days post-hatching the four branchial arches were developing. In the larvae of 4 days post-hatching the caudal fin continued to develop. Five days post-hatching in the fin fold around the body first elements of the dorsal and anal fin started to appear. In the 6th day post-hatching the ethmoid region started to differentiate. The decomposition of cartilage matrix in the pectoral fins has begun. Posterior to the anus the anal fin started to develop. Eight days post-hatching three otoliths in the otic capsules were present. In the same age the pelvic fins started to develop. In the caudal fin the epural was first seen as a small cartilage above the posterior notochord. First three anterior vertebrae appeared 10 days post-hatching. At this stage the bone of pharyngeal arch started to stain with alizarin red. Thirteen days post-hatching partially ossified pharyngeal teeth were visible. During the next day the base of neurocranium as well as parts of the hyoid arch started to ossify. Twenty three days old larvae had fully developed all elements of the neuro- and splanchnocranium as well as the axial skeleton.

0383 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008; STOYE GENETICS, DEVELOPMENT & MORPHOLOGY

Functional Morphology of the Pectoral Fins in a Benthic Fish, *Myoxocephalus octodecimspinosus*, the Longhorn Sculpin

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Actinopterygian fishes are named for the bony, segmented rays that support their fins. It is the curvature and relative position of individual fin rays that control the shape and movement of the fins as a whole. Despite their importance, we know little about the diversity of fin ray form and function. The fin rays of benthic fishes support a potentially more diverse repertoire of fin-based behaviors than that of their open-water relatives. This is because some fins, like the pectoral fins, are often used for substrate contact as well as for swimming behaviors. I used a three-fold approach to investigate the relationship between individual pectoral fin ray curvature and whole-fin function in a benthic fish species, *Myoxocephalus octodecimspinosus*, the longhorn sculpin. First, I characterized the three-dimensional pectoral fin kinematics using high-speed video. I then calculated the three-dimensional curvature of individual fin rays during two behaviors, substrate contact and swimming, that place different functional demands on the pectoral fins. This allowed me to relate the curvature of individual fin rays to the shape and function of the pectoral fin as a

whole. Second, I compared the bending properties of the individual pectoral fin rays of the longhorn sculpin. The bending tests were performed on freshly dissected rays. The bending properties of the rays in this species are unlike those previously described for ray-finned fishes. Third, I described the microstructure of individual bony elements of each fin ray. I used microCT scanning to examine fin ray morphology in detail. Longhorn sculpin have a unique fin ray microstructure that likely contributes to their unusual bending properties.

0194 Herp Biogeography, Salon 4&5, Saturday July 26, 2008

Multi-locus Comparative Phylogeography of Two Australian Arid-zone Skink Complexes

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The spinifex deserts of Australia harbor an exceptional diversity of lizards, yet they lack the conspicuous geographic barriers often invoked to explain genetic structuring between and within species. Instead, habitat specificity has been implicated as a factor leading to the divergence of these arid-zone lizards, as lizard taxa differ in their degree of habitat specificity and in their relative abilities to disperse across unsuitable habitat. Our comparative phylogeographic study of two species with largely overlapping ranges and different habitat preferences, *Ctenotus pantherinus* and *Lerista bipes*, provides an opportunity to investigate the role of biogeographical history, habitat specificity, and dispersal ability in creating the genetic structure of extant populations. Both *C.pantherinus* and *L.bipes* are found throughout the spinifex deserts of Western Australia, but they differ in micro-habitat specificity, with the terrestrial *Ctenotus* living in association with spinifex grass clumps and the fossorial *Lerista* restricted to loose sand ridges. Analysis of DNA haplotype patterns reveals well supported, geographically structured mitochondrial DNA clades within *Ctenotus pantherinus*; corresponding analyses of nuclear loci show lower levels of geographic structuring. MtDNA haplotypes in *Lerista bipes* have a more complicated geographic pattern, possibly stemming from cryptic taxonomic diversity, higher levels of gene flow, or lineage sorting issues. Both ecological differences among species and contrasting information content of nuclear and mitochondrial markers helps explain the high phylogeographic diversity of these species complexes.

0551 AES Conservation, Kafka/LeMaratine, Sunday July 27, 2008

Do Rare Earth Metals Deter Spiny Dogfish? A Feasibility Study on the Use of Mischmetal to Reduce Dogfish Catches in Hook and Lobster Gear in Gulf Of Maine

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Spiny dogfish, *squalus acanthias*, are considered to be unacceptably abundant by many inshore fishermen (commercial and recreational) during the summer and fall in the Gulf of Maine. Finding a practical and economic dogfish deterrent for application in various fishing gears is of strong interest. An industry-science

collaboration afforded six research trips during September 2007. Triangular slices of a cerium/lanthanide alloy ('Mischmetal') were incorporated into three baited gears (longlines, rod and reel gear and lobster traps) and the catches were compared for 'treatment' (Mischmetal present) versus 'control' (mischmetal absent). Field observations were inconclusive for the lobster gear since the traps caught no dogfish, regardless of treatment. Some reduction in dogfish catch was recorded for rod and reel (~2%) and longline (~9-25%), but these results were not statistically significant. One complicating factor was the high rate of Mischmetal dissolution, which led to the rapid disintegration of the Mischmetal slices in all gears. *In situ* video footage verified that dogfish feeding behaviour is persistent on bait, regardless of Mischmetal presence. A parallel laboratory study provided video-taped, behavioural observations on the effects of alloys versus a chemically inert stainless steel 'decoy', under varying levels of food satiation and dogfish density. The laboratory assessments found some evidence of aversive behaviour in dogfish approaching baits protected by Mischmetal, but only when the dogfish had been fed to satiation before undertaking the study; after any period of starvation, no aversion to Mischmetal was observed. Dogfish density had no effect on feeding in the laboratory and the *in situ* footage showed that bait pursuit by one dogfish would escalate to frenzied feeding by multiple dogfish, with or without Mischmetal. Overall, there is little evidence to suggest that Mischmetal has the potential to reduce dogfish catches in either commercial or recreational gear types in the Gulf of Maine.

0560 Fish Systematics II, Salon A&B, Friday July 25, 2008

Phylogenetic Relationships of the Cyprinid Subfamily Rasborinae (Order Cypriniformes) Inferred from Mitochondrial and Nuclear Sequence Data

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The subfamily Rasborinae is a diverse group of cyprinid fishes, found primarily across southern Asia, with members also occurring in Africa. This subfamily is notable for including the model organism, *Danio rerio*, as well as many species popular in the aquarium trade. Previous workers have recognized distinct lineages within the Rasborinae, but relationships within the subfamily as well as its monophyly remain uncertain. For this study, more than 100 taxa representing over 30 putative rasborin genera were sampled for sequence data. Representative species were drawn from previously recognized subgroups of rasborins; taxon sampling included both African and Asian species. Outgroup taxa ranged from species of other cyprinid subfamilies to species from more distantly related ostariophysan groups. Our analyses are based on two mitochondrial genes (COI, *cyt b*) and two nuclear genes (RAG1, rhodopsin) evaluated using parsimony, maximum likelihood, and Bayesian methods. Although the results of our analyses do not support a monophyletic Rasborinae as currently constituted, there is support for a clade that includes *Rasbora* and most of the other putative rasborins (Rasborinae *sensu stricto*). The status of the rasborins as well as their relationships to other cyprinid groups will be discussed. This study is part of the Cypriniformes Tree of Life Initiative.

0248 Fish Systematics IV, Salon A&B, Monday July 28, 2008

Systematics of the Genus *Anisotremus* Gill, 1861 (Haemulidae: Perciformes)

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The family Haemulidae is present in the Atlantic, East Indian and Pacific oceans. They are mainly marine fishes with a few brackish species and rarely present in fresh water. Despite being widely distributed in both American coasts and appear frequently in local fisheries, few papers about their phylogenetic relations have been published to date, mostly limited to species descriptions and some biological and ecological information. Nowadays, the phylogenetic relations and the biogeographic history of *Anisotremus* are poorly known. The genus *Anisotremus* includes ten species, which were considered in this work as the ingroup. 52 bony characters were examined; polarization was made by the outgroup method, which includes selected species of the genera *Genyatremus*, *Haemulon*, *Pomadasys*, and *Orthopristis*. All the characters were treated as unordered. A branch and bound search was performed with the ACCTRAN character state optimization, in addition to procedures of resampling for each of the nodes in the cladogram. The strict consensus tree, product of two parsimonious solutions, has a length of 119 steps and consistency and retention indexes of 0.521 and 0.689, respectively. According to the evidence, *Anisotremus* sensu stricto is not a monophyletic group. The inclusion of *Genyatremus luteus* in *Anisotremus* or the use of another generic arrangement for the branch including *G. luteus* and the two basal species, *Anisotremus dovii* and *A. pacifici*, could be to the solution to this systematic and taxonomic conflict. The main synapomorphies defining those clades are related to the oral and pharyngeal regions. The genus *Orthopristis* seems to be the sister group of *Anisotremus*, which would be in agreement with Mago (1961). The validity of the transisthmian species pair *A. taeniatus*-*A. virginicus* is confirmed.

0485 Poster Session II, Saturday July 26, 2008

Stomach Content Analysis of *Kuhlia xenura* in Kolekole Stream, Hawai'i

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Fishes in the family Kuhliidae are found in subtropical and tropical fresh, estuarine and marine waters of the Indo-Pacific. *Kuhlia* are important culturally and as a food fish in the Hawaiian Islands, which makes their management a significant scientific concern. Recent studies have split the originally named species *Kuhlia sandvicensis* into two distinct species: *K. sandvicensis* and *K. xenura* (which appears to be endemic to Hawai'i). It is known that *K. xenura* can migrate between freshwater and fully marine habitats, experiencing 0 to 36 ppt. Their migration pattern makes them an important vessel for nutrient and energy flow between the two habitats. This stomach content analysis study is a component of an ongoing series of projects to analyze the biology of the recently split *Kuhlia* species in Hawai'i. Fish were collected during day and night hours from freshwater and estuarine habitats of

Kolekole Stream on the Island of Hawai'i. Diet content analysis has found both larval and adult food items of terrestrial, freshwater and marine origins, including Actinopterygian fishes, Dipterans, Neuropterans, Hymenopterans, Isopods, Arachnids, Copepods, Decapod crustaceans, Oligochaetes, and Turbellarians. In addition, freshwater algae (primarily filamentous greens and diatoms) were found in most but not all fish. Preliminary data analysis suggests that the top four food items found are *Macrobrachium lar* larvae, adult dipterans, dipteran chironomid larvae, and ants. A trend is observed between night and day samples, where all night samples included an abundance of *Macrobrachium* larvae not seen in day samples. Chironomid larvae were also more abundant in night samples. Ongoing analysis will include comparisons of stomach volume and food type in terms of the relative importance of each item. Enhanced understanding of the diet of these endemic, euryhaline fish will likely promote an awareness of ecological connectivity between marine and freshwater ecosystems in Hawai'i.

0751 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

Kill 'Em All: The Amazing Reptilian Immune System

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Many herpetologists would attest anecdotally to the fact that reptiles have extraordinary immune systems. For example, we often observe that our field or laboratory reptile subjects have wounds that heal very quickly and with little apparent negative effect on the animals, and we remark that our study reptiles recover very quickly from surgeries and other manipulations that could cause a high degree of mortality in mammalian or avian subjects. However, very little is known about just how the immune systems of reptiles impart such protection from pathogens, and few studies have examined relationships between reptilian immune function and aspects of their disease ecology, parasitism, or potential medical applications. Studies have shown that the complement system of spiny lizards (genus *Sceloporus*) is able to kill the spirochetes that cause human Lyme disease (*Borrelia burgdorferi*) in the ticks that infest them. A recent study on American alligators demonstrated that blood proteins have the ability to protect against a myriad of pathogens, and can even kill the human immunodeficiency virus *in vitro*. Research in my laboratory shows that blood from squamate reptiles also demonstrates a high propensity to kill bacterial pathogens *in vitro*, and that reptilian immune function has a complex relationship with circulating hormones, reproductive state, and various other physiological parameters. In addition, the rapid wound-healing of squamate reptiles can be used as an easily quantifiable marker of innate immune function. Because of the ease of study and surprising strength of the immune systems, investigations of reptilian immune function hold the promise of providing a wealth of information in both basic and applied sciences.

0121 Poster Session II, Saturday July 26, 2008

Annual Body Temperature Profiles of Free-Ranging Male Northern Pacific Rattlesnakes (*Crotalus o. oreganus*)

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Since most physiological and behavioral processes of reptiles are temperature-dependent, collecting accurate and plentiful data on body temperatures (T_b) of free-ranging reptiles allows us to better understand the role of thermal biology in other organismal processes. Thermochron iButtons can be surgically implanted into the body cavities of many reptiles, and can remotely collect T_b at programmed intervals. I implanted 10 male Northern Pacific rattlesnakes (*Crotalus o. oreganus*) with radiotransmitters and with iButtons programmed to log T_b every two hours. After 1.5 years, the iButtons were removed and downloaded. Lowest mean daily T_b was in January, and highest was in August, consistent with environmental temperatures. In general, T_b was usually higher when snakes were surface active than when they were in refugia. However, snakes spent most of August in refugia and still had very high T_b; surface activity may have been limited by high temperatures during that month that penetrated into refugia. Mean daily variance and standard deviation of T_b were very low in winter months (October-February), reflecting the inactivity of overwintering snakes. These values were highest during spring months (March-June) and September, reflecting the increased surface activity of the snakes. Values were mid-range in July and August, when snakes were relatively inactive but high daytime surface temperatures likely penetrated to the snakes' refugia. Remote, automated T_b data collection using technology such as iButtons is a powerful tool for providing unbiased data on the thermal biology of free-ranging reptiles. These data could potentially be used to remotely estimate surface activity, calculate energy budgets, examine effects of microhabitat on thermal biology, and many other applications.

0107 HL Graduate Research Award, Salon A&B, Sunday July 27, 2008; HL

Effect of climate change on thermal regimes inside natural nests of a lizard species with temperature-dependent sex determination

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Species in which ambient temperatures directly determine offspring sex may be at particular risk as global climates change. However, whether or not climate change affects sex ratio depends upon the effectiveness of buffering mechanisms that link ambient regimes to actual nest temperatures - for example, females may simply lay nests earlier in the season, or in more shaded areas, such that incubation thermal regimes are unchanged despite massive ambient fluctuation. Based on 10 years of monitoring nests in the field at an alpine site in south-eastern Australia, we show that lizards (*Bassiana duperreyi*, Scincidae) have adjusted their seasonal timing of oviposition as well as nest depth in response to rising ambient temperatures, but have been unable to compensate entirely for climate change. That inability stems from the fact that the seasonal march of soil temperatures - and thus, the degree to which thermal regimes at the time of laying predict subsequent conditions during incubation - also have shifted with climate change. As a result, mean incubation

temperatures in natural nests now have crossed the thermal threshold at which incubation temperature directly affects offspring sex in this population.

0495 AES Systematics & Biogeography II, Jarry/Joyce, Sunday July 27, 2008

Global Phylogeography of the Great (*Sphyrna mokarran*) and Smooth (*Sphyrna zygaena*) Hammerhead Sharks

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The great (*Sphyrna mokarran*) and smooth hammerhead (*S. zygaena*) sharks are globally distributed species of significant conservation concern because they have high bycatch rates and high value fins. The great hammerhead has been assessed as endangered and the smooth hammerhead as Lower Risk / Near Threatened by the IUCN Redlist. There is no information on the population structure of either species to inform management and conservation efforts. We report on an ongoing assessment of the global population structure of both species using nuclear microsatellite markers and complete mitochondrial control region (mtCR) sequences (approximately 1098 nucleotides) from 78 great and 85 smooth hammerheads. Great hammerhead samples analyzed thus far included 59 North Atlantic and 6 Indo-Pacific individuals. Smooth hammerhead samples analyzed included 14 Atlantic, 23 North Pacific, 28 Southeast Pacific and 19 Indo-Pacific individuals. Analyses of the great hammerhead mtCR revealed strong geographical subdivision into two distinct evolutionary lineages with little exchange of haplotypes between the lineages ($F_{ST} = 0.704$, $P < 0.005$) and little to no detectable genetic structure within either lineage. Smooth hammerhead mtCR revealed strong geographical subdivision into four separate populations with no evidence of gene flow between the populations ($F_{ST} = 0.802$, $P < 0.00000$) and little to no detectable genetic structure within the populations. Analyses of microsatellite loci from both species are currently underway. Despite the modest regional distribution of samples analyzed thus far, the data suggest that genetic population subdivision in these species may be extensive, making it likely that proper management will require a multi-regional approach.

0080 Fish Systematics III, Drummond, Saturday July 26, 2008

Phylogeny and evolution of the shrimp/goby mutualism in the Pacific

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A paradigmatic example of marine symbiosis is that of shrimp gobies and their shrimp. In this mutualism, snapping shrimp (genus *Alpheus*) dig a burrow that they inhabit with a partner goby. The shrimp is nearly blind, and the goby acts as a sentinel, communicating in a tactile language of tail flicks detected by the shrimp's elongated antennae. An estimated 110 goby species in 10 genera participate in this mutualism in the Pacific, along with approximately 20 species of alpheid shrimp. This imbalance in diversity indicates either that there are many cryptic and/or undescribed shrimp species, or that speciation between gobies and shrimp has not proceeded in concert. We describe novel field techniques for capturing mutualistic

gobies and shrimp, hypothesize phylogeny for both partners based on DNA sequence data, and compare the phylogenies to determine whether or not a pattern of cospeciation exists. We found that of the mutualists we sampled (29 goby species in seven genera and eleven shrimp taxa), some undescribed diversity among shrimp was indicated, but not enough to equal the number of goby species partnered with them. No cospeciation pattern was detected between the shrimps and gobies, instead we identified many generalist taxa of both gobies and shrimp. The distribution of different pairings seems most likely to be determined by ecology, not by evolutionary relationships.

**0514 Fish Ecology I, Drummond, Thursday July 24, 2008; STOYE
ECOLOGY & ETHOLOGY**

**Mosquitofish as Biotic Resistance to Invasion: Predation on Two
Nonindigenous Poeciliids**

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Predation by native species may limit the invasibility of communities. Mosquitofish *Gambusia* spp. are common, small-bodied poeciliids native in many freshwater systems in the USA. Previous work has shown that predation by mosquitofish on small-bodied fishes to be a strong factor in shaping community structure both with naturally co-occurring fishes and where mosquitofish have been introduced. Furthermore, recent research demonstrates that mosquitofish are not strictly gape-limited and can effectively prey on fishes of similar size. Florida has many established nonindigenous fishes, yet few are small-bodied. We experimentally investigated what role mosquitofish predation may have in limiting invasions of small-bodied nonindigenous fishes. In a series of three mesocosm experiments using two common ornamental poeciliids (swordtail *Xiphophorus hellerii* and variable platyfish *X. variatus*) we tested 1) the effect of predator density on adult survival following introduction, 2) the effect of predator density on a stage-structured population, and 3) effect of habitat structural complexity on predation efficiency of mosquitofish. Mosquitofish successfully killed adults of both species even though these individuals were significantly larger than the mosquitofish. Density effects of mosquitofish were not significant in platyfish survival, where survival remained high across treatments, but was a significant factor with swordtails, which had lower survival with increasing mosquitofish densities. Mosquitofish presence was shown to have a strong negative effect on survival of juveniles of both species. Interestingly, mosquitofish predation efficiency on swordtails was shown to actually increase with increasing stem density, although results were not significant with platyfish. Our results suggest that predation on juveniles by mosquitofish is likely a strong factor in limiting invasion success of these species. Direct mortality on adults also may be a factor with swordtails. In both species there was an observed shift in habitat use in the presence of mosquitofish and this may be an important indirect effect, perhaps facilitating other predators.

0357 Fish Systematics I, Salon A&B, Friday July 25, 2008

Taxonomy of the Catfish Genus *Amphilius* (Teleostei: Amphiliidae) in Kenya and Eastern Tanzania

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African catfishes of the genus *Amphilius* (Teleostei: Amphiliidae) are small to moderate-sized fishes native to small streams throughout sub-Saharan Africa. Twenty-four species are recognized, but the taxonomy of *Amphilius* is poorly studied and the genus is believed to be much more diverse than presently recognized. Most of the species have restricted distributions and show a high level of endemism. The species with large distributions are thought to be species complexes with many populations worthy of taxonomic recognition. Skelton (1984) revised the east African species of *Amphilius* and recognized *A. uranoscopus* as a widely distributed species. However, this species is extremely variable in pigmentation and other morphological characteristics. We examined all available specimens, including recently collected material from eastern Tanzania and Kenya, to determine the identity of several nominal species currently in the synonymy of *A. uranoscopus* and to discover undescribed diversity in the complex. We conclude that current taxonomy is inadequate to describe the diversity in Kenya and eastern Tanzania and provide evidence for recognition of several new species as well as some currently in the synonymy of *A. uranoscopus*.

0255 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008

Ontogenetic variation in effect of ration size on growth of *Scyliorhinus retifer*

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Chain catsharks, *Scyliorhinus retifer*, are continental shelf- and slope-dwelling elasmobranchs of eastern North and Central America. This species has been relatively unstudied and it is important to understand some of the basic elements of their natural history to comprehend the larger roles they play, such as their ecologic impact as predators within an ecosystem. The main purpose of this study is to determine how daily maintenance ration will affect growth and gross conversion efficiency during ontogeny. Previous studies have examined how different daily ration levels affect growth and gross conversion efficiency of teleost fishes; however, few studies have dealt with this issue in cartilaginous fishes, and no studies have examined the ontogenetic variation in this relationship for any shark species. This study examines a cold-water species with a considerably slower metabolism compared to similar studies on other cartilaginous fishes. We used four feeding regimes in juveniles and adults to examine the relationship between food intake and growth. We hypothesize that the percentage of food intake that will be used for growth will be highest in juveniles and lowest in adults. We also hypothesize that gross conversion efficiency will peak at an optimum ration that will lead to a decrease in increasing rations beyond this optimum point.

0663 General Ichthyology II, Salon 6&7, Saturday July 26, 2008

Phylogenetic Signals from the Guts of Stomachless Piscivores (Belonidae: Beloniformes)

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Needlefish have a global temperate and tropical distribution occurring in oceanic, coastal, estuarine and fresh waters. They are primarily piscivorous yet lack a stomach, the principal digestive organ in piscivorous fishes. Intestinal pH ranges from 6.0 to 7.3. Oral teeth are caniniform, only holding but not cutting captured fish prey. They have adaptations in both jaw and pharynx that allow them to swallow relatively large fish whole. Little mechanical digestion occurs as a function of passage through the pharyngeal mill apart from possible scale loss and integumental scoring caused by the anteriorly directed posterior teeth of the fifth ceratobranchial dentition. Ingested fish tend to be held in the posterior portion of the intestine just anterior to the rectal valve where it appears that intestinal enzymes alone break them down. These data are compared with comparative data from other members of the order to assess competing phylogenetic hypotheses concerning the Beloniformes.

0004 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT SYSTEMATICS/EVOLUTION

Exploring the Faunal Connection between the Ozark Plateau and the Appalachian Mountains: A Phylogeographic Study of the Long-tailed Salamanders (Plethodontidae: Splerpinae: *Eurycea*)

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The Ozark Plateau is a major geographic feature in eastern North America that harbors a wide diversity of endemic plants and animals. The colonization of these highlands is believed to have occurred from numerous independent invasions from adjacent areas, including the Appalachian Mountains and the Coastal Plain. Although in recent years there have been several detailed phylogeographic studies of eastern North American, few examine species groups that are distributed across the Ozarks and adjacent areas to test the origins of fauna in this physiographic region. Long-tailed salamanders of the genus *Eurycea* are widespread throughout both physiographic areas and are found in relatively high abundance providing an ideal model system to investigate the faunal connections that exist between these regions. This group contains four nominate taxa: the long-tailed salamander, *E. longicauda longicauda*, from the Appalachians, the dark-sided salamander, *E. l. melanopleura*, endemic to the Ozark Plateau, the three-lined salamander, *E. guttolineata*, widespread in the Coastal Plain and the cave salamander, *E. lucifuga*, that is distributed across both the Appalachians and the Ozarks. Using mitochondrial and nuclear DNA sequence data, I closely examined the phylogeographic relationships among the long-tailed salamanders. I specifically tested the timing and patterns of dispersal and colonization into the Ozark Plateau and/or Appalachian Mountains. The nuclear and mitochondrial sequence data obtained provides taxonomic and systematic resolution for the current subspecies *E. l. melanopleura*. Additionally, the existence of hybridization and intergradation between *E. l. longicauda*, *E. l. melanopleura* and *E. lucifuga* previously suggested based on morphological assessments was examined.

0537 Poster Session III, Sunday July 27, 2008

Upland Movements of Juvenile Eastern Tiger Salamanders (*Ambystoma tigrinum tigrinum*) on Long Island

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The long-term survival of the New York State endangered eastern tiger salamander is of special concern due to rapid development of its last remaining habitats on Long Island. Understanding the characteristics of ponds and vernal pools utilized by amphibians like the tiger salamander, as well as the upland habitats used throughout the year, is essential to the conservation and proper management of these species. A radio-telemetric study is currently underway at Brookhaven National Laboratory on Long Island, New York. Data were collected from 2004 to 2007 at three pond locations. Fifty-nine juveniles have thus far been captured and implanted with transmitters. Single night movements ranged 4 to 269m. The average distance from the edge of the wetland was 82.5m, while the average total distance travelled was 109.8m. Animals were tracked for an average of 66 days. Implanted animals have been lost due to predation, loss of transmitter signal, or are still being tracked. Based on our findings, we feel that the current 30m buffer zone for wetlands and aquatic breeding habitats and the corridors to maintain connections with adjacent areas beyond 150m are insufficient to allow for dispersal of juvenile tiger salamanders.

0556 Poster Session III, Sunday July 27, 2008

The North American Reporting Center for Amphibian Malformations and Online Amphibian Information Portal

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Amphibians face many important conservation challenges globally; the dissemination of important information should not be one of them. To this end, the Southern Appalachian Information Node of the USGS National Biological Information Infrastructure (NBII-SAIN) and the University of Georgia's Savannah River Ecology Lab (SREL) launched the NBII Amphibian Site and North American Reporting Center for Amphibian Malformations. Together, these online resources constitute a valuable information repository that supports the collaborative efforts of herpetologists as they seek out information about amphibian populations worldwide. By also providing the public a means of reporting malformed amphibians in an easily accessible website, SREL and NBII-SAIN assist the scientific community's need to identify amphibian populations that may warrant further study. Verified, searchable records of documented malformations can provide researchers early warning and just cause for continued monitoring. By engaging the public in citizen science, NBII-SAIN and SREL are raising awareness about amphibian conservation issues. In addition to searchable data records and the NARCAM reporting interface, visitors to the NBII Amphibian Site (www.nbio.gov/amphibians) can browse crucial topics pertaining to amphibian conservation, such as amphibian disease and the chytrid fungus, amphibian declines

and climate change, and amphibian monitoring programs. The amphibian site also highlights diverse USGS science resources including datasets, species distribution maps, images, and identification guides. Specific to each topic area, the site also features predefined queries of the NBII resources catalog, making simple work of retrieving peer-reviewed online resources and upcoming conferences of interest for amphibian conservation.

0504 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT CONSERVATION

Interspecific Effects of Upland Forest Clearing on Amphibian Migrations: Implications for Habitat and Population Connectivity

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Forest clearing has been shown to reduce survival and promote evacuation of resident amphibians. Therefore, forest clearings may act as barriers to migrating amphibians and limit the connectivity of breeding ponds to adjacent uplands or limit the interconnectivity of local population patches. To examine the effects of canopy removal on amphibian breeding migrations we created 4 replicate experimental arrays in forest habitat on the Savannah River Site, Aiken, SC, USA. Each array had 4 forest harvesting treatments applied to upland habitat immediately adjacent to amphibian breeding ponds: (1) an unharvested forest (>30 yr old); (2) a partially thinned forest; (3) a clearcut with coarse woody debris retained; and (4) a clearcut with coarse woody debris removed. We intercepted amphibians as they migrated to and from wetlands through these habitats using drift fences with pitfall traps. We found limited evidence for treatment effects on the number of individuals immigrating to wetlands through the upland habitats except in open-canopy breeding *Bufo terrestris* and *Rana* spp. which were captured in significantly greater numbers immigrating to wetlands through clearcuts. We also identified a trend, albeit non-significant, for *Ambystoma opacum* to immigrate to wetlands through unharvested forest. We captured significantly greater numbers of salamanders (*A. opacum* and *A. talpoideum*) emigrating out of the wetlands through unharvested or partially thinned forests than through clearcuts. Comparing salamanders with frogs, we found that a significantly greater proportion of salamanders used forested habitat for migrations rather than clearcuts. Our results reflect the important differences that exist in the ecology and vagility of amphibian species. Further, they suggest that landscape-level effects of forest clearing, such as reductions in gene flow or local and metapopulation persistence, may be greater for pond-breeding salamanders than for pond-breeding frogs in the Coastal Plain region.

0257 Poster Session II, Saturday July 26, 2008

Effect of Predation on Body Shape and Life History of Females of *Gambusia* (Teleostei: Poeciliidae)

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Predation can have a streamlining effect on body shape of fishes, which may reduce reproductive allocation by reducing abdominal space available for reproduction. Inversely, theoretical and empirical evidence show that increased reproductive allocation is optimal in environments with increased adult mortality rates. Here we have a possible conflict: predation risk can simultaneously decrease reproductive allocation by selecting for higher escape speeds which can in turn cause a reduction in abdominal space, but also select for an increase in reproductive allocation according to life-history theory. There are few studies that address this potential conflict. We are analyzing the relationship between predation, abdominal space, and reproductive allocation in species of *Gambusia* using a comparative approach. Specifically we are testing the hypothesis that predation and abdomen size interact in a complex way to determine reproductive allocation of females of *Gambusia*. Specimens have been gathered from museum and our own collections. Life history data have been obtained from dissections. Body shape data has been obtained from lateral- and ventral side photographs. Currently we have data from 22 species, comprised by 68 collections. Each of these species was classified according to the predation or water current regime they live in. Our preliminary analyses showed a large variation in life history traits and body shape within the genus. Our hypothesis will be tested using confirmatory Structural Equation Modelling. We will continue pursuing our main objective, to make an assessment of the effect of predation and current, on morphology, life history, performance, and feeding characters for the species of the genus *Gambusia*.

0632 Poster Session I, Friday July 25, 2008

Using Fuzzy Model to Age Estimation of Freshwater Stingrays Species from Rio Negro Basin, Brazil

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Accurate assessment of elasmobranch age is necessary to obtain estimates of growth, mortality and longevity rates. The purpose of this study was through Fuzzy method developed a model for noninvasively determining the age of two species of freshwater stingrays from Rio Negro Basin: *Potamotrygon motoro* e *P. cf. histrix*. One of assumption of the model is that the first maturation occurs in the point of inflection of length and weight curve obtained in the model crisp. The Fuzzy model incorporates the variations that in fact happen in the experimental data. The feasibility of estimating the age by a computer model based on a Fuzzy system was previously reported to teleost fish. The result obtained through Fuzzy model to *Potamotrygon cf. histrix* provide a significant fit to observed data for capture and release studies. Nevertheless the first maturation age of *Potamotrygon motoro* is overestimated using this method, and a model adjustment it is necessary.

0590 Poster Session II, Saturday July 26, 2008

Using GIS and Ecological Niche Modelling to Investigate the Environmental Factors Regulating Amphibian Distributions in Missouri

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A significant challenge in understanding patterns of biodiversity is determining the degree to which the distributions of organisms are regulated by either broad-scale environmental factors (e.g., climate) or local interactions (e.g., competition, microhabitat availability). We are investigating the effects of broad and local-scale abiotic factors on the distributions of ten pond-breeding amphibians in eastern Missouri. Maximum entropy (Maxent) ecological niche models have been developed for each species using temperature and precipitation data, as well as georeferenced locality data. We are testing the predictive ability of these species distribution models using field survey data from amphibian breeding ponds in eastern Missouri. Field surveyors utilize calling adult anuran surveys, egg mass surveys, and larvae surveys to detect amphibians. We are also comparing the accuracy of the niche model predictions to local-scale variables (e.g., pond hydroperiod and canopy cover) that have been demonstrated to be important in regulating amphibian community structure. Initial results indicate that, for most species, the niche models did not predict species presence as well as the local environmental variables. However, Maxent predictions for *Rana sylvatica* exhibited better than random ability to predict species occupancy in areas where individuals were present. In addition, jackknife tests indicated that maximum temperature of the warmest month was the most important climatic variable contributing to the accuracy of the *R. sylvatica* prediction. As *R. sylvatica* is at the southern edge of its geographical range in the study area, this may suggest that broad-scale climate variables are more important in regulating the distribution of species at the edge of their ranges, while local environmental factors may control species distributions near the center of their ranges.

0181 Reptile Ecology, Salon 6&7, Friday July 25, 2008

Eastern Fence Lizards Clean the Agent of Lyme borreliosis from Blacklegged Ticks

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Western blacklegged ticks (*Ixodes pacificus*) are cleaned of Lyme disease-causing spirochetes, *Borrelia burgdorferi*, after feeding on western fence lizards (*Sceloporus occidentalis*). This has been proposed as a partial explanation for the relative scarcity of Lyme borreliosis in the western U.S., where *S. occidentalis* commonly serves as a host for larval and nymphal ticks. We investigated the role that the sister taxon, the eastern fence lizard (*S. undulatus*) may play in *B. burgdorferi* persistence in the Northeast, where most Lyme borreliosis cases occur. Our objective was to test the hypothesis that *S. undulatus*, like its western congener, actively clears *B. burgdorferi* infection from infected ticks. We collected lizards in southern New Jersey, where *I. scapularis* and *B. burgdorferi* are common. In the field, we found little naturally-occurring parasitism of *I. scapularis* on *S. undulatus*, during a time of year when

nymphal *I. scapularis* were actively host-seeking in the Northeast. In the lab, we first fed *B. burgdorferi*-infected nymphal ticks on *S. undulatus* and then checked the molted ticks for infection. We found that *S. undulatus* cleaned *I. scapularis* of the Lyme pathogen. We subsequently fed uninfected larval ticks on challenged lizards to assay for transmission of *B. burgdorferi*, and while transmission to larvae was not completely blocked, it was extremely low. Our data strongly suggest that *S. undulatus* is not a highly competent reservoir for *B. burgdorferi*, at least not for the *B. burgdorferi* strain (Vallhalla, Westchester County, N.Y.) we used. However, *S. undulatus* may be more permissive to other *B. burgdorferi* strains. It appears that *S. undulatus* do not serve the same role in reducing Lyme borreliosis risk as do western fence lizards, because eastern fence lizards are far less important as hosts for *I. scapularis*.

0720 Herp Conservation, Salon 4&5, Sunday July 27, 2008

Population Viability Modelling of the Gopher Tortoise (*Gopherus polyphemus*) and its Implications for Managing Tortoise Populations

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The gopher tortoise is still widespread across the southeastern U.S., although the species is believed to be in serious decline. Biologists and land managers face the dilemma of having to make decisions about how best to manage the remaining populations. When attempting to select among in-situ and ex-situ management options, there are no good decision tools for evaluating or predicting whether the existing population is viable in the long term. We developed demographic models for both native and translocated gopher tortoise populations and used those models to predict outcomes for a variety of population conditions and management scenarios. Baseline models for naturally occurring populations were constructed in VORTEX from demographic values currently available in the literature. All basic model scenarios resulted in declining populations, though populations of 100 animals were unlikely to experience extinction over 100 years and populations of 250 animals were modelled as persisting for 200 years. In all cases, it was clear that juvenile survivorship rates need to be much higher than reported to achieve stability. Populations not likely to be viable will require management intervention, including habitat and/or population manipulations. In-situ protection and management are preferable where possible, and the models suggest that improving habitat can improve long-term population viability. When habitat management alone is unlikely to ensure population viability, manipulations of the population itself, including translocation, may be necessary.

0710 Herp Conservation, Salon 4&5, Sunday July 27, 2008

Impacts of Invasive Brown Anoles (*Anolis sagrei*) on the Arthropod Fauna of Cabbage Palms (*Sabal palmetto*) in Florida

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Invasive species often displace ecologically similar native species, but the effects of such displacements on other food web elements are not well-studied. In Florida, dense populations of an invasive lizard, the brown anole (*Anolis sagrei*), can displace populations of the native and ecologically similar green anole (*Anolis carolinensis*) in open or disturbed habitats. Cabbage palms (*Sabal palmetto*) are commonly abundant in such habitats and are frequently occupied by green and brown anoles. I investigated the potential for brown anole invasions to impact the arthropod fauna of cabbage palms by censusing palm canopy arthropods and conducting timed anole counts on a series of 33 similar islands that varied with respect to brown anole presence and abundance. Using regression analyses, I asked whether brown anole abundance was a significant predictor of arthropod richness or abundance per palm, both overall and for specific taxonomic and functional groups. Brown anole abundance was negatively related to both total arthropod richness and abundance, and regression models indicated that highly invaded islands would be expected to have approximately 35% fewer arthropod species and 40% fewer individuals per palm than identical uninvaded islands. The abundance of brown anoles was also negatively related to the abundances of salticid and other cursorial spiders, ants, crickets, and beetles. Somewhat surprisingly, brown anole abundance was not significantly related to web spider abundance, nor did it predict the abundances of cockroaches or hemipterans. Since brown anoles have been shown to displace green anole populations on the islands used in this study, these results suggest that green and brown anoles do not have equivalent effects within island food webs, at least for arthropod communities on cabbage palms.

0251 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

Phylogeography of the orangebelly darter, *Etheostoma radiosum*

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We studied phylogeography of the orangebelly darter, *Etheostoma radiosum*, over its geographic range in the Ouachita highlands of southwestern Arkansas and southeastern Oklahoma, USA. Analyses focused on uncovering evolutionary forces that shaped present-day distributions of three subspecies, with emphasis on evaluating concordance of haplotype divergence in the mitochondrial (mtDNA) control region and morphological variation. A mtDNA genealogy, derived from nucleotide sequence data, indicated monophyletic Blue and Little River clades that differed from remaining clades by nine and six substitutions, respectively. Samples from the Kiamichi and Ouachita Rivers shared a common haplotype, but unique haplotypes were also identified at lower frequency within each basin. Clear Boggy and Washita River samples shared a common haplotype that differed by one substitution from the common Kiamichi-Ouachita haplotype. Blue and Little River

populations were isolated from the remainder of *E. radiosum* earliest in evolutionary time, followed by more recent divergence of Clear Boggy and Washita systems from the Kiamichi and Ouachita rivers. Morphological divergence and subspecific designations are mostly concordant with findings of the molecular analysis. Recognition of a distinct Little River form appears warranted.

**0534 General Ichthyology III, Drummond, Sunday July 27, 2008; STOYE
GENERAL ICHTHYOLOGY**

**Molecular Genetic Variation in Subspecies of the Circumtropical
Needlefish *Platybelone argalus***

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Marine needlefishes (Beloniformes: Belonidae) are common fishes found worldwide in the tropics and subtropics. The circumtropical species *Platybelone argalus* is restricted to oceanic environments found well offshore of coastal continental waters, frequently inhabiting waters around oceanic islands. Based on morphological variation there are currently eight geographic subspecies of *P. argalus* described and summarized in previous studies. Possibly, there are subspecies that have been geographically separated to the extent that there has been no gene flow between populations for a sufficient time period to have diverged genetically. The objective of our study is to determine the taxonomic status of subspecies of *P. argalus*. Using molecular genetic techniques, such as DNA sequencing, we will assess genetic variation between the populations based on DNA sequences of cytochrome b gene and D-loop region. Preliminary results from mtDNA cytochrome b and D-loop sequences indicate genetic variation between Atlantic and Pacific populations.

0164 Poster Session III, Sunday July 27, 2008

**Validation of Daily Increment Formation on Otoliths and Birth Date
Calculation for Young-of-the-Year Black Sea Bass (*Centropristis striata*)**

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Black Sea Bass (*Centropristis striata*) are an important recreational and commercial fish species in coastal Massachusetts. A better understanding of their life history characteristics, including the accurate determination of their local spawning patterns is essential to the effective management of the fishery. The primary objective of this study is to determine birth dates using daily otolith increments of young of the year (YOY) fish. The formation of daily increments in the otoliths was first validated in the laboratory with a tetracycline immersion experiment. Tetracycline immersed YOY sea bass were maintained for 30 days in a recirculating aquarium system and their otoliths examined to determine the number of rings formed in the experimental time period. For birth-date analysis, sea bass were collected from 5 coastal and 8 offshore sites within Buzzards Bay and Nantucket Sound in the late summer and early fall of 2006 and 2007. Sagittal otoliths were removed, and prepared for analysis by sectioning, polishing, and treating with trypsin. Daily rings were observed through a compound microscope (4X and 10X) and computer enhanced daily rings counted. Birthdates from each sample are being used to identify spawning patterns

for the local population of sea bass. Because the coastal and offshore sites were from two separate areas in coastal Massachusetts waters, (Buzzards Bay and Nantucket Sound) the possibility of differing birth dates and spawning patterns will be explored. This study will allow for the spatial and temporal comparisons of YOY sea bass while in residence in their juvenile habitats.

0480 Poster Session II, Saturday July 26, 2008

Amazonian Poison Frogs Depositing Tadpoles with Andean Competitors: an Ancient Ecological Trap?

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Reproductive habitat selection in anurans is an important determinant of an individual's fitness. Although previous studies have shown that anurans select reproductive habitat on the basis of many cues, relatively few have addressed competition risk as a potential cue. We investigated whether a widespread Amazonian frog, *Ameerega trivittata*, selects habitat for tadpole deposition on the basis of intra- or interspecific competition risk. Competition experiments from a previous study allowed us to determine the effects of competition *a priori* and therefore assess whether habitat selection in response to competitors was adaptive. Our results show that montane populations of *A. trivittata* adaptively select tadpole habitat in response to conspecific competitors. Conversely, their habitat selection in response to a heterospecific competitor (*A. bassleri*) is maladaptive and appears to function as natural ecological trap. We suggest that this ecological trap is maintained by high levels of gene flow from lowland populations that are naïve to the competitor, and that the montane population of *A. trivittata* avoids extinction through its connectivity to lowland populations.

0516 AES Reproduction, Kafka/LeMaratine, Saturday July 26, 2008

Androgen Receptors In The Bonnethead Shark (*Sphyrna tiburo*): A Means To Understanding The Functional Role Of Steroids In The Male Reproductive Tract

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Androgens and the androgen receptor (AR) play important roles in virilization, spermatogenesis, and sexual behavior in vertebrates. An understanding of the distribution and levels of expression of the ARs on the cellular and tissue level demonstrates the pattern of responsiveness to the androgenic hormones in a given organism. In this study, the ARs of the reproductive tract of the male bonnethead shark, *Sphyrna tiburo*, were detected on a cellular level using *in situ* hybridization (ISH) and immunocytochemistry (ICC) while levels of AR expression were measured using relative quantitative PCR. ISH results localized the AR RNA in the interstitial cells, Sertoli cells, and developing sperm of the testes, and mature spermatozoa within the seminal vesicles and the epididymides. The ICC methods used to detect the AR protein using a rabbit polyclonal antibody, PG-21, produced comparable results in the shark testes but did not yield positive results in the seminal vesicles or

the epididymides. However, the Leydig gland, whose secretions contribute to the seminal fluid, demonstrated consistent AR immunoreactivity. The use of relative PCR revealed that these organs have variable levels of AR gene expression that significantly differ with the stage of the shark's seasonal reproductive cycle. Additionally, the presence of steroidogenic enzymes, such as 17 α -hydroxysteroid dehydrogenase, was detected cellularly as a measure of androgen synthesis using ICC. Serum steroid hormone levels are often presumptively correlated with reproductive events whereas knowledge of the cognate receptors provides insight into the cells and processes that are regulated by the hormones. By characterizing AR distribution in the reproductive tract and the steroidogenic enzymes in the testes of male *S. tiburo*, this study provides the basis for future research on the direct and indirect effects of androgenic hormones in this species. These results, along with comparisons of AR distribution in other elasmobranch species, will be discussed.

0491 Poster Session I, Friday July 25, 2008

Re-examination of Growth Rates of Female Bonnethead (*Sphyrna tiburo*) from Two Different Populations from the Eastern Gulf of Mexico Based on Tag-Recapture Data

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Juvenile and adult *Sphyrna tiburo* were tagged with external nylon-barbed tags and released along Florida's Gulf coast beginning in November of 1991. Length and time-at-liberty data from 105 usable recaptures were used to examine growth rates of female sharks from the eastern Gulf of Mexico. The time at liberty ranged from 2 to 2,029 days while the measured growth increments ranged from -5.4 to 29.8 cm. A maximum likelihood approach was employed for the analysis of the growth increment data derived from this tagging and recapture study. This approach allowed for the estimation of von Bertalanffy parameters as well as measurement error, growth variability, and uses mixture theory to provide an objective way of dealing with outliers. A bootstrapping method was utilized to estimate confidence limits of the parameters. Analyses were performed combining all usable samples from all areas and by separating them in two different populations based on previous studies that concluded that there is latitudinal variation in growth rates for this species. These results will be discussed and compared with previous published results from age-at-length data for female bonnetheads inhabiting similar regions of Florida.

0586 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008

Captive Records of Manta Rays in Okinawa Churaumi Aquarium

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From thirty years, from 1978 to 2008, we have kept a total of 19 Manta Rays (*Manta birostris*) in captivity at the Okinawa Expo Aquarium and its immediately adjacent successor, the Okinawa Churaumi Aquarium. We are the first Aquarium in the world to keep manta rays successfully, and as of January 20, 2008, we hold the world record

for the longest time in captivity of a single individual, 15 yrs. 8 months. A female manta pup, the first-ever conceived and born in captivity, was born here on June 17, 2007. For 24 years, until 2001, 14 of these rays were kept either in the 1,100 m³ tank or the open-sea pen associated with the Expo Aquarium. In 2001, when the new 7,500 m³ tank was ready at Churaumi, four of these rays were transferred directly to it, where they have been kept until now. The large Churaumi tank was built to serve as both a display and experimental tank, with the twin goals of exhibiting Whale Shark and Manta Ray feeding behaviors, and studying their reproduction in captivity. We have been fortunate to make observations on mating and birthing behavior of captive adult Manta Rays, and to collect reproductive data, such as size and age at reproductive maturity, gestation time, litter size, size and weight of newborn, most of which is information new to science. Our observations and data, including data on survival times in captivity, are reported and discussed in this report. Among the four species in the Family Myliobatidae kept in our Aquarium (including *Manta birostris*, *Mobula japonica*, *M. diabolus*, *M. tarapacana*), Mantas have shown the best adaptability to captive settings. Because of our demonstrated ability to keep and observe animals successfully over long periods of time, we believe keeping wild animals in captivity can lead to making valuable contributions to understanding their biology.

0764 General Herpetology II, Jarry/Joyce, Monday July 28, 2008

The EMBL/TIGR/JCVI Reptile Database

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The EMBL Reptile database was founded in 1996 and has been the largest and most prominent reptile database on the web since then. In 2007 the database moved from European Molecular Biology Laboratory (EMBL) to The Institute of Genomic Research (TIGR) and then to the J Craig Venter Institute (JCVI) in Rockville, Maryland. Currently it contains more than 8,800 reptile species with data on synonyms, distribution, types, and more than 25,000 references. From the outset the database has been focusing on species-level taxonomy but also provides information on phylogeny and other biological subjects. The current release (May 2008) has also links to photos (on the web) for 3,463 species (~39%) of which more than 2,500 photos of more than 1,500 species are on our own server. Every year the database adds on the order of ~100 species with a record increase in 2007 of more than 150 species. Several years ago we started to collect original descriptions of reptile species. Several hundred descriptions published before 1900 have been made available on our website (see URL below). In a related project, major historical works have been digitized and are available on CD-ROM, including Duméril and Bibron's "Érpetologie Ge_nerale" (10 volumes), Boulenger's catalogs (6 volumes), and complete runs of the Annals and Magazine of Natural History (383 articles pre-1900), Proceedings of the Academy of Natural Sciences of Philadelphia (129 articles pre-1900), Zoologischer Anzeiger (127 articles, 1880-1905), and the Proceedings of the Zoological Society of London (in progress). The database is freely available on the web although CD-ROM and download versions are available for a small fee (or free for contributors who donate photos, literature, or data). Demos of the database will be given in Montreal. The database is available at <http://www.reptile-database.org>.

0380 General Ichthyology I, Drummond, Saturday July 26, 2008

High Diversity in Goatfishes (Mullidae) of the Western Indian Ocean: Two New Species of the Genus *Upeneus*

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The Western Indian Ocean fish fauna is particularly rich in species requiring detailed taxonomic, systematic, and ecological studies. Here we report the finding of two new species of goatfishes of the genus *Upeneus* (Mullidae) based on recently collected material from coastal waters of East Africa, Madagascar and the Seychelles. A part of the collection was made during a cruise with the RV *F. Nansen* off South Africa and Mozambique in 2007. The two new species can be clearly distinguished from other closely related species by a combination of morphometric, meristic, and color characters. *Upeneus* sp.nov.1 differs from the co-occurring *U. guttatus* in numbers of dorsal fin spines (8 versus 7), pectoral fin rays, gill rakers, as well as in coloration. It differs from *U. japonicus* of the Pacific in dorsal fin spine number (8 versus 7), body coloration, and morphometric characters. *Upeneus* sp.nov.2 differs from the Pacific *U. mouthami* in number of lateral line scales, number of gill rakers, head shape, and paired fin lengths. Currently 16 valid *Upeneus* species (two-thirds of the total species of *Upeneus*) are known from the Western Indian Ocean. Further plans include studies of intra- and interspecific morphological and genetic variation among the *Upeneus* and a review of this genus for an account of the family to be included in a book on littoral fishes of the Western Indian Ocean.

0742 Herp Genetics, Salon A&B, Sunday July 27, 2008

Multiple Datasets Lead to a Novel Conclusion: The Case for Male-mediated Gene Flow in the *Phrynocephalus przewalskii* Complex of Toad-headed Lizards

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The central Asian deserts are broken up by large rivers and mountain ranges that provide an assortment of selection regimes and physical barriers. The toad-headed lizards in the *Phrynocephalus przewalskii* complex thrive throughout this dynamic landscape. Thus, one might expect to see an assortment of species and contact zones where hybridization occurs. Indeed, morphological and mitochondrial DNA datasets supported this hypothesis. Our research attempted to unravel the evolutionary relationships of this 'species complex'. We focused on the eastern portion of this complex's range where three distinct species were believed to exist. Using 7 microsatellite loci over 9 populations from 4 mitochondrial clades we discovered an unexpected result. It appears that members of the *P. przewalskii* complex are a single, panmictic population with gene flow dominated by male movements. Green sea turtles are another animal that demonstrates strong, male mediated gene flow. Male mediated gene flow has significant implications for systematics. Results based strictly on mtDNA will never accurately reflect the evolutionary history of species with male biased gene flow. These results emphasize the importance of incorporating data from both the nuclear and mitochondrial genomes in any systematic analysis.

0358 Fish Development/Reproduction, Salon 6&7, Sunday July 27, 2008

A Test for Genetic Associations between Male Nuptial Coloration and Female Mating Preference or Male Aggression Bias in a Polymorphic Cichlid Fish

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Both inter- and intrasexual selection has been implicated in the origin and maintenance of species flocks of cichlid fishes inhabiting lakes Malawi and Victoria. Simultaneous disruptive selection by female mating preference and male-male competition can in theory lead to speciation without geographical isolation if both act on the same male trait. Female mating preference can generate discontinuities in gene flow between morphs, whilst male-male competition can generate negative frequency-dependent selection stabilizing polymorphism of the male trait. The probability of speciation without geographical isolation is greatly enhanced when female mating preference and/or male aggression bias are genetically associated with the trait they operate on. Genetic associations between mating preference, aggression bias, and male nuptial coloration have never been tested for. In this study we focused on these associations in the haplochromine cichlid genus *Pundamilia* from Lake Victoria. We crossed *Pundamilia* females from a phenotypically variable population with males of the same population taken from alternative extreme ends of the phenotype distribution (blue or red). We then quantified mating preferences of the female offspring, and the aggression biases and coloration of the male offspring. We found no evidence of an association between mating preferences of female offspring and coloration of the sires. Male offspring of a red sire were significantly redder than males of a blue sire, which indicates that intrapopulation variation in male nuptial coloration is heritable. Males of the red sire directed more aggression to red males than to blue males, but males of the blue sire did not show any bias. There was a positive association between male aggression bias and its own body coloration among all lab-bred males. This association, which may be due to physical or linkage disequilibrium, could facilitate maintenance of the color polymorphism.

0118 Poster Session II, Saturday July 26, 2008

Vascular Dynamics in the Snake Spectacle

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The vasculature of the reptilian spectacle presents a unique visual problem to those species that possess it. Physiologically necessary on the one hand, optically detrimental on the other, a curious balance between physiological and visual needs must have been struck to achieve optimal fitness. Research by Ludicke (1940, 1969, 1973) attempting to correlate the distribution of vessels with visual need was not entirely conclusive (eg. areas serving the binocular field or the fovea do not have a

lower density of vessels). We thus hypothesized that the dynamics of spectacle blood flow could be engaged to minimize the deleterious visual effects. In our lab, spectacle blood flow of 3 coachwhip snakes (*Masticophis flagellum*) was observed using a slit-lamp equipped with an infrared light source and video monitoring system. Subjects were observed while at rest and while moving targets were presented. At rest, flow followed a cyclical ON-OFF pattern that was very regular within sessions but variable between them ($p < 0.0000$) – as examples, the cycle could consist of 30 seconds of flow for 600 seconds of no flow, or 60 seconds of flow for 120 seconds of no flow. Thermoregulation, residual handling stress, and fed state may all be responsible for this variation. When visually presented with moving targets, the frequency of ON flow events was significantly reduced for the duration of the stimuli ($p < 0.028$). During the shedding cycle, spectacle flow was always ON, regardless of visual stimuli. It is unclear whether we are observing a phenomenon specifically to assist with vision, or if this is a general sympathetic response to the visual stimuli (ie. “fight or flight”) that draws cutaneous blood away from the surface. Regardless, the end result remains the same: in times of visual need, spectacle vessels constrict, resulting in a potential improvement to vision.

0414 Herp Conservation, Salon 4&5, Sunday July 27, 2008

Road Salt Runoff: The Relative Contribution of Direct and Indirect Effects on Aquatic Food Webs

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Recently, ecologists are discovering that anthropogenic sources of stress (e.g., pollutants) may not have direct lethal effects on species, but might alter the strength and direction of trophic interactions when stress is examined in the context of the entire ecological community. Road deicers have recently been identified as a rising chemical pollutant to freshwaters in the United States resulting in salinization. We examined the impacts of salt stress on lentic food web dynamics in two microcosm experiments. In May – July 2007, we assessed gray treefrog (*Hyla versicolor*) tadpole survival, growth and periphyton feeding rates under a sodium chloride (NaCl) gradient (60-945 mg/L Cl⁻). Gray treefrog egg masses were obtained from the Patuxent Wildlife Research Center, tadpoles added to microcosms at the free-feeding stage, and periphyton sampled every 10 days. From December 2007 – January 2008 we also examined the effects of NaCl on phytoplankton and zooplankton using the same NaCl gradient described above. Microcosm ponds were sampled over 4 weeks for phytoplankton biomass and zooplankton abundance. We found that NaCl stress had no direct impact on tadpole survival or growth and no direct effect on periphyton growth. Salt loading had positive effects on phytoplankton whereby chlorophyll-a concentration was greatest in microcosms containing moderate and high NaCl concentrations. The high NaCl treatment reduced zooplankton survival. Plausible explanations include indirect effects on zooplankton due to a shift in the phytoplankton community (i.e., shifts in their primary food source) or direct lethality to zooplankton. Overall, our results suggest that low levels of environmental toxicants that are elevated in the built environment can lead to complex patterns in pond food webs. Differential susceptibility among trophic levels to salt stress in our system might very well lead to altered trophic interactions, even the relative strength of bottom-up versus top-down control.

0176 Poster Session II, Saturday July 26, 2008

Influence of Habitat Heterogeneity and Climate Variables in Brazilian Anuran Communities

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Amphibians are particularly influenced by spatial heterogeneity and high levels of precipitation, because these factors offer a great variety of breeding microhabitats. Here, we analyzed which environmental descriptors of breeding ponds are related to the species composition, and which climate variables influence the species richness among anuran faunas. We performed a Mantel correlation test among the matrix of species composition (Jaccard coefficient) and each one of the matrix (Euclidian distance) of five environmental descriptors (edge types, hydroperiod, size of water bodies, vegetal cover and vegetal structure in the edge) of 37 water bodies from four localities in southeastern Brazil. We also compiled published data from 37 localities in Brazil and extracted climate data (annual mean precipitation and annual mean temperature) from available database of worldclim (<http://www.worldclim.org/current.htm>), using DIVA-GIS mapping software. Linear multiple regression was applied among species richness and climate data of each locality. Three environmental descriptors (edge types, vegetal structure in the edge, and hydroperiod) were correlated to species composition of 37 water bodies. Thus, length of water availability (hydroperiod: $r = 0.16$ and $p = 0.00$), humidity (edge types with humid or flooded soil: $r = 0.38$ and $p = 0.00$), and structure of plants (edge with herbaceous, shrubby and arboreal plants: $r = 0.29$ and $p = 0.00$) showed to be the primary factors affecting the composition of anuran species in breeding ponds. Climate data was related to species richness in the studied localities ($F_{(4,32)} = 4.31$, $p = 0.02$), but only rainfall was related to species richness (beta = 0.34 and $p = 0.03$), while temperature was not related (beta = - 0.26 and $p = 0.10$). The present study corroborates that high levels of precipitation, mainly in forested areas, represent a linkage to occurrence of high number of anuran species.

0461 AES Student Papers II, Kafka/LeMaratine, Friday July 25, 2008; GRUBER

Factors Influencing the Abundance of Sympatric Ray Species over a Shallow Sandflat in Shark Bay, Western Australia

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Shallow habitats of tropical regions often support diverse ray communities, but few studies have investigated how they may partition habitats or resources. Between 2006 and 2008 we examined spatiotemporal variation in ray species composition and abundance over a shallow sandflat in Shark Bay, Australia using belt transects. At least nine species of rays were observed over the flats. More species and individuals were observed when water temperatures were high. The most common species were the giant shovelnose ray (*Rhinobatos typus*), reticulate whipray (*Himantura uarnak*), cowtail ray (*Pastinachus sephen*), and blackspotted whipray (*H. toshi*). Factors

influencing species abundance varied. Blackspotted whipray abundance increased with increasing temperatures but was equal among microhabitats and across tidal heights. Abundances of giant shovelnose rays, reticulate whiprays, and cowtail rays, however, were affected by water temperature, microhabitat, and tidal height. These rays were most common in a narrow band close to shore and increased in abundance only within this microhabitat as temperature increased. These three species also increased in abundance at lower tidal heights when temperatures were high. Feeding pit densities were highest closest to shore, despite preliminary evidence that prey densities are no higher in this microhabitat than other microhabitats and contrary to predictions of behavioral thermoregulation, rays tended to rest in the warmest water available. The patterns exhibited by giant shovelnose rays, reticulate whiprays, and cowtail rays could be driven by predation risk from great hammerhead and tiger sharks, which are common at higher temperatures, but cannot access shallow habitats at low tidal heights.

0047 Herp Behavior, Salon A&B, Thursday July 24, 2008

Effects of *Batrachochytrium dendrobatidis* Infections on Larval Foraging Performance

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There is increasing evidence of pathogen induced modifications in host behaviour, including alterations in foraging behaviour or foraging efficiency. Changes in behaviour may compromise host fitness indirectly by reducing growth and development. Chytridiomycosis is an emerging infectious disease of amphibians caused by the pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*) and has played a role in the worldwide decline of amphibians. In larval anurans, *Bd* infections may result in reduced growth and developmental rates. Two hypotheses exist for this phenomenon: *Bd* infected larvae are lethargic and spend less time foraging compared to non-infected larvae or *Bd* infections cause the loss of keratinized structures in the oral apparatus, thereby reducing the foraging capabilities of infected larvae. To test for differences in foraging activity and efficiency, we conducted experiments examining the effects of *Bd* on larval foraging time and efficiency of larval Grey Treefrogs (*Hyla versicolor*) and Fowler's Toads (*Bufo fowleri*). If *Bd* infections reduce larval activity, we predicted that infected larvae will spend less time foraging compared to non-infected larvae. However, if *Bd* induced oral deformities inhibit normal foraging efficiency, we predicted that infected larvae will forage for the same amount of time as non-infected larvae, but will have less food in their alimentary track compared to non-infected larvae. To test these hypotheses, we conducted two experiments that ran concurrent with each other. In the first experiment, we used a repeated measures design and tested for differences in foraging activity of *Bd* infected and non-infected larvae. In a second experiment, we tested for differences in the short-term ingestion rates of similarly staged larvae by examining the amount of food in their alimentary track after a 3 hour foraging period. Preliminary data from larval *H. versicolor* suggest that *Bd* infected larvae spend less time foraging compared to non-infected larvae. However, in the foraging efficiency trials, there were no differences in the amount of food ingested between infected and non-infected larvae. These data suggest that reduced larval growth rates observed in previous experiments with this species may not be from *Bd* induced changes in foraging ability. Further data will be presented with both *H. versicolor* and *B. fowleri* larvae.

0034 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008

Captive Biology of the Pygmy Devil Ray (*Mobula munkiana*) at the Monterey Bay Aquarium

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Relatively little is known about the captive biology and husbandry care of the devil rays (family Mobulidae). In 2005 the Monterey Bay Aquarium embarked on a collection trip to the Sea of Cortez, Baja California Sur, Mexico. One pygmy devil ray (*Mobula munkiana*) was held for one year and seven months at the Tuna Research and Conservation Center. During this time we learned animal handling and feeding techniques for this species and gathered some initial information on captive biology. A pilot respirometry study was conducted to measure routine metabolic rate; preliminary results indicate a mean MO_2 of 136.2 ± 5.0 (S.E.) $mg\ O_2/kg/hr$ at 21 °C. We hope to continue more respirometry and bioenergetics studies in the future, as well as continuing to develop husbandry techniques for these active rays

0229 Poster Session III, Sunday July 27, 2008

Effects of Forest Clearcutting and Buffer Width on Demography of Vernal Pool Amphibians

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Conservation of vernal-pool-breeding amphibians is inhibited by inadequate understanding of the amphibians' upland habitat requirements. Upland forested buffer zones around vernal pools have been proposed as a management strategy for these amphibians. However, the effectiveness of buffer zones as mitigation for habitat disturbance has yet to be substantially validated. Specifically, few studies have examined the effects of clearcutting and buffer width on demography of amphibians breeding in vernal pools. We used clearcutting to experimentally manipulate upland buffer widths at 11 vernal pools. Over the next four breeding seasons, we used drift fences and pitfalls traps to capture, identify and count all amphibians entering and exiting the pools. We marked each exiting spotted salamander (*Ambystoma maculatum*), blue-spotted salamander (*Ambystoma laterale*), and wood frog (*Lithobates sylvaticus*) for recapture, and documented sex, age class, mass, and snout-vent length. We are using these data to assess the impacts of buffer width on such population parameters as sex ratio, size structure, fecundity, and population size variability. We will use results from this study to improve forestry best management practices.

0467 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

Barcoding Reef Fish Larvae: Dispersal and Connectivity Studies and Identification of Rare Species

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The utility of barcoding for studies of the early life history of reef fishes has only begun to be explored. Despite the importance of questions of connectivity between reefs and distant islands, little is known about the long-distance dispersal of reef fish larvae. Comprehensive open-ocean samples of larvae are uncommon and identifications are difficult, especially to species. Resolving species is, however, necessary, since most interesting questions of connectivity are at the species level. Barcoding provides an excellent method to identify larvae to species and thus often can help reveal the origin of the dispersing cohort. I applied this technique to a large sample of larvae I collected from the open ocean along the equator about 1,000 km from the coast of Ecuador and 400 km from the Galapagos Islands. Species-level identifications revealed some surprising results: the cohort included a razorfish species supposedly endemic to Baja California (2000 km from the collection site), as well as a suite of reef fishes and continental fresh-water species indicative of an origin in Central America. These findings greatly expand our model of the dispersal abilities of reef fish larvae. In addition, barcoding also helps to identify the larvae of rare species, which are typically undescribed and usually remain undetected among conspecifics. I present an example of this with the identification of larvae of the rare and threatened giant cubera snapper from my collections in Caribbean Panama.

0127 Poster Session II, Saturday July 26, 2008

Ichthyofaunal Survey of the Rivers of the Eastern Arc Mountains in Tanzania

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Between 8 September and 4 October 2007, we conducted a preliminary survey of fish species in several rivers draining the Eastern Arc Mountains of coastal Tanzania, including the Uмба, Sigi, Pangani, Ruvu, Wami and Ruaha/Rufiji River basins. The Eastern Arc Mountains are renowned for a high level of endemism among plants and terrestrial animals and are considered one of the world's top conservation "hot spots." Despite early exploration of this area during both British and German colonial periods, the ichthyofauna of this important region is still poorly known. A total of 29 field sites were sampled, with an emphasis on fast flowing streams arising in the Usambara, Uluguru and Udzungwa Mountains, individual ranges within the Eastern Arc Mountains. We employed a variety of methods to collect fishes including seines, cast nets, dip nets and an electroshocker. Approximately 75 species of fishes, from 17 families, were collected. Rheophilic catfishes like *Chiloglanis* (Mochokidae) and *Amphilius* (Amphiliidae), as well as species of *Labeo*, *Garra* and *Barbus* (Cyprinidae) are particularly well represented in these collections. Preliminary assessments of the material indicate the presence of several new species, including but not limited to the families Amphiliidae, Mochokidae, Cichlidae, and Mormyridae. The limited sampling of this vast area and its conservation significance strongly suggest that

further collecting efforts are necessary to accurately and thoroughly document the fishes of this region. Specimens and associated tissue samples are deposited at the Cornell University Museum of Vertebrates and Florida Museum of Natural History.

0163 Fish Physiology, Salon 6&7, Sunday July 27, 2008

Jaw Protrusion Enhances Suction Feeding Performance in Fishes

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The ability to protrude the jaws during prey capture is a hallmark of teleost fishes, widely recognized as one of the most significant innovations in their diverse and mechanically complex skull. An elaborated jaw protrusion mechanism has independently evolved multiple times and is a conspicuous feature in several of the most spectacular fish radiations, ultimately being found in approximately half of living species. Variation in jaw protrusion distance and speed is thought to have facilitated the remarkable trophic diversity of these groups, although its mechanical consequences for feeding performance remain unclear. Here we show, using a hydrodynamic perspective that rapid jaw protrusion enhances by up to 50% the force exerted on prey items during suction feeding, thus improving prey capture ability. This counterintuitive mechanism represents the first general advantage recognized for suction feeding fishes that protrude their jaws. Furthermore, using a phylogeny of centrarchid fishes, we report an intimate evolutionary association between the capacity to generate high-velocity suction flows and rapid jaw protrusion during suction feeding, indicating that these two innovations evolved synergistically to enhance suction feeding ability. The force requirements for capturing aquatic prey appear to have been a strong selective factor for the evolution of jaw protrusion in modern fishes.

0734 Fish Conservation, Drummond, Sunday July 27, 2008

Age-0 Fish Assemblages of the Apalachicola River and Floodplain, Florida, in Relation to Altered Hydrology and Movement Patterns of Reproductive Adults

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The Apalachicola River is the largest river by discharge in Florida and has one of the most extensive forested floodplains of Gulf Coastal rivers. Decades of regulated hydrology, long-term droughts, and increased water consumption have significantly affected aquatic habitats and fish communities in the floodplain and the river. Allocation of water resources to restore and protect aquatic habitats and management of associated fish populations are major issues within this stressed system. Of particular concern are low-flow conditions and habitat availability during critical life-history phases of floodplain-dependent fishes. Studies were conducted from 2002-2007 to characterize fish communities within the floodplain, with emphasis on examining assemblage structure and temporal appearance of the age-0 year class. Sampling strategy varied each year from 2002-2004 to address spatiotemporal heterogeneity. Efforts in 2006-2007 were directed to: (1) further refine

estimates of peak spawning periods, (2) compare river and floodplain catches as related to an artificial oxbow restoration project, and (3) search for correlates of age-0 fish abundance of selected target species with movement activities of reproductive adults as determined by acoustic telemetry. For the entire study period a total of about 64,000 age-0 fish were collected from over 1,500 light-trap sets. At least 50 taxa were recorded from floodplain habitats representing about 55% of all freshwater and diadromous species in the Florida portion of the drainage. Families represented by greatest abundance were cyprinids, centrarchids, catostomids, and percids. Habitat heterogeneity and variation in distribution of species belonging to different habitat or trophic guilds accounted in part for differences in relative abundances of individual taxa among waterbodies and macrohabitats. Recruitment extended from early spring to late summer with peaks from March to May. A simple binomial likelihood model for estimating the probability of adult fish using the mainstem and/or floodplain tributaries suggested a relationship between flow regime and probability of fish using a given habitat.

0152 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008

A new species of angelshark, *Squatina* sp. nov., from the western North Pacific (Chondrichthyes: Squatiniformes, Squatinidae)

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A recent taxonomic study (Walsh and Ebert, 2007, *Zootaxa*, 1551: 31-47) redescribed and confirmed the occurrence and validity of four squatinid species (*Squatina formosa*, *S. japonica*, *S. nebulosa*, and *S. tergocellatoides*) in the western North Pacific (WNP). These squatinids can be distinguished from each other by several distinctive characters including: the relationship of the pelvic fin tips to the first dorsal fin origin, pelvic girdle width, upper lip arch shape, and the presence or absence of mid-back thorns and ocelli on the pectoral fins. Examination of a squatinid species caught off the Philippine Islands, previously identified as *S. formosa*, was found to reveal several distinct characters inconsistent with other WNP squatinids. These distinctions include differences in the head width, pelvic insertion and pelvic base length, and unique caudal and upper lip arch shapes. We contend that these differences warrant designation of a new species of WNP squatinid. A revised dichotomous key for the region is presented that now includes all five known WNP squatinid species.

0099 Poster Session III, Sunday July 27, 2008

Habitat Use and Movement Patterns of Eastern Hognose Snakes (*Heterodon platirhinos*) in Southcentral New Hampshire

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The protection of rare, threatened, or endangered species largely depends on suitable natural history information to develop appropriate conservation plans. We present the results of a two-year radiotelemetry study of eastern hognose snakes (*Heterodon platirhinos*), listed as threatened by the state of New Hampshire. We radiotracked 8

adult eastern hognose snakes (seven females, one male) on New Boston Air Force Station (NBAFS), a 1,144 ha site in southcentral New Hampshire that contains a variety of landcover types. We found that snake home range sizes, calculated using minimum convex polygons (MCP) and 50% fixed kernel estimates, varied considerably among individuals (MCP: 7.2 – 116.0 ha; fixed kernel: 1.4 – 11.3 ha). To determine snake selection of particular habitat types or other geographical and topographical features of NBAFS, compositional analyses of discrete variables and repeated-measures analyses of variance of continuous variables were performed to compare the characteristics of snake locations to random locations on the station. Overall, snakes selected open habitats (old fields, clearcuts, and parkland) and avoided forested and wetland habitats. Snakes selected sandy and gravel-sand mixed soils more often than soils with exposed rocks or stones. Snakes also selected locations with lower slopes and with shorter distances to streams. These results are consistent with observations of eastern hognose snake resource use in other parts of the species' range. We suggest that the maintenance of open early successional habitats as a component of forested landscapes will be critical for the persistence of eastern hognose snake populations in the northeast USA.

0081 Poster Session II, Saturday July 26, 2008

Variation in Amount of Forest Habitat Influences Orientation of Juvenile Amphibians Emigrating from Breeding Ponds

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Juvenile dispersal is important for the persistence of amphibian populations. Previous studies have observed non-random orientation in juvenile amphibians emigrating from breeding ponds; however, the environmental cues associated with these movements are not well understood. We examined the emigration behavior of recently metamorphosed juveniles of three pond-breeding amphibian species from three woodland ponds. We found that juvenile small-mouthed salamanders (*Ambystoma texanum*), American toads (*Bufo americanus*), and wood frogs (*Rana sylvatica*) exhibited non-random orientation upon exiting the breeding ponds. Furthermore, we found a positive relationship between captures of juvenile small-mouthed salamanders and wood frogs and width of the surrounding forest habitat, indicating that these species are selecting areas with broader forested habitat upon exiting the breeding ponds. Our results indicate that migrating juvenile amphibians may rely on direct environmental cues as the orientation of small-mouthed salamanders and wood frogs was influenced by width of the surrounding forested habitat. These observations support previous studies suggesting that maintaining forest habitat, along at least a portion of breeding ponds, is important for the persistence of amphibian populations.

0613 Reptile Ecology, Salon 6&7, Friday July 25, 2008; STOYE ECOLOGY & ETHOLOGY

Spatial Ecology of Male Northern Water Snakes, *Nerodia sipedon sipedon*, in the Beaver Archipelago

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Sexual dimorphism is common across the animal kingdom and can sometimes cause a differential in attention paid to a particular sex by researchers. In the case of northern water snakes (*Nerodia sipedon sipedon*) this is manifested by an inordinate proportion of studies focusing female snakes, as they are larger and more obvious. Traditionally males have been considered only during the breeding season. This study examined the differences between the sexes by focusing on unknown behavioral characteristics of males (post breeding season). PIT tagging and radio telemetry were used to facilitate the collection of data on BMI and factors related to habitat selection. Results suggested that BMI increases over the course of the year, as expected. In terms of micro-habitat selection, males seem to have individual preferences that do not correlate with any other factors. Likewise there were significant differences detected between individual males for mean body temperature. These results emphasize the need for further study of more cryptic male sex and especially for the use of a larger sample of individuals in order to tease apart the determining factors for microhabitat and mean body temperature selection.

0101 Amphibians in Ecosystems Symposium, Salon 6&7, Sunday July 27, 2008

Multi-Trophic Level Effects of Terrestrial Salamanders in Forest-Floor Food Webs

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Terrestrial salamanders are hypothesized to play an important role within the detrital food web of the forest-floor through top-down regulation of invertebrates and ecosystem processes. However, salamanders reside within a complex food web in which the strength and direction of predator effects are influenced by species composition, bottom-up forces (detritus supply), and abiotic factors. Also, predators can have multiple effects in addition to predation, including trait-mediated effects, regulation of apparent and actual competition among prey species, indirect effects on non-prey species, and direct subsidies to lower trophic levels through waste products. I will summarize results of long-term field and short-term laboratory experiments through which my students and I have documented such complexities in the ecological role of the red-backed salamander (*Plethodon cinereus*). A 5-year field experiment investigating the impact of *P. cinereus* demonstrated that salamanders can have significant effects on diversity and density of invertebrates. However, salamander effects varied among invertebrate taxa and over time. The strongest effects of salamanders are positive indirect effects that increased density of some invertebrate taxa. Interaction strengths between salamanders and invertebrates varied in strength and sign with a gradient of litter resources, with strong positive interactions at low litter supply and negative interactions at high litter supply. Covariance of litter supply and interaction strength was non-linear for several taxa for which neutral to positive interactions were observed at intermediate litter levels.

Microcosm experiments indicated that positive effects of salamanders were exerted through regulation of apparent or actual competition and/or subsidies in the form of salamander wastes or skin secretions. A field experiment comparing effects of removals of salamanders and arthropod predators to un-manipulated controls indicated that trait-mediated effects also play an important role. The implications of these results with regard to food web theory and effects on ecosystem processes will be explored.

0339 AES Conservation, Kafka/LeMaratine, Sunday July 27, 2008

Counting Elasmobranchs

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Recent widespread evidence documenting large-scale shifts in elasmobranch populations has changed the perspective of research methodology from observational studies to a more predictive framework based on meta-analysis of fisheries data and population modelling. However, this shift has not effectively addressed the fundamental problem with censusing elasmobranch populations which is that long-lived and potentially rare and declining species continue to be decimated, and in some cases they are removed for the sole purposes of censusing. Given that many shark species have declined to dangerously low levels of abundance at alarming rates, there is a need to implement non-destructive methods of censusing these highly vulnerable species. I synthesize methods used to count marine fishes, with an emphasis on elasmobranchs, and make the argument that volunteer scuba divers can provide valuable data that should be used in the assessment of global elasmobranch populations. I first review the most commonly used methods for censusing elasmobranch populations. Then I cover non-extractive methods- how they work, and their ability to include elasmobranchs. Subsequently, I present results of a model that simulated fish and divers in the three most commonly used underwater visual census (UVC) methods, roving-diver technique, belt-transect technique, and stationary-point count. Here, I discuss the accuracy of these UVC methods for estimating fish density at different fish speeds and investigate the best method for censusing fish at low densities. Finally, I review the utility of Citizen Science and present the North American Breeding Bird Survey (BBS) as an example of a successful application of volunteer surveys. Using the BBS as an analogy, I propose that marine scientists employ volunteer scuba divers to report elasmobranch sightings in a way that can be valuable for monitoring and conservation.

0153 HL Graduate Research Award, Salon A&B, Sunday July 27, 2008; HL

The Interaction between Mean and Variance of Nest Temperature Affects Primary Sex Ratios in an Agamid Lizard

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Temperature-dependent sex determination (TSD) may enhance parental fitness because it enables male and female offspring to be produced at their respective optimal incubation temperatures. Indeed, recent work suggests that male and female offspring of many agamid lizards may differ in their optimal timing of hatching, and

that TSD in these species may have evolved to generate adaptive seasonal shifts in offspring sex ratios. To explore this hypothesis, I studied how changes in the mean and variance of nest temperature over the season may influence seasonal shifts in offspring sex ratios in an Australian agamid lizard with TSD (*Amphibolurus muricatus*). By radio-tracking gravid females, I located 44 nests spanning the entire reproductive season (Oct-Feb). Nest temperatures and the resultant sex ratios were recorded from each nest. Although both mean and variance in nest temperatures changed seasonally, a concomitant shift in clutch sex ratio was not statistically significant. This non-significant relationship between nest temperature and predicted primary sex ratios in the field may have been obscured by egg mortality and/or confounding maternal effects. A subsequent laboratory-based egg incubation experiment that mimicked natural nest temperatures (and minimized egg mortality and confounding maternal effects) demonstrated that both mean and variance in nest temperature induces variation in offspring sex ratios. Moreover, a significant interactive effect of thermal mean and variance on primary sex ratios illustrates that complex interactions among different environmental parameters during embryonic development affect offspring phenotypes in ways that could impact fitness.

0399 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

Fish Faunal Regions of the Southern United States: Isolation by Distance as a Structuring Mechanism

Melvin Warren

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The southern United States supports one of the richest temperate freshwater fish faunas on Earth. Fishes of the region also show high levels of drainage endemism, suggesting isolation as an important mechanism structuring the fauna spatially. I examined geo-spatial structure of this large, rich fauna using a database of 685 fish taxa with each taxon allocated across 51 drainage units. I used the total native fauna and faunal subsets (darters, minnows, catfishes, and suckers) to define fish faunal regions and to examine the association of isolation by distance and fish assemblage structure among drainage units. I used distance matrices and cluster analyses to compare geo-spatial structuring among faunal subsets and drainage networks. I used non-metric multidimensional scaling analysis as an independent test of the adequacy of cluster-derived faunal regions. The analysis revealed eight, highly distinctive faunal regions (Atlantic North; Atlantic South; Florida Peninsula and Panhandle; Mississippi River (including Interior Highland tributaries) plus the Ohio River, and Red River mainstems; Western Gulf Slope; Tennessee and Cumberland Rivers and Ohio River tributaries; and Missouri River and tributaries plus the Illinois-Neosho River). The phenetic relationships of the fauna of drainage units (all native and subsets) were significantly and strongly congruent with geographical linkages of drainages (isolation by distance). Overall, the results indicate highly, distinct, strongly geo-spatially structured inter-drainage and inter-regional native fish faunas.

0545 Reptile Ecology, Salon 6&7, Friday July 25, 2008; STOYE ECOLOGY & ETHOLOGY

Ecological Effects of Food Supplementation in Fer-de-Lance (*Bothrops asper*).

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A growing body of work has shown that food limitation can have wide-ranging effects on predators. In reptiles, energetic resources can directly influence life-history parameters including growth, reproduction, and survivorship; less well-documented is the relationship between food availability and spatial ecology under field conditions. Ambush-hunting snakes such as pitvipers may be particularly well-suited to such studies as they are typically infrequent feeders with relatively low space usage, and whose activities are often correlated with prey availability. I investigated the effects of food supplementation on a population of fer-de-lance (*Bothrops asper*) in Costa Rica. Free-ranging snakes were assigned to either a "control" (n=6) or "fed" group (n=5) and monitored via radiotelemetry for up to one year. Fed snakes were offered a pre-killed rat in the field once every two weeks, to simulate increased but not unnaturally high prey availability. I compared spatial patterns between treatment groups in terms of home range (minimum convex polygons, 95% kernel density), movement rate, and both macro- and microhabitat usage. Differences in body condition (mass-length ratio), survivorship, and non-spatial behaviors (percentage of evenings spent ambushing, shelter usage) are also reported.

0424 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

Macroecological Patterns at the Mesoscale: Distribution, Abundance, and Body Size of Amphibians and Reptiles on Forest Islands in Northeastern Bolivia

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Here we explore three common macroecological patterns on naturally-occurring forest islands in a forest-savannah transition zone in northeastern Bolivia: the distribution-abundance relationship, the abundance-body size relationship, and the distribution-body size relationship. We utilized partial correlation analysis to investigate associations between pairs of variables independent of the effects of the third variable, and we partitioned our total data set taxonomically to explore variation in relationships among variables. For both amphibians and reptiles, there were strong, positive correlations between distribution and abundance: abundant species were widespread in the environment. Large-bodied amphibians were widely distributed among forest islands, but this was not the case for reptiles. We attribute the positive association between distribution and body size seen in amphibians to dispersal limitation of small-bodied species. There was an inverse relationship between abundance and body size for amphibians; small bodied species are more abundant than large-bodied species, but this was not the case for reptiles. We explore the implications of the differences in the abundance-body size relationship between amphibians and reptiles in light of competing ideas about how resources are partitioned among species in local communities.

**0323 Fish Physiology, Salon 6&7, Sunday July 27, 2008; STOYE
PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY**

**An Adaptive Physiological Response to Thermal Habitat Alteration by the
Globally Invasive Species, *Gambusia affinis***

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The Invasive Species Specialist Group of the World Conservation Union (IUCN) has included the western mosquitofish, *Gambusia affinis*, as one of the world's 100 worst invasive species. Initially introduced in many areas as a means to control the mosquito populations, *G. affinis* is currently the most widely distributed freshwater fish in the world, inhabiting every continent except Antarctica. The ability to tolerate or adapt to diverse environmental conditions is commonly considered a trait of invasive species. A broad thermal tolerance, in particular, allows potentially invasive species to disperse across a larger latitudinal gradient. The results of this study establish upper and lower critical thermal limits for three populations of *G. affinis* across seasons at two acclimation temperatures, including a population exposed to artificially elevated temperatures produced by a steam-electric power station. Thermal temperature polygons were established to describe this species' eurythermicity, and to assess the capacity of this invasive species to adapt to anthropogenic alterations of its thermal habitat, which has broad implications for invasive species exposed to ongoing, global climate change.

0578 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

**Thermal Physiology and Field Observations Support Microhabitat
Diversification and Spatial Resource Partitioning Among *Plestiodon
fasciatus*, *P. laticeps*, and *P. inexpectatus***

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Three species of five-lined skinks (*Plestiodon fasciatus*, *P. laticeps*, and *P. inexpectatus*) occur in syntopy across much of the Southeastern United States. These closely-related species, at one or more levels of development, all exhibit a like phenotype and a high amount of prey resource overlap as documented by published gut content data. Under competitive exclusion hypotheses, these species should therefore not locally co-occur. This study confirms, through analysis of habitat type and canopy cover at the point of capture, that *P. inexpectatus* and *P. fasciatus* do not typically inhabit the same forest habitat. In fact, where their ranges overlap, *P. fasciatus* inhabits closed-canopy hardwood forests, while *P. inexpectatus* inhabits open forested habitats such as Longleaf Pine Savannah and coastal scrub forests. Outside of the range of *P. inexpectatus*, *P. fasciatus* inhabits a wider variety of habitats. *P. laticeps* is routinely found in sympatry with either species. Due to their large adult size, *P. laticeps* may be able to utilize larger prey, thereby partitioning available resources. Physiological data - oxygen consumption and its temperature response (Q_{10}) - supports the hypothesis that these species differ with respect to their metabolic response to temperature. *P. fasciatus* exhibits a high Q_{10} at the interval that exceeds the mean daily summer temperature of sampled closed canopy forests (~25°C). *P. inexpectatus* exhibits a dramatic decrease in metabolic rate on the interval that falls

below the mean daily summer temperatures of sampled Longleaf Pine Savannah habitat. The VO₂ of *P. laticeps* is the least temperature sensitive. Collectively, these findings indicate that an evolutionarily conserved physiological niche among species/populations may play an important role in spatial resource partitioning and maintenance of biodiversity between two of these three closely-related species.

0455 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008; GRUBER

The Intrinsic Elasmobranch Gill Design Potentially Limits Gas Exchange and the Aerobic Performance of the Shortfin Mako, *Isurus oxyrinchus*, a Lamnid Shark

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The lamnid sharks (family Lamnidae) demonstrate a remarkable evolutionary convergence with tunas (family Scombridae) for high-performance swimming. Analysis of gill structure and function in the shortfin mako, *Isurus oxyrinchus*, a lamnid shark, reveals similarities to tunas in the presence of specializations to maintain gill rigidity during ram ventilation and to permit the O₂ transfer required for fast, sustainable swimming. However, mako and tuna gill specializations have structurally different bases due to intrinsic differences in the gill design of elasmobranchs and teleosts. The elasmobranch gill has a more tortuous water pathway, and *in vivo* measurements of mako gill resistance suggest that this design limits total gill surface area in comparison to some teleosts. Thus, while mako gill areas are larger than non-lamnid shark species, they are significantly less than those of tunas. The larger size of elasmobranch erythrocytes also increases mako respiratory lamellar thickness and gas diffusion distances in comparison to tunas. These intrinsic characters limit gas exchange and may prevent lamnid sharks from reaching the scope of sustainable aerobic performance achieved by tunas.

0043 Fish Systematics III, Drummond, Saturday July 26, 2008

***Crystallaria cincotta*, a New Species of Darter (Teleostei: Percidae) from the Elk River of the Ohio River drainage, West Virginia**

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A new species of percid, *Crystallaria cincotta* (Diamond Darter) was described recently from the Cumberland, Elk, Green, and Muskingum river drainages of the Ohio River basin, USA. It differs from populations of *Crystallaria asprella* (Crystal Darter) of the Gulf Coast, lower Mississippi River, middle Mississippi River, upper Mississippi River, and Wabash River drainages by having a reduced number of cheek scale rows restricted to the post-orbital region, a falcate margin on the pelvic fins, a preorbital blotch distinctly separate from the anterior orbital rim, and a wide mouth gape. The Diamond Darter population of the Elk River is also divergent genetically from Crystal Darters of the Gulf Coast, lower Mississippi River, and upper Mississippi River drainages. Since 1980, sampling efforts have produced a

total of 12 Diamond Darters from the lower 36 km section of the Elk River, West Virginia. The relatively small number of Diamond Darters collected from the lower Elk River likely indicates species rarity, but may also reflect sampling gear avoidance. Based on museum specimens and sampling efforts, the distribution of the Diamond Darter has decreased dramatically since the late 1800s with population extirpations in Kentucky, Ohio, and Tennessee.

0029 Poster Session III, Sunday July 27, 2008

Development of a Handbook on Gopher Tortoise (*Gopherus polyphemus*) Health Evaluation Procedures

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The gopher tortoise is a widespread species, but one at risk. Recently, greater interest in the survival of the species has led to a series of programs and proposals for a region-wide program of cooperative management. Relocating the animals when their habitat is threatened by human disturbance is a common management practice on both public and private lands. However, numerous diseases and health conditions affecting the species have the potential to influence the success of these relocations. A process to better incorporate health and disease related information into management decision-making was identified as an important missing element. The newly developed manual contains decision trees, charts and other such aids, including a special section identifying warning flags of potentially serious health problems. The manual thus facilitates decision-making regarding the health status of gopher tortoises by land managers, military and otherwise, when developing management plans involving relocation or augmentation of tortoise populations on their lands. The primary emphasis is on basic physical examinations of gopher tortoises because the manual was specifically designed for use by land management personnel. Additional information and resources are provided for instances when more comprehensive health assessments are needed. This manual is part of a larger project initiated within the US Army environmental research program to address specific gaps in information regarding gopher tortoise population ecology and health.

0677 Poster Session I, Friday July 25, 2008

Migration of a High Trophic Level Predator, the Salmon Shark, Between Distant Ecoregions

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Knowledge of how animals move through the environment, and the characteristics of habitats they select, are essential to understanding the ecological functions they

are fulfilling in each habitat, which in turn is necessary to predict responses to environmental change. High trophic level organisms are known to exert structural influences through the food web, so understanding the range, migration and foraging strategy of abundant predators is necessary to understand ecosystem function. As a result of the difficulty of studying pelagic marine animals, our knowledge of their life history and ecology has developed slowly. Recent advances in monitoring technologies have enabled researchers to remotely follow individual animals over seasonal and multi-year timescales, revealing long-distance migrations in a variety of marine taxa. In this study, satellite telemetry is used to monitor the behaviour of salmon sharks, and remote sensing to characterize their environment, thereby obtaining both animal behaviour and habitat data. Salmon sharks undertook long-range migrations wherein behavioural indices were correlated with regional habitat characteristics. Quantitative movement analyses to determine speed, path straightness and first passage time revealed focal area behaviours in northern and southern regions, with transiting behaviours at mid-latitudes. Individuals migrating to a highly productive southern region stayed longer than those moving to a low productivity region. The combination of multi-year time-series of animal behaviour with synoptic environmental data allows us to understand how the habitats that animals select differ from one another, the key factors influencing habitat selection, and the likely responses to change.

0679 AES Habitat & Movement I, Jarry/Joyce, Saturday July 26, 2008

Migration and Habitat Use of Blue Sharks in the Eastern North Pacific Ocean

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The blue shark is the most abundant pelagic shark in the world and is likely to be an important predator in open ocean ecosystems. Blue sharks have been captured in enormous numbers in high seas fisheries over many decades, sustained only by the wide distribution and high fecundity of the blue shark, but major reductions in abundance have occurred in some ocean basins and the IUCN lists the species as 'Lower Risk Near Threatened'. Knowledge of the biology of this species is important to help us understand how pelagic communities function, and why some elasmobranch species are more vulnerable to overexploitation and extinction than others. We studied the spatial ecology of blue sharks via satellite telemetry by tagging sharks in two locations within the California Current System of North America. Sharks made extensive use of the rich upwelling system off Baja California, California and Oregon, and also made long distance movements into oligotrophic regions of the subtropical gyre and the eastern tropical Pacific. Blue sharks did not appear to undertake movements in a coordinate manner as they dispersed from the tagging locations. Blue sharks inhabited cool upwelled waters, warm tropical waters to near 30°C, and waters beneath the thermocline to 7°C. The sharks undertook extensive diving to depths in excess of 700 m. Diving was frequently greatest during daytime, but sharks undertook dives at all times of the day. Knowledge of the movements and habitat usage of this abundant pelagic shark will improve our understanding of pelagic ecosystems and inform the development of high seas fishery management schemes.

0568 Poster Session II, Saturday July 26, 2008

Evolution of Neurotoxins in Rattlesnakes: DNA and Peptide comparisons

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A number of rattlesnakes possess PLA₂ β-neurotoxins in their venoms, which contributes to high toxicity and low LD₅₀ values. These toxins exist in heterodimeric form as complexed A (acidic) and B (basic) subunits, and include crotoxin, Mojave toxin, and sistruxin, among others. Published DNA and amino acid sequences for these three toxins were compared to determine patterns of evolution related to individual subunits, species phylogeny and relationships to related taxa. Based on mRNA constructs and cDNA sequences, A (chaperone) subunits are conserved relative to B (neurotoxic) subunit DNA sequences. The reverse was observed for peptide sequences of these toxins. Previous hypotheses of gene duplication and parallels to species differentiation are supported.

0667 Fish Systematics I, Salon A&B, Friday July 25, 2008

Phylogenetics and Bioinformatics of Fishes and Herps: Web Tools for Taxonomy and Evolution in the Encyclopedia of Life

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Rapid access to information is arguably the defining revolution of our times. This is true of all fields in biology, as the growth of accessible information on species, geography, genetics, evolution and ecology transcends our ability to process and analyze it. Large-scale, web-based bioinformatics projects provide opportunities for biologists to aggregate multiple kinds of information about organisms, and will create new ways of conceiving of exciting biological questions, analyzing data, and rapidly communicating about biodiversity. The Encyclopedia of Life is one of many bioinformatics projects that may offer opportunities for the ASIH audience to rapidly integrate multiple sources of data for synthesizing information on taxonomy, specimen collections, biogeography and phylogenetics. The EOL will develop web content for all described species on Earth, including fossil taxa, and by collaborating with FishBase, Catalog of Fishes, Catalog of Life, and the Tree of Life Web Project (among others) we now have over 50,000 species pages, most of them depending on FishBase content. Web tools for contributing to and editing the EOL are nearly ready, and will enable ASIH members to make EOL pages according to our vision. In addition, a dynamic phylogenetic tree browser is a top priority of the Biodiversity Synthesis Center (BioSynC), a branch of the EOL in Chicago. We propose to begin construction of a supertree for Fishes (contributed to by many) that will provide a browser for EOL fish content, as a model for other groups of organisms (like Herps) as more content becomes available on the site. BioSynC welcomes proposals for synthesis meetings on topics in lower vertebrate taxonomy, biogeography and evolution as a means of jump-starting web-based tools that will accelerate the pace of our science. We also are interested in discussing the process of linking to information about Fishes and Herps, from collection databases and genetics, to images, video, and other data sets that will help web-based projects evolve into the kinds of useful, interactive tools that we can all see on the horizon.

0738 Herp Stressors/Snake Conservation, Salon 6&7, Monday July 28, 2008

Quantitative Genetics Meets the Evolutionarily Significant Unit: The Case of the Endangered San Francisco Garter Snake, *Thamnophis sirtalis tetrataenia*

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Molecular genetic studies of neutral markers have suggested that an endangered subspecies of garter snake, *Thamnophis sirtalis tetrataenia*, is not a distinct entity. However, *T.s. tetrataenia* is readily diagnosable at the phenotypic level by color pattern. The most parsimonious explanation for the discrepancy between neutral genotypic markers and phenotypic markers is that *T.s. tetrataenia* has diverged phenotypically from other populations of *T. sirtalis* through rapid adaptive evolution. We propose that quantitative genetic theory can be used to assess the evolutionary significance of the of *T.s. tetrataenia* phenotype. Specifically, we ask whether the shift from an ancestral blotched morph to a derived striped morph could have occurred through a simple change in population trait means, or whether a more fundamental genetic reorganization occurred. We quantify blotch width at scale rows four and six using a dataset obtained from a large scale breeding study of *T. sirtalis* color patterns and present estimates of heritability and genetic correlation for the two traits. Our results reveal that sufficient heritable variation exists for dorsolateral blotches to evolve into a variety of novel shapes. However, a positive genetic correlation between the blotch widths at scale row four and six render a rapid evolutionary shift towards a striped form relatively unlikely. We conclude that analysis of genetic architectures can be a useful tool for evaluating the evolutionary significance of diagnostic traits.

0739 Poster Session I, Friday July 25, 2008

A mtDNA Phylogeny of the Subfamily Amphistichinae Sheds Light on Anal Fin Color Polymorphism in the Silver Surfperch, *Hyperprosopon ellipticum*

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Polymorphisms within populations can provide insights into microevolutionary processes. However, before polymorphisms can be truly considered as such, the assumption must be met that all individuals belong to one panmictic population, rather than multiple sympatric species. A case in point is the silver surfperch, *Hyperprosopon ellipticum*. Individuals collected from the same time and locality express a striking polymorphism for anal fin color (orange vs. black vs. colorless). Previous work has established that the trait is not sexually dimorphic. We used mtDNA sequence data to obtain a phylogeny for the genus *Hyperprosopon* (3 species) and its sister genus, *Amphistichus* (3 species), which together comprise the subfamily Amphistichinae. We also obtained sequence data for each color morph within *H. ellipticum*. We discuss our results in light of ecological factors that may contribute to the observed polymorphism.

0359 Amphibians in Ecosystems Symposium, Salon 6&7, Sunday July 27, 2008

Effects of Amphibian Population Declines on the Structure and Function of Neotropical Streams

Matt Whiles¹, Karen Lips¹, Sue Kilham², Cathy Pringle³, Piet Verburg³, Roberto Brenes¹, Scott Connelly³, Checo Colon-Gaud¹, Meshagae Hunte-Brown², Chad Montgomery⁴, Scot Peterson¹

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Amphibians can be important consumers in both aquatic and terrestrial habitats and likely represent an important link between the two, particularly in the tropics where amphibian diversity and abundance are high. In the last two decades, amphibian populations have declined dramatically around the world, with catastrophic declines occurring even in protected upland regions of the tropics. Studies of amphibian declines generally focus on identifying causes and documenting patterns, but we know little of the ecological consequences of these losses. Through the Tropical Amphibian Declines in Streams (TADS) project, we have been examining the ecological roles of amphibians in Central American headwater streams and quantifying the consequences of their declines. Our studies indicate that stream-dwelling tadpoles in these systems perform a variety of ecological functions, ranging from grazing to detritus processing, and that their loss influences algal communities and primary production, quality of particulate organic material (seston) exported from the streams, populations of other consumers such as stream invertebrates and riparian snakes, and reach-scale food web structure and nutrient cycling. In general, amphibian declines result in increased algal biomass, changes in grazing invertebrate communities, decreased internal recycling of nutrients and seston quality, and reduced abundances of some riparian snake species. Hence, along with the inherent tragedy of these losses, tangible ecological changes in stream and riparian ecosystems are occurring. Understanding the ecological consequences of amphibian declines provides insight into the consequences of declining biodiversity and is central to the conservation and management of remaining amphibian populations.

0499 Herp Genetics, Development & Morphology, Drummond, Saturday July 26, 2008

Do Snakes Have Predetermined Germ Cells?

Mary White, Brian Crother

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Among vertebrates there are two major mechanisms for determining primordial germ cells, the founder cells of the germ lineage. In birds, frogs, and some fish, PGCs are determined by molecules localized in a specific germ plasm of oocytes and/or early embryos. Salamanders and mammals do not have germ plasm early in development. Instead, in these animals germ cells must be induced much later during embryogenesis by mechanisms similar to the induction of other mesodermal tissues. Although the mechanism for germ cell determination is not known for squamates, it has been suggested that snakes and some groups of lizards predetermine germ cells, while other groups of lizards have induced germ cells. We

will review morphological evidence and present molecular evidence for the mechanism of germ cell determination used by snakes.

0628 Poster Session III, Sunday July 27, 2008

A Re-examination of Relationships Among the Palm Pit Vipers (Bothriechis)

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The genus *Bothriechis* consists of seven to nine currently-recognized species of Palm Pit Vipers from South and Central America. Relationships among species of the genus *Bothriechis* have been hypothesized using morphology, allozymes, and mitochondrial DNA. Although phylogenies derived using morphology and allozymes are largely congruent, mitochondrial DNA suggests a different set of relationships. For example, morphology and allozymes point to a sister relationship between *B. lateralis* and *B. bicolor*, while mitochondrial DNA suggests that *B. lateralis* and *B. nigroviridis* are sisters; this has been explained as the result of possible introgression because the species are syntopic (Note that these studies did not include *B. thalassinus* which was described more recently). The combined morphology/allozyme data set hypothesized a sister relationship between *B. aurifer* and *B. rowleyi*, while mitochondrial discovered a *B. marchi*/*B. rowleyi* clade, *B. aurifer* as sister to *B. bicolor*. It has been hypothesized that the mtDNA is misleading this case. To test this, we have re-examined relationships among member of the genus *Bothriechis* using a nuclear DNA data set. Results will be discussed in context of nuclear and mitochondrial phylogenies.

0112 AES Devil Ray Symposium, Jarry/Joyce, Friday July 25, 2008

The Bycatch Fishery for Mobulid Rays in Eastern Indonesia

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Although mobulids are taken in a variety of fisheries throughout much of their range, details of these fisheries are poorly documented. In Indonesia, mobulid rays are landed as bycatch by artisanal gillnet fishers targeting skipjack tuna. Between April 2001 and March 2006, more than 20 surveys of Indonesian fish landing sites were carried out to determine the species, size and sex compositions of the chondrichthyan catches. This study contributes to the limited knowledge on biological aspects and fisheries information for the Mobulidae. The data were derived from 409 mobulids that were examined during the fish landing site surveys. At one particular landing site, it was estimated that 1575 mobulid rays (equivalent to ~320 tonnes) are landed annually. The most abundant of the five species was *Mobula japonica* (~50%), followed by *Mobula tarapacana* (~24%), *Manta birostris* (~14%), *Mobula thurstoni* (9%) and *Mobula cf kuhlii* (2%). The four most abundant species were represented by a wide size range of each species and, in the case of *Mobula japonica*, by embryos, neonates and fully-mature individuals. The disc width at maturity (DW_{50}) of males, derived from the proportion of males at each size class with fully-

calcified claspers, ranged from 1538 mm for *M. thurstoni* to 3752 mm for *M. birostris*. In recent years, there has been an increasing demand for various body parts of mobulids. Branchial filter plates, which are used for traditional Chinese medicines, are the most valuable, fetching as much as 30 \$US a kilo (dry weight). The skins are dried and deep fried and the flesh salted and dried and these are used for human consumption, while cartilage is dried for export as a filler for shark-fin soup. The very low fecundity of the large and probably long-lived mobulid rays make the stocks of their species particularly susceptible to further increases in fishing.

0484 AES Student Papers III, Kafka/LeMaratine, Friday July 25, 2008; GRUBER

Correlated Evolution of Selachian Tooth Morphology, Diet, and Ecology

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Due to the cartilaginous nature of the skeleton, the fossil record for sharks is overwhelming composed of teeth. Hypotheses regarding diet, feeding habit, and evolution are therefore usually inferred from a combination of qualitative dentition characteristics and the possible prey items that are contemporaneous in the fossil record. To date, a rigorous evolutionary analysis of the above characters has not been undertaken. The goal of this study is to assess the correlated evolution of tooth morphology, diet, and ecology in extant selachian families using independent contrast analysis. Each family was represented by one to four species, dependant on the degree of tooth morphology variation in the family, with filter-feeding species excluded. For each species, a series of morphometric measurements were taken on teeth on the right side of the upper and lower jaws of up to five individuals. These measurements were used to calculate quantitative tooth morphology characters, including cusp aspect ratio, notch angle, cusp inclination indices, and percent of tooth base overlap. Data about ecology and diet were taken from the literature. The above characters were mapped onto an existing phylogeny. Independent contrast analysis was then used to search for correlated evolution of these characters, with branch lengths set to unity. Preliminary results indicate no phylogenetic pattern for teeth of the upper jaw. These teeth tend to be highly variable in morphology intraspecifically, even within families such as Lamnidae and Carcharhinidae. However for teeth in the lower jaw, families with cusps that are less broad tend to have teeth that are also angled more distally relative to the jaw symphysis and deeper notches. There appears to be no pattern for degree of tooth base overlap in either the upper or lower jaws; this instead appears to be correlated with prey handling behaviour.

0454 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

Decline and Conservation of Amphibians in Central America

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The status of amphibians in Central America was reviewed as part of a volume in the Amphibian Biology series. We describe the Central American environment, describe patterns of amphibian species richness and patterns of endemism in the context of ecological associations and biogeographic patterns. We use the Global Amphibian Assessment (GAA) dataset to explore the conservation status of amphibians in the region. We review conservation threats in light of a meta-analysis of conservation of Central American amphibians; 43 papers out of 401 valid studies of amphibians in Central America from 1967 to 2007 dealt with conservation. Our analysis revealed gaps in spatial coverage for the region and a paucity of studies focused on particular processes. Most research in Central America has focused on losses associated with the spread of chytridiomycosis. We also review conservation actions in place and conclude with statements concerning future research in Central America.

**0321 Conservation in Canada, Salon 4&5, Saturday July 26, 2008;
CARCNET/RÉCCAR**

The Effect of Wood Frog Tadpole Presence on Boreal Chorus Frog Growth and Metamorphosis

Arthur Whiting, Cynthia Paszkowski

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Recruitment to metamorphosis in temporary ponds depends on rapid growth and development of aquatic larvae. Reduction in larval growth and/or development may reduce recruitment affecting local population persistence. We investigated the effect of wood frog tadpole presence on the growth and recruitment to metamorphosis of boreal chorus frogs in the Aspen Parkland of Alberta. Both species are abundant and co-occur at 95% of sites surveyed within Elk Island National Park. Growth rates of chorus frog tadpoles in the field decreased with increasing wood frog density. Manipulations within mesocosms explored the effect of wood frog presence and nutrient addition on the growth and metamorphosis of boreal chorus frog larvae. Results were consistent with field observations – boreal chorus frog tadpoles grew faster and larger in the absence of wood frogs and at higher nutrient concentrations. Laboratory experiments examined the non-interactive effects of wood frog tadpoles on boreal chorus frog tadpole growth and metamorphosis. Presence of wood frogs in dark mesh cages and removal of wood frog feces showed no effect on growth of chorus frog tadpoles. Slower growth and smaller chorus frog metamorphs were found in the presence of wood frog when their feces were moved from the mesh cages into the chorus frog tank. A third experiment is to be conducted to determine the influence of wood frog feces without wood frog presence on the growth of boreal chorus frog tadpoles. The laboratory results suggest that growth inhibition is not the result of food based competition or physical interference within mesocosm or field locations, but rather some metabolic inhibitor present in the feces of wood frog tadpoles.

0111 Herp Behavior, Salon A&B, Thursday July 24, 2008

Can She-male Flat Lizards (*Platysaurus broadleyi*) use Multiple Signals to Deceive Male Rivals?

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A central theme in animal communication is understanding what constrains signalling and keeps a signal honest. An equally fruitful approach is to examine cases of dishonest signalling. Female mimicry, when certain males take on the appearance of females, is most commonly a male alternate reproductive tactic that is condition-dependent, but which can be frequency-dependent. A number of adaptive explanations for female mimicry have been proposed that include avoiding the costs of aggression, gaining the upper hand in combat, sneaking copulations with females on the territories of other males, and gaining physiological and survival benefits. Previous studies of female mimicry have focused on a single mode of communication, although most animals communicate using multiple signals. Male Augrabies flat lizards adopt alternate reproductive tactics in which one group of males (she-males) mimic females. We tested whether she-males are able to mimic females using both visual and chemical cues. We tested chemical recognition in the field by removing scent and relabelling females and she-males with either male or female scent. At a distance, typical males (he-males) could not distinguish she-males from females using visual cues. During close encounters, he-males correctly determined the gender of she-males using chemical cues. She-males are therefore able to deceive he-males using visual, but not chemical, cues. To effectively deceive he-males, she-males avoid close contact with he-males during which chemical cues would reveal their deceit. This strategy is likely adaptive because he-males are aggressive and territorial and by mimicking females, she-males are able to move about freely and gain access to females on the territories of resident males.

0322 Poster Session II, Saturday July 26, 2008; CARCNET/RÉCCAR

The Role of Tadpoles in Temporary Pond Food Webs within the Aspen Parkland of Alberta

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Little is known about the role of larval amphibians in aquatic food webs. Stable isotope analysis provides a means to examine the trophic roles of amphibian larvae and explore potential resource overlap with other web members. We were interested in the potential resource overlap between wood frog and boreal chorus frog tadpoles and its effect on tadpole growth within temporary ponds in the Aspen Parkland of Alberta. Few studies have performed stable isotope analysis on amphibian tissues to examine the role of larvae and adults within food webs of temporary ponds. We sampled from six ponds within Elk Island National Park and five ponds in the surrounding agricultural areas. The isotopic signals of tadpoles suggested that resource overlap occurred in some locations, but was not related to differences in growth of chorus frogs across ponds. Both species tended to be at the same low trophic position, but food source varied with pond. In addition to food web structure, we collected larval samples from eggs through to metamorphosis and from

adults. Isotopic signals through ontogeny show differences between terrestrial diets and aquatic resources.

0701 Poster Session III, Sunday July 27, 2008

AmphibiaWeb; A Dynamic Online Resource Aiding Amphibian Conservation

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AmphibiaWeb provides on-line information on amphibian conservation, declines, and natural history, including an ever-growing database containing an up-to-date list of all amphibian species recognized worldwide, by family, striking a balance between the most current taxonomic research and standards accepted by the herpetological community at large; more than 11,000 photos of amphibians from around the world via CalPhotos; and over 1,700 species accounts, including many for new species. We now provide cutting-edge dynamic mapping for amphibian species by overlaying vouchered, georeferenced museum specimen data (via HerpNet) onto Global Amphibian Assessment's expert opinion maps. Among other new features, we also provide a separate, publicly available compendium of newly named amphibian species from the scientific literature. Additionally, AmphibiaWeb is serving as a testing ground for new ways to map phylogenetic information by integrating amphibian phylogenetic data from AmphibiaTree with georeferenced specimen data from HerpNet.

0386 Poster Session II, Saturday July 26, 2008

Composition, Distribution, and Diversity of Pelagic Fishes around Oceanic Islands

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Oceanic islands of volcanic origin have a narrow shelf and a steep slope that enhance the spatial overlap among coastal and oceanic fauna. During six pelagic surveys in the Canary archipelago, Eastern Central Atlantic, over 65 000 fishes belonging to 211 species were collected at depths between 8 and 1035 m. The mesopelagic families of the bristlemouths (Gonostomatidae) and the lanternfishes (Myctophidae) accounted for about 50 % of all specimens. Four different assemblages associated with mesopelagic, epipelagic-oceanic or neritic-coastal habitats could be identified using multivariate classification and ordination methods. Two of these assemblages were shelf-associated differing in the proportion of meso- and epipelagic species. These data indicate intense horizontal migrations of mesopelagic fishes (mainly Myctophidae) into the neritic realm and increased spatial interactions between neritic and oceanic habitats. No marked differences among oceanographically similar areas of the entire archipelago were found. A considerable heterogeneity in species distribution was found off SE Fuerteventura in an area with high hydrographic variability and abrupt topography. We conclude that both topography and

hydrography are important factors influencing the distribution and abundance of pelagic fishes in this oceanic archipelago.

0675 AES Student Papers II, Kafka/LeMaratine, Friday July 25, 2008

Not All Nursery Areas Are Created Equal: The Importance of Small Scale Nursery Habitat for Delaware Bay Sandbar Sharks

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Due to declines in sandbar shark populations, efforts are underway to better understand habitat use in nursery areas for rebuilding depleted stocks. Large numbers of young-of-the-year (YOY) and age 1+ juvenile sandbar sharks reside in Delaware Bay from early summer through early fall. We utilized an automated telemetry array (Vemco VR-2) to monitor sandbar shark habitat utilization patterns during their residency in Delaware Bay. We hypothesized that our principal receiver array was near or within primary nursery habitat based on previous studies. Additional receivers were attached to navigational buoys within Delaware Bay. We monitored the movement patterns of 59 sandbar sharks that were surgically implanted with coded acoustic transmitters during the summers of 2005 and 2006. In total over 46,000 detections of telemetered sandbar sharks were recorded. The vast majority (92%) of total detections occurred within the hypothesized nearshore primary nursery habitat compared to receivers located in deeper waters and at the entrance to Delaware Bay. Site fidelity for returning sandbar sharks was high (42%) in years following the implantation of transmitters. Of the returning individuals (n=25), a high proportion (80%) were comprised of age 1+ juvenile sandbar sharks. The low rate of returning YOY sandbar sharks to Delaware Bay suggests either a high mortality rate during the first year of life or low fidelity to Delaware Bay in the second summer. The high degree of site fidelity and abundance of near shore detections illustrate the importance of such a small portion of Delaware Bay to juvenile sandbar shark stocks. Data from this research may improve the protection and understanding of sandbar shark habitat while residing in Delaware Bay.

0040 Amphibian Ecology, Jarry/Joyce, Monday July 28, 2008

Reproductive Success And Sexual Selection In Wild Tiger Salamanders (*Ambystoma tigrinum*)

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Variation in reproductive success is most pronounced in species where mate competition and mate choice are likely, sexual dimorphisms exist, and in populations containing strongly biased operational sex ratios. This situation occurs in many Ambystomatid salamanders, and thus they have served well as evolutionary models for the study of sexual selection. We used molecular genetic markers to study sexual selection in a breeding congregation of adult tiger salamanders (*Ambystoma tigrinum*) from northwestern Indiana. Using hypervariable microsatellite loci, we genotyped 155 mature adults and 1341 larvae from 90 egg masses. Parentage analyses revealed

108 crosses among 31 dams and 60 sires. Both sexes engaged in multiple successful matings, which was three times more common among females (64%) than males (27%). However, the standardized variance in mating and reproductive success was higher in males. Bateman gradients were significant and nearly identical in both sexes, suggesting that reproductive success was enhanced by increased mating success and that the intensity of sexual selection was roughly equal between sexes. The adult morphological attributes we measured (snout-vent length, tail height, tail length, and mass) were not correlated with mating or reproductive success in either sex. The apparent lack of sexual selection on morphological characteristics may be a result of sperm storage, sperm competition among males, alternative mating tactics utilized by smaller males, and/or random induction of spermatophores by females.

**0700 Herp Stressors/Snake Conservation, Salon 6&7, Monday July 28, 2008;
STOYE CONSERVATION**

**Evaluating the Effects of Multiple Stressors in Agricultural Streams Using
In Situ Tadpole Enclosures**

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There has been a recent push in aquatic ecotoxicology for studies to demonstrate more realistic exposure conditions and more explicit connections with the natural contexts in which exposures to contaminants typically occur. This desire for increased realism has led to an increase in in situ enclosure experiments, which may be especially suitable for agricultural streams and other systems experiencing multiple natural and anthropogenic stressors. Studies with caged amphibian larvae have a fairly long history in lentic systems, but have been much more limited in streams. I tested two tadpole enclosure designs for stream systems—a submerged hemicylindrical steel mesh cage, and a floating plastic enclosure after my own design. Enclosures were deployed for one month at five agriculturally impacted stream sites in northern Missouri. Plains leopard frog (*Rana blairi*) tadpoles showed survival up to 100% in floating enclosures and higher survival in floating than submerged enclosures across all sites, despite the fact that both enclosure designs occupied nearly the same portion of the water column in these shallow streams. Tadpole length, mass, and developmental stage differed among sites, but not always predictably across the gradient of agricultural land use. Interactions between site and enclosure type were also strong. These results indicate that floating plastic enclosures may be a valuable means of evaluating the effects of complex contaminant exposures on amphibian larvae in a near-natural context.

0641 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT ECOLOGY

Effects of Prey Type on Prey Handling, Digestive Metabolism, and Post-prandial Locomotor Performance in the Banded Watersnake, *Nerodia fasciata*

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Despite the importance of prey availability to predator populations, assessments of prey availability seldom consider differences in quality among prey types. To aid our understanding of factors that influence the distribution and abundance of the banded watersnake (*Nerodia fasciata*), we compared quality of prey characteristic of ephemeral and permanent wetlands: paedomorphic salamanders (*Ambystoma talpoideum*) and sunfish (*Lepomis marginatus*), respectively. Specifically, we compared nutritional composition and morphology of the prey taxa and used a series of repeated-measures experiments to examine handling (number of prey consumed, maximum prey size, and handling time), digestive metabolism (specific dynamic action, SDA), and post-prandial locomotor performance (reduction in maximum crawling speed) of snakes fed *Ambystoma* and *Lepomis*. Although the two prey types were similar in nutritional composition, snakes consumed larger *Ambystoma* than *Lepomis* (maximum meal sizes 105% vs. 50% of snake body mass), consumed more individual *Ambystoma* than *Lepomis* of similar size per feeding event, and exhibited longer handling times for *Lepomis* than *Ambystoma* within prey size treatments. Overall, SDA profiles were similar for snakes digesting the two prey types, with no significant effect of prey type on total volume of O₂ consumed above standard metabolic rate, peak rate of O₂ consumption, digestive scope, or SDA coefficient and only subtle differences between the prey types in the shapes of the SDA curves (time to 50% and 75% decrease from peak O₂ consumption). However, prey types differed in their impact on post-prandial locomotor performance; snakes fed *Lepomis* suffered a 45% reduction in maximum crawling speed 1 h post-feeding, compared to a 23% reduction for *Ambystoma*. Our results indicate that prey taxa may differ substantially in quality, even when their nutritional compositions are similar. Differences in quality of available prey may have substantial ecological consequences and may contribute to variation in density and demography among snake populations.

0341 General Ichthyology II, Salon 6&7, Saturday July 26, 2008

Sexual Size Dimorphism and Body Size Allometry in a European Pipefish Species

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Mating success and fecundity are positively correlated with body size in both sexes of male-pregnant *Syngnathus* pipefish. As male pipefish brood eggs on their tail and female egg production occurs in her ovaries located in her trunk, fecundity selection is predicted to act differently on male and female size. Female body size is also under sexual selection, as large females are preferred by males. We investigated sexual size dimorphism and body size allometry in the broad-nosed pipefish *Syngnathus typhle*, based on the hypothesis that fecundity and sexual selective pressures act differently in males and females. Measurements of overall body size and body proportions were

taken from seven populations of *S. typhle* sampled across a wide geographical range. Males and females differ significantly in trunk length, tail length and total body size. Patterns of female growth in the trunk and the tail vary significantly among populations, while male tail grows more rapidly than does his trunk in all populations. This results in sexual size dimorphism that is specific for a body region: for a given body size, females have a longer trunk than do males, while males have a longer tail. Female biased dimorphism in overall body size was found in three populations. Morphological variation in the broad-nosed pipefish supports the hypothesis that fecundity selection on male tail length is responsible for a region-specific sexual size dimorphism and different patterns of growth in male and female *S. typhle*. Female biased dimorphism in overall body size is likely a product of sexual selection.

0311 Poster Session II, Saturday July 26, 2008

Interactions between Fishes and Invasive Jellyfish in the Upper San Francisco Estuary, USA

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Jellyfish populations are increasing around the world in response to anthropogenic alterations of the oceanic environment. Jellyfish invasions are often harmful to planktivorous fishes, because they can successfully compete for planktonic prey and will feed upon fish eggs and larvae. In the upper San Francisco Estuary, there are three abundant invasive jellyfish (*Maeotias marginata*, *Blackfordia virginica*, and *Moerisia* sp.). We present a conceptual model of the potential impact of jellyfish competition and predation on four declining planktivorous fish populations (Delta smelt, YOY striped bass, threadfin shad, and longfin smelt) and describe studies on jellyfish abundance and distribution, prey selectivity, and dietary overlap with fishes. Invasive jellyfish are potentially contributing to the decline and/or recovery failure of planktivorous fishes in the upper San Francisco Estuary.

0580 Poster Session III, Sunday July 27, 2008

Brown Tree Snake Invasion Risk Assessment for the Continental United States

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Brown tree snakes (*Boiga irregularis*) are a mildly venomous, rear-fanged constrictor which is native to Australia, Papua New Guinea, and other Melanesian Islands. These snakes were unintentionally introduced to the island of Guam sometime after WWII, possibly on a cargo shipment from Australia. Due to population explosions around 1960, the brown tree snake (BTS) is now an invasive species causing significant economic, biological, and human health problems on Guam. Brown tree snakes have been found in Hawaii, Texas, Alaska, and Oklahoma as hitchhikers in planes, ships, and cargo coming from Guam. This is why it is important to identify the areas within the continental United States which are at the highest risk for brown tree snake invasion. A similarity assessment was done between areas within the BTS home range and areas within the continental United States using distance analysis.

Using aspects of climatic tolerance for BTS, we were able to identify areas at the highest risk for BTS invasion. Another assessment was also done between Guam and areas in the continental United States to examine the differences between invasion from Guam and invasion from the BTS home range. In both assessments, areas with the most similar temperature and precipitation to that of the compared area (either the home range or Guam) are identified as highest risk. The high-risk areas which are identified in this assessment will be important targets for increased public education, training and awareness. The North America Brown Tree Snake Control Team (NABTSCT) will use this assessment for mapping high-risk locations on the NABTSCT website for public access, leading to increased awareness.

0024 Herp Stressors/Snake Conservation, Salon 6&7, Monday July 28, 2008

Investigating Rural Kenyan Teachers' Attitudes Toward Snakes: New Perspectives for Teaching

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A 3-month quasi-experimental mixed-methods study was conducted mid-September through mid-December 2005 to investigate rural southeast Kenyan teachers' attitudes toward snakes. 60 teachers from 6 villages near Mt. Kasigau were surveyed and interviewed about their attitudes toward snakes to obtain baseline data before and after a herpetofauna institute. 25 teachers representing 5 of the 6 villages attended a 6-hour seminar on reptiles and amphibians. From these 25 teachers, 8 teachers from 3 villages were afforded additional educational opportunities about snakes, and 2 teachers from this group of 8 were teamed with 2 herpetologists as mentors. Findings suggest that teachers' attitudes toward snakes, within a culture where all snakes are feared and killed onsite, can change toward a more favorable orientation when faced with a scientific perspective of snakes, learn taxonomic/ecological information about snakes, and observe positive modeling of snake handling.

0500 Herp Systematics, Drummond, Friday July 25, 2008

A Preliminary Phylogeny of the Genus *Acanthosaura* Gray 1931, Inferred from Mitochondrial and Nuclear DNA

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The Southeast Asian agamid lizard genus *Acanthosaura* Gray, 1931 currently contains six recognized species (*A. armata*, *A. capra*, *A. coronata*, *A. crucigera*, *A. lepidogaster*, and *A. nataliae*). It ranges throughout Myanmar, Thailand, Cambodia, Laos, China, and Malaysia (including its off shore islands, Pulau Tioman, Pulau Aur, Pulau Perhintian, Pulau Perhintian Kecil and Pulau Langkawi). An analysis of the mitochondrial and nuclear DNA coupled with maximum parsimony (MP) and maximum likelihood (ML) analyses were used to test the hypotheses (1) *Acanthosaura* cf. *crucigera* from the Cardamom Mountains forms a distinct group separate from *Acanthosaura crucigera* from its type locality in Thailand (2) *A. armata*, *A. crucigera*, and *A. lepidogaster* are composed of multiple cryptic species (3) *Acanthosaura* cf. *armata* from Pulau Aur and Pulau Tioman form the sister group to other *A. armata*, (4) *Acanthosaura* cf. *crucigera* from Pulau Langkawi is more closely related to

Cambodian *A. cf. crucigera* then to *A. crucigera* from Thailand, following other biogeographic patterns. This will be the first time nuclear DNA and all recognized species will be included in a phylogenetic context.

0584 Poster Session III, Sunday July 27, 2008; STORER ICHTHYOLOGY

The Phylogenetic Distribution of Siluriform Venom Glands

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Though many species of catfishes have long been known to produce venoms associated with the dorsal and pectoral-fin spines, the distribution of this trait throughout the Order Siluriformes has yet to be determined. The histological examination of fin spines taken from museum specimens, including representatives from 32 of the 34 currently recognized (extant) catfish families (including over 100 genera) has revealed the presence of venom glands in species from at least 20 families. For several of these families, this represents the first time that venomous representatives have been demonstrated. The results of this study indicate that approximately 1500-1700 species of catfishes should be presumed venomous. Mapping of the presence of venom glands onto recently generated siluriform phylogenies indicates at least two independent developments of venom glands in catfishes. Multiple losses of venom glands are found throughout the Order, in lineages in which the fin spines have been lost or extensively modified. Though the presence of venom glands was consistent in most families examined, cases were found in which two genera from the same family differed in the presence vs. absence of venom glands. Robust species level phylogenies of siluriform families and genera are needed to more clearly trace the evolutionary history of venom glands (and their secretions) in these groups, and may also offer insight into the ecological factors that have favored this intrafamilial incongruence.

0345 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008; GRUBER

Electroreception in Turbid Waters: Comparison of Two Euryhaline Elasmobranchs from Northern Australia, *Pristis microdon* and *Glyphis* sp. A

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Juvenile freshwater sawfish, *Pristis microdon*, share their habitat with juveniles of another rare elasmobranch species, the speartooth shark *Glyphis* sp. A. Both species are euryhaline and spend at least their immature stages in the turbid waters of Northern Australian rivers. Although food preferences are not completely established for either species, there is a clear overlap in prey items, such as catfish and freshwater prawns. In the present study, we compare reactions of each species towards prey-simulating electric fields in order to identify any differences in prey

manipulation related to their unique body morphologies. Low-level electric fields (nVcm^{-1} - μVcm^{-1}) were presented in salinities of 23.5 – 33.5 ppt, both on the tank floor and in the water column. Inactive dipoles served as controls and the active dipole was swapped randomly. Both *Glyphis* and *Pristis* actively approached the low level electric fields and bit the dipole source when presented on the tank floor. However, only *Pristis* reacted to dipoles presented within the water column. Detailed video analysis generated information on the different approach and attack strategies used by each species. The video footage was also used to determine the threshold sensitivities for both species. *Glyphis* demonstrated responses to field created by a current of 10 μA , and *Pristis* responded to currents of 35 μA .

0760 Poster Session II, Saturday July 26, 2008

Body Temperature Selection and Thermoregulatory Efficiency of the Giant Garter Snake

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The Giant Garter Snake (*Thamnophis gigas*) is a threatened species precinctive to the Central Valley of California. Despite a large body of literature on the thermal ecology of garter snakes, relatively few studies have examined body temperature selection and thermoregulatory efficiency of these snakes where they occur in benign thermal environments. The thermal ecology of the Giant Garter Snake is of particular interest because it is the largest of the garter snakes, is highly aquatic, and is restricted to a Mediterranean climate. We examined multiple hypotheses regarding temporal, sexual, and behavioral differences in the selection of body temperatures and thermoregulatory precision of the Giant Garter Snake using temperature-sensitive radio telemetry and an information-theoretic analytical approach. Similar to other garter snakes, individual Giant Garter Snakes selected body temperatures near 30°C. Male and female Giant Garter Snakes did not exhibit differences in body temperature selection or thermoregulatory efficiency most of the year, including the midsummer gestation period. Resting individuals thermoregulated more precisely than individuals active on land or in water. Despite potential energetic costs, individuals emerged from hibernacula to bask on warm, sunny days in winter. The relatively benign Mediterranean climate, coupled with the Giant Garter Snake's occurrence in a complex and variable thermal environment, contribute to the apparent reduced importance of thermoregulatory behavior for the Giant Garter Snake relative to its congeners.

0293 Poster Session I, Friday July 25, 2008

Phylogenetic Relationships of Labeonini (Teleostei: Cyprinidae) Inferred from Four Nuclear and Three Mitochondrial Loci

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The Labeonini (sensu Rainboth, 1991) is a tribe of the subfamily Cyprininae, the largest subfamily of Cyprinidae. Species of this tribe are widely distributed in the

freshwaters of tropical Africa and Asia. Currently, around 31 genera and 400 species are included in this tribe. Most species are adapted to inhabit fast-flowing water and exhibit unique modifications of their oromandibular morphology. The monophyly of this tribe has been tested and generally accepted by previous morphological and molecular studies. The major objective of this study was to reconstruct the phylogenetic relationships of the tribe Labeonini, test its monophyly and explore its subdivisions, their intrarelationships and their biogeography. Nucleotide sequences of four nuclear and three mitochondrial loci were collected from 21 Labeonini genera, 47 species throughout its distribution range. Maximum parsimony, maximum likelihood and Bayesian analyses were conducted using combined dataset. The monophyly of Labeonini was well supported. Three clades could be recovered within the tribe. These clades are not consistent with the groupings of previous workers and with current taxon resampling, do not exhibit any logical geographic pattern.

0291 Fish Conservation, Drummond, Sunday July 27, 2008

Predicting Invasions of Gars (Actinopterygii: Lepisosteidae) in Mainland China Using Native Range Data and Ecological Niche Modeling

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Gars (Lepisosteidae) are top predators in freshwater systems. Their native distributions range from southeastern Canada and eastern North America south to Costa Rica and the Caribbean. No fossil or extant gars have ever been described from China. In 1990s, however, gars were imported into Mainland China as pet fish. In recent years, more and more gars have been found in natural waters across the country. We have compiled records in China, and found gar reported more frequently in coastal provinces and with a general trend inland. Up to four gar species may have been found: longnose gar *Lepisosteus osseus*, shortnose gar *L. platostomus*, spotted gar *L. oculatus*, and alligator gar *Atractosteus spatula*. Native range data and ecological niche modeling were used to predict the invasive potential of each species and also Florida gar *L. platyrhincus* in Mainland China: all except the Florida gar have the potential to be able to spread broadly in southern, eastern and central China. Alligator gar may also be able to spread to northern and eastern China, while Longnose gar may be able to invade the northeast. Florida gar may only restrict to small areas of southern China. The consequences of potential establishment of gars could be profound for Chinese aquatic diversity: gars may feed mainly on small cyprinids, loaches, and some catfishes in China, and they may also compete with native piscivorous fishes. Gars also have the potential to spread from China into Southeast Asia.

0196 Poster Session I, Friday July 25, 2008

Evolution of the Spinous Dorsal- and Anal-fin Rays of Cyprinine Fishes (Ostariophysi: Cyprinidae: Cyprininae)

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Several members of the Cyprininae possess a thickened, spine-like leading fin ray in the dorsal and anal fins. These 'spines' are formed by the ontogenetic fusion of individual lepidotrichia segments and thus differ from the true spines of acanthomorph fishes, which are never segmented. Though the presence or absence of spinous rays are important characters in taxonomic keys of cyprinine fishes, little is known about their evolutionary origins. We investigated the evolution of the spinous rays of cyprinine fishes using a molecular phylogeny of the subfamily. Four characters relating to the spinous rays were investigated using ancestral character state reconstruction: (1) presence/absence (p/a) of the spinous dorsal-fin ray; (2) p/a of spinous dorsal-fin ray serrations; (3) p/a of the spinous anal-fin ray; (4) p/a of the spinous anal-fin ray serrations. We predicted *a priori* that the spinous rays of cyprinine fishes were each the result of a single evolutionary event. Due to ambiguous optimization on our molecular phylogeny, it is not possible to definitively state the number of independent acquisitions of the spinous dorsal-fin ray of cyprinine fishes and it appears that there have been numerous losses of this structure. The evolution of the spinous anal-fin ray of cyprinine fishes is much clearer and is the result of two independent evolutionary events (once on the branch leading to *Cyprinus* + *Carassius* and once on the branch leading to *Puntioplites*). Previous authors had hypothesized a close relationship between *Cyprinus*, *Carassius* and *Puntioplites* based on the presence of the spinous anal-fin ray in these taxa. We hypothesize that, based on differences in morphology (presence vs. absence of spinous anal-fin ray serrations) and our molecular phylogeny, the spinous anal-fin rays of *Puntioplites* and *Cyprinus* + *Carassius* are not homologous.

0526 AES Functional Morphology, Jarry/Joyce, Friday July 25, 2008

A Neural Basis for a Shark's Motor Repertoire? Quantifying the Complexity of the Cerebellum using Magnetic Resonance Imaging (MRI)

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The cerebellum appeared at the onset of the chondrichthyan radiation and is known to be essential for executing fast, accurate, and efficient movement, yet there is still much controversy surrounding its absolute function, which remains unresolved. Comparative data on cerebellar anatomy from cartilaginous fishes with disparate behavioral repertoires can provide critical information on cerebellar function and development, and ultimately vertebrate evolutionary trajectories. Recent work has shown patterns of brain organization in sharks that are correlated with ecological parameters. Cerebellum size has strong allometric correlations, but there exists significant interspecific variation in corpus folding. We have previously developed a visual grading method, ranging from 1-5, which provided a classification scheme for cerebellar foliation. When applied to a range of species (n=81), the highest foliation levels (4-5) were found in agile predators that lived in 3D environments, such as

Isurus oxyrinchus, *Alopias vulpinus*, and *Sphyrna mokarran*. However, visual classification is limited as it does not parameterize structural variations, and thus does not provide a quantitative method for characterization and comparison of foliation; these methods can often miss subtle but important differences between species that may have high evolutionary significance. Here we provide such a quantitative method using Magnetic Resonance Imaging (MRI) in conjunction with shape analysis methods. The degree of foliation was quantified using three different measures of geometric variation following image segmentation: (1) local tissue curvature (2) cortical flattening, and (3) spherical harmonic decomposition. These methods were preliminarily applied to 5 shark species with varying levels of foliation (based on the visual classification scheme). These methods greatly extend the visual foliation index by providing quantitative methods for interpreting and analyzing the architecture and surface structure of chondrichthyan brains. Through these, we plan to explore the extent to which adaptive, developmental, and phylogenetic processes are driving neural evolution.

0200 Poster Session II, Saturday July 26, 2008

Osmoregulation in the Diamond-backed Watersnake (*Nerodia rhombifer*): Salt Stress is Stressful

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Changes within the physical environment of freshwater systems have begun to affect the natural distribution of native species. Increases in water salinity, due to agricultural inputs, have forced some freshwater organisms out of previously inhabited areas. In addition, riverine species may reach a local range limit if the river drains into salt water. On the physiological side, previous work speaks of salt stress without examining if the stress hormones (e.g., cortisol, corticosterone) increase after exposure. As an ecophysiological model, we used a species that frequently inhabits lotic systems with an estuarine zone (*N. rhombifer*). The extent of *N. rhombifer*'s salinity tolerance is unknown, as is whether this exposure causes the animal to experience inordinate amounts of physiological stress. We subjected 28 adult snakes to a one-week constant exposure to 0, 9, 18, and 27 ppt saline solutions in a repeated measures design. Plasma osmolality and corticosterone concentrations were measured before and after the exposure. To test salt tolerance in small snakes, we divided 39 neonates into one of three treatments (0, 9, and 18 ppt saline solutions) for one-week constant exposure and measured survivorship. Under the testing regime, the LD50 for salt was 27.0 ppt in adults and calculated to be 22.8 ppt in neonates. Baseline plasma osmolality and corticosterone in adults averaged 312.6 ± 22.5 mMol/kg and 5.5 ± 4.2 ng/ml, respectively. *Nerodia rhombifer* is a strong hyper-/hypo-osmoregulator, but shows decreased osmoregulatory performance and signs of salt stress above 9 ppt, with increases in plasma osmolality of up to 150 mMol/kg over baseline and a corresponding increase (up to 5-fold) in corticosterone. Increases in corticosterone have been shown to negatively affect the sex steroids, which may affect reproductive success. Salt intolerance may potentially play a role in limiting the species' distribution along rivers that have an estuarine zone.

0199 Cottonmouth Symposium, Salon 4&5, Monday July 28, 2008

Ecophysiological Research on Cottonmouths: Model Species and Special Cases

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The ecology of cottonmouths (*Agkistrodon piscivorus*) has been well studied in a variety of systems. Despite being a ubiquitous feature of both natural and man-made habitats throughout the southeastern United States, cottonmouths have received surprisingly little attention in physiological investigations. Cottonmouths are not only interesting in their local ecophysiological context, but also potentially important as model organisms. Krogh's principle states, as cited in Bennett (2003), "For a large number of problems there will be some animal of choice, or a few such animals, on which it can be most conveniently studied. (August Krogh [1929])". In many ways, cottonmouths embody this principle. Cottonmouths serve as key members of both aquatic and terrestrial food webs and their generalist diet provides links to many species. The species has wide latitudinal and altitudinal ranges and occurs in a variety of freshwater, terrestrial, and insular habitats where they exhibit considerable local adaptation. From a practical viewpoint, cottonmouths are ideal focal species. They are often locally abundant and easily captured. In the laboratory setting, cottonmouths are easily maintained, tractable, and require a relatively small amount of space. Adequate precautions must be taken, of course, to ensure their safe care and use. In our presentation, we will review and discuss the ecophysiological literature related to cottonmouths, organized according to sub-disciplines of investigation (e.g., thermal biology and energetics, osmoregulation and water balance, digestive physiology, toxicology, etc.). We will examine current research and propose future directions in the hope of better understanding this organism and promoting its use in research.

0269 Poster Session I, Friday July 25, 2008

Two New Species of *Hypostomus* Lacépède (Teleostei: Loricariidae) from the Rio Paranaíba and Rio Grande, Upper Rio Paraná Basin, Central Brazil

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Widespread through Neotropical region species of the genus *Hypostomus* constitutes one of the most speciose genus of the Siluriformes encompassing from 117 species (without synonymization of *Squaliforma*, *Aphanotorulus* and *Isorineloria*) to 138 species (with synonymization). However, misidentification are commonly found in the literature. These errors were attributed to the broad morphological variation of most species, great number of available names, very old original descriptions, and ill-conserved type specimens. Aggravating that situation, molecular data has shown that about one-third of the current *Hypostomus* species are still undescribed. Monthly ichthyological surveys were carried out from March 1996 to March 2002 in the rio Corumbá basin, a tributary to the rio Paranaíba, upper rio Paraná basin, Goiás State, Brazil. The analysis of several collected *Hypostomus* specimens allowed the recognition of two undescribed species of *Hypostomus*. One of them, *Hypostomus* sp. n. 1, is distinguished from all congeners, except *H. albopunctatus*, by having pectoral-

fin spine equal or smaller than pelvic-fin spine. From *H. albopunctatus*, it is distinguished by having roundish dark spots over body and fins (vs. clear spots). The second, *Hypostomus* sp. n. 2, is distinguished from all its congeners, except *H. multidentis*, by having more than 115 dentary and premaxillary teeth (vs. less than 109) and by having teeth with two symmetrical cusps (vs. asymmetrical). It is distinguished from *H. multidentis* by having dark roundish spots over body and fins (vs. clear spots). Additional samples of *Hypostomus* revealed that the two new species were also found in the rio Paranaíba and in the rio Grande, upper rio Paraná basin.
