

ABSTRACTS – 2008

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

Adams to Delpiani

0469 General Herpetology I, Salon 4&5, Sunday July 27, 2008

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Community Organization in *Plethodon* Salamanders: Categorical but Not Continuous Patterns of Body Size Assortment

A long-standing goal in evolutionary ecology is to determine whether the organization of communities is reflective of underlying deterministic processes. Research on *Plethodon* salamanders has revealed that species interactions are important drivers of phenotypic evolution within communities, and that these interactions play a role in community composition. Specifically, at both a regional and continental scale, the number of large and small *Plethodon* that co-occur at individual localities is highly non-random, suggesting that body size plays an important role in community membership. However, whether these processes generate regular patterns of body size dispersion has not been investigated. In this study, we measured 96,996 adult *Plethodon* from 3,154 geographic localities, and used several null model approaches to determine whether *Plethodon* communities exhibited body size assortment (i.e. community-wide character displacement). We found that only 2-species communities exhibited greater body size dispersion than was expected from chance, whereas communities containing, 3, 4, or 5 species did not. Further, these results are largely explained by the presence of a single large and a single small *Plethodon* at particular localities. Our results suggest that competitive interactions shape communities at a 'categorical' level (i.e. how many large and how many small *Plethodon* can co-exist), but do not further drive the evolution of body size within particular communities.

0294 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008

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Biting for Blood: A Novel Jaw Mechanism in Haematophagous Candirú Catfish (*Vandellia* sp.)

Teleostean evolution is characterised by specialisations of the trophic apparatus, where oral and pharyngeal jaw mechanisms have enabled an efficient and highly diverse prey capturing and manipulating behaviour. Oral jaws with immovable premaxillaries being ancestral, many teleostean lineages exhibit an increasing trend towards premaxillary mobility and protrusion, especially extensive in suction feeding fishes. Immovable premaxillaries are found at least in four lineages of basal teleosts (Osteoglossomorpha, Anguilliformes, Ostariophysi and Protacanthopterygii). The basal condition in catfish (Siluriformes), within the Ostariophysi, also involves plate-like premaxillaries that are strongly connected immovably to the ethmoid. This condition is found in nematogenyids and diplomystids, both considered basal (depending on molecular or morphological

evidence, respectively). However, as is the case in many other teleostean lineages, specialised feeding habits in some catfishes have also been linked to premaxillary mobility, as for example in some algae scraping loricariids. A not so distinct relative of these loricariids also comprise taxa showing an extremely unusual feeding habit for a fish, *i.e.* blood sucking. Within the Trichomycteridae, the clade Tridentinae-Stegophilinae-Vandelliinae seems to reflect an evolutionary history towards improved parasitic behaviour, with haematophagy making the candirú vandelliinecatfish notorious. Vandelliines are known to exhibit unusual upper and lower jaws, with specialised teeth on the premaxillaries, assumed to be an adaptation for slashing gill filaments of their hosts. However, the morphology of the jaws (strange shape of ethmoid and premaxillaries, lower jaws without a symphysis) also suggest that the whole mechanism of 'biting' in vandelliines is distinct from that of other catfish, and even other teleosts. This includes novel joints and novel muscles. A detailed morphological analysis of the musculo-skeletal system of the oral jaw apparatus in *Vandellia* sp. and allied trichomycterids, including 3D-modelling, is performed to unravel this apparent novel jaw mechanism.

0416 Northern Herps Symposium, Salon 6&7, Friday July 25, 2008

Frog Life Below Zero: Oxygen And Antioxidants

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Winter presents a series of challenges for wildlife and, in turn, animals have adapted in their own unique ways to survive multiple stresses on animal physiology and biochemistry. The wood frog, *Rana sylvatica*, uses a remarkable strategy of winter survival – freeze tolerance – and these frogs have been extensively used as a vertebrate model for studying the mechanisms of cryoprotection. During freezing, frogs must endure a variety of stresses including cell dehydration, anoxia/ischemia, and potential tissue damage by ice crystals growing in extracellular fluid spaces. One aspect of survival is a profound suppression of physiological and metabolic processes that leaves cells in a state of low activity. Transitions to and from a hypometabolic state is a closely regulated process which includes selected changes in gene expression under the regulation of a series of transcription factors. FOXO transcription factors have recently been shown to be involved in regulating many cell functions such as cell cycle arrest, apoptosis, and coping with oxidative stress. Oxidative stress can derive from a variety of external and internal sources and it is essential that cells have protective antioxidant defenses that defend against damage caused by reactive oxygen species (ROS). In the case of frozen frogs this can include contributing to long term cell viability over days/weeks in the frozen state and dealing with a surge of ROS production when oxygen is reintroduced to tissues after thawing. The effect of freeze/thaw on protein levels of FOXO1 and FOXO3 were assessed in wood frog organs using immunoblotting. Transcript levels of *foxo1*, *foxo3*, *catalase* and *MnSOD* were also analyzed by RT-PCR. Catalase and MnSOD (manganese superoxide dismutase) are two key antioxidant enzymes regulated by FOXOs, and show differential expression during freezing. The results demonstrate that regulation of FOXOs and their target genes is important for cellular defense during freeze/thaw.

0084 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008;
GRUBER

Age, Growth and Reproduction of the Bering Skate, *Bathyraja interrupta* (Gill & Townsend, 1897), from Alaskan Waters

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Life history traits of a common commercial bycatch species from the Gulf of Alaska were examined. Collections of *Bathyraja interrupta* were obtained from annual surveys, port sampling of commercial catch and observer collections from 2005 to 2007 in the Gulf of Alaska. Observed total lengths for males ranged from 19-82 cm and females from 20-87 cm. There was no difference in mean MIRs amongst months ($n = 131$, $F = 0.903$, $p = 0.481$) using samples from 6 consecutive months. No significant difference was found in *B. interrupta* growth parameters between sexes ($F = 0.8259$, $p = 0.4804$). *B. interrupta* has a relatively short life span with growth parameters comparable to other skates of a similar size ($L_{inf} = 126.40$, $k = 0.07$, $t_0 = -2.32$). Age estimates show a minimum longevity of 12 years for males and 13 for females. Total lengths at 50% maturity were approximately 68 cm for males and 70 cm for females (Males: $r^2 = 0.8836$, $p < 0.0001$, $n = 40$; Females: $r^2 = 0.9947$, $p < 0.0001$, $n = 43$), which corresponds to 7 years and 7.5 years respectively (Males: $r^2 = 0.9937$, $p < 0.0001$, $n = 12$; Females: $r^2 = 0.9969$, $p < 0.0001$, $n = 14$). Gravid females were found in all months between April and September.

0277 Poster Session III, Sunday July 27, 2008

Species Richness and Cladal Diversity in Freshwater Fishes of the Americas

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Species-richness is not distributed evenly among taxa. Most species are members of a few, highly diverse clades, whereas most taxa are species-poor. This sort of distribution with the shape of "hollow curve" is well described by a power function with an exponent close to -1. Power laws describe empirical scaling relationships in a broad range of natural phenomena and are widely used to explain the ecological mechanisms that constrain biodiversity. However, the relationships between species richness and cladal diversity remain poorly understood, and the mechanisms that promote differential net diversification among clades are almost entirely unknown. Here we report species-richness profiles for the two largest freshwater faunas of the Americas; the 'Amazon superbasin' (ASB) and 'Mississippi superbasin' (MSB), with regional boundaries delineated by hydrogeographic and ichthyofaunal criteria. ASB fishes from tropical South and Middle America include 5,738 species in 65 clades, and MSB fishes from temperate and subtropical eastern North America include 954 species in 88 clades. Species-richness was assessed among clades (*i.e.*, species or higher taxa) with evolutionary origins in freshwater, rather than among taxa of a given Linnaean rank (*e.g.*, family). Biogeographic age calibration was used to estimate minimum clade ages from the geological dates of vicariant events that isolated sister taxa. We find strong associations of species richness with two clade-level properties, phylogenetic age and geographic range, and with an organismal

property, mean body size. We also report for the first time an inverse relationship between species-richness and the power function exponent of dominance-diversity curves, suggesting that the rate of cladal diversification is dependent on species-richness. Neotropical freshwaters retain a relatively intact Gondwanan diversity, in comparison with the depauperate ichthyofaunas of other continents due to Neogene cooling and aridification; *i.e.*, the exceptional Neotropical species-richness is a relict of the Late Cretaceous-Early Tertiary global greenhouse.

0492 Poster Session I, Friday July 25, 2008

Target-Training in the Brownbanded Bamboo Shark (*Chiloscyllium punctatum*) and Nurse Shark (*Ginglymostoma cirratum*)

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The capability of sharks learning repetitive tasks was undertaken in this experiment. One male bamboo shark *Chiloscyllium punctatum* (63 cm TL) and one male nurse shark *Ginglymostoma cirratum* (110 cm TL) held in captivity since the beginning of 2007, were used in this experiment. Between September 2007 and April 2008, 61 trials were conducted to determine if these sharks could distinguish between colors (black square vs. white square targets), and shapes (white circle vs. white square targets). The sharks were trained to correctly identify with the targets using a reward system. The rewards were obtained when the sharks correctly hit their snout against the white square target for distinguishing between color and shape. The bamboo shark could obtain a maximum of eight pieces of fish, whereas the nurse shark was allowed a maximum of three, consistent of a normal regimen used by the aquarium. The bamboo shark correctly identified both the color and shape targets 437 out of 488 opportunities (89.5%), the nurse shark had a success rate of 167 out of 183 (91.2%). The assumption that some species of sharks rely on their barbels: as a means of identifying objects, rather than sight was also investigated. Initial response time varied, but decreased over time. The sharks appear to rely more on their eyesight for color distinction than on tactile behavior for shape discrimination. (Supported funding Ripley's Aquarium, South Carolina, Advisor Dr. Dan Abel)

0213 Herp Reproduction, Salon 4&5, Sunday July 27, 2008

The Relationship Between Mating Season and Vitellogenesis in the Colubrid Snakes of North America

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Snakes in the family Colubridae are diverse and widespread. In temperate North America, the reproductive cycles of the three subfamilies considered here, Colubrinae, Natricinae and Xenodontinae, are similar in both sexes. Females begin vitellogenesis in the spring and ovulate in late spring to early summer. In both oviparous and viviparous species, the young are hatched/born in the summer. Estrus, the period of time when females are sexually attractive and receptive, occurs in the spring (unimodal) in all species and in the summer/fall (bimodal) in some species. The age of the sperm at fertilization is identical in both mating patterns. The major difference between snakes with the unimodal and bimodal patterns is where

the sperm are stored during the winter; in the vas deferens in unimodal snakes and in the oviduct in bimodal snakes. A phylogenetic analysis of the occurrence of the unimodal and bimodal patterns suggests that these traits are phylogenetically plastic, however, the bimodal pattern is more prevalent in small semifossorial species. Elevated plasma testosterone levels coincide or immediately precede the mating seasons. In most colubrids spermatogenesis begins after the spring mating season, a pattern described as post-nuptial spermatogenesis. There are, however, several species of snakes in which spermatogenesis begins before mating, a pattern termed pre-nuptial spermatogenesis.

0209 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008

Egg Morphology of Species in the Tribe Gobiosomatini (Teleostei: Gobiidae) Using Scanning Electron Microscopy

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The tribe Gobiosomatini (American seven-spined gobies) comprises 40% of the New World gobiid fauna (Birdsong & Robins, 1995). They occupy diverse habitats for which an adaptive radiation pattern has been hypothesized (Ruber et al., 2003). Scanning electron microscopy was used to examine morphological egg characters, which were then mapped on a known phylogeny to elucidate relationships and examine character congruence between and within genera in Gobiosomatini. The resulting tree was examined for patterns relating to phylogeny, habitat and environmental stimuli. Egg differences among genera were noted with respect to: shape, distance between eggs, length of long and short axes, zona radiata thickness, width of and pattern surrounding micropylar region, length of filament region attached to the substrate, filament base width and egg-to-substrate distance. The zona radiata thicknesses varied greatly from 0.7 μ m (*Coryphopterus dicrus*) to 6 μ m (*Bathygobius soporator*). Interesting vegetal pole protuberances were noted in both *Elacatinus oceanops* and *Tigrigobius macrodon*. Morphological egg plasticity and dispersal pattern of *Bathygobius soporator* were examined, and the characters were not found to vary significantly when altering the microhabitat substrate. Egg characters did not vary significantly when laid on natural or unnatural substrate in *Gobiosoma ginsburgi*. Other relationships among these parameters were considered and will be discussed.

0146 AES Devil Ray Symposium, Jarry/Joyce, Friday July 25, 2008

Manta Rays, *Manta birostris*, in the Maldives: Seasonal Distribution and Economic Value

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The Republic of Maldives in the central Indian Ocean is home to large numbers (many '000s) of Manta Rays, *Manta birostris*. They are an important component of the nearshore pelagic ecosystem, and a significant attraction for tourist divers and

snorkellers. The aims of this study were to map the seasonal distribution of manta rays within the Maldives, and to assess their economic value for tourism. Seasonal distribution and economic value were determined from personal observations, interviews with experienced divers and a national survey of fishermen. The distribution of Mantas is strongly influenced by the seasonally alternating monsoon currents. Mantas occur on the (seasonally alternating) downstream sides of the atolls, and are rare on the upstream sides, switching sides biannually with changing currents. Manta presence is correlated with turbidity and ocean colour, both proxies for zooplankton abundance. Diving and snorkelling with Mantas is estimated to be worth about US\$ XX million per year. Tourism is the largest sector of the Maldivian economy; appreciation of the value of marine-life, and particularly of the charismatic mega fauna, can play a major role in its conservation.

0381 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

Temperature Insensitivity Of Chameleon Tongue Projection: Maintaining Performance At Low Temperature Via An Elastic Power Amplifier

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Ectotherms such as lizards are constrained in their activity by the impact of environmental factors on their physiology, for example, the effect of temperature on muscle contraction velocity. Low temperatures are expected to hinder the ability of many lizards to pursue prey by impacting performance of muscle-powered movements such as locomotion and tongue protrusion. Chameleons are unusual among lizards in that they do not pursue prey by chasing and lunging, but instead use ballistic tongue projection to ambush prey. We hypothesize that chameleons are able to maintain tongue projection performance at low temperatures—despite the strong influence of temperature on muscle dynamics—by virtue of their tongue projection mechanism, which uses rapid elastic recoil of collagenous sheaths within the tongue. We further hypothesize that tongue retraction performance, which relies on the retractor muscle doing work directly on the tongue and prey, is affected strongly by temperature. To test our hypotheses, we imaged *Chamaeleo calyptratus* at 3000 Hz feeding on crickets at 15-35°C. For each feeding event, we calculated average and instantaneous velocity, acceleration and power of the tongue and calculated Q_{10} values for both projection and retraction. In accord with our hypothesis, our results reveal that *C. calyptratus* is able to maintain tongue projection performance over the examined temperature range and that velocity of elastically powered projection is far less sensitive to temperature ($Q_{10}=1.03$) than muscle-powered retraction ($Q_{10}=1.65$). The temperature insensitivity of tongue projection, combined with the ambush hunting strategy of chameleons, may ease temperature limitations on their activity patterns and may explain observations of chameleon activity over a wider temperature range than sympatric lizard species. Other elastically powered movements, such as frog jumping and salamander tongue projection are expected to show a similar pattern, which may be a general mechanism by which ectotherms can maintain performance at a range of temperatures.

0581 Poster Session II, Saturday July 26, 2008

Seasonality Syndrome and Proliferating Pythons

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Population growth of exotic Burmese pythons in Florida has raised concerns about range expansion. Rodda et al. (2008) and Barker and Barker (2008) recently estimated the native range. A conspicuous distributional gap exists in the Thai/Malay peninsula, Borneo, and Sumatra. A somewhat similar gap is known for *Calloselasma*, *Daboia*, and *Varanus bengalensis* (cf. Tweedie, Wuster et al., and Auffenberg), and was noted previously for *Python molurus* (see O'Shea). Numerous avifaunal transitions occur in this region, at the boundary between deciduous and rainforest. The recurrent pattern is best explained by specialization for distinctly seasonal environments. I suggest that *P. molurus* exhibits an adaptive syndrome of traits for seasonality: preference for open deciduous forest, gregarious occupation of subterranean retreats in the cool/dry season, the formation of dominance hierarchies, and mating within retreats. One implication for population control is that artificial burrows may be effective attractants in some environments. If natural retreats are used repeatedly, spoor tracking may also prove useful. Burrow usage suggests that physiological tolerances limit distributions. I take a simplistic approach to the limited question of whether Burmese pythons can spread beyond the Florida peninsula. I compare Florida to the Chinese subtropics. A mean January minimum of 2.5 °C tracks the Chinese range of *P. molurus*, and highlights the thermally unique Sichuan Basin; anthropogenic introduction to this region is possible. By this cold hardiness criterion, pythons can clearly expand beyond peninsular Florida. Frost free periods >250-300 d/yr also encompass the Chinese range; expansion beyond FL depends on which value is the better estimate. The metabolic time for female nutrient acquisition (conditions averaging ≥ 20 °C) also indicates that spread out of FL is possible. The model of Rodda et al. may overestimate the northern extent of climatic suitability, but their call for vigilance should be heeded below the Fall Line.

0623 Cottonmouth Symposium, Salon 4&5, Monday July 28, 2008

Cottonmouth Feeding: Jack of All Prey, Master of the Dead

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Cottonmouths are predator/scavengers of aquatic and hydrophilic prey. They hunt on land and in water, but concentrate their efforts in very shallow water. Ambush sites near objects (e.g. woody debris) that detain or channel prey are often used, as are sites that afford some overhead cover. Beaver dams are a favored foraging environment. Cottonmouths sometimes hunt at quite low temperatures (15 °C). Cottonmouths mainly use ambush tactics, but they may change ambush sites more frequently than other viperids. In the laboratory, foraging cottonmouths were actually more active than watersnakes. Foraging cottonmouths rely more on chemosensory input than do rattlesnakes. Cottonmouths appear to deposit chemical cues by head-rubbing objects near sites of prey encounters. Foraging individuals often come into contact with one another. Cottonmouths are euryphagous, taking all vertebrate groups and some arthropods. Some evidence suggests a coevolutionary

arms race between cottonmouths and frogs. Ambush posture and attack mode are variable, and differ ontogenetically. Juvenile cottonmouths attract prey by caudal luring. Nonmammalian prey are held until subdued; fish are often eaten alive. Mammals are released after being struck, and typical SICS retrieval is used. Cottonmouths lack the proficiency of specialized piscivores for capturing and handling fishes, rarely handling or consuming prey underwater. Scavenging of carrion is species-typical, probably reflecting the hydric cycles and attendant die-offs of aquatic prey in the swamps they favor. Juveniles rarely take dead fish, whereas adults prefer them. Location of carrion may rely on nasolfaction. An annual "boom-or-bust" pattern of food intake is the norm. Fruitful topics for future investigation include mechanisms yielding dietary generality, sensory control of various stages of feeding, ontogeny of foraging tactics, spatial memory in a water-land mosaic, interaction of foraging behavior and sociality, roles of venom for feeding on different prey, and correlates of extreme variation in food intake.

0762 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

Appraising Neotropical Amphibian Diversity: Current Trends and Inferences from the Global Amphibian Assessment

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The Global Amphibian Assessment (GAA) has become a landmark reference in global amphibian conservation and amphibian biology since its official launch in 2004. In order for it to continue to provide current information, however, regular updates must be undertaken, in this way allowing for further assessment or reassessment of amphibian-related patterns. The Neotropics host roughly half of all known amphibian species (2915 of 5915 species as of December 2005), and are also thought to contain a large undescribed amphibian fauna, making this an important region to monitor in terms of species richness, habitat associations and conservation. We provide an update to the existing GAA and examine the patterns that emerge both within the 2008 Neotropical update and in relation to the 2006 update and 2004 complete assessment. Species accounts, maps and preliminary conservation status (based on the IUCN Red List Categories and Criteria) were generated for all new and revalidated Neotropical species. These materials were then assessed by the authors or reviewers of each species, where possible. Since the last (2006) update and up to December 2007, 183 new and revalidated (including elevation of subspecies to species category) Neotropical species have been added to the GAA database, bringing the total number of described Neotropical species to 3091 (including the removal of junior synonyms). Anurans comprise 97% of these 183 species; the remaining 3% is comprised of salamanders. The new species are distributed among 17 families, with Strabomantidae reporting the highest number of species (57 spp.), followed by Hylidae (27 spp.). The latter, however, reports the highest number of genera (12). The countries with the greatest number of newly described/revalidated species are Peru and Brazil, with 49 and 48 species, respectively, followed by Bolivia (23 spp.). We will further discuss habitat associations and the conservation status of these new species.

0286 Poster Session II, Saturday July 26, 2008

Ecological Separation of Striped and Unstriped Forms of *Plethodon cinereus*

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When studying speciation, researchers commonly examine reproductive isolation in recently diverged populations. Polymorphic species provide an opportunity to examine the role of reproductive isolation in populations that may be in the process of divergence. We examined a polymorphic population of red-backed salamanders (*Plethodon cinereus*) for evidence of sympatric ecological separation by color morphology. Recent studies have correlated temperature and climate with color morphology in this species, but no studies have looked at differences in diet or mate choice between color morphs. We used artificial cover objects to monitor salamander diet, mating preference and surface activity over a two year period at a field site in northeastern Ohio. We detected differences in diet and mate preference between two color morphs, striped and unstriped. The diets of striped individuals were significantly more diverse and were made up of more profitable prey than the diets of unstriped salamanders. Opposite sex pairs were more likely to be made up of individuals of the same color morph and striped males were more likely to occur with larger females than were unstriped males. We corroborate findings of earlier studies suggesting that the unstriped form is adapted to warmer conditions. Unstriped individuals were the first to withdraw from the forest floor as temperatures fell in the late fall. We found no evidence that the color morphs responded differently to abiotic factors such as soil moisture and relative humidity, but in the late summer and fall, unstriped salamanders tended to be found at warmer temperatures than did striped salamanders. Individuals of *P. cinereus* make up over 98% of salamanders observed at our study site. Thus, we speculate that ecological separation in this population may result from niche expansion in a species-poor salamander community.

0125 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

Identifying Canadian Freshwater Fishes through DNA Barcodes

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Fish identification can be problematic, especially when phenotypic variations overlap between species and when morphological character have been degraded or express differentially during ontogeny. Furthermore, even for a well-studied fauna such as the freshwater fishes of North America, there is still some undescribed cryptic

diversity remaining. In this context, and following the commitment of the Canadian Barcode of Life Network to barcode the freshwater resources of our nation, we developed a molecular tool to identify the Canadian freshwater fishes. A total of 652-bp have been obtained for 1360 individuals belonging to 191 species including 86 genera and 28 families. The nearest-neighbour distance between species averaged 7.5%, which was 30-fold higher than the mean within species distance of around 0.3% and 13-fold higher than the mean maximum intraspecific distance of around 0.6%. Among the set of 191 species, nine species (5%) included several distinct clusters and 15 species (8%) exhibited barcode sequences and lineages that were shared or overlapped with those of other species. This study has shown the efficacy of COI barcodes for diagnosing North American freshwater fishes since most species examined here corresponded to a single, cohesive array of barcode sequences that were distinct from those of any other species.

0113 Poster Session I, Friday July 25, 2008

The Brain of *Mobula japonica* (Spinetail Devilray, Myliobatiformes, Elasmobranchii) in Gross Morphological and Ecological Perspectives

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The difference in brain mass among different taxonomic radiations is one important measure of brain evolution. In the present study the brain mass to body mass ratio and external morphological features of *Mobula japonica*'s (spinetail devilray) brain are described. *M. japonica* extended the upper boundary of the minimum convex polygon described earlier by other authors for batoids, which is plotted on a double logarithmic scale of brain to body mass. The new data had high leverage to the regression, compared to other batoids, causing some change in the allometric coefficient. The encephalization quotient was higher than unity, therefore it can be concluded that the actual brain mass is greater than expected by the given body mass. The most prominent brain parts were the huge and high telencephalon, giving 61 % of the total brain mass and the convoluted, strongly foliated cerebellum, with 19 %. *M. japonica* had the highest percentage of telencephalic mass from all batoids studied so far, while squalomorph sharks are represented by 24-31 %, galeomorph sharks 35-66 %, and batoids 33-51.1 %. The cerebellum of the *Mobula* was most similar to that of lamniform and advanced carcharhiniform sharks, which had extremely high foliation, and the cerebellum could be divided into 3 lobes with deep sulci. A structural dimorphism of cerebellar foliation was detected between genders, albeit with a small sample size. No such gender-related dimorphism was detected in brain mass/body mass ratio. Other brain parts were similar to those of other elasmobranch species. The data are discussed in terms of their systematic or evolutionary significance.

**0748 Fish Systematics II, Salon A&B, Friday July 25, 2008; STOYE
GENERAL ICHTHYOLOGY**

**Resolving the Phylogeny of Frogfishes (Lophiiformes: Antennariidae):
Evidence from mtDNA and Ovarian Morphology**

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Phylogenetic relationships among members of the family Antennariidae (Order Lophiiformes) were inferred from partial sequences of the ribosomal 16S and cytochrome C oxidase subunit I (COI) mitochondrial genes. Sequences were aligned and analyzed using parsimony and likelihood methods of phylogenetic inference. Nineteen species were included, representing ten of the twelve described genera and five of the six recognized species-groups, as well as an unidentified species, possibly representing a new genus. Results indicate that the genus *Antennarius* is not monophyletic, forming two clades basal to all other antennariids. *Antennatus* and *Histrion* also nest within a clade of *Antennarius*. Ovarian structure and molecular characters support the monophyly of a clade that includes *Phyllophryne*, *Kuiterichthys*, *Echinophryne*, *Tathicarpus*, *Rhycherus*, *Lophiocharon*, and *Histiophryne*.

**0729 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT
SYSTEMATICS/EVOLUTION**

**Phylogenetic Relationships among Australian Agamid Lizards Using
Nuclear and Mitochondrial DNA Data**

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Australian agamid dragon lizards include notable species such as the frill-neck lizard and thorny devil. Previous molecular phylogenetic hypotheses using mitochondrial DNA loci provided support for monophyly of some genera but found strong support for nonmonophyly of others. Nuclear DNA is known to be less variable than mtDNA but may provide support for deep relationships among species that are poorly resolved using mtDNA. However, only one phylogenetic analysis has used nuclear DNA. We perform combined and separate analyses of mtDNA and nuclear DNA from the potassium voltage-gated channels (KCNA4 and KCNA10) for about 90% of Australian agamid lizard species. Our results are entirely congruent with previous mtDNA analyses.

0569 AES Systematics & Biogeography I, Jarry/Joyce, Saturday July 26, 2008

**Phylogeny of Skates, Rays, and Allies (Chondrichthyes: Batoidea) Using
RAG-1 and Complete Mitochondrial Genomes: Preliminary Results**

Neil Aschliman, Gavin Naylor

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Skates, rays and their allies (Batoidea) are a prominent but under-studied clade of stem vertebrates that exhibit broad morphological diversity. Batoids include forms

as varied as ragged-snouted sawfishes, circular torpedo rays and seven-meter-wide mantas. How did this diversity in form arise from a shark-like ancestor? The lack of a reliable phylogenetic hypothesis has impeded an understanding of the changes in body form affecting the diversification of this group. The most taxon-rich batoid phylogenies are morphological and have been important in identifying suites of characters that appear constrained and/or convergent. Even so, the lack of confidence in any one topology has led to ambiguity about the way in which putatively convergent changes were brought about. Previous molecular phylogenies have included very few taxa and limited sequence data. We generated both nuclear DNA sequence data (RAG-1, ~60 taxa) and the complete protein-coding component of the mitochondrial genome (~25 taxa), sampling broadly across Batoidea. Data were analyzed under Maximum Likelihood and Bayesian approaches, and a number of well-supported clades were recovered. Some are novel, while others are anticipated by morphology.

0156 Herp Conservation, Salon 4&5, Sunday July 27, 2008

Artificially Constructed Wetland Habitat as a Recovery Action for Species at Risk Amphibians, South Okanagan Valley, BC

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The Okanagan valley is under intensive urbanization and agricultural development, where 85% of the natural wetlands and riparian areas have been drained or altered. Surveys of amphibian Species at Risk have been conducted in the south Okanagan since 2003. Of 108 ponds inventoried, approximately 88% experience at least one harmful impact resulting from human actions. Our project goal is to establish a mosaic of fishless, non-contaminated wetlands while securing conservation agreements between private landowners and Ducks Unlimited Canada. Project objectives include: 1) habitat restoration and enhancement to increase the quality and quantity of habitats, 2) increase knowledge and participation in recovery actions of the species among the public and stakeholders, and 3) monitor amphibian populations to evaluate recovery actions. Restoration and enhancement of sites were selected using three main criteria: close proximity (< 500 m) to known breeding populations of the Threatened Great Basin Spadefoot (*Spea intermontana*) or the Endangered Tiger Salamander (*Ambystoma tigrinum*), close proximity to waterways (< 500 m), and a minimum distance from roadways (> 100 m). In fall 2006 and 2007 we constructed six ponds and enhanced six wetlands. In Spring 2007, amphibians were detected at three of the six project sites; Spadefoots successfully metamorphosed at one site. In 2008, the sites and surrounding wetlands will be monitored for calling frogs, the presence of eggs, and metamorph emergence. In 2008, three additional wetland sites will be enhanced, including predatory fish removal. The impact of upland habitat modification (i.e. agricultural soil compaction) and the availability of sandy soil required by burrowing amphibian species will be examined. The project aims to increase the quality and quantity of amphibian breeding habitat and the connecting upland habitat corridors.

0218 AES Devil Ray Symposium, Jarry/Joyce, Friday July 25, 2008

Framework for the Establishment of a Global Conservation Program for Manta and Modula Rays

Robert Aston

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Since the year 2002, the 501(c)(3) non-profit organization, The Manta Network (TMN), has been establishing a global framework for the conservation, protection and management of manta and modula rays. Aspects of this framework include a Manta Science Advisory Board, Manta Research Affiliates Program, Global Manta Database and resources library, sponsored field research, educational programs and a manta awareness program that includes the scientific community, conservation groups, the dive industry, underwater photographers, the media and the general public. Results of these programs will be discussed including the development of an online global database, automated spot identification software, manta research and expeditions and the use of a uniquely designed, underwater, live IP video camera system for research and education.

0644 Poster Session III, Sunday July 27, 2008

Genetic Estimates of Population Structure of the Endangered Okaloosa Darter

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Effective management of listed species requires an understanding of the threats and status of target populations. The Okaloosa darter (*Etheostoma okaloosae*) has been listed as Endangered since 1973 due to its limited distribution and presumed threats posed by invasive species and habitat loss or perturbation. The Okaloosa darter is restricted to six streams draining into the Choctawhatchee Bay, Florida. Little is known about population histories and levels of isolation of these stream populations. Analysis of complete cytochrome b sequences from >200 darters fin-clipped from all six streams has identified three lineages (net divergence 0.6-0.9%) that are geographically restricted and reflect past isolation. Data on nuclear divergence (microsatellite loci) are being examined to contrast with mtDNA (to be presented). Although most immediate challenges for endangered fish are ecological, consideration of evolutionary processes can broaden options for management. In the case of the Okaloosa darter, the identification of distinct evolutionary lineages may influence management and recovery actions for the species.

0397 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008; STOYE GENETICS, DEVELOPMENT & MORPHOLOGY

Taxonomy, Population Genetics, and Body Shape Variation of Alabama Spotted Bass *Micropterus punctulatus henshalli*

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Alabama spotted bass (*Micropterus punctulatus henshalli*) are found in the Mobile River basin above the Fall Line in Alabama and northwest Georgia and are sympatric with redeye bass (*M. coosae*). We tested (i) the uniqueness of *M. p. henshalli* relative to Northern spotted bass (*M. p. punctulatus*) and *M. coosae*, (ii) the validity of Bailey's zone of intergradation, and (iii) for population structure in spotted bass by analyzing variation among five nuclear microsatellite DNA loci, mitochondrial cytochrome *b* sequences, and body shape for fish from the Mobile River basin and other drainages. Results indicated population genetic differentiation, microsatellite deviation from Hardy-Weinberg equilibrium, and admixture among populations, which swamped phylogenetic signal. STRUCTURE analyses consistently grouped individuals into nine to twelve populations, with fish from the Alabama plus Tallapoosa Rivers and Ohio River forming the most distinctive clusters. Phylogenetic analyses of *cyt b* sequences recovered a clade containing Alabama spotted bass and redeye bass haplotypes, suggesting potential hybridization between these taxa. Microsatellite DNA variation tends to support this hypothesis for some, but not all, populations. Body shape analyses are inconclusive with respect to hybridization among these taxa.

0369 Fish Ecology II, Salon A&B, Monday July 28, 2008; STOYE ECOLOGY & ETHOLOGY

Effects of Predator Accumulation on Community Structure of Fishes in Marine Protected Areas

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One of the main goals in community ecology is to understand how communities are structured and how they function. Marine Protected Areas (MPAs) are changing community structure. One change is that larger, older predatory fish accumulate within long-term MPAs. Predation pressure from these large piscivores may increase mortality in smaller fishes, and juveniles, including conspecifics, and potentially alter community structure and dynamics. This study investigates whether predator accumulation in an MPA has altered the species assemblage and size structure of the fish community. Replicated underwater visual transects were used to quantify species and size structure of the fish assemblage inside and outside of a long-term MPA near Santa Catalina Island, California (USA). All demersal species were surveyed at 8-week intervals over a 12-month period. Size of each fish encountered was estimated to the nearest cm. Non-metric multidimensional scaling (nMDS) was used to evaluate whether the species and size structure of the assemblage inside the MPA differed from that found outside. Initial results of nMDS indicate that fish assemblages inside the MPA were distinguished from those outside by a greater abundance in large predatory species and unexpectedly, in the smallest size classes. However, trends of lower abundance did appear among the larger individuals of small size classes. Cohort analyses for the larger individuals of those small size

classes demonstrated greater mortality within the MPA. These trends suggest more intense predation on juveniles and slightly larger species of small size classes. These results indicate that large predators in MPAs alter species assemblage and size structure. These findings provide a basis for more realistic predictions of how MPAs may be expected to affect marine fish communities.

0741 Northern Herps Symposium, Salon 6&7, Friday July 25, 2008

Yolk and Integumentary Carotenoids are Not Mobilized to Supplement the Antioxidant Capacity of Hatchling Western Painted Turtles (*Chrysemys picta bellii*) during Hypoxic Stress

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Hatchlings of the painted turtle, *Chrysemys picta*, hibernate terrestrially and can survive subfreezing temperatures by supercooling or by tolerating the freezing of their tissues. An ischemic hypoxia develops when tissue perfusion is limited by low temperature and/or freezing. Damage by reactive oxygen species is minimized because hatchlings of *C. picta* have high constitutive antioxidant defenses. Although preliminary research indicates that antioxidant enzymes are an important component of the antioxidant defenses of turtles during hypoxia exposure, little is known about the contribution of non-enzymatic antioxidants to total antioxidant capacity. Carotenoids are lipid-soluble antioxidant pigments that can be incorporated into the integument to produce colorful ornamentation. Western painted turtles, *C. p. bellii* are distinguished from the other *C. picta* subspecies by their orange-red plastron. Because they cannot synthesize carotenoids and they do not feed, the pigments in a hibernating hatchling's shell are derived and maintained from their yolk. Under stressful conditions, reallocation of carotenoids from bodily sinks towards physiological functions (antioxidant defense, immune function) has been observed in other vertebrate taxa. We examined whether *C. p. bellii* hatchlings, in response to 8-d hypoxia treatment, mobilize carotenoids to the plasma from yolk, and/or from the plastron. Plastron redness, lipid-soluble antioxidant capacity, and carotenoid content of yolk and plasma did not differ between the hypoxia treatment and normoxic controls. Our results indicate that stored carotenoids are not mobilized by *C. p. bellii* in response to hypoxia.

0711 Poster Session III, Sunday July 27, 2008

***Sparus aurata* (Perciformes: Sparidae): A New Potential Harmful Invader in the Gulf of California**

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The gilthead sea bream *Sparus aurata* Linnaeus, 1758 is a Mediterranean fish reaching 70-cm total length and 6-kg weight. It is described as an opportunistic predator though more specialized toward gastropods and bivalves. The introduction of commercial cultures of the gilt-head sea bream in different coastal areas and bays may cause ecological problems such as an increase of eutrophication, introduction of

diseases, and even the ecological disruption of local ecosystems. In September 2005, a transnational company introduced juvenile individuals of *Sparus aurata* in cages in Bahia de La Paz, Gulf of California. The Mexican environmental authorities forced the company to remove all the gilt-head sea bream during July 2007 from the bay. However, on 3 October 2007 an individual female *S. aurata* was captured in the wild during experimental fishing work, swimming freely in the bay. Until 27 December 2007 fifteen specimens 290-335 mm TL had been captured. In order to evaluate the potential success to establish in the area the specimens were analyzed for feeding habits and reproductive stage. The analysis of stomach contents showed 19 different items. Mollusks were the most important food item (IRI: 57.27%) and among them the gastropods were the preferred (39.11%). Secondarily food items were macroalgae (7.53%) and crustacean (2.39%), including also uncommon prey-item as legs of grasshoppers and echinoderms. The analysis of histological sections of gonads stained with hematoxylin-eosin indicated the majority sea breams were hermaphrodites with ovary tissue in stage I and II. Only one specimen showed ripe ovary tissue with hydrated oocytes. We concluded that the escapee of *S. aurata* are able to survive in the bay invading different habitats since the origin of the food is from sandy, reef and mangrove areas; they are maturing as described for the Mediterranean and probably they will be able to reproduce during 2008.

0105 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

From Larvae to Lineages: Investigations of Shorefish Diversity in the Tropical Atlantic

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The identities of pelagic larval stages constitute the largest gap in our knowledge of the coral-reef fish fauna of the tropical Atlantic. This fundamental taxonomic information is necessary before larvae can be used in studies of, for example, evolution, fisheries biology, and ecology. Over the past 15 years, we have identified larvae of numerous Belizean fishes by rearing net-collected larvae at the Smithsonian's marine station at Carrie Bow Cay. More recently, we have begun matching larvae to adults using mitochondrial cytochrome oxidase 1 sequences (DNA Barcodes). As well as greatly enhancing our ability to provide species identifications of larvae, the molecular data from Belizean fishes reveal more species diversity in many genera than our present classifications suggest. Because much of the Belizean fish fauna is believed to occur throughout the Caribbean and other areas of the tropical Atlantic, we are expanding our DNA barcoding efforts to other geographical areas. In addition to re-analyzing species diversity of cryptic reef fishes throughout the tropical Atlantic, the ultimate goals of our work include reconstructing species-level phylogenies of a diversity of tropical Atlantic shorefish genera, from which we can investigate patterns of morphological divergence and speciation.

0619 Poster Session II, Saturday July 26, 2008

Assessing the Use of Artificial Structure in a Fragmented Landscape: Herpetofauna as a case study

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As habitat fragmentation increases due to urbanization and/or agriculture, the likelihood of remaining habitat patches being able to support viable animal populations decreases. Herpetofauna are model organisms for studying the impact of habitat fragmentation on animal populations, as they are relatively easy to sample and often rely on more than one habitat type for population persistence. We discovered an abandoned homestead on our campus and completely encircled the homestead with a drift fence. Our objectives with the drift fence study were to (1) inventory and monitor local herpetofauna, (2) assess the use of the homestead as a rookery site and (3) assess the use of the homestead as a hibernaculum. Between 4/25/07 and 11/15/07 we captured 473 animals, representing 9 reptile species and 7 amphibian species. Interestingly, the *Agkistrodon contortrix* (Copperhead) and *Thamnophis sirtalis* (Garter Snake) we captured during the summer were all gravid and entering the homestead site. Thus, data we collected this summer supported our hypothesis that artificial structure provided by the homestead may be used as a rookery area for some herpetofaunal species. In addition, 8 of 10 snakes captured in late fall (9/26 – 10/26/07; represented the last month of snake activity at the fence) were entering the homestead site. Thus, data collected during the fall supported our hypothesis that artificial structure provided by the homestead may be used as a hibernaculum area for some snake species.

0521 AES Age & Growth/Reproduction, Kafka/LeMaratine, Saturday July 26, 2008

Determination of Age in Atlantic Angel Sharks: What Does it All Mean?

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Species-specific age and growth estimates, while necessary for age-structured population dynamic models, are often difficult to obtain for elasmobranch species. Although angel sharks (Squatinae) are highly exploited and considered 'endangered' in many parts of their range, very few studies have examined the age and growth of species in this family, likely due to difficulties associated with traditional ageing techniques. Investigation of Pacific angel shark *Squatina californica* vertebrae found band deposition to be related to somatic growth, but temporally unpredictable. Atlantic angel sharks *Squatina dumeril* were collected for age and growth analysis (n=343) from fishery-independent and dependent sources from January 2001 through June 2007. Vertebral samples were collected from the area of the spinal column located dorsally to the abdominal cavity, and band counts were obtained from whole, halved, and sectioned (0.6 mm) vertebral centra. Several methods were employed in order to investigate the age and growth of the Atlantic angel shark, including traditional growth models using band counts (e.g. von Bertalanffy Growth Model and Gompertz Growth Model), and newer Bayesian methods that estimate L_{∞} (asymptotic size) using only length data.

0051 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008;
GRUBER

**Maturity, Fecundity, and Reproductive Cycle of the Spotted Ratfish,
Hydrolagus colliei (Lay and Bennett, 1839)**

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Size at maturity, fecundity, and reproductive periodicity of the spotted ratfish, *Hydrolagus colliei*, were estimated from off the coast of California, Oregon, and Washington. Maximum body size and size at median maturity were greater for females than males. Skeletal muscle concentrations of the steroid hormones testosterone (T) and estradiol (E₂) predicted similar, but slightly smaller sizes at maturity than morphological criteria. Stage of maturity for males was estimated identically using either internal organs or external secondary sexual characters, facilitating non-lethal maturity assessments. Latitudinal differences in sizes at median maturity were observed, with greater values north of Point Conception for females, and north of Cape Mendocino for males. Peak parturition occurred from May through October, with elevated skeletal muscle concentrations of E₂ in females correlating with ovarian recrudescence during November through February. No significant seasonal trends in female T were apparent, but mean female 11-ketotestosterone (11KT) was 300% greater in April than any other month during the parturition season. There was marginal evidence for increased number and size of ova with maternal size. Extrapolation of the hypothesized 6-8 month egg-laying season to observed mean parturition rates of captive specimens yielded an estimated annual fecundity of 19.5-28.9 egg cases. Differences in fecundity among higher taxonomic classifications of chondrichthyans were detected, with chimaeriform fishes being more fecund than myliobatiform, squaliform, and rhinobatiform fishes.

0379 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT
ECOLOGY

**Seasonal Habitat Use and Movement of Cascades Frogs (*Rana cascadae*) in
Washington**

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Cascades frogs (*Rana cascadae*) are endemic to montane ecosystems in the Pacific Northwest and are declining in the southern part of their range. They are considered "near threatened" by the World Conservation Union and are a "species of concern" in Washington by USFW. There are few studies that track amphibian movement after they leave their breeding pools. This project will track a population of Cascades frogs in the foothills of the North Cascades throughout the year using radio-telemetry. Since there have been no studies on the overwintering strategies of the Cascades frog this study will focus on how this species survives half the year in extreme winter conditions. Physiological data on energy storage will be gathered before and after hibernation and compared to a lower elevation site. Baseline data will be gathered on population size and correlated with temperatures and dissolved oxygen at hibernation sites measured near the frogs in both aquatic and terrestrial habitats. Frog movement will be tracked between hibernation, breeding and summer foraging sites. Preliminary data indicate that *R. cascadae* are not freeze tolerant like

the Wood frog (*Rana sylvatica*), and require specific micro-habitats during hibernation.

0453 Poster Session III, Sunday July 27, 2008

Osteological Description of Fish Species from the Family Carangidae

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A wide study in trophic biology of top predators demonstrates that family Carangidae constitutes an important prey in their diets. However the advanced digestion state of the prey and a few comparative osteological information of these species, their identification is not possible to lower taxa. Thus the present research aims the comparative study of some carangid fishes from the Eastern Pacific Ocean, mainly with the neurocranium, jaw bones, hyomandibular and axial skeleton to know interspecific differences in these bones to recognize the characters which facilitate the carangid species identification in the stomach contents of top predators. The fishes were identified in fresh, and their skeleton preparation was using the softening in warm water and the dermestid beetles methods. We found that the family has their own characters that allow separate between other families like the presence of lateral laminate in the neurocranium between the sphenotic-pterotic and parietal-epiotic bones, the high crest formed by the frontal and supraoccipital, and a total of 24 vertebrae in the axial skeleton. The neurocranium and hyomandibular are different from each species. Also, *Selene peruviana* is distinguished by the elevation of the supraoccipital crest and the ascending and the nasal process are joined in the premaxilla; *Decapterus macarellus* by the position and form of sphenotic. The nasal process in *Seriola rivoliana* is triangular and flattened; however in *Selar crumenophthalmus* is shorter than the ascending process, and in *Trachinotus rhodopus* is thin and extended. Also more characteristics are shown in the pictures to identify species.

0092 Amphibians in Ecosystems Symposium, Salon 6&7, Sunday July 27, 2008

Examining the Relative Role of Ectotherms and Endotherms in Food Webs

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I present a hypothesis for understanding the important differences between the roles that ectothermic and endothermic organisms play in food webs. Ectotherms devote comparatively little of the energy they consume to maintenance of body heat or other activities beyond growth and reproduction; therefore, ectotherms are able to convert a greater proportion of consumed resources into biomass than endotherms. Such an allocation strategy means ectotherms can achieve extremely high densities in many habitats. As a result, ectotherm-dominated food webs may have predator foraging behavior, food web length, and food web stability that differ from food webs or chains with a large endotherm component. Specifically, I outline support for the idea that ectotherm-based food chains are longer than endotherm-based counterparts. I also suggest reasons why the fields of conservation biology and ecology should

pursue further clarification on the roles ectotherms and endotherms play at the community and ecosystem level.

0638 Fish Systematics I, Salon A&B, Friday July 25, 2008

Utility of the Nuclear Growth Hormone Gene for Inferring Phylogenetic Relationships among Actinopterygian Fishes

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Previous work on the nuclear growth hormone gene (GH) suggests that it is an excellent locus for estimating phylogenetic relationships among rayfin fishes. In this study, we used an expanded alignment of coding region sequences comprising 654 nucleotide characters to infer phylogenetic relationships among 235 actinopterygian taxa, including 157 ostariophysans and 78 non-ostariophysans, plus sarcopterygian outgroups, produced in this study or obtained from Genbank. The final dataset comprised 600 variable sites of which 401 were phylogenetically informative at the actinopterygian level. The data set was subjected to phylogenetic analysis partitioned by codon with R-Y coding at the third codon position. We translated the nucleotides to amino acid sequences to understand character state changes across the resulting phylogeny. (Bayesian consensus tree), Teleosts (elopomorphs to acanthomorphs) are resolved with strong posterior-probability support (27 unambiguous amino acid changes including 13 synapomorphies). Ostariophysans (Cypriniforms, Siluriformes + Characiforms) are well supported (9 unambiguous amino acids changes; 3 derived) and sister to another well-supported group comprising protacanthopterygians (Salmoniformes plus Esociformes) plus acanthopterygians (13 unambiguous changes; 5 derived). The lone osmeriform included in the study (*Plecoglossus altivelis*) is sister to remaining Euteleosts. The large number of amino acid changes and changes in certain amino acids that affect protein folding (e.g., cysteine residues) suggest that changes in GH protein structure have occurred over the course of actinopterygian evolution.

0300 Poster Session III, Sunday July 27, 2008

Genetic Differentiation of Spotted Salamanders (*Ambystoma maculatum*) in a Fragmented Landscape in Southwest Ohio

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The fragmentation of suitable habitat for amphibians is occurring at an alarming rate across the US. This puts populations already stressed in further peril. Genetic exchange across populations is curtailed by fragmentation. This affects some species more than others, depending on several factors including a particular species ability to cross inhospitable terrain. Lack of species specific knowledge makes conservation decisions difficult. Loss of genetic diversity through loss of genetic exchange can increase the probability of local extinctions through inbreeding and stochastic events. Spotted salamanders inhabit forested areas with access to vernal pools for breeding. Contiguous forest should allow genetic exchange between subpopulations maintaining genetic diversity. In southwest Ohio much of the remaining land available for development is forested wetlands that were unsuitable for agriculture.

Molecular genetic methods (microsatellites) were used to sample three populations of Spotted Salamanders (*Ambystoma maculatum*) located in isolated forests in southwest Ohio for genetic diversity. Populations from 40 to 103 kilometers apart were compared. Each forested area had a single breeding pond in which Spotted Salamanders had been observed. *F_{st}* values were high indicating isolation of the three populations from each other. Values were similar ranging from 0.1487 to 0.1746 (mean = 0.1647, SD = 0.0140). None of the populations were in Hardy-Weinberg Equilibrium with a deficit of heterozygotes.

0261 Fish Ecology I, Drummond, Thursday July 24, 2008

Is Prey Detection Mediated by the Widened Lateral Line Canal System in the Lake Malawi cichlid, *Aulonocara hansbaenchi*?

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The peacock cichlids of Lake Malawi (*Aulonocara* spp.) are characterized by widened lateral line canals, a morphology that has been shown to enhance sensitivity to local water flows such as those generated by infaunal invertebrate prey. We tested the hypothesis that 1) search behavior and prey detection behavior in *Aulonocara hansbaenchi* are different in light (day) and dark (night) conditions, and that 2) live prey (that generate hydrodynamic stimuli capable of stimulating the lateral line) would be preferred over dead prey. Six live and six dead brine shrimp were tethered in pairs in six petri dishes randomly placed among 12 petri dishes in the sandy substrate of an experimental tank. Standard digital video was used to characterize search and prey detection behavior of individual fish. At night, prey detection was generally preceded by a glide (no acceleration or fin movements), and then a pause and 180 degree swimming reversal re-positioning the prey under the mandible prior to strike. During the day, prey detection tended to be preceded by a glide, and a change in orientation. Furthermore, a significantly higher number of live prey were eaten at night, but during the day high numbers of both live and dead prey were eaten. These data suggest that the lateral line is used to detect prey at night, while vision and lateral line are important for prey detection during the day. The widened lateral line canal morphology in *Aulonocara* is convergent with that in taxa in more than a dozen families (e.g., some *Notropis*, *Glyptocephalus*, Melamphaeidae), some of which are known to feed on infaunal prey or in midwater. *Aulonocara hansbaenchi* is easily reared and crossed with other Lake Malawi cichlids and will be used to understand the developmental and genetic bases for functional evolution of the lateral line system among fishes.

0757 General Herpetology II, Jarry/Joyce, Monday July 28, 2008

Snake Abundance and Species Richness in Managed Riparian Forests Along the Middle Rio Grande in New Mexico

Heather Bateman¹, Alice Chung-MacCoubrey², Howard Snell³, Deborah Finch¹

¹USDA Forest Service Rocky Mountain Research Station, Albuquerque, NM, United States, ²USDI NPS Mojave Desert Network, Boulder City, NV, United States, ³University of New Mexico, Albuquerque, NM, United States Minor Outlying Islands

To understand the effects of removal of non-native plants and fuels on wildlife in the riparian forest of the Middle Rio Grande in New Mexico, we monitored snakes from 2000 to 2006 using trap arrays of drift fences, pitfalls, and funnel traps. We used a non-parametric Wilcoxon signed rank test to compare trapping methods. We used a repeated measures analysis of variance (ANOVA) to compare capture rates in treated and untreated riparian forest. We recorded 158 captures of 13 species of snakes from 12 study sites. We captured more snakes in funnel traps than in pitfalls. The most frequently captured species included Common Kingsnake (*Lampropeltis getula*), Gophersnake (*Pituophis catenifer*), Plains Black-headed Snake (*Tantilla nigriceps*), and Plains Hog-nosed Snake (*Heterodon nasicus*). We did not detect an effect of non-native plants and fuels removal on the rate of captures; however, we recommend using other trapping and survey techniques to monitor snakes to better determine the impact of plant removal on the snake community. Compared to historical records, we did not report any new species but we did not capture all snakes previously recorded. Black-necked Gartersnakes (*Thamnophis cyrtopsis*), which are closely tied to aquatic habitats, were not captured during our study – possibly indicating the loss of off-channel semi-aquatic habitats along the Middle Rio Grande.

0285 Herp Systematics, Drummond, Friday July 25, 2008

Phylogeny of the Gekkotan Lizards of the World

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Gekkotan lizards constitute one of the most diverse and species-rich clades of squamates and are among the most ecologically important groups of all nocturnal vertebrate insectivores. Geckos should be an ideal group for asking a diversity of biological questions, but this has been prevented by the lack of an appropriate phylogenetic framework. We used DNA sequence data derived from a combination of five nuclear genes and five mitochondrial genes to investigate relationships among ~525 species of geckos representing 105 genera under maximum parsimony, maximum likelihood, and Bayesian inference. Living gekkotans are divided into seven major clades, here recognized as family level units. Southwest Pacific geckos (Carphodactylidae, Diplodactylidae and Pygopodidae) form a monophyletic group that split from other gekkotans no later than the mid-Cretaceous. Two other families, Sphaerodactylidae and Phyllodactylidae, account for most New World geckos, but have trans-Atlantic distributions. Gekkonids *sensu stricto* are the most diverse clade and include several major monophyletic subgroups (Afro-Malagasy geckos, the *Gekko* group, *Hemidactylus* + *Cyrtodactylus*) as well as some unanticipated groupings (e.g., *Nactus* + *Heteronotia* + *Dixonius*). Although at odds with earlier hypotheses of

relationship, our results are largely consistent with morphological data. However, they suggest that many characters previously regarded as phylogenetically informative are, in reality, highly homoplastic — at least at more hierarchically inclusive levels.

0589 Poster Session III, Sunday July 27, 2008

On the Absence of a Plethodontid from the Northern Great Plains of Manitoba with Comments on Our Description of a New Species, *Plethodon prairiensis* sp. nov., that is Based on No Specimens or Data

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In 1926, E.R. Dunn published his monograph on the salamander family Plethodontidae, thus setting the stage for research on this group, a productive area that bears fruit even today. One of the authors (CKB) has extensive experience with working with almost no data, and we take this form of analysis to the next appropriate level: the description of a phenomenon with no evidence for it except a dot on a range map showing the world-wide distribution of plethodontids. Whereas some may argue that the dot merely represents a stray splash of ink from Dunn's quill pen, we contend that the locality could actually be real and that Dunn just forgot to include an account of the strange plethodontid that inhabits the Great Plains of Manitoba. We argue that an undiscovered population in this strategic area helps to explain the migration of plethodontids from Korea into the western and eastern American clades during the late Mesozoic, and elucidates plethodontid relationships much more clearly than shadowy evidence from DNA analyses. We propose that *Plethodon prairiensis* is the sister taxon of all North American plethodontids, and we speculate that it looked a lot like *Hemidactylium*, but had five toes.

0648 Fish Systematics IV, Salon A&B, Monday July 28, 2008

A New Character for the Taxonomy of Lamprey

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Papillae along the posterior margin of the gill pore and a mid-lateral central process were examined for 33 of 34 recognized species of northern and southern hemisphere lamprey. The number, size, shape and arrangement of the papillae are diagnostic for all genera and most species. Anadromous parasitic lampreys have the largest number of papillae and freshwater, non-parasitic species have the smallest number and the largest papillae. The central process is a hollow structure that is completely absent from all species in the Genera *Icthyomyzon* and *Mordacia*, but present in all other genera. Gill pore papillae and the central process also distinguish forms of lamprey. For example, the anadromous parasitic Pacific lamprey have approximately 65 to 75 pigmented, pencil shaped papillae, throughout their distribution from off the east coast of Russia to off the west coast of California. However, a freshwater parasitic form in California that has not been distinguished from the Pacific lamprey has approximately 15 papillae that form unpigmented,

fleshy bars. To date, 49 distinct gill pore and central process structures have been identified, some of which when combined with standard morphological measurements indicate the possible existence of new species. Thus, gill pore papillae may be as useful in lamprey taxonomy as gill raker structure has been for bony fishes.

0098 Amphibians in Ecosystems Symposium, Salon 6&7, Sunday July 27, 2008

An Invasive Frog Affects Ecosystem Processes Through Nutrient Recycling as Opposed to Trophic Cascades

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A frog endemic to Puerto Rico, *Eleutherodactylus coqui*, invaded Hawaii in the late 1980s likely via the floriculture trade. This species is regarded as a pest because of its loud mating call and economic impacts on private property values and the nursery industry. Because *E. coqui* is a generalist insectivore that can attain extremely high densities (up to 89,000 individuals/ha), the invasion is also of ecological concern as *E. coqui* may negatively impact endemic species, especially invertebrates, through both direct and indirect effects. *E. coqui* has been the focus of a \$4 million/year control effort on all four main Hawaii Islands and is now largely restricted to the Island of Hawaii. The impacts of *E. coqui* on flying, phytophagous, and leaf litter invertebrates; herbivory, plant growth, and leaf litter decomposition rates; and leaf litter and throughfall chemistry were studied at two sites on the Island of Hawaii. *E. coqui* significantly reduced invertebrate abundance at only one of the two study sites. *E. coqui* decreased herbivory rates, and increased plant growth rates, leaf litter decomposition rates, and nutrient availability in decomposing litter and throughfall across both study sites. Path analyses suggested that *E. coqui* increased plant growth rates and leaf litter decomposition rates more through associated increases in nutrient availability (nutrient recycling) than through changes in the invertebrate community (trophic cascades). This is the first study I know of identifying the importance of a nutrient recycling mechanism using a terrestrial, vertebrate predator. A previously conducted experiment in Puerto Rico, using similar methods, determined the effects of *E. coqui* on the invertebrate community and ecosystem processes in its native range. Across its native and introduced ranges, the effects of *E. coqui* on invertebrates varied by study site, but the effects of *E. coqui* on ecosystem processes were similar.

0197 Conservation in Canada, Salon 4&5, Saturday July 26, 2008;
CARCNET/RÉCCAR

Mitochondrial Evidence of Pleistocene Range Fluctuations in Blanchard's Cricket Frog (*Acris crepitans blanchardi*) across the Mid-western United States

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Cricket frogs (*Acris*) are highly aquatic members of the treefrog family Hylidae, and occur exclusively in North America. The genus consists of two species and five subspecies, with Blanchard's cricket frog (*A. crepitans blanchardi*) as the most northern and western form. Reported declines in northern populations of this subspecies prompted the investigation of its genetic structure to further understand its biology, historical biogeography, and to evaluate potential conservation actions. Mitochondrial control region sequences of 479 individuals from 107 sites across its range were determined. One hundred one haplotypes were found, giving a haplotype diversity of 0.77. However, overall nucleotide diversity was relatively low (0.0089), as was genetic differentiation (sequence divergence = 3.6%). A combination of phylogenetic, spatial, and demographic analyses identified several groups within this subspecies, and demonstrated that its present structure has likely been primarily shaped by climatic fluctuations that occurred during the Pleistocene. Maximum likelihood phylogenetic analysis distinguished two main clades that roughly correspond to the northeast and southwest portion of the range. The southwest region was likely a refugium for Blanchard's cricket frog during the unstable climatic conditions of the Pleistocene, as it possesses high genetic diversity and has been at demographic equilibrium throughout much of its history. In contrast, the northeast region appears to have experienced multiple range expansions and contractions in response to the repeated advance and retreat of glacial ice. This is supported by several signatures in the mitochondrial data, including low genetic diversity, star phylogenies, and unimodal pairwise mismatch distributions. The retreat of the last ice sheets approximately 20 000 BP allowed Blanchard's cricket frog to colonize as far north as southern South Dakota and Michigan, resulting in a gradient of decreasing mitochondrial diversity to near-monomorphism in the most northern part of its range. The exclusion of the southwest clade from the region north of Kansas and east of Missouri indicates that a northern-adapted form may exist in this area. This possibility should be considered when evaluating recovery strategies for northern populations of Blanchard's cricket frog.

0198 Poster Session II, Saturday July 26, 2008

Conservation Genetics of the Highly Endangered Puerto Rican Crested Toad (*Peltophryne lemur*)

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The Puerto Rican crested toad (*Peltophryne lemur*) is the only bufonid endemic to Puerto Rico. Historically found at nine scattered locations around Puerto Rico and on Virgin Gorda, it is currently represented by a single wild and two captive populations. The main factors contributing to its decline are habitat alteration,

inundation of coastal breeding ponds during tropical storms, and, potentially, predation and competition by the introduced marine toad (*Bufo marinus*). Recovery efforts for this species have been extensive, including captive breeding of both northern and southern populations, reintroduction of >90 000 tadpoles, habitat restoration and construction of breeding ponds, and public outreach and education. To guide future conservation efforts, genetic variation and differentiation was assessed by profiling individuals from the three groups at the mitochondrial control region and six microsatellite loci developed for this study. Only two mitochondrial haplotypes were found (sequence divergence = 1.66%), with one localized to each of the southern and northern populations. Moderate genetic variation exists at microsatellite loci in all three groups, with no evidence of inbreeding as assessed by heterozygote deficiency. The captive southern population has not diverged substantially from the only remaining wild population on the south coast of Puerto Rico at either mitochondrial or nuclear loci ($F_{ST} = 0.028$). In contrast, qualitative and quantitative analyses of the microsatellite data suggest that northern and southern populations have been separated for some time, with little overlap in alleles at five of six loci ($F_{ST} = 0.313-0.340$). Despite this strong differentiation, the two lineages are no more divergent than many populations of other amphibian species. As the northern breeding colony is on the verge of extirpation, it is recommended that a third colony be established in which northern and southern individuals are bred together, in order to preserve any northern adaptive traits that may exist.

0402 Herp Stressors/Snake Conservation, Salon 6&7, Monday July28, 2008

Food as a Conservation Tool: Lessons From Field Studies of Snake Bioenergetics

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Basic science is most valuable when it informs and directs applied science. Studies of field bioenergetics have demonstrated a tight coupling between food resources and fundamental life-history responses of pit vipers and many other snakes. Pit vipers in particular are extreme examples of low-energy adapted organisms and they exhibit high sensitivity to changes in resource abundance. Geographic patterns of growth, body size and sexual size dimorphism have been linked to variation in resource abundance or primary productivity. Likewise, snakes generally respond to experimental or natural resource augmentation with corresponding increases in growth rate, body size and body condition. I discuss several well-documented examples of increased growth, body size, or population density of snakes in response to uniquely abundant food resources. These published studies, coupled with information from experimental studies suggest that manipulation of food resources may be an extremely valuable technique for remediation of snake populations. Indeed, efforts to conserve snake populations often stop at preservation of suitable habitat and reduction of obvious sources of mortality (e.g., road-kill, collecting). Habitat manipulations designed to improve prey densities may complement these more traditional conservation techniques.

0328 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

Multiple Speciation Events in Amazonian Lowland Forest Fishes Driven by Andean Tectonics

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The richest biota in the world is found in the lowland rainforests of Amazonia. Despite its enormous importance as source of biodiversity, little is known about the evolutionary processes that generate diversification in Amazonia. Here we present the results of a comparative multigene and multispecies study aimed at elucidating the history of diversification of forest-dependent fishes from the Rio Negro basin, central Amazonia. We conducted extensive field expeditions along the Rio Negro basin and amassed samples of four fish groups (cardinal tetras, pencilfish, hatchetfish and rummy nose tetras) from 25 tributaries – an effort that corresponds to over 100 co-distributed populations and 2,000 individuals. Data from mitochondrial DNA and newly developed microsatellite DNA markers were obtained for all individuals. Our analyses unravelled extremely localized population structures and cryptic speciation. Inferred patterns of reproductive isolation and evolutionary distinctiveness are consistent with the existence of several cryptic (but deeply divergent) species. A comparative phylogeographic analysis clarified the histories of these fish populations and disclosed a remarkable result that has implications to understand biotic diversification in Amazonia: all speciation events in the lowland forests can be accounted by geomorphologic processes related to the uplifting of the Andes Mountains. We detected high concordance between the formation of tectonic arches and sub-arches in the Rio Negro and the distribution and history of cryptic species. This is the first multispecies and multigene study to present strong support for the palaeogeographic model of speciation in Amazonia. We also discuss on the implications of our comparative approach to evaluate the relative contribution of ecological and geographic processes underlying population differentiation and speciation in Amazonia.

0657 Poster Session I, Friday July 25, 2008

Reproductive Biology of Hammerhead Shark *Sphyrna lewini* in Salina Cruz, Oaxaca, Mexico

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The hammerhead shark *Sphyrna lewini* was the most caught shark in Oaxaca. However the reproductive aspects of the specie in this area of Mexico are unknown. Samples and data were collected every week at the artisanal fishing between September 2004 and June 2006. A total of 991 hammerhead sharks (342 females and 649 males) also juveniles (45 to 160 cm TL) and adults (170 – 288 cm TL) were sampled. Sex ratio in adults was 1F:2M. The hammerhead shark was present all year but the biggest abundance was in May to July, this is the season when the pregnant females appear. Size of first maturity for females was 220 cm TL (increase in diameter of the oocyte, width of the oviductal gland). The histological analysis showed that males have diametric testes, sperm in epididymis, ductus deferens and compound spermatozeugmata in seminal vesicle, which suggests a size of first

maturity for males at 180 cm TL. We don't found sperm storage in the oviductal glands of females but this condition has been confirm for the specie. We recorded 40 pregnant females with an interval of 6 to 40 embryos. Births were in July to August and the birth size was between 41 to 51 cm TL. We propose Salina Cruz, Oaxaca as a nursery area for hammerhead shark *Sphyrna lewini*.

0501 Poster Session II, Saturday July 26, 2008

Thermal Effects on Strike-induced Chemosensory Searching in the Cottonmouth, *Agkistrodon piscivorus*

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Cottonmouths exhibit Strike-Induced Chemosensory Searching (SICS) after striking and releasing prey. SICS is characterized by sustained, rapid tongue flicks as the snake attempts to locate the chemical trail left by fleeing prey, which is then trailed and eventually swallowed. This trailing behavior presumably results from selective pressure to balance foraging success with avoidance of injury from retaliatory bites. SICS, which integrates a variety of snake behaviors, is affected by many proximate factors such as prey type, relative prey size, the reaction of the prey during or following the strike, the number of prey previously struck, and various others. The purpose of this study was to test the effects of ecologically-relevant temperature variation on SICS in the cottonmouth using three temperature treatments of 14-16°C, 20-22°C, and 28-30°C. Although snakes foraged successfully at all three temperatures, cottonmouths at warmer temperatures tended to release prey more often, and then relocate and swallow prey sooner, than snakes at lower body temperatures. These data suggest that environmental temperatures have the potential to influence foraging success in cottonmouths via thermal dependencies of SICS components.

0298 Poster Session III, Sunday July 27, 2008

Evaluating the Success of Timber Rattlesnake Relocation Efforts in Eastern Kansas

Rebecca Benjamin, Sean Kimbrell, William Donovan, Mindy Walker

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There has never before been a documented experiment that attempted to permanently relocate a population of *Crotalus horridus* (Timber Rattlesnakes). This project is of interest because it is both a conservation effort on the behalf of a threatened species of venomous reptiles and an unprecedented research opportunity to examine the consequences of their relocation. A disjunct population of Timber Rattlesnakes (n≈200) in eastern Kansas was under threat of development. Twenty-nine snakes were removed from this den site and relocated to a safe habitat. All individuals were weighed, measured and implanted with microchips for identification. Scale clippings were taken for further identification and genetic analysis. Seven of these individuals had radio-transmitters with unique frequencies surgically implanted in their abdominal cavities for future telemetry tracking. These snakes were tracked every third day of their active season of 2007 to document their foraging routes and examine their general health. Prey density and diversity were

also assessed. One of the seven radio-implanted snakes was lost to predation, while the remaining six survived the first active season and successfully entered a den. Upon recapture in 2008 the snakes will be reweighed and remeasured for comparison to the initial capture data. Blood samples will be collected from each snake for genetic analysis. Morphologic and genetic results obtained from the 2008 tracking season will indicate the success of the relocation. Thus far, our results indicate that the relocation of a population to an appropriate habitat may be a promising conservation technique.

0046 Poster Session I, Friday July 25, 2008

The Reproductive Ecology of *Manta birostris* off Southern Mozambique

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Manta birostris is common in southern Mozambican coastal waters with 450 individual rays identified, based on their unique dorsal and ventral markings, in the area around Inhambane since 2003. Manta rays are present year-round and use many inshore reefs as cleaning stations. Observation of this population over five years has revealed previously unreported aspects of their reproductive biology and behaviour. The study population in southern Mozambique is sexually segregated, with a female to male sex bias of 3.5:1. Sexual dimorphism in size is apparent between the sexes. The high re-sighting rate (40%) of individuals infers a semi-resident local population that has allowed the reproductive condition of known individuals to be regularly assessed. Male rays appear to transition from immaturity to maturity around a disc width (DW) of 3 meters, whereas females mature at about 4 m DW based on observed pregnancies and reproductive pectoral fin scarring. Pregnancies have been observed in over 60 individuals. Courtship and mating behavior typically occurs between October and January, but appears to be punctuated. Parturition occurs in the summer months, from late November to early February. Typically a single pup is born per litter. The smallest free-swimming individual accurately measured in the field was 1.5 m DW, while a 1.3 m DW pup was extracted in early October from a dead specimen. Preliminary data suggests that the gestation period in this population is 12-13 months. While at least four females were seen to be pregnant in consecutive years, the majority of individuals had a biennial or even triennial reproductive cycle.

0204 Conservation in Canada, Salon 4&5, Saturday July 26, 2008; CARCNET/RÉCCAR

The Effects of Habitat Barriers on Movements and Gene Flow in Northern Map Turtles (*Graptemys geographica*)

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Habitat loss and fragmentation are considered to be the leading causes of turtle declines worldwide. Northern Map Turtles (*Graptemys geographica*) are highly aquatic, freshwater turtles, listed as a species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada. This listing is based primarily on perceived threats and general turtle life-history characteristics, rather than on actual

published data about the species' biology in Ontario. The Trent-Severn Waterway (TSW) is a 386 km navigational route linking Lake Ontario to Georgian Bay via a series of 44 locks and over 100 dams and control structures. We hypothesized that the locks and dams on the TSW are acting as barriers to movements and gene flow in Northern Map Turtles, and predicted that Map Turtles would have significantly reduced movements and genetic diversity in areas of high lock density. Radio transmitters were attached to turtles in high lock density (N=8) and a low lock density (N=12) areas and movements were followed. Tissue samples were collected from turtles (N=105) in reaches separated by locks and dams along the waterway. Turtles in the high lock density area had significantly shorter daily and seasonal movements than those in the low lock density site, indicating that the locks and dams are acting as barriers to movements. Anecdotal evidence suggests that these barriers are not impenetrable, as turtles may move through the locks with boat traffic, or climb around the locks during nesting migrations. Genetic analyses, using microsatellite markers, will elucidate gene flow, and allow us to determine whether the locks and dams are isolating genetically distinct populations. The ultimate goal of this project is to gather information relevant to the creation of viable management strategies and conservation initiatives for Northern Map Turtles.

0477 Poster Session III, Sunday July 27, 2008

Tools for Planning and Designing Conservation Buffers

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¹USDA National Agroforestry Center, Lincoln, Nebraska, United States, ²Natural Resources Conservation Service, Lincoln, Nebraska, United States

Conservation buffers can benefit aquatic and riparian biodiversity by creating habitat, protecting water quality, enhancing the microclimate, and providing opportunities for species movement. Buffers can also provide other environmental and socio-economic benefits such as soil protection and landowner economic diversification. Balancing these benefits can be a challenging task of determining what opportunities, limitations, and trade-offs exist in each situation, and of designing a buffer system that achieves the best balance among them. To meet this challenge, the USDA National Agroforestry Center is developing a suite of buffer planning and design tools to accommodate a range of landscape considerations in combination with each landowner's unique decision-making process. These tools can be used individually or in combination to plan and design buffer systems that satisfy landowner needs and goals while protecting and enhancing ecological functions and values. Some of the tools being developed include: 1) Multi-scale Suitability Assessments Techniques: GIS-based assessments to determine where buffers can achieve biodiversity, water quality, soil, and economic diversification goals. 2) Buffer Width Design Tool: An empirical-based graph for estimating buffer width to achieve a desired level of water quality protection. 3) Planning and Design Guidelines: Illustrated field guide for designing conservation buffers for multiple objectives. Synthesized from over 1,400 peer-reviewed journal articles. 4) CanVis: Image-editing software for creating photo-realistic simulations of buffer design alternatives. 5) Buffer\$: An analysis spreadsheet tool for evaluating the economic costs and benefits of converting a crop field to a conservation buffer.

0474 Biodiversity & Agriculture II, Drummond, Saturday July 26, 2008

Biodiversity in Agricultural Landscapes: Creating a Shared Vision

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Agricultural lands must provide numerous services these days from food, feed, fiber and fuel production to biodiversity protection. Unfortunately many of these services are sometimes at odds with other, such as the current expansion of biofuel production and its impacts on aquatic and riparian habitat. Conservation buffers, both riparian and upland, are an effective strategy for protecting and enhancing riparian and aquatic biodiversity in agricultural landscapes. They create and safeguard habitat, protect water quality, enhance the microclimate, and restore habitat connectivity for species movement. Planning and design of these systems however must be tackled at both the landscape scale where many of these ecological functions are expressed and at the site-level where landowner needs and objectives are addressed. At the USDA National Agroforestry Center, we've developed a planning framework and a suite of tools for designing multi-functional conservation buffers. The multi-scale framework incorporates a regional reconnaissance, landscape assessments, and site-scale buffer plans; providing context for the planning effort and identifying locations for buffers to more effectively achieve biodiversity, water quality, soil protection, and economic diversification objectives – either individually or simultaneously. Site-scale buffer planning is supported by several tools that help 1) determine the physical design of the buffer, including width, configuration, and plant species selection, 2) evaluate the cost-benefits of different buffer scenarios, and 3) landowners to visualize buffer design alternatives on their property. Through planning, landowner and community stakeholder goals can be brought together into a shared vision necessary for supporting aquatic and riparian biodiversity.

0307 Fish Ecology I, Drummond, Thursday July 24, 2008

The Tale of the Two Shoals: How Individual Experience Influences Shoal Behaviour

Zehev Benzaken, Kevin Warburton

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This project examined how the spatial behaviour and cohesion of rainbow fish (*Melanotaenia duboulayi*) shoals are affected by the contrasting previous experience of individual shoal members. The main variables considered were: overall group size, the time since group members were exposed to a positive (food) or negative (threat) experience, and the proportions of shoal members having the two types of experience. The food and threat stimuli were introduced close to a habitat patch, to which fish were normally attracted. Shoals of two fish were exposed to food or threat for thirty minutes. Their behaviour was then recorded in twenty-minute trials after different lengths of time had elapsed since exposure (0, 1, 24 and 48 hrs). Shoals made up of different combinations of food-exposed and threat-exposed fish were used (0+2, 1+1, 2+0). Two fish shoals continued to use the patch, possibly because of a protection trade-off where for a small group the refuge benefits of the patch

outweighed the perceived risks associated with open water, or because of lower efficiencies in terms of learning and mutual reinforcement in small shoals. I will propose several experiments to answer these questions that remained unanswered such as the protection trade-off by remaining at the patch and the learning deficiency of small shoal. With this talk I hope to promote discussion of how to answer these unresolved questions.

0244 Poster Session II, Saturday July 26, 2008

The Role of Prescribed Burn on *Pinus palustris* (Longleaf Pine) Community Composition And Structure: A Multiple Taxa Approach to Adaptive Management

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Rapid development, commercial timber practices, and fire suppression have relegated the once dominant matrix community, *Pinus palustris* (longleaf pine) savannah, to scattered isolated remnants on protected lands. While current management practices use prescribed burning to mimic natural fire regimen, few studies have assessed community response to such activities beyond the focal species approach. We present ongoing research that quantifies changes in longleaf pine community composition and structure across a range of taxa (i.e., plants, herpetofauna, invertebrates, and microbes) that utilize longleaf pine uplands, and associated isolated wetlands, on a large riverine island. In six paired sites (i.e., burned v. control) a nested sampling design was used to assess vegetation (i.e., overstory, shrub, herbaceous, and longleaf seedling regeneration) as well as abiotic factors (e.g., soil nutrients, litter depth) known to constrain plants and herpetofauna. Direct (i.e., drift fence array) and indirect (e.g., call surveys) herpetofaunal sampling occurred proximate vegetation plots, quantifying species occurrence, diversity and richness. Microbial and invertebrate sampling efforts are ongoing with completion anticipated in summer 2008. Of the taxonomic groups sampled, plant community (and associated edaphic conditions) exhibited the greatest statistical differences between treatments with increased longleaf pine seedling density ($p < 0.001$), reduced litter depth ($p < 0.001$), and reduced herbaceous cover ($p = 0.047$) occurring on burned sites. A total of 179 herpetofauna, representing 21 species, were captured in 1164 array nights. While no overall differences occurred in herpetofaunal richness and diversity between burned and unburned sites, several species exhibited treatment preferences including *Notophthalmus viridescens dorsalis* (unburned; $p = 0.076$), *Hyla femoralis* and *Storeria occipitomaculata* (burned; $p = 0.069$ and $p = 0.042$, respectively). Large bodied snakes occupied unburned sites more ($p = 0.07$), but sample size precludes definitive conclusion. Extensive drought influenced results as species of interest responded differently to drought-related stress (e.g., migration, aestivation), affecting observed distributions. Our research suggests that for fire management to be successful, quantifiable parameters specific to species of interest must be assigned a priori and monitored concurrently with management application.

0646 Poster Session I, Friday July 25, 2008

***In-vivo* Muscle Dynamics of Thresher Sharks During Sustained Swimming**

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This study presents the first phase of a collaborative research project that investigates several aspects of locomotor muscle function and design in the thresher sharks (Alopiidae). Threshers are a group of large, pelagic sharks easily recognized by their elongate upper caudal lobe. The alopiids represent the only genus to contain species with both lateral and medial positions of the red aerobic locomotor muscle (RM). Thus, the alopiids provide the ideal system in which to test the hypothesis that the medial RM position in the common thresher shark (*Alopias vulpinus*) provides the basis for a propulsion mechanism similar to that found in the lamnid sharks and different from sharks with lateral RM. Field studies captured common thresher sharks and used sonomicrometry to quantify the *in-vivo* muscle dynamics of the red and white muscle (WM) during sustained swimming. Preliminary data on RM strain (at first dorsal fin), at a tailbeat frequency of 0.5Hz, was consistently greater than that of the WM and decreased significantly during simulated swimming movements (when the RM was not stimulated; i.e., passive swimming). By contrast WM strain did not differ between active and passive swimming. A comparison of RM and WM phase during swimming showed instances in which RM shortening both led and trailed that of the surrounding WM, with no phase difference observed during the passive swimming experiments. This finding suggests that, similar to lamnid sharks, the common thresher RM shears relative to the WM. Therefore, these results suggest that the common thresher may exhibit a similar uncoupling of RM shortening and local body bending as seen in the thunniform lamnids.

0377 AES Systematics & Biogeography II, Jarry/Joyce, Sunday July 27, 2008

Defining Management Units of a Migratory Species: the Global Genetic Population Structure of the Tiger Shark (*Galeocerdo cuvier*)

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The tiger shark (*Galeocerdo cuvier*) is a migratory and globally distributed species, inhabiting warm-temperate and tropical waters. This species likely plays a key role in marine ecosystems and recent evidence of its over-exploitation and population decline in some regions underscores the need for accurate delineation of its population structure worldwide to inform management efforts. We analyzed the

global population structure of tiger sharks ($n = 289$) using 11 nuclear microsatellite loci and sequences of the entire mitochondrial control region ($n = 201$). Population-level microsatellite analyses revealed strong genetic differentiation among tiger sharks from Atlantic and Indo-Pacific waters ($F_{ST} > 0.102$), and between samples from South Africa and the Southwestern Atlantic ($F_{ST} = 0.185$). There was relatively weak differentiation among sample sites within basins ($F_{ST} < 0.026$). Although individual-level analyses using the software STRUCTURE and BAPS found significant within-basin differentiation, these groupings did not correspond to geographic capture locations, suggesting extensive mixing of adult populations within basins. Preliminary mitochondrial sequence analysis revealed high congruence with nuclear markers, showing strong division of the Atlantic and Indo-Pacific groups. Collectively, these findings imply a strong barrier to dispersal across the South Atlantic, and between ocean basins. In contrast, open ocean expanses appear not to inhibit dispersal across the Indo-Pacific, suggesting an absence of barriers to gene flow across this basin. The detection of mainly basin-wide management units emphasizes that managing and conserving large, migratory species will require collaborative, multi-national and global-scale approaches.

0005 Fish Ecology I, Drummond, Thursday July 24, 2008

Reproductive Anatomy, Gonad Development and Spawning Seasonality of Nurseryfish, *Kurtus gulliveri* (Perciformes: Kurtidae)

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The nurseryfish, *Kurtus gulliveri* of northern Australia, is remarkable for the fact that the males carry the egg mass on a supraoccipital hook on their forehead. Plankton samples of larval nurseryfish indicate a prolonged spawning season (June-November) that more or less corresponds with the Dry Season in the Northern Territory. The paired, elongate testes are located in the posterior position of the body cavity suspended by the mesorchium. The Gonadosomatic Index (GSI) of males was small and highly variable (mean 0.14, 0.01-0.27) from June-November. The histological structure of testicular lobes showed maturing and mature stages that contained spermatocytes, spermatids, and spermatozoa. The paired, bean-shaped ovaries contained about 5000 oocytes (1176-9783) and were located in the rear of the abdominal cavity. GSI averaged 1.58 (0.36-4.48). Ovarian histology revealed primary growth, cortical alveolar oocytes, vitellogenic oocytes, coalesced yolk, and atresia. The occurrence of postovulatory follicles and late vitellogenic oocytes in the ovaries clearly indicate that nurseryfish females are batch spawners. Maturing testes showed signs of previous spawnings indicating that males are capable of spawning several times throughout the spawning season. We speculate that nurseryfish may spawn in a manner similar to their closest relatives, cardinalfishes (Apogonidae), with eggs carried on the male's hook instead of orally.

0481 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

MtDNA Phylogeography of *Barbus intermedius* (Pisces: Cyprinidae) from Ethiopia

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Barbus intermedius, a large and hexaploid East African freshwater minnow, is well known for its morphological plasticity. Two subspecies of *Barbus intermedius* are recognized: *B. intermedius intermedius*, from Ethiopia and northern Kenya, and *B. intermedius australis*, from Lake Baringo, Kenya. Since the species description in 1835 there have been few attempts to examine geographic variation in this species in order to resolve its complex taxonomic history. We analyzed sequence variation in mtDNA cytochrome *b* gene sequences in 82 specimens representing *B. intermedius*, *B. bynni*, *B. paludinosus*, *B. gananensis*, and outgroup taxa from *Garra*, *Labeo*, and *Varicorhynchus*. Fourteen populations of *B. intermedius* in four major drainage systems in Ethiopia were analyzed. Phylogenetic analyses revealed two mitochondrial lineages, corresponding to a north-south split in the drainages. The northern lineage included specimens from the Blue Nile (including Lake Tana) and Awash drainages, and northern Rift Valley lakes. The southern lineage consisted of specimens from the Omo-Gibe drainage system and southern Rift Valley lakes and rivers. These divergent mtDNA lineages are indicative of potentially long independent histories. Splitting *B. intermedius* into two species requires additional assessment of morphological character variation.

0463 AES Food & Feeding, Kafka/LeMaratine, Saturday July 26, 2008

Diet of the Roundel Skate, *Raja texana*, from the Northern Gulf of Mexico

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To evaluate the trophic role of skates in benthic marine ecosystems, diet and feeding habits of the roundel skate, *Raja texana*, have been examined from offshore waters in the northern Gulf of Mexico. Diet was assessed by life-stage (immature and mature) and quantified using several relative measures of prey quantity: percent by number (%N), percent by weight (%W), frequency of occurrence (%O), the index of relative importance (IRI), IRI expressed on a percent basis (%IRI), %IRI based on prey category (%IRI_{PC}), and the geometric index of important based on prey category (%GII_{PC}). Analysis of stomachs from 222 immature individuals (195 non-empty; mean) and 191 mature individuals (167 non-empty) indicate shrimp make up 90.7 %IRI_{PC} (69.6 %GII_{PC}) of immature skate diet, with decapod shrimp and euphausiids the most important identifiable type present. Although in smaller amounts, fishes were found in the diet of immature skates (7.9 %IRI_{PC}, 18.8 %GII_{PC}), with *Bregmaceros* spp. the most important identifiable species present. Mature skate diet was also predominantly shrimp (64.8 %IRI_{PC}, 46.6 %GII_{PC}); however, fishes made up a much larger percentage by prey category (24.8 %IRI_{PC}, 26.9 %GII_{PC}). Crabs and other crustaceans were also relatively important in the diet of mature animals (4.4 %IRI_{PC}, 12.1 %GII_{PC} and 2.7 %IRI_{PC}, 9.5 %GII_{PC}, respectively).

0371 Fish Ecology I, Drummond, Thursday July 24, 2008

Fish and Invertebrate Assemblages in Seasonal Headwater Streams

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Channelization of streams results in modifications of the meandering of streams. Changes in natural stream meandering affects erosional and depositional patterns and subsequent pool-riffle development where there is a diversity of substrate sizes. Channelized streams experience higher rates of drying in late summer and early fall due to efficient water movement and higher water temperatures. Approximately 70 % of east-central Indiana landuse is rowcrop agriculture and stream channelization is common. For this study we defined streams that dry in late summer and early fall as seasonal, and perennial streams maintain flow throughout the year. We sampled 14 sites for fishes and invertebrates in seven headwater streams within the Buck Creek watershed. We predicted that alterations in natural channel structure, which change the seasonal drying of the streams, would also change the fish and invertebrate assemblages. Abundances of invertebrates and fishes were analyzed in separate Detrended Correspondence Analyses (DCA) ordinations in PC-ORD. Subsequent invertebrate DCA axes were tested for significant correlations with habitat scores, water quality variables, and abundance of fishes. Fish DCA axes were tested for significant correlations with habitat and water quality variables. No significant differences in fish and invertebrate assemblages were found in comparisons of seasonal vs. perennial streams. However we did find significant correlations with habitat and water quality variables.

0145 Poster Session II, Saturday July 26, 2008

The Effect of Parasite Infection on Phonotaxic Response in the Mink Frog, *Rana septentrionalis*

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Parasites are typically detrimental to their hosts, and effects include modulation of behaviors important to host fitness. The mink frog, *Rana septentrionalis*, is the final host of the digenean flatworm, *Halipegus eccentricus*, which inhabits the eustachian tube. Extreme infection results in complete occlusion of the eustachian tubes, and could adversely affect a frog's hearing. The tympanic membranes are coupled internally through the buccal cavity via open eustachian tubes, thus vulnerable to pressure changes induced by the presence of *H. eccentricus*. I tested phonotaxic response in mink frogs to determine if hearing is affected by infection of *H. eccentricus*, reflected in a lower frequency of positive responses, or a longer latency to response. Male and female frogs were placed one at a time in a floating choice arena, given 10 min to acclimate, and 10 min to respond to a conspecific advertisement call broadcast from a speaker. Positive phonotaxis was recorded if the frog approached the broadcast speaker. Individuals were then measured, checked noninvasively by looking down the eustachian tubes from the open oral cavity, then released at the capture site. Infection rates were relatively high: 44.6% of males had at least one *H. eccentricus* in one or both sides, and 37% of females were infected. Infected and uninfected males differed significantly in responses, with uninfected males responding more frequently than infected males. There was no difference in latency

of the response. For females, infected and uninfected individuals exhibited similar response rates, and there was no significant difference in the latency to response. For both males and females, though, infected individuals took slightly longer to score a phonotactic response. Therefore, infection by flatworm parasites in the eustachian tube of mink frogs may indeed affect a frog's response to a conspecific call.

0362 Fish Systematics III, Drummond, Saturday July 26, 2008

Morphological Diversity of Gas bladders in Thorny Catfishes (Siluriformes: Doradidae)

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The thorny catfish family Doradidae (Siluriformes) exhibits great morphological diversity in gas bladder anatomy associated in part with the modified elastic spring apparatus. Although ichthyologists have long appreciated the complexity of these structures, few studies have examined variation within the whole family. The present contribution describes, categorizes and illustrates gas bladder morphology in all known species of doradids, noting inter- and intra-specific variation and ontogenetic changes where they occur. The most basal doradids exhibit a simple cordiform gas bladder, whereas in some derived taxa it becomes abbreviated anteroposteriorly and acorn-shaped. The gas bladder walls may be smooth or have few to many simple or branched diverticulae restricted to specific areas or liberally distributed around its periphery and sometimes on dorsal and ventral surfaces. In some taxa, a secondary bladder is formed by elongation of both or just one of the posterior chambers and a narrow constriction between primary and secondary bladders. In large-size species the gas bladder exhibits internal trabeculae, and in two non-related genera the gas bladder is reduced with thick walls and reduced posterior chambers. Intra-specific differences are relatively minor, and most often reflect ontogenetic changes especially in some large-size species. Comments on the utility of this character complex for phylogenetic analysis of doradid relationships are provided.

0360 Poster Session I, Friday July 25, 2008

New Species of *Leporinus* Spix (Characiformes: Anostomidae) from Rio Curuá, Irixi-Xingu Basin, at Serra do Cachimbo, Brazil

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A new species of the genus *Leporinus* Spix (Characiformes, Anostomidae) is presented from the rio Curuá, a tributary of the rio Irixi, Xingu basin, at Serra do Cachimbo, Pará State, Brazil. The new species can be diagnosed by its unique coloration, which consists of round dark spots widespread over the body, and by the following combination of inferior mouth, dental formula 3/4, 37 to 38 scales in lateral line, 4/3-4 transversal series of scales, and 12 circumpeduncular scale series. The new species most closely resembles *L. reticulatus* from upper Tapajós basin, by having widespread dark spots. The new species is apparent endemic to the rio Curuá, above the great waterfalls near Cachoeira da Serra at Serra do Cachimbo. Comments on the endemism of upper rio Curuá are provided.

0387 Herp Stressors/Snake Conservation, Salon 6&7, Monday July28, 2008

Western Rattlesnake Conservation in the south Okanagan Valley, British Columbia

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Radio-telemetry was used on male Western Rattlesnakes (*Crotalus oreganus*) to assess the value of short distance translocation (SDT) and snake fencing as management tools for protecting snake populations. Between April 2004 and October 2005, we evaluated the effectiveness of SDT by investigating how 500m SDT affected the spatial ecology, body condition, and behaviour of Western Rattlesnakes in a field study near Osoyoos, BC, Canada. Twelve of 14 (85.7%) rattlesnakes managed with SDT returned to the general area they were removed from on one or more occasion (range 1-7 times). Rattlesnakes managed with SDT showed a significant increase in total distance moved over an active season when compared to non-translocated snakes, but there was no evidence to suggest SDT had an effect on activity range size, body condition, behaviour, or mortality rates. SDT to high quality undisturbed habitats was not successful as a long-term solution to snake-human conflict because most translocated snakes returned to conflict areas within a short time (mean 19.9 ± 8.7 days). In 2006, a 5km snake fence was erected to reduce snake-human interactions in a campground in the same study area as the SDT work. There were no known mortalities found along or near the fencing and no observations were made of any snakes in distress. Of the nine snakes tracked in the fence treatment area, only two were observed in association with the fence (i.e. closer than 2m) throughout the season and only one was able to escape the fenced area.

0489 Herp Stressors/Snake Conservation, Salon 6&7, Monday July28, 2008

Pesticide Exposure And Reproductive Effects In Native Amphibian Species Living in Agricultural Habitats, South Okanagan Valley, British Columbia (2003-2005)

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Egg mortality was assessed in four species in ponds in an intensive fruit growing area of the south Okanagan valley, BC, Canada. Species tested were the Great basin spadefoot (*Spea intermontana*) (federally listed as threatened), western toad (*Bufo boreas*) (special concern in Canada), and two species that are not at risk: pacific tree frog (*Pseudacris regilla*) and Columbia spotted frog (*Rana luteiventris*). Enclosures with eggs were placed in ponds in non-agricultural reference ponds located 500 to 1000 m from sprayed sites, conventionally sprayed orchards, and organic orchards. Current-use pesticides occurred at concentrations as high as 1410 ng/l for diazinon; 57 ng/l endosulphan-sulphate in sprayed sites and the highest single day sum total of

pesticides was 1519.8 ng/l among sites. Reference ponds contained up to 411.6 ng/l sum total of pesticides demonstrating that as in other agricultural landscapes ponds in conservation areas are exposed to pesticide drift. For all species and years, hatching success was lowest at sprayed sites with sites regularly having 0% hatching success for all species. Hatching success was highest (72 to 96%) at the non-agricultural reference sites, but in organic orchard sites egg mortality was as low as 62%. There were significant correlations among water chemistry, pesticides and hatching success. Nine pesticides correlated negatively with Great basin spadefoot hatching success. Concentrations of nitrate, total dissolved phosphorus, and total phosphorus also correlated with hatching. For Pacific Tree Frog there were no significant correlations with pesticide concentrations however hatching success correlated negatively with water chemistry as well. When the toxicity of three of these pesticides was tested in a laboratory setting, spadefoot eggs were consistently more sensitive than tree frogs but individual pesticides induced less than 20% mortality of eggs of either species.

0138 AES Student Papers II, Kafka/LeMaratine, Friday July 25, 2008; GRUBER

Reproductive Biology of the Banded Guitarfish, *Zapteryx exasperata*, from the Gulf of California México

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The banded guitarfish, *Zapteryx exasperata*, is an important target specie in the artisanal elasmobranch fishery into the Gulf of California during spring and early summer. Males and females banded guitarfish have two functional testes and ovaries, respectively. Using the logistic model median size at maturity (L50%) was estimated 64 cm total length (TL) for males and 69 cm TL for females. Average length of pregnant females was 78.8 ± 3.8 cm TL. Histological analysis showed sperm clumps in the epididymis and no evidence of sperm storage in the oviducal gland was observed. Embryos development starts in February and ends in June or early July when embryos average size (149.1 ± 17.8 cm TL) reach the reported birth size (15-22cmTL). Oocyte development is concurrent with the embryonic growth with largest oocyte diameter of 25 mm in July. Mean fecundity was estimated at 7 pups (range 1-13, s.d. = 2.92) with a 1:1 embryos sex ratio. Reproductive cycle in banded guitarfish from the Gulf of California seems to be 1 year long. Differences of the reproductive pattern with the population of the Mexican Pacific are discussed.

0139 Poster Session I, Friday July 25, 2008; CARRIER

Description of the Banded Guitarfish Reproductive Tract and Embryos Development

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No information is known about the reproductive tract anatomy in the banded guitarfish. Males possess two functional compound-type lobulate testes. In immature individuals, testes appear as a small pink structure attached in the anterior portion of the epigonal organ ranging in length between 10 to 80 mm. Testes of mature individuals range from 40 to 100 mm. Microscopic examination of testes indicate that banded guitarfish possess multiple germinal zones located on the dorsal surface. Females possess two functional external type ovaries. Immature females have undeveloped ovaries with small, clear, yolkless oocytes less than 5 mm in diameter, the uterus appear narrow and the oviducal gland is difficult to distinguish from the rest of the oviduct. In mature females vitellogenic oocytes range from 5 to 25 mm. Embryos were found to be equally distributed in each uterus. At the beginning of the gestation, all fertilized oocytes in each uterus are contained in a single, thin, amber colored envelope that remain until the embryos complete their development. At the second month of development (April) embryos start to be distinguishable with a mean total length of 26 mm and without coloration; three months later, embryos reach the birth size 186 mm TL and the yolk was completely absorbed.

0074 Fish Systematics I, Salon A&B, Friday July 25, 2008

Phylogeography and Systematics of the Slender Madtom, *Noturus exilis*

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The Slender Madtom, *Noturus exilis*, is disjunctly distributed in the eastern and interior highlands with additional isolated populations in glaciated regions in Wisconsin, Illinois and Iowa. A previous phylogeographic study of *N. exilis* found high levels of genetic structure among populations and deep phylogenetic splits among several geographically defined clades. Variation in fin pigmentation also has been noted. These features suggest unrecognized taxonomic diversity in *N. exilis*. We explored this possibility using mitochondrial and nuclear markers to further assess genetic structure and phylogeographic relationships. High levels of population structure throughout the range of *N. exilis* were observed, and identical haplotypes were only found within river systems and not shared at large distances or among drainages. Three deep phylogenetic divisions (4.8-6.2% sequence divergence) were found: (A) the Red River (White River), (B) the Arkansas and Neosho rivers, and (C) the remainder of the interior and eastern highlands. Within clade C, several geographically defined clades were recovered including: (1) upper White River, (2) Black River (White River), (3) Strawberry River (White River), (4) middle Cumberland and Tennessee rivers, (5) lower Cumberland River, and (6) Missouri, Kansas, St. Francis, Illinois, and lower Ohio rivers. Interestingly, the White River is comprised of four genetically divergent units that are not closest relatives.

Examination of morphological variation is underway to see if populations from the exclusive, geographically-concordant clades are diagnostic morphologically.

0682 General Ichthyology III, Drummond, Sunday July 27, 2008

The Genus *Symphysodon* Heckel, 1840 (Perciformes: Cichlidae) and how its Three Species can be Defined from Their Habitat and Chemical Water Parameters, Better than from Their Molecular or Morphological Characters

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The systematics of the cichlid genus *Symphysodon* has been revised recently twice and the molecular results were similar in both papers (Ready, Ferreira & Kullander 2006; Bleher, Stölting, Salzburger & Meyer 2007). In both publications three clades within the genus and three species were recognized. Without going into the details of the nomenclature of each MS, it is worth mentioning that Bleher et al. proved, by analyzing the distribution and the habitats of each one of the three species, that each species lives in its own habitat with its own chemical water parameter and nowhere else. That they live allopatric and normally never meet, and if they occasionally do, like during extreme floods in Amazonia where they live, natural hybridization may take place. In the present study the chemical parameters of each species are shown (from more than 250 parameters taken), the distribution limits of each species and where natural hybridization has occurred. This study is a result of more than 300 field trips during the last 43 years throughout most of the central and lower Amazon rivers and lakes. The result may prove that chemical water parameters are not only for the *Symphysodon* species the main factor of isolation during evolution, but probably for many other fish species as well. This study also shows that the chemical water parameters, which have never been taken in consideration for fish species taxonomy, should be used more frequently by researchers. In addition, in this study some results from breeding *Symphysodon* species in different water parameters in captivity, as well as results from hybridizing in aquaria during the last four decades are shown.

0086 AES Functional Morphology, Jarry/Joyce, Friday July 25, 2008

Stingray Swimming: Three-dimensional Kinematics of Pectoral Fin Locomotion

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Batoids swim using distinctive undulations and oscillations of expanded, flexible pectoral fins. Previous work has described fin motion in two dimensions, placing species along a continuum from undulatory to oscillatory locomotion. However, the flexible fins of stingrays allow complex deformations, in addition to the traditionally described anterior-posterior propulsive wave. A three-dimensional analysis of pectoral fin motion is needed to fully describe batoid locomotion, including changes in kinematics with swimming speed, and to generate hypotheses about fluid flow around the flexing fin. In this study we characterize the pectoral fin motion of freshwater stingray *Potamotrygon hystrix* in three dimensions. Three synchronized, one megapixel high speed video cameras (250 frames/s) were calibrated using direct

linear transformation and used to film three individuals (mean disc length=13 cm) swimming at two speeds (1.5 and 2.5 disc lengths/s). Multiple finbeats per individual, per speed, were analyzed to create a three-dimensional model of the moving fin, with approximately thirty points describing surface deformations. Kinematic variables including wave speed, frequency and amplitude were determined for the propulsive wave, and combined with angular variables to quantify fin motion in other planes, based on x, y and z excursions of points across the fin surface. This three-dimensional analysis of batoid locomotion reveals fin postures with significant hydrodynamic implications, including a “cupping” of the distal margin. Future experiments using particle image velocimetry will explore these implications and characterize flow patterns around the fin.

0212 Herp Conservation, Salon 4&5, Sunday July 27, 2008; STOYE CONSERVATION

Forest Management Alters Multi-scale Habitat Selection and Breeding Success of Wood Frogs (*Rana sylvatica*)

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Animals select habitats that maximize their individual lifetime fitness, and the fitness potential of a habitat is the effect of this habitat on an individual's survival and reproduction. We used radio-telemetry data collected on 72 adult frogs and logistic regression modeling to assess habitat selection at three scales (seasonal home range, weekly activity center, daily microhabitat) in multiple seasons in response to an unharvested control and three forest management strategies: clearcutting (with removal of all merchantable timber > 10 cm diameter), clearcutting with coarse woody debris retention, and partial harvesting with removal of < 25% canopy cover. We also used observations of adults in two populations and a logistic regression model to assess the breeding success of individuals captured in each treatment in this managed forest. Over the course of two tracking periods, radio-transmitted frogs selected the partially harvested treatment, tended to select unharvested treatment, and spent 5 ± 2 days longer in these forested treatments than in the clearcut treatments (with and without coarse woody debris retained). The best supported model indicated frogs were more likely to occupy weekly activity centers with more complex ground structure. Frogs selected daily microhabitats with higher canopy cover, more complex ground structure, and moist but not wet substrates. Of the 180 frogs that we captured entering two breeding ponds, 61 bred successfully, and larger frogs and frogs from the forested treatments were more likely to breed. Our data suggest that the fitness potential of the clearcut treatments is lower than that of the forested treatments. Furthermore, coarse woody debris retention, especially in clearcuts, should ameliorate some of the effects of harvesting, and partial harvesting with removal of < 25% canopy cover is a forest management strategy that may not adversely influence the abundance or fitness of *R. sylvatica*.

0221 Fish Systematics IV, Salon A&B, Monday July 28, 2008

Phylogenetics and Evolution of New World Anchovies (Engraulidae)

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Anchovies (Engraulidae) are highly abundant clupeomorph fishes that provide a vital component of local ecosystems and constitute one of the most heavily commercially harvested fisheries worldwide. However, there is currently no explicit hypothesis of phylogenetic relationships available for these ecologically and economically important fishes. Here we provide an initial phylogenetic analysis of the putatively monophyletic New World anchovy clade, composed of approximately 80 species. This clade is interesting because it includes both marine and freshwater species, and shows a case of extreme miniaturization (in the South American genus *Amazonsprattus*). We present a preliminary phylogenetic analysis of New World anchovies including 7 of the 9 genera, based on both mitochondrial and nuclear DNA sequence data. Using the resulting phylogeny, we consider the evolution of miniaturization and biogeographic transitions between marine and freshwater habitats.

0115 Northern Herps Symposium, Salon 6&7, Friday July 25, 2008

Habitat Use is Linked to Components of Fitness Through the Temperature-Dependence of Performance in Ratsnakes and Map Turtles

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For ectothermic reptiles, habitat selection is mechanistically linked to fitness through the temperature-dependence of performance. Many reptiles occupy thermally heterogeneous environments and regulate their body temperature through selective use of habitats within their environments, making reptiles ideal subjects to understand the fitness consequences of habitat use. Our goal here was to investigate the link between habitat selection, thermoregulation, and fitness by comparing the expected distribution of performance for real ratsnakes and map turtles that thermoregulate through selective use of habitat with the performance of hypothetical snakes and turtles that are assumed to use habitats randomly. Thermal data for real snakes and turtles were obtained using temperature-sensitive radio-transmitters implanted in free-living individuals, whereas thermal data for hypothetical animals were obtained by sampling environmental temperatures that a randomly moving individual would encounter. Thermal data were then transformed into performance using experimentally derived equations relating performance (swimming speed) to temperature. Habitat selection allowed snakes and turtles to avoid lethal temperatures and resulted in an average improvement of 18% in locomotor performance. A more exact measure of the fitness improvement accrued through habitat selection will have to await data relating body temperature to ultimate measures of fitness and a deeper understanding of the contribution of different performances to fitness.

0683 Cottonmouth Symposium, Salon 4&5, Monday July 28, 2008

Life-history of a Population of Cottonmouths (*Agkistrodon piscivorus*) in East-central Alabama

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We conducted a capture-mark-recapture study of a Cottonmouth (*Agkistrodon piscivorus*) population at Tuskegee National Forest, in east-central Alabama over 4 years (2001-2004). During this time period we made a total of 391 observations on 198 marked individuals. This population is characterized by relatively small adults (mean male SVL = 67.9 ± 9.0 cm, mean female SVL = 62.6 ± 5.0 cm) with a significantly female-biased sex ratio (0.39 males/female) that was evident across seasons and years. Reproductive data indicate the frequency of reproduction is highly variable across years and that, on average, females invested 26.2 ± 0.093 % of their body mass into relatively small (4.1 ± 1.5) litters. Growth in free-ranging individuals was significantly lower than lab-reared individuals and may be attributed to variable resource levels. Using the Cormack-Jolly-Seber (CJS) model we obtained an estimate of annual survival (0.79) that is among the highest reported for snakes. Although we did not detect an effect of body size on survival, the probability of recapturing individuals increased with body size up to a snout-vent-length of 82 cm, after which it remained approximately constant. Our findings provide new information about Cottonmouth life history and, in combination with similar Cottonmouth datasets across its range, will enhance our knowledge of Cottonmouth demography and population dynamics.

0278 General Herpetology I, Salon 4&5, Sunday July 27, 2008

Sex in Unisexual Salamanders: Discovery of a New Sperm Donor with Ancient Affinities

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Although bisexual reproduction has considerable evolutionary benefits, several populations of unisexual all-female vertebrates are known to exist. Unisexual salamanders in the genus *Ambystoma* are common around the Great Lakes region in eastern North America. Based on mitochondrial DNA sequences, they originated from a hybridization event that involved a female that shared a common ancestor with *A. barbouri* 2.4 to 3.9 million years ago but, unexpectedly, *A. barbouri* nuclear genomes are unknown in unisexuals. Unisexual salamanders steal sperm from donors of normally bisexual species so their reproductive mode is described as kleptogenesis. Most known unisexuals are polyploid and they all possess at least one *A. laterale* genome. One or more genomes are taken from other sperm donors that may include *A. jeffersonianum*, *A. texanum* and *A. tigrinum*. We examined unisexual adults and larvae in a southern Ohio pond where unisexual individuals exist with male *A. barbouri*. This population provided a unique opportunity to test hypotheses pertaining to the role of *A. barbouri* in the co-evolution of the disparate cytoplasmic and nuclear components in unisexual salamanders. Microsatellite DNA loci, mitochondrial DNA sequences, and genomic *in situ* hybridization (GISH) were used

to identify the genomic constitution of individuals. *Ambystoma barbouri* was found to be an acceptable sperm donor for unisexuals but only contributed genomes in ploidy elevated individuals. There was no evidence for contemporary genome replacement with an *A. barbouri* genome. In the absence of *A. jeffersonianum*, this Ohio population is likely experiencing a recent switch in sperm donors from *A. jeffersonianum* to *A. barbouri* and demonstrates the evolutionary flexibility and dynamics of kleptogenesis.

0705 Poster Session I, Friday July 25, 2008; CARRIER

Identification by Video Surveillance of Species-specific Bait Manipulation by Lemon Sharks, *Negaprion brevirostris* and its Influence on Capture Susceptibility

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Anyone familiar with shark fishing knows that some species can successfully remove bait from a hook without getting caught. This ability whether through species-specific mouthing techniques or individual differences in bait manipulation has potentially significant implications for fisheries management. If catch rate is affected by behavioural differences in bait handling this can lead to a species-specific bias with regard to, abundance estimates and CPUE. This could erroneously imply that there are greater or fewer numbers of a particular species. We investigated the question of capture susceptibility in the field using a 30 m long section of long line with a single baited gangion. An underwater video camera placed near the rig enabled us to record the behaviour of each lemon shark approaching and interacting with the baited hook. Analysis of the video records provided materials to identify inter- and intraspecific variations in bait handling behaviour which in turn influenced whether a shark became hooked or not. One objective of the study was to examine whether the negative stimulus of capture could result in rapid learning whereby a shark would actively avoid a baited hook as a result of being hooked. We investigated this by first marking juvenile lemon sharks with colour-coded dart tags at the study site (Bimini lagoon). Their interactions with baited hook were also observed and videotaped from a 16ft tower. Data collected included approach duration, number of approaches, as well as a number of bait-handling behaviours. We thus determined if a shark that was previously caught (i.e. negatively conditioned), actively avoided the baited hook or displayed caution (slower approach time) on subsequent trials over a period of months. Supported by grants from the Hoover Foundation, BBFS, National Science Foundation and Leverhulme Foundation.

0636 Herp Genetics, Development & Morphology, Drummond, Saturday July 26, 2008

Does Paedomorphosis Drive Morphological Divergence in the Oklahoma Salamander?

Ronald Bonett

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Paedomorphosis is widespread in salamanders and may be the impetus for much of the morphological variation seen among different forms. In the most extreme cases paedomorphosis includes a series of correlated developmental truncations that result in adults with an almost completely larval morphology and aquatic ecology. Developmental mode (paedomorphosis vs. metamorphosis) is highly labile among populations of the Oklahoma salamander, *Eurycea tynerensis*, with most populations exhibiting only a single strategy. Paedomorphosis is common in porous chert bottom streams where *E. tynerensis* has constant access to subsurface water, while metamorphosis is required in locations where streambeds are highly compact and surface streams dry-up completely during summer months. The existence of multiple independent replicates of isolated paedomorphic and metamorphic populations across the distribution of *E. tynerensis* in the western Ozarks provides a unique system for studying the role of paedomorphosis and subsequent life history shifts in patterns of morphological evolution. Here I present a morphological examination of *E. tynerensis* to test if paedomorphosis and long term associations with aquatic habitats is driving subsequent morphological evolution at the population level.

0364 Herp Stressors/Snake Conservation, Salon 6&7, Monday July28, 2008

Evaluating How Nutrient Input Influences Insecticide Exposure on Larval Amphibians

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Chemical contamination is widespread and represents a realistic environmental factor in most systems. Understanding how presence of nutrients in aquatic system may influence the effects of contaminants is necessary to have general predictive power and to properly guide chemical regulation and management. In this study, I examined effects of an insecticide across varying amounts of leaf litter input on tadpoles of American toads (*Bufo americanus*) reared from hatching through metamorphosis and on green frogs (*Rana clamitans*) reared from hatching through onset of cold weather in outdoor mesocosm ponds. These studies suggest contaminants nutrient input can alter the effect of the insecticide. While low nutrient input generally had negative impacts on growth and survival of tadpoles, insecticide exposure generally had positive effects on metamorphosis resulting from a trophic cascade. However, tadpoles exposed to low nutrient conditions and the insecticide showed the lowest growth and development. These results suggest that environmental conditions (and conditions in mesocosm studies) can influence the impact of a contaminant and change it's effect on amphibian metamorphosis from positive to negative.

0110 Fish Systematics II, Salon A&B, Friday July 25, 2008

Classical And Molecular Cytogenetics of the Species from Superfamily Cobitoidea (Teleostei, Cypriniformes) – a Review

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Superfamily Cobitoidea is composed of four families (Gyrinochilidae, Catostomidae, Cobitidae, Balitoridae), 99 genera and 842 species. Most of so far published data contain the chromosome number and karyotype. Majority of the taxa belonging here characterized by diploid ($2n = 50$ or $2n = 48$) or polyploid ($2n = 100$) chromosome number. Some of species, especially from family Cobitidae, via hybridization processes followed by genome duplication during meiosis, produce polyploidy. Naturally occurring allopolyploid cobitids and their parental species are the most cytogenetically investigated among Cobitoidea. Hybridizing species of loaches possess $2n = 50$ or $2n = 48$ chromosomes and karyotypes characterized by domination of biarmed elements. Most of the cytogenetically investigated species characterized by multiple, from two to three, NOR bearing chromosome pairs and location of 'major' rRNA corresponded with GC rich DNA sites. Cytogenetic features of Cobitoidea taxa such as number and location of AgNORs, 28S rRNA and chromatin composition by different banding patterns are compared and discussed.

0719 Fish Conservation, Drummond, Sunday July 27, 2008

Establishing Fish as *in situ* Bioindicators of Extreme Events and Natural Hazards

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Extreme Events and Natural hazards are inevitable, although unpredictable - both spatially and temporally. Because of their ubiquitous distribution in aquatic ecosystems, fish and their associated fisheries could potentially serve as important *in situ* bioindicators of the effects of both extreme events and natural hazards. Many fish attributes suit this purpose, including response variables at individual, species and community levels of organization. Given that resources for investigations are limited, some attributes are more efficient, effective, and biologically meaningful than others. To help establish research plans to investigate the potential for fish to serve as bioindicators, a decision matrix was created with regard to space, time, and variable-response potential. In addition, a decision tree is presented that facilitates choices of species, stocks, populations, and communities appropriate for investigation. More subjective criteria, such as the presence of historical, species-specific databases, are also used in the variable inclusion process as well as the economic and social value as viewed by the public. Lastly, it is advocated that a national/international network of research facilities become established that is multi-jurisdictional and multi-disciplinary to evaluate the spatial and temporal effects of natural hazards on fishery ecosystems. Integration of long-term species-response data will allow a full evaluation of fish interactions with extreme events and natural hazards.

0409 Poster Session III, Sunday July 27, 2008

Raccoon Predation on a Northern Wood Turtle Population – a New Event at the Limit of its Range

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Mortality by predation in adult Wood turtles (*Glyptemys insculpta*) is largely unknown. We documented a mortality event linked to mammalian predation that reduced the number of adults, especially female breeders, in a northerly population. The objective of this study is to describe predation events by Raccoons (*Procyon lotor*) on adult females during the laying season and its impacts on the Shawinigan river population (Québec), one of the most important known population in Canada. Between 1996 and 2003, the population appeared stable and adult mortality was low (7 cases out of 500 adults handled). None of the breeding females annually monitored (avg. =35,8 females/yr) was ever found dead on, or near, the main breeding site. However, in 2004, a minimum of 9 breeding females, i.e. 25% of females using the nesting site, were killed. Visual observations and necropsies on carcasses confirmed that the raccoon was the predator. Subsequent capture, marking and recapture activities (in 2005) confirmed that a predation level of almost 50 % on the adult population had occurred. In the absence of these observations, the decrease in adult numbers could have been attributed to other factors such as illegal harvesting. We are concerned about this high rate of mortality as the rate of predation exceeds the 5% threshold known to cause a decline in turtle populations.

0766 Fish Conservation, Drummond, Sunday July 27, 2008

Population Viability of Australian Grey Nurse Sharks Under Fishing Mitigation and Climate Change

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Increasing rates of biodiversity loss require biologically realistic approaches to identify the most threatened taxa that may benefit from efficient intervention. This is particularly so for the marine environment where only recently have we begun to appreciate the magnitude of the destruction. The worldwide decline in apex marine predatory sharks is particularly disconcerting because we still understand little of their basic demography, and even less about how threatened populations will fare under rapid climate change. We developed a series of stochastic, density-dependent population viability models for the Critically Endangered grey nurse shark (*Carcharias taurus*) from eastern Australia to predict medium- (3 generations) and long-term (40 generations) extinction risk. Models were constructed using measured and inferred demographic rates, estimates of shark meshing and fishing mortality,

and predictions of range shift under climate change. We found that under current reported rates of recreational, commercial and mesh fishing mortality, the estimated population of *C. taurus* (148 – 766 individuals) has a > 40 % chance of becoming quasi-extinct (< 50 females) within 3 generations (~ 50 years). If fishing mortality rates are under-reported, the probability of extinction rises to nearly 100 % over the same interval. For the population to persist for at least 3 generations, at least 3 to 4 times the estimated population size is required. The effects of various management interventions were modelled. The greatest reduction in extinction risk was achieved through a reduction in fishing-related mortality by using non-offset circle hooks. A shift from meshing nets to drumlines for beach protection and an increase in the enforcement and extent of sanctuary zones also reduced extinction risk, but only marginally. Our models predict that range expansion southwards within warming of surface waters is likely to reduce extinction risk if the western and eastern populations begin to exchange individuals. Our results demonstrate the necessity of including all major sources of uncertainty into stochastic population viability analyses – including the predicted effects of climate change – and the utility of contrasting different management interventions to maximise a threatened population's probability of persistence over the foreseeable future, even when detailed life history information is missing.

0439 Poster Session III, Sunday July 27, 2008

Amphibian Reproduction in a Suburban Landscape: The Value of Manmade Habitats

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The installation and maintenance of stormwater ponds to detain and treat runoff from impervious surfaces is a common method of stormwater control in developed areas. However, the function of these ponds to capture pollutants is of concern for wildlife species that use the ponds, particularly pond-breeding amphibians. In this study, we aim to describe the use of these stormwater ponds by pond-breeding amphibians relative to other available habitats in suburban areas. We chose three landscapes in the Red Run watershed of Baltimore County, Maryland; landscapes consisted of a stream segment, the surrounding forest buffer, and any adjacent stormwater ponds that would be accessible to pond-breeding amphibians. We also chose three rural landscapes in Oregon Ridge Park in Baltimore County, Maryland, where no stormwater ponds were available. We used preliminary surveys during late winter 2007 to identify all possible breeding habitats for amphibians and then performed call, egg mass and larval surveys to measure breeding effort at each habitat in spring and summer 2007. Across the suburban landscapes, we found calling males or egg masses in only 34% of available habitats and larvae in only 15%. Moreover, of the habitats that had breeding activity, 50% were stormwater ponds, and the rest were a result of past human activity such as road construction. This pattern was reinforced in the rural landscapes, where amphibians were primarily found breeding in human-created habitats. More importantly, late-stage larvae were found only in manmade ponds in all study areas. The results of this study indicate that, at least in human-dominated landscapes, manmade habitats may be as important to amphibian conservation as natural wetlands or pools, and that management strategies for such habitats could greatly benefit amphibian conservation in urban settings.

0558 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT ECOLOGY

The Cost of Being Sexy: Effect of Host Lizard Sex on Ectoparasite Feeding Success

Amber Branske

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According to the immunocompetence handicap hypothesis, sex differences in ectoparasite loads observed in field studies may be due to costs associated with testosterone production. In order for secondary sex characters related to testosterone to be accurate fitness predictors, there should be costs associated with the production of these characters. This concept was examined in a study of Western Fence lizards (*Sceloporus occidentalis*) and a common ectoparasite, larvae of Western Black-legged ticks (*Ixodes pacificus*). Tests conducted in the laboratory examined the relationship between host sex and tick feeding success and duration. A gravid female *I. pacificus* was obtained, and its eggs were maintained in the laboratory until they hatched. Tick larvae were applied to adult male and female *S. occidentalis* and allowed to attach. Lizards were kept in mesh cages suspended over pans of water in environmental chambers. As ticks detached from the lizards, they fell into the water and floated, facilitating quantification of feeding success. Each day, the water was examined for the presence of shriveled, dead ticks (indicating unsuccessful feeding) or healthy, engorged ticks (indicating successful feeding). Ticks that fed on male lizards had a significantly higher feeding success (number of ticks that successfully fed) and shorter feeding duration than ticks that fed on female lizards, suggesting that the immune response of male lizards to ticks was not as robust as that of female lizards. Future studies will include examination of specific components of the immune response, as well as testosterone manipulations in males to determine whether testosterone is responsible for the host sex difference in tick feeding parameters.

0763 General Herpetology II, Jarry/Joyce, Monday July 28, 2008

Arroyo Toads (*Bufo californicus*) in Southern California; Trends from Five Years of Population Monitoring using Proportion Area Occupied (PAO) of Tadpoles and 10 Years of Adult Counts

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In 2003, we implemented a new monitoring program for the endangered arroyo toad (*Bufo californicus*) on Marine Corps Base Camp Pendleton (MCBCP). To address the problems associated with large variations in adult toad activity, we employed a spatial and temporal monitoring approach that tracks the presence of arroyo toad breeding populations by documenting presence of eggs and larvae. Sites are surveyed up to four times per year to calculate and account for imperfect detection probabilities. We also continued to conduct nighttime counts of adult toads from a transect monitoring program implemented in 1996. In this presentation, we review the major trends and findings of the first five years of the spatial monitoring program and over a decade of adult count transects. These include the findings that 1) toad activity has been highly variable among years, but relatively stable over the last decade, 2) associations between activity and rainfall are dependant upon hydroperiod, 3) proportion of wet area occupied appears to be the most stable

monitoring metric, and 4) both proportion area occupied (PAO) and probability of detecting arroyo toads are negatively associated with the presence of non-native aquatic species. Direct and indirect associations with bullfrogs (*Rana catesbiana*) and crayfish (*Procambarus clarkia*) and are discussed.

0666 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT ECOLOGY

Environmental Transmission: A Mechanism of Disease-induced Amphibian Extinctions

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Pathogens that are highly transmissible, infect multiple hosts, and have reservoirs are those most likely to cause extinction of host populations. *Batrachochytrium dendrobatidis* (*Bd*) is an aquatic fungal pathogen of amphibians that has contributed to declines and local extinctions of some host species, but little is known of how it moves through populations. Given that *Bd* can survive outside an amphibian host, and that it has been detected on habitat surfaces during an epizootic, it is likely that *Bd* may have other means of enhancing transmissibility aside from direct contact. However, it is unknown whether free-living zoospores are infective, and thus far transmission has been assumed to be direct. I tested the hypothesis that *Bd* can be transmitted indirectly by means of free-living zoospores that are encountered by a naïve host, and that transmission would be higher in wet versus dry habitats. I infected lab reared *Rana sphenocephala* juveniles, placed them in constant temperature chambers, and applied different seasonal moisture regimes. Chambers are 5 gal buckets with 6 cm of pea gravel substrate and sealed Plexiglas tops fitted with a misting mechanism to control moisture levels. Chambers of saturated treatments (tropical wet-season or temperate spring and fall) are sealed to prevent evaporation and drying treatments (tropical dry season or temperate summer) are vented to promote lower moisture. After four weeks, I removed the infected frogs and introduced naïve frogs to test whether they would become infected, and if a difference in the frequency of indirect transmission exists among the moisture treatments. Additionally, if environmental transmission occurs, the efficacy of an infected host indirectly transmitting the pathogen should be a function of its zoospore discharge rate. We tested for differences in zoospore discharge rates among juvenile frogs of different size classes by placing infected animals in a small chamber with a Millipore filter in the bottom for 24 hours. All samples were assayed for infection or quantitative differences in zoospore discharge rate using qPCR. A standard dilution curve using known quantities of zoospores for reference was developed. Infection status, pathogen load, and / or zoospore discharge samples are currently being analyzed via qPCR, and results will be presented. By knowing driving force behind the spread of *Bd* we can focus on factors that are critical to infecting new hosts.

0445 AES Management, Jarry/Joyce, Sunday July 27, 2008

Status of Atlantic Shark Management in the United States

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The Highly Migratory Species (HMS) Management Division of the National Marine Fisheries Service (NMFS) is responsible for the management of the Federal Atlantic shark fisheries including the Gulf of Mexico and Caribbean Sea. In late 2006, NMFS revised the stock status of several large coastal sharks (LCS), including sandbar, dusky, blacktip, and porbeagle sharks, based on the findings of recent stock assessments. Since then, the HMS Management Division has been developing management measures that will change the regulations for all commercial and recreational fishermen, as well as scientists and aquarium collectors. Implementation of this rule is expected in early Summer 2008. In addition to these measures, the HMS Management Division will be beginning the rulemaking process to change regulations on small coastal sharks (SCS) based on the 2007 stock assessment. This process is anticipated to begin in early Summer 2008. The alternatives initially considered in this rulemaking will be based on the findings of the 2007 stock assessment, as well as comments received during upcoming public scoping meetings.

0237 Poster Session III, Sunday July 27, 2008

Fire History and Sand Skink (*Plestiodon reynoldsi*) Population Abundance

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The sand skink (*Plestiodon reynoldsi*) is a small fossorial lizard with reduced limbs and slender body. Because they are entirely restricted to isolated patches of Florida scrub, sand skinks are listed as threatened under the Endangered Species Act. The scrub habitat is a fire maintained ecosystem, but the effect of prescribed fire on sand skink population abundance is not understood. The goal of our study was to establish the relationship between fire history in scrub habitat and sand skink population biology. In March of 2007 at Archbold Biological Station in Highlands County Florida, we installed 36 enclosures fitted with pitfall traps to estimate the absolute number of sand skinks per enclosure in three categories of time since last fire: less than 6 years, 7 to 19 years, and 20 to 40 years. During the spring of 2008 we also fitted enclosures with cover boards to find a relationship between sand skink density and presence of sinusoidal tracks left by the movement of sand skinks. We present the results from two years (Spring 2007, Fall 2007 and Spring 2008) of surveying sand skink population densities. We observed higher sand skink densities in areas that have not been burned for 20 years or longer, and found many environmental variables to vary along with time since fire. The relationship between prescribed fire and sand skink population abundance, along with the use of cover boards to standardize survey techniques should provide land managers with additional information helpful to the conservation of this species.

0727 Fish Systematics IV, Salon A&B, Monday July 28, 2008

Geographic and Temporal Patterns of Diversification in *Sebastes* Rockfishes

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The latitudinal biodiversity gradient is one of the most well documented geographic patterns seen in life on earth (Hillebrand 2004; Mittelbach et al. 2007). Despite this, the underlying processes responsible for this pattern remain poorly understood. One potential explanation for the biodiversity gradient is that lineages inhabiting lower latitudes have higher rates of net diversification (speciation rate – extinction rate) potentially due to factors such as higher rates of molecular evolution (Rohde 1978; 1992), increased importance of biotic interactions (Wallace 1878; Dobzhansky 1950; Fischer 1960), increased opportunities for species formation (Moritz et al. 2001; Gentry 1989), or larger geographic areas over which to diversify (Rosenzweig 1995) at lower latitudes. To date, however, few studies have investigated with statistical rigor whether net rates of diversification are elevated at lower latitudes (But see Wiens et al. 2006; Wiens 2007; Weir and Schluter 2007). Furthermore, none, to our knowledge, have investigated this pattern in marine fishes. Therefore we investigated the latitudinal pattern of diversification in rockfishes of the genus *Sebastes*. The program BEAST v1.4.7 (Drummond and Rambaut 2007) along with two fossil calibrations was used to reconstruct a chronogram using seven mitochondrial and two nuclear genes. The midpoint of the latitudinal distribution of each species was collected from the literature and using these tip values midpoint latitude was calculated for each node in the tree. Rates of net diversification were estimated for each node in the tree using the equations of Magallon and Sanderson (2001). Mesquite v2.01 (Maddison and Maddison 2007) was used to estimate independent contrasts for both midpoint latitude and net rate of diversification across the tree. Regression analyses of contrasts showed a significant negative correlation between diversification rate and latitude ($p < 0.01$). These results provide evidence that latitudinal patterns of diversification rates parallel those for species diversity in *Sebastes* rockfishes. We discuss these results within the context of previous research and supplement them with an investigation of the temporal patterns of diversification in *Sebastes*.

0027 Poster Session III, Sunday July 27, 2008

The Importance of Natural History, Landscape Factors, and Management Practices, in Conserving Pond-breeding Salamander Diversity

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I have analyzed presence, abundance and patterns of coexistence of 11 species of pond-breeding salamanders from 178 managed sites in Ohio, Indiana, Illinois and Michigan. These sites include 17 that have been monitored for 11-14 years and 10 sites that have been monitored from 4-7 years. The two most abundant species, *Ambystoma tigrinum* and *A. texanum*, use open habitats such as grasslands and savanna, and are found in single species communities significantly more often than expected by a null model. Several other species were more likely to coexist with certain species in assemblages and communities of 4 or more species occurred significantly more often than predicted by null models. All of these sites have

fishless seasonal or semi-permanent wetlands and forested upland habitat. Among populations with long-term data, five species declined at some sites and two species increased at some sites. The declining species all prefer mature forest upland habitat and typically breed in fishless seasonal wetlands, whereas the increasing species use more open upland habitats and semi-permanent to permanent wetlands. Regression and General Linear Models indicate that the timing of prescribe burns was the most important factor in determining the relative abundance of pond-breeding salamander larvae. Most species were negatively affected by springtime prescribed burns. It took a mean of 4.6 years for populations of these species to recover to pre-burn levels. *A. tigrinum* was also negatively affected by prescribed burns, however their mean time to recover was just 1.6 years and this was typically followed by an increase that exceeded pre-burn abundance. *A. texanum* was not significantly affected by spring burns. Conservation oriented management practices should avoid springtime prescribed burning of wetlands and surrounding upland habitats that are used by pond-breeding salamanders.

0039 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

A 14-year Study of Amphibian Populations and Metacommunities in Rural Northwest Indiana

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I used data from 14 years of surveying the amphibian fauna (14 species) of Jasper County, Indiana, USA, to detect population and diversity trends, and to test hypotheses regarding the influence of landscape, climatic, and biotic factors on amphibians abundance and diversity. There were a number of species associations within the amphibian community. Most species associations were positive, except Chorus frogs were negatively associated with Tiger Salamanders. Precipitation in November, January, February, April, and May, and temperature in September through July had the greatest influence on annual variation in amphibian breeding activity, abundance, and species richness. There was support for the hypothesis that the degree of wetland isolation and hydroperiod heterogeneity influence amphibian abundance. The number of wetlands in a cluster was correlated with species richness, amphibian abundance, and the number of years with amphibian populations. Wetland clusters with 15 or more wetlands had significantly more species, abundance, and number of years with breeding activity, than smaller wetland clusters and isolated wetlands. Wetland clusters with wetlands of two or three types of hydrology had significantly more species, abundance and number of years supporting amphibian populations than wetlands with just one hydrology type or isolated wetlands. At the landscape level, large amphibian metacommunities were associated with large wetland clusters that have hydroperiod heterogeneity, upland habitat with native vegetation, and upland habitats capable of supporting umbrella species of wildlife.

0375 Sustainable Harvest Symposium, Drummond, Monday July 28, 2008

Is Harvest of the Snapping Turtle Sustainable: When is a Whale Not a Fish?

Ronald Brooks

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Snapping Turtles are still widespread across North America and have been introduced successfully outside their historic range. An established view of the species is that it is common and, at best, a nuisance that needs to be kept in check. A recent view is that *Chelydra* is a valuable component of wetland ecosystems and at risk of serious declines in abundance and distribution because of a diversity of anthropogenic threats. The species' long-lived life history may even put the *Chelydra* at risk of extinction. Despite the plethora of data and models supporting the claim that chronic increased juvenile and adult mortality rates can not be sustained by turtles and other long-lived species, application of this view often meets resistance from stakeholders (e.g. fisheries), particularly with respect to the snapping turtle. The clash between the traditional views of those who kill the turtle for food or to protect other wildlife and the more recent environmentalist views represent a classic confrontation. Here I will summarize data and models that suggest snapping turtles are not different from sturgeon, sea turtles, or sharks and that their abundance will continue to decline in the face of harvest especially when harvest mortality is added to road mortality, persecution, and other factors. I also discuss whether there is an impact on ecosystems when turtles are reduced to fragments of historic populations. However, this issue is much broader than a debate over *Chelydra* and I have portrayed the opposing sides as exploitation versus conservation though other terms could be substituted. To some extent, the debate is reminiscent of the great courtroom battle over whether whales are fish or mammals in that although there is science to support both sides, there is also a lot of self-interest and emotion on both sides.

0378 Northern Herps Symposium, Salon 6&7, Friday July 25, 2008

Is Global Warming Creating Giant Canadian Turtle Hatchlings And Reducing Fitness?

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Climate change is an ubiquitous topic and it is interesting to consider its potential effects on reptiles at the northern limits of their distribution. Seasonal temperature variations are known to affect follicular development in a wide range of ectotherms, and it is also well known that turtles often show significant annual variations in egg size, an irritating deviation from theories of optimal egg size. In our long-term studies of reproduction in 3 turtle species (*Chelydra serpentina*(1977-2006), *Glyptemys insculpta*(1991-2004), *Chrysemys picta*(1990-2006)) in south-central Ontario, we observed that average summer and fall, but not spring, temperatures and egg size have been increasing over the past 30 years. We tested the hypothesis that temperature accounted for annual variations in egg size. Summer and fall temperatures were positively correlated with egg size the following year in all 3 species. In *C. serpentina* and *G. insculpta*, temperature appeared to be increasing egg size by acting directly on patterns of follicular development, and by moderating rates of resource acquisition; conversely, only the direct effects of temperature on follicular

development, moderated changes in egg size of *C. picta* . Furthermore, removal of temperature effects (*C. picta*) and/or nutritional effects (*C. serpentina* and *G. insculpta*) from the data led to disappearance of annual variation in egg size. The fitness consequences of 'involuntary' increases in egg size and clutch size are apparent in *C. picta*, in which females, but not males, exhibited a decrease in body condition between 1990 and 2006. *C. serpentina* did not exhibit a consistent change in body condition over time. Our study underscores the importance of assessing the effects of climate change on a species-specific basis, as even taxa with close common ancestry can vary in their response to climate change.

0717 Fish Systematics I, Salon A&B, Friday July 25, 2008

Nucleotide Bias, Codon Usage, Selection, and Phylogenetic Analysis - Investigations Based on Hundreds of Fish Mitochondrial Genomes

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The availability of many complete mitochondrial genome sequences from fishes allows for the broad-scale characterization of the ways in which these genomes evolve. A phylogenetic hypothesis for 230 actinopterygian species was used as an evolutionary framework for investigating the relationship between nucleotide composition and codon usage. Maximum likelihood estimates of the rates of synonymous and nonsynonymous substitutions were used to assess the effects positive (directional) and negative (functional constraint) selection acting on mitochondrial genomes. We show that directional mutation pressure has a major influence on synonymous codon usage and that the intensity of bias varies with position in the genome. In addition, the rate of nonsynonymous substitution is more strongly correlated with genomic position than with specific genes. This suggests that rates of amino acid substitutions in mitochondrial proteins are controlled more by variable mutation pressure than by natural selection acting on protein function. These findings are discussed in terms of their potential effects on molecular phylogenetic analysis and how phylogenetic inaccuracy might be identified and minimized.

0353 Poster Session I, Friday July 25, 2008

Assembling the Euteleost Tree of Life

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The "Assembling the Euteleost Tree of Life" (EToL) project aims to produce a robust hypothesis of relationships among the diverse assemblage of fish lineages that comprise the euteleost radiation. With nearly 18,000 species, monophyly and relationships of some orders and many suborders and families have proven phylogenetically intractable. The EToL collaboration will produce the largest and most taxonomically extensive dataset of morphological and molecular character states from which to develop and test evolutionary hypotheses in this group. Although EToL is designed with a strong emphasis on the generation and analysis of data from DNA sequences, it also promises to shed new insight on morphological character homology and character state variation across the Euteleostei. To generate hypotheses of homology of morphological characters in the group, the development and variability of target traits will be examined along ontogenetic series of 50 strategically selected taxa. These observations will focus primarily on characters that have been previously used to infer relationships in subsets of euteleosts. EToL activities will generate a morphological character state matrix from 300 euteleost taxa for up to 450 traits that have been shown informative in previous phylogenetic studies. EToL activities will also result in a dataset encompassing nearly 20,000 nucleotide sites from approximately 1,500 euteleost species. Target genes have been partially identified through a genomic database mining routine. Mining more reliable gene markers from public sequence databases is underway. The taxonomic sets used in this collaborative effort are designed to provide the basis for a "backbone" euteleost phylogeny that will guide future, more taxonomically focused investigations. Here we describe the EToL project's organization, data collection strategies, progress to date and expected results. We also identify opportunities to extend the scope of the project's objectives through collaboration with youth groups, members of the general public, and the global community of ichthyologists.

0190 Poster Session I, Friday July 25, 2008

Diet Composition of Four Abundant Skate Species of the Gulf of Alaska

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Stomach content analysis is being performed on four of the most abundant skate species in the Gulf of Alaska. Through participation on fishery independent trawl

surveys (National Marine Fisheries Service and Alaska Department of Fish and Game), stomach samples of *Raja rhina*, *R. binoculata*, *Bathyraja aleutica*, and *B. interrupta* were collected and preserved immediately at sea for high resolution stomach content analysis. Preliminary results suggest commercially important species such as tanner crab (*Chionoecetes bairdi*) and northern pink shrimp (*Pandalus eous*) are a significant dietary component of the larger species (*R. rhina*, *R. binoculata*, and *B. aleutica*), whereas a diversity of smaller-sized prey were found within the stomachs of *B. interrupta*. Future work will focus on intra- and interspecific variation in diet as sample sizes become sufficient for quantitative statistical analyses. The results of this study will help to determine the trophic interactions of these common demersal predators in the Gulf of Alaska ecosystem.

0478 Herp Behavior, Salon A&B, Thursday July 24, 2008

A Key Ecological Trait Drives the Evolution of Monogamy in a Peruvian Poison Frog

Jason Brown, Kyle Summers

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There is considerable debate concerning the ecological and social factors that promote the evolution of monogamy. We report on an unusual example in which a simple change in an ecological trait (phytotelm pool size for tadpole rearing) is correlated with the evolution of monogamy. The Peruvian poison frog *Dendrobates imitator* is a Mullerian mimic of *Dendrobates variabilis* in the central cordillera of northern Peru. Molecular phylogeographic evidence indicates that this species recently colonized the area inhabited by *D. variabilis*. Detailed behavioral observations and ecological surveys revealed that *D. variabilis* uses large phytotelmata for tadpole rearing, has uniparental male care and a promiscuous mating system. In contrast, *D. imitator* uses small phytotelmata for tadpole rearing and exhibits social monogamy, pair-bonding and biparental care with tadpole provisioning. Preliminary molecular genetic analyses support our behavioral observations of monogamy. Reciprocal transplant experiments demonstrate that biparental care is required for tadpole growth and survival in small but not in large phytotelmata. Pool choice experiments demonstrate that these species show opposite size preferences of phytotelm for tadpole deposition. Competition experiments show that *D. variabilis* tadpoles are better adapted for competition and cannibalism than *D. imitator* tadpoles. In summary, our research suggests that the transition to rearing tadpoles in very small phytotelmata drove the evolution of biparental care and monogamy in Peruvian poison frogs.

0023 Herp Genetics, Development & Morphology, Drummond, Saturday July 26, 2008

Size and Cycle in *Desmognathus* Salamanders: Proximate Contributions to Miniaturization in *D. aeneus* and *D. wrighti*

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Desmognathus aeneus and *D. wrighti* are the smallest of the 21 species of the supergenus *Desmognathus* and the subfamily Plethodontinae. Whereas all other

species of the genus *Desmognathus* have biphasic life cycles and free-living aquatic larvae, *D. aeneus* and *D. wrighti* have direct development, a trait shared with *Phaeognathus hubrichti*, the only other member of the supergenus. Based on continuing life-history studies in syntopic populations of *D. aeneus*, *D. wrighti*, and the biphasic *D. ocoee*, I offer data on egg/hatchling size, growth, and size/age at sexual maturation, that allow estimation of the contribution of these factors to adult body size. *Desmognathus ocoee* was selected for comparison not because of an especially close relationship with either *D. aeneus* or *D. wrighti*, but because it is the next-smallest species in the assemblage under study, and is presumably subject to the same environmental conditions as *D. aeneus* and *D. wrighti*. An exponential model of growth in standard length ($SL(t) = SL_0e^{rt}$) adequately serves to describe growth rates prior to sexual maturation, which are similar in the three species ($r \approx 0.4$). Miniaturization in both *D. aeneus* and *D. wrighti* appears to be a consequence of (1) smaller egg and hatchling sizes (hatchlings 6.0-7.0 mm SL in *D. aeneus* and *D. wrighti* versus 9.0-9.5 mm in *D. ocoee*), (2) precocious sexual maturation (2-3 years in *D. aeneus* and *D. wrighti* versus 3-4 years in *D. ocoee*), and possibly (3) lower growth rates following maturation, in comparison with *D. ocoee* (and other biphasic desmognathans). The absence of a free-living larva as an outcome of the shortening of the life cycle conforms to a pattern of developmental acceleration that has contributed to miniaturization in *D. aeneus* and *D. wrighti*.

0542 AES Student Papers II, Kafka/LeMaratine, Friday July 25, 2008; GRUBER

Utilizing DNA Microsatellites to Study Population Structure of Spiny Dogfish, *Squalus acanthias*, in the Western North Atlantic

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In the year 2000, as a result of the declining spiny dogfish stock, the Atlantic States Marine Fisheries Commission implemented an Interstate Fisheries Management Plan that places an annual quota limit on US landings. Thus, this is a timely opportunity to conduct studies that provide updated life history information on this species. Since population structure is an important component of any successful management plan, the objective of the present study is to employ DNA microsatellite markers to determine the population structure of spiny dogfish in the Northwest Atlantic. To assess molecular markers, fin clips were taken from sharks at six locations along the eastern coast of the United States and Canada. Due to evidence suggesting a possible north/south division between spiny dogfish populations in the Western North Atlantic, the six sampling locations were selected with three being north and three being south of Cape Cod, MA. DNA was then extracted from the fin clips and four microsatellite loci were amplified using polymerase chain reaction with fluorescently labeled primer sets specifically developed for spiny dogfish. The products were genotyped and alleles for each locus were scored based on size. Hardy Weinberg Equilibrium was examined as well as statistical analyses using F statistics and pairwise comparisons to determine the presence or absence of any population structure present within spiny dogfish in the Northwest Atlantic. Preliminary results suggest little to no division between northern and southern sampling locations, but more samples are being analyzed as well as comparisons between individual locations. By utilizing this approach to acquire updated knowledge of population structure, it allows for improved accuracy and reliability of the underlying biological information obtained for and incorporated into fisheries models for spiny dogfish in the Atlantic waters off the coasts of Canada and the United States.

0566 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

Artificial Night Lighting Affects Anuran Larval Growth and Development

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Artificial night lighting (such as light pollution) in amphibian habitats can alter perceived photoperiod and has the potential to reduce plasma levels of photoperiodic hormones such as melatonin. Melatonin plays an important role in regulating other hormones including many of those involved in growth and development. Although the photoperiodic nature of melatonin expression is well established, it is unclear how much light at night is necessary to disrupt melatonin production and whether or not such disruption can affect larval growth and development. In a laboratory experiment, we compared the growth and development of African Clawed Frog (*Xenopus laevis*) tadpoles under three different night lighting treatments simulating different levels of light pollution and a dark control. All tadpoles were exposed to 100 lx daytime illuminations on a 12L:12D photoperiod. In the control treatment, tadpoles experienced a normal nocturnal illumination of 0.0001 lx (bright starlight). In the three experimental treatments, tadpoles experienced unnaturally high nocturnal illuminations of 0.01 lx, 1 lx, and 100 lx that correspond to different potential levels of light pollution in larval habitats. In our study, artificial night lighting affected larval size and the proportion of larvae that metamorphosed by the end of the study (approximately 2 months). A greater proportion of larvae metamorphosed in the naturally dark control treatment than in the brighter experimental treatments. Within the experimental treatments, larvae in the brightest treatment were significantly smaller than larvae in the dimmest treatment. Larvae in the control treatment were significantly smaller than larvae in the dimmest experimental treatment but did not differ in size from larvae in the other lighting treatments, probably because of their faster progression to metamorphosis. We conclude that consistent exposure to even small amounts of artificial light at night can affect anuran larval growth and development.

0725 Poster Session I, Friday July 25, 2008; STORER ICHTHYOLOGY

Shape Analysis and Systematic Status of the Blenny Darter, *Etheostoma blennioides*, a Percid Fish from the Tennessee River Drainage

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The Blenny darter, *Etheostoma blennioides*, is comprised of two morphologically distinct subspecies of fish, *Etheostoma blennioides blennioides* and *Etheostoma blennioides sequatchiense*. The purpose of this study was to examine the degree of morphological variation between the two subspecies to determine if a taxonomic revision was needed. The degree of sexual dimorphism that exists within each subspecies was also examined. Preliminary results and a genetic data set suggested that enough visible differences existed for each subspecies to be elevated to species level and that fin lengths would differ between the sexes in each subspecies. Body shape variation was calculated through traditional morphometric methodology and analyzed by performing a sheared principle components analysis. Thirty-seven characters were used to assess the body shape of 100 specimens (50 of each subspecies). The two measurements of snout shape and the caudal peduncle length were found to have significantly high loadings in a sheared PCA. The graph of the principle component II vs. principle

component III of the sheared PCA conveyed no overlap between the two polygons putatively representing the subspecies, indicating that *E. b. blennius* and *E. b. sequatchiense* are distinct species. These results suggest that the two subspecies of *Etheostoma blennius* are distinguishable based on body shape analysis (primarily snout shape and caudal peduncle length) and should be elevated to species level.

0754 Poster Session III, Sunday July 27, 2008

Genetic Confirmation of Hybridization between *Catostomus fumeiventris* and *Catostomus santaanae* (Cypriniformes: Catostomidae) in the Santa Clara Drainage

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The presence of morphological intermediates has suggested that *Catostomus fumeiventris* and *C. santaanae* hybridize in the Santa Clara drainage where both were introduced many decades ago. We used starch gel electrophoresis of codominant gene products to confirm the genetic interaction between these two species of fishes. Both F₁ and F₂ generations of hybrids were identified, but both parental species still maintained their genetic integrity. Of 160 specimens obtained from Sespe Creek north of Fillmore CA on 15 May 2006, 125 were genetically identified as *C. santaanae*, 11 as *C. fumeiventris*, 10 as F₁ hybrids and 14 as F₂ hybrids. The F₂ hybrids appeared to be the progeny of F₁ x F₁ crosses or backcrosses to *C. santaanae*.

0753 General Herpetology II, Jarry/Joyce, Monday July 28, 2008

Skeletochronology of a Paedomorphic Population of Tiger Salamanders (*Ambystoma tigrinum*) in Swalls Pond, Ward County, North Dakota

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Ambystoma tigrinum, the Tiger salamander, is a thoroughly described species. This species has the widest ranging North American distribution within the Ambystomatids. Tiger salamanders live in many different types of habitats and have a diverse life history including the retention of larval characteristics into sexual maturity (paedomorphosis). We report skeletochronology in a population of paedomorphic Tiger Salamanders from Swalls pond North Dakota. Toes were extracted from a random sub-sample of collected salamanders. Salamander toes were processed and prepared using a protocol according to Schneider (2004), modified from a standard protocol developed by Leclair Jr. et al. (2000) and Leclair Jr. and Castenat (1987). Findings indicate that many individuals are in the same cohort (1,2, and 3 years). Length frequencies and assessment of sexual development within this population indicate that females may need to be at least 3 years of age before first reproduction! Males within the same cohort may be reproductively ready after the first summer.

0594 Poster Session III, Sunday July 27, 2008

An Assessment of Heavy Metal Toxicity in Embryonic and Larval Axolotl (*Ambystoma mexicanum*)

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Embryos and 75 day old larvae of the model organism *Ambystoma mexicanum* were treated with differing concentrations of the heavy metals Cadmium (CdCl₂) and Methyl mercury (HgCH₃). Each experiment exposed embryos and larvae to 8 treatment levels including controls. Treatment levels for cadmium were 0ug/L, 15ug/l, 50ug/l, 150ug/l, 1500ug/l, 15,000ug/l, 150,000ug/l and 1.5million ug/l. Treatment levels for methyl mercury were 0ug/l, 1.5ug/l, 5ug/l, 15ug/l, 50ug/l, 150ug/l, 1500ug/l and 15,000ug/l. All treatment groups were observed every 12hrs during the 96hr treatment for mortality, physical anomalies and behavioral anomalies. Tissue samples were collected from deceased individuals and organisms were fixed in 10% formalin and preserved in 70% ethanol for future analysis. Embryos were also scored for developmental progress. We present the embryonic and larval LC-50 values as well as developmental staging and percent survivorship. Toxicologically, cadmium LC-50 concentrations were higher than mercury. Additionally, mercury may have a greater effect on survival beyond exposure period at lower ecologically relevant doses.

0597 Poster Session II, Saturday July 26, 2008; CARCNET/RÉCCAR

The Smooth Green Snake and the Northern Red-bellied Snake: A Comparison of the Ecology of Two Small, Terrestrial, Northern snakes

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Brandon University, Brandon, Manitoba, Canada

The smooth green snake (*Liochlorophis vernalis*) and the northern red-bellied snake (*Storeria occipitomaculata occipitomaculata*) are small, terrestrial colubrid snakes reaching the extremes of their distributions in southwestern Manitoba. While both species are constrained by short, active seasons they differ substantially in morphology and reproductive mode (*L. vernalis* is oviparous and *S. occipitomaculata* is viviparous). The aim of this study is to compare the ecology of these two species in Manitoba by asking two specific questions. First, do these two northern snakes occupy similar ecological niches? Second, what are the local hibernation characteristics in comparison to their hibernation sites at other localities? We addressed these questions with a mark-recapture study using active searching and searching under artificial cover. Local hibernation patterns were determined using drift fences and trapping, active searching, and implantation of temperature data loggers at the hibernation sites. The study was conducted from spring 2007 to summer 2008 in southwestern Manitoba, Canada. Approximately equal numbers of both species were located, although hibernation characteristics were determined only for *S. occipitomaculata*. Sexual dimorphism was evident only in *L. vernalis* (females were larger) and gravid females of both species were last captured in mid-July. *S. occipitomaculata* were captured at lower temperatures and tended to be captured in habitat more closely associated with water although in the third week of June there appeared to be a pulse of activity in more xeric prairie and associated habitat. *L. vernalis* were almost always associated with prairie and prairie ecotone habitat types.

S. occipitomaculata used abandoned ant nests for hibernation sites and were active at these sites until September 25, 2007. Hibernation site characteristics will be determined in spring 2008.

0135 AES Habitat & Movement I, Jarry/Joyce, Saturday July 26, 2008

Juvenile Lemon Sharks (*Negaprion brevirostris*) Around South Caicos, Turks & Caicos Islands: A Nursery Without Neonates?

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The School for Field Studies, Center for Marine Resource Studies, South Caicos, Turks and Caicos Islands

Juvenile lemon sharks (*Negaprion brevirostris*) depend on shallow near shore areas as nurseries. These critical habitats may be vulnerable due to their proximity to land and exposure to anthropogenic impacts. This study aimed to assess the use of shallow habitats by immature lemon sharks around South Caicos, Turks & Caicos Islands, an island facing burgeoning coastal development and tourism. Specific objectives were to investigate the abundance of sharks using the area, their size frequency distribution, growth rates, and residency. Sharks were caught with monofilament gillnets at selected sites around South Caicos between August 2006 and present. A total of 100 individuals were captured and tagged with T-bar tags (August to December 2006) and passive integrated transponder tags (January 2007 to present). The area sampled appears to be used predominantly by juveniles of an intermediate size class (mean PCL 63.8 ± 1.02 cm S.E.; range 50.5 - 91.0 cm). No individuals had open umbilical scars and no adults were observed during the study period, suggesting that pupping may occur elsewhere and neonates may use alternative areas until they attain a larger size. Preliminary results indicate a fast growth rate (26 cm yr⁻¹ PCL) compared to other well-studied lemon shark populations. A relatively low recapture rate (15.2%) was recorded which may be attributed to high mortality, size-related emigration, or sampling effort spread across a large open study area. The use of nurseries throughout this species' range could be more complex than originally thought and the details of ontogenetic shifts in habitat use may be location specific. For a more comprehensive understanding of lemon shark life history, further research in alternative locations is required. This would enhance our ability to conserve this species, especially in the face of rapid coastal development occurring worldwide.

0019 AES Management, Jarry/Joyce, Sunday July 27, 2008

Estimation of Discard Mortality in Blue Sharks Using Pop-up Archival Tags, with Implications for the Status of the North Atlantic Population

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A confounding issue in the interpretation of shark population status is the survival rate of sharks discarded at sea. In the Northwest Atlantic, virtually all blue sharks (*Prionace glauca*) caught by the Canadian and U.S. large pelagic longline fleets are discarded after capture, for a total of more than 30,000 mt annually. Observer records of >10,000 blue sharks indicated that ~20% appeared to be dead at the time of

discarding, with most of the remainder being injured to varying degrees. To estimate the medium-term survival rate of the discarded blue sharks, we applied popup archival transmitting (PAT) tags to more than 45 blue sharks discarded as part of ongoing commercial fishing operations. Tags were programmed to release from the sharks after 3-6 months. Survival rates greatly exceeded expectations, with most of the mortality occurring within 3 days of release. Injured blue sharks appeared to return to what was interpreted as normal behaviour about 3 weeks after release. The implications of delayed discard mortality to population status calculations are substantial.

0171 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008

Giant Devil Ray Satellite Tagging in the Mediterranean Sea

Simonepietro Canese, Andrea Cardinali, Teresa Romeo, Michela Giusti, Eva Salvati, Michela Angiolillo, Silvestro Greco

ICRAM (Central Institute for Marine Research), ROME, Italy

The giant devil ray (*Mobula mobular*) (Bonnaterre 1788) is the only mobulid species regularly present in the Mediterranean Sea. The distribution, biology and ecology of this species are poorly known and, given its high bycatch mortality, low reproductive capacity and limited range, it is enlisted in the IUCN endangered species list (A4d). The present study describes the diving behavior and movements of three individuals tagged with Popup archival satellite tags in the Messina Strait (Central Mediterranean Sea) during summer 2007. Two tags were programmed to detach from the individuals after 120 days and one after 60 days. All tags detached at the pre-established time and far from the tagging positions (156 – 421 km). The data collected show the ability of these individuals to dive extremely deep (up to 700 meters). Despite this, they spend most of their time (81.5 %) between the surface and 50 meters, in waters having temperature between 20° C and 29° C. The preference for warm surface waters exposes this species to threats such as accidental captures in driftnets and surface long lines.

0006 Poster Session III, Sunday July 27, 2008; STORER ICHTHYOLOGY

The Impacts of Armored Catfish (Siluriformes: Loricariidae) on Invaded Freshwater Ecosystems

Krista Capps

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Armored catfishes (Siluriformes: Loricariidae) are bottom-dwelling fishes native to Central and South America. They are characterized by having a ventral sucker lips, large bony plates, and novel jaw musculature and tooth morphology. Although Loricariidae is one of the most diverse fish families in the world (>680 species described), little is understood about the trophic ecology of this group. These fishes, also known as “plecos”, are common in the aquarium trade, and are frequently released into freshwater environments. Globally, loricariids are one of the most successful invasive fish families and have an approximate 80% success rate invading new environments. Actively reproductive loricariids have been collected in Texas, Florida, Hawaii, and Nevada and isolated fish have been collected in at least five more states. Populations of these fishes have also been recorded in Mexico,

Puerto Rico, Australia, Europe, Indonesia, Taiwan, Singapore, Java, Sumatra, and the Philippines. Loricariid invasion has been linked to native species displacement and increased siltation, and these fishes are considered threats to many rare ecosystems. Although armored catfish introductions are well-documented in the throughout the world, the community and ecosystem-level effects of these fishes in invaded habitats are yet to be determined. In this study, I examined the community and ecosystem-level impacts of loricariid invasion by reviewing published records of introduced populations. I identified the primary threats of exotic loricariids to native communities and ecosystem processes and I determined the regions of the world in which loricariid invasion is having the greatest impact. I also used the loricariid invasion in southern Mexico as a case study to examine the potential impacts of loricariid physiology on nutrient cycling in invaded systems.

0281 Poster Session III, Sunday July 27, 2008

Orientation of Vernal Pool Amphibians in an Industrial Forest Landscape

Emma Carcagno, Kimberly Babbitt

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Amphibians that breed in vernal pools spend a majority of their lives in adjacent upland habitat. Understanding the migration and dispersal patterns of these amphibians is a critical aspect of effective conservation and land management. We used clearcutting to manipulate buffer widths at 11 vernal pools in northeastern Maine on land managed for timber production. Each pool was completely encircled with a drift fence and pitfall traps. We captured wood frogs (*Lithobates sylvaticus*) and spotted salamanders (*Ambystoma maculatum*) as they entered and exited pools and documented orientation of ingress and egress across three breeding seasons. We examined a total of 4,993 adult and 20,141 metamorph wood frogs; 2,719 adult and 1,992 metamorph spotted salamanders. Orientation at all pools for both species was nonuniform, differed across pools, and was inconsistent among years. The direction of orientation also differed between species as well as between adults and metamorphs. Our results suggest that amphibian migration and dispersal patterns are spatially and temporally complex. This complexity implies that identifying predictable 'corridors' of concentrated amphibian movement for protection would likely be an ineffective approach to managing the upland habitats surrounding these pools.

0466 Herp Behavior, Salon A&B, Thursday July 24, 2008

Preliminary Analysis of the Diet and Foraging Behavior of Mohave Rattlesnakes (*Crotalus scutulatus*)

Michael Cardwell

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The natural behavior of Mohave rattlesnakes (*Crotalus scutulatus*) was investigated in the western Mohave Desert using radiotelemetry from August 2001 through November 2004. This presentation describes a preliminary analysis of the diet and foraging behavior of adult rattlesnakes in this population, based on witnessed events and scat analysis. Data are analyzed in the context of such factors as season, body and air temperatures, time of day, photoperiod, moon phase, precipitation, and

microhabitat. These sit-and-wait predators demonstrated a strong preference for rodents, primarily heteromyids such as *Dipodomys*. Other taxa, both endothermic and exothermic, were attacked opportunistically with a range of prey-handling behaviors.

0600 Poster Session II, Saturday July 26, 2008

Techniques for Identification of Prey by Scat Analysis

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While existing literature documents a variety of techniques to identify mammals from their hair morphology, including several dichotomous keys, virtually all previous references are restricted specifically to the use of dorsal guard hairs. There is little written about how to apply these techniques and keys to scat analysis, where all of the hair of a prey animal is mixed together in a tightly compressed bolus. How are dorsal guard hairs identified? What techniques are useful in such analyses? To what taxonomic level can completely digested prey be identified? We present the techniques that have been useful in our efforts to identify prey taxa from rattlesnake feces and make suggestions to improve the efficiency of similar future efforts.

0398 Reptile Ecology, Salon 6&7, Friday July 25, 2008

Latitudinal Variation in Behavioral Thermoregulation by Ratsnakes (*Elaphe Obsoleta*)

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Behavioral thermoregulation by ectotherms is assumed to provide the benefit of improved physiological performance at the cost of increased risk of predation and lost opportunities for foraging and mating. As thermal environments become more challenging, higher benefits would favor increased thermoregulation, but higher costs would favor decreased thermoregulation. Available evidence to date suggests that snakes in thermally challenging environments thermoregulate more (i.e., benefits exceed costs). To determine whether this pattern holds intraspecifically, we compared the thermoregulatory behavior of black ratsnakes, *Elaphe obsoleta* in the center of the species' distribution in Illinois with that at the species' northern limit in Ontario. Although ratsnakes in both populations preferred almost identical temperatures, Illinois ratsnakes maintained temperatures closer to their preferred range through the day and across the season. These superior temperatures were not realized as a result of increased thermoregulation, however, because ratsnakes in Illinois generally thermoregulated less than ratsnakes in Ontario. Our results support the hypothesis that the benefits of thermoregulation have a greater influence than costs on snake thermal strategies. For ratsnakes at their northern range limit thermoregulation may be essential for populations to be viable, whereas at the center

of the species' distribution, the principal advantage of thermoregulation may be to allow ratsnakes to extend their active season.

0505 Poster Session III, Sunday July 27, 2008

The IUCN Global Marine Species Assessment - Laying the Foundations for Marine Conservation

Kent Carpenter, Suzanne Livingstone, Beth Polidoro

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The Global Marine Species Assessment (GMSA) is the new initiative of the Biodiversity Assessment Unit (BAU) of the World Conservation Union/ Species Survival Commission and Conservation International/ Center for Applied Biodiversity Science. The growing realization of the seriousness of increasing threats, such as global warming, over-fishing and coastal development, to marine biodiversity has prompted successful BAU methodology to be applied the marine realm. The GMSA programme compiles important baseline information on individual marine species, and using IUCN Red List Criteria, assesses their threat of extinction. This essential species-level information will be used to generate regional and global marine hotspot analyses and identify key marine biodiversity areas, as well as being used for species level conservation efforts. The GMSA is collaborating with initiatives such as the Census of Marine Life and the Food and Agriculture Organization, together with expert taxonomist and ecologist consultation to determine the Red List status of large clades of marine species. The GMSA aims to assess all boney fishes, primary habitat-producing organisms and selected echinoderms and mollusks (approximately 20,000 species) by 2010.

0230 AES Student Papers II, Kafka/LeMaratine, Friday July 25, 2008; GRUBER

Movements and Nursery Habitat of Juvenile Thresher Shark (*Alopias vulpinus*) in the Southern California Bight

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The common thresher shark, *Alopias vulpinus*, comprises the largest commercial shark fishery in California waters. However, very little is known about the early life history of this species. We used acoustic telemetry to study the movement patterns and habitat preferences of juvenile common thresher sharks in their nursery habitat along the coast of southern California, between March 2006 and September 2007. Seven juvenile threshers (fork length: 66 to 108 cm) were tagged with temperature and depth sensing acoustic transmitters and tracked for up to 75 h. In contrast to behavior recorded for adults and subadults in an earlier study, juveniles almost exclusively utilized shallow waters of the continental shelf. Juvenile threshers exhibited diel patterns in depth preference, remaining closer to the surface at night and deeper by day, often near bottom depth. The depth and habitat preferences of

thresher sharks make them vulnerable to artisanal gillnet fisheries in California and Baja California waters.

0060 Poster Session I, Friday July 25, 2008

Ecology of Three Elasmobranch Species in the Atol das Rocas Biological Reserve, off Northeast Brazil

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¹University of Florida, Gainesville, FL/Southeast, United States, ²Universidade Federal Rural de Pernambuco, Recife, PE/Northeast, Brazil

Atol das Rocas, a unique atoll in the South Atlantic Ocean, was the first designated marine reserve in Brazilian waters. From August 1999 to December 2007, 28 surveys, averaging 20 days each, were carried out in the Atol das Rocas Biological Reserve aimed at studying the population demographics and behavior of three common elasmobranch species present in the area. Visual censuses were used to document the use of habitat and population structure of nurse shark (*Ginglymostoma cirratum*) and southern stingray (*Dasyatis americana*). In addition, a tag-recapture study estimated the population size and growth of young lemon sharks (*Negaprion brevirostris*). A total of 73 young lemon sharks were caught, without mortality, ranging in total length (TL) from 60- 70 cm for females and 70- 80 cm for males. The population size of young lemon sharks in the region was estimated at 147±36 individuals. Females and males showed an increase in TL of 12.7 cm/year and 12.4 cm/year, respectively. A total of 184 rays were sighted in the visual censuses. Of these, 85% presented some distinguishing marks that were photographed. The population of southern stingray in the Atol das Rocas, based on the analysis of re-sightings in different surveys, was estimated at 99.2 ± 17.1 individuals. Mean number of nurse sharks sighted in each expedition was 123.34 ± 48.75, with TL's ranging from 42-293 cm. The extreme tidal regime present in the Atol das Rocas has a significant influence on the behavior of these three elasmobranch species. The area hosts unique populations of these species, underscoring the need to implement proper conservation and management measures.

0062 AES Management, Jarry/Joyce, Sunday July 27, 2008

Fishing Gear Modifications to Reduce Elasmobranch Mortality in Pelagic and Bottom Longline Fisheries off Northeast Brazil

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Terminal gear modifications, particularly the use of circle hooks, are showing promising results in reducing bycatch mortality for teleost fishes, but similar data on elasmobranchs are rare. We conducted two experiments to test the influence of hook type and physical position of the hook in catch composition, catch rates, and mortality of elasmobranchs with longline fishing gear. In the first experiment, a commercial vessel conducted 12 pelagic longline research sets off the coast of Natal,

Northeast Brazil. In the second, 1,128 bottom longline research sets were monitored off the coast of Pernambuco, Northeast Brazil. The vertical hook position comparisons in the bottom longline fishery were analyzed by deploying half of the hooks demersally and the other half suspended in midwater using only "J" (size 9/0, 10° offset) hooks. For hook type comparisons, circle (size 18/0, 0° offset) and "J" (size 9/0, 10° offset) hooks were alternated along the mainline for each pelagic or midwater set. Catch rates for blue, night, silky, tiger, shortfin mako, dusky, nurse, and oceanic whitetip sharks were significantly higher for circle hooks in the pelagic longline experiment. However, all shark species caught by circle hooks were hooked significantly more often in the mouth in contrast with "J" hooks, which hooked more often in the throat or gut. Suspending the hooks midwater versus demersally reduced the catches of blacknose sharks (-85%), nurse sharks (-97%), and southern stingrays (-68%), while increasing the catch rates of bull (+20%) and tiger sharks (+20%). For the midwater sets, the number of tiger, bull, and blacknose sharks and southern stingrays alive at haulback was significantly higher for circle hooks. However, no significant mortality differences between hooks were found for nurse, hammerhead, and blacktip sharks. No significant differences in catch rates between hook types were found for any species in the midwater sets.

0144 Fish Systematics I, Salon A&B, Friday July 25, 2008

Taxonomic Review of the Species of *Hisonotus* (Siluriformes: Loricariidae) from the Rio Uruguay Basin and the Laguna dos Patos System

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Hisonotus belongs to Hypoptopomatinae, a group of loricariids including more than 80 species grouped in 18 genera. *Hisonotus* has about 18 species distributed in southeastern basins of South America. Here, we review the taxonomic composition of the genus in Laguna dos Patos system and in Rio Uruguay basin. Laguna dos Patos system has the species: *H. nigricauda*, *H. laevior* (senior synonym of *H. leptochilus*), *H. taimensis*, plus seven new species. *Hisonotus laevior*, *H. nigricauda*, plus one of the new species are widely distributed and sympatric in most of the Laguna dos Patos system, contrasting to *H. taimensis* and the other new species which have limited distributions. Most of the new taxa are restricted to upper portions of Rio Jacuí drainage where the widely distributed species are not present. *Hisonotus laevior*, *Hisonotus taimensis* plus a new species from the Rio Camaquã drainage share some derived features which are likely synapomorphies of a clade inhabiting almost the entire Laguna dos Patos. Rio Uruguay basin has the species: *H. nigricauda*, *H. ringueleti* (senior synonym of *H. candombe*), *H. aky*, *H. charrua*, plus four new species. *Epactionotus aky* is transferred to the genus *Hisonotus* because it does not have the diagnostic characters of *Epactionotus*, and by sharing derived features with the *Hisonotus* species from upper Rio Uruguay basin. The new species described from Rio Uruguay basin are restricted to its upper portions. The greater diversity in the upper Rio Uruguay compared to the lower portions can be explained by its complex relief. Rapids and waterfalls are dispersal barriers for most *Hisonotus* species, and are likely the cause of allopatric speciation during the process of drainage evolution. A similar aspect is found in the headwaters of Rio Jacuí basin, which possesses several endemic and restrictedly distributed species.

0232 Fish Development/Reproduction, Salon 6&7, Sunday July 27, 2008

Developmental Morphology of the Caudal Fin Skeleton of the South American Catfish *Lophisilurus alexandri* Steindachner, 1877 (Siluriformes: Pseudopimelodidae)

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Ontogeny often provides the most compelling evidence for proposing hypotheses of primary homology and is critical to interpreting the origin and transformation of complex structures in a phylogenetic framework. Developmental studies on catfishes (Siluriformes) adopting an evolutionary perspective are scarce in the literature. In an attempt to provide a new anatomical foundation for these studies, we describe the developmental morphology of the caudal fin skeleton of the South American catfish *Lophisilurus alexandri*, the single species of this genus, which is thought to be endemic to the Rio São Francisco basin, Brazil. The present study represents the first treatment on the ontogeny of the caudal skeleton for a species of the family Pseudopimelodidae. The developmental series was obtained through induced spawning in wild specimens; eggs were incubated until hatching, and larvae were reared under laboratory conditions. Specimens were fixed daily and cleared and double-stained for bone and cartilage. The sequence of chondrification and ossification was recorded for each day. The poverty of ontogenetic information about the caudal complex in siluriforms widely precludes an evolutionary interpretation for most of our findings. Presently, however, it is possible to highlight some relevant observations, such as the complex composition of the neural and hemal spines associated with the caudal fin, the early ossification of the second ural centrum, the sudden anterior displacement of the posteriormost basidorsal (associated to the second ural centrum) which obfuscates its delimitation in late stages, and on the nature of the uroneural, which is likely homologous to the neural arch of the second ural centrum.

0091 General Ichthyology III, Drummond, Sunday July 27, 2008; STOYE GENERAL ICHTHYOLOGY

Phylogenetic Relationships among Members of the *Notropis* Subgenus *Hydrophlox*

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The *Notropis* subgenus *Hydrophlox* (Jordan 1878) has contained as many as 33 species since its description. In 1970, Swift redefined the subgenus to include nine taxa: *N. rubellus*, *N. baileyi*, *N. nubilus*, *N. chlorocephalus*, *N. lutipinnis*, *N. chiliticus*, *N. chrosomus*, *N. rubricroceus*, and *N. leuciodus* based primarily on breeding coloration and scale and pectoral fin tuberculation. Since then, *N. rubellus* has been shown to be allied with members of the subgenus *Notropis* and placement of other members of *Hydrophlox* has been questioned. A molecular phylogeny generated from three markers, (mtDNA: ND2; and nuclear DNA: ITS1 and partial Rhodopsin) reveals a core *Hydrophlox* monophyletic clade comprised of five taxa: *N. rubricroceus*, *N.*

chiliticus, *N. chlorocephalus*, *N. lutipinnis*, and *N. chrosomus*. Morphology, distribution and behavior support the conclusion that *Hydrophlox* as it is currently known is polyphyletic and warrants redescription.

0122 Amphibian Conservation, Salon 4&5, Saturday July 26, 2008

Getting Closer to Reality: Amphibian and Reptile Detection Probabilities for Western Great Lakes Inventory and Monitoring Programs

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Ever search for something, not find it, but wonder if you simply over-looked it? We investigated this problem for amphibian and reptile sampling methods in the western Great Lakes. Effective inventory and monitoring programs are critically important in determining species status, and documenting changes in abundance and geographic distribution. However, data on the effectiveness of various survey methods are scarce. We tested the effectiveness of several herp monitoring methods in the Lake Superior and Lake Michigan basins, over-sampling to develop detection probabilities and minimum sampling requirements for each method and species, for use in proportion of area occupied modelling, which allows the use of less robust data from existing programs for regional analyses (i.e. calling frog surveys). We detected up to 20 species per sampling area. Call surveys, aquatic funnel traps, and casual observations detected the most species, but method success varied with the species present. Detection probabilities greater than 0.3 (recommended for occupancy modelling) were obtained for most species by standard methods, but many species had high variance in detection probabilities, among samples, sites, and season. The minimum number of samples required for 95% confidence in detection was calculated for each species and method. We identify overlaps in sampling methods for maximizing species detection and sampling efficiency. Species with low variance in detection and low sampling requirements are best suited to long term monitoring programs. Species with high variance in detection and/or high sampling requirements are more difficult to inventory, monitor, or manage, and a trade off exists between sampling effort required and confidence in knowing the occupancy of any specific site. Obtaining detection probabilities, understanding the variance in detection probabilities among sites, species, and over time, and correcting for false negatives in data analyses where species are under-sampled, is recommended for developing successful inventory and monitoring programs.

0284 HL Graduate Research Award, Salon A&B, Sunday July 27, 2008; HL

Phylogenetic Relationships of the *Dactyloa* Clade of *Anolis* Lizards

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The clade *Anolis* is composed of nearly 370 species distributed from southern North America to northern South America, including Central America and the Caribbean

islands. Previous phylogenetic studies on *Anolis* have focused on Caribbean and/or Central American species. What little is known of South American anoles is mostly from morphological characters or molecular data from a limited number of species. We present new nucleotide sequence data from one nuclear (RAG-1, ~2900b) and two mitochondrial (ND2, ~1500b; COI, ~700b) genes to resolve phylogenetic relationships of a major subgroup of South American anoles, the *Dactyloa* clade. We included 38 *Dactyloa* species from Colombia, Ecuador, Panama, Venezuela and the Lesser Antilles, as well as 12 outgroup species (4 non-*Anolis* Polychrotinae and 7 non-*Dactyloa Anolis*). Preliminary Bayesian analyses of all three genes combined do not support *Dactyloa* as a monophyletic group, but only because *Anolis occultus* (a non-*Dactyloa Anolis*) is nested within it. In addition, the data provide strong support for the monophyly of the species previously referred to *Phenacosaurus*, and the Lesser Antillean *Dactyloa* species (the *roquet* series). The series *punctatus*, *latifrons* and *aequatorialis* previously circumscribed based on morphological characters appear to be non-monophyletic.

0483 Herp Genetics, Salon A&B, Sunday July 27, 2008

Adaptive Evolution and Functional Redesign of Core Metabolic Proteins in Snakes – Does Broad-Scale Molecular Adaptation Underlie Snake Evolution?

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Adaptive evolutionary episodes in core metabolic proteins are uncommon, and are even more rarely linked to major macroevolutionary shifts. We conducted extensive molecular evolutionary analyses on snake mitochondrial proteins and have discovered compelling evidence suggesting that the proteins at the core of aerobic metabolism in snakes have undergone a process of functional evolutionary redesign. We demonstrate that mitochondrially-encoded oxidative phosphorylation proteins in snakes have endured a remarkable process of accelerated and apparently adaptive evolution, with unprecedented levels of positive selection, coevolution, convergence, and reversion at functionally critical residues. Cytochrome C oxidase subunit I (COI) has experienced extensive modification of normally conserved residues involved in proton transport and delivery of electrons and oxygen. Thus, the core of snake aerobic metabolism appears to have been selectively reorganized. This presumably adaptive process of evolutionary redesign of snake COI coincided with adaptive bursts in other mitochondrial proteins and substantial changes in mitochondrial genome structure. These also generally coincided with or preceded major shifts in ecological niche and the evolution of extensive physiological adaptations related to lung reduction, large prey consumption, and venom evolution. The parallel timing of these major adaptive events suggests that adaptive redesign of metabolic and mitochondrial function may have substantially contributed to the evolution of snakes, and may underlie the extreme physiological and metabolic efficiency, flexibility, and innovation observed in snakes.

0651 AES Reproduction, Kafka/LeMaratine, Saturday July 26, 2008

The Reproductive Cycles of North American Sharks

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The reproductive cycle of sharks is how often a species breeds and consists of two parts or periods. The first is the vitellogenesis period, when nutrients stored in the liver are transferred to the developing oocytes, and when oocytes accumulate yolk and grow rapidly. The second part consists of the gestation period, or the time of embryonic development from fertilization to birth. These two periods, vitellogenesis and gestation, can run concurrently or consecutively, and the duration of each period is variable. In a given population, the females can be reproductively synchronous or asynchronous. Synchronous females are in the same stage of the reproductive cycle, while in a population of asynchronous females, all are at different stages of the cycle. Different types of reproductive cycles can be discerned: 1. Biennial cycle with concurrent vitellogenesis and gestation, as in the spiny dogfish and other squaloid sharks. 2. Biennial cycle with consecutive vitellogenesis and gestation, the type of reproduction found in many of the sharks of the genus *Carcharhinus* and *Sphyrna mokarran*. The nurse shark (*Ginglymostoma cirratum*) exhibits a similar biennial cycle but with a much shorter gestation period. 3. Annual cycle with concurrent vitellogenesis and gestation, a type cycle found in the more advanced sharks of the genera *Rhizoprionodon* and some *Sphyrna* (e.g., *S. lewini* and *tudes*). 4. Lamnoid annual cycle with discontinuous ovulation, as in the sand tiger shark (*Carcharias taurus*) and probably the mako (*Isurus oxyrinchus*). 5. Lamnoid annual cycle with continuous vitellogenesis, as in thresher sharks (*Alopias*). 6. Triennial cycle with consecutive vitellogenesis and gestation. A triennial cycle with an 18 month gestation period has been postulated for the dusky shark (*Carcharhinus obscurus*) and for the tiger shark (*Galeocerdo cuvier*). Caribbean data shows the tiger shark to have a 12 month gestation period. It is likely that there are many other patterns of reproductive cycles but it may take a long while to elucidate these, given the difficulties of obtaining specimens.

0723 Poster Session I, Friday July 25, 2008

Construction of a Cyprinid Prototype

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The origin of the Cyprinidae remains hidden in a yet to be discovered fossil record. Without this information it might be helpful to construct a hypothetical ancestral form to see what it would look like. It could be assembled using the plesiomorphic character states taken mostly from the skeleton. To attempt such a project a character survey was conducted on a fairly large representation of the family Cyprinidae plus extensive literature review. Comparative specimens were included from the Catostomidae, Cobitidae, Botiidae, Balatoridae and Gyriinocheilidae. Out-group study specimens were drawn from the Characiformes, Siluriformes, Clupeiformes and Salmoniformes. Published information was also relied on for these groups plus the Gonorynchiformes, fossil Anotoptysi and fossil Otoptysi. Results of the survey thus far have determined the plesiomorphic character states for the following: median fin placement and shape, scale morphology, caudal skeleton and tail,

portions of the anterior axial skeleton, pectoral and pelvic girdles, opercular series, suspensorium, hyoid bar, infraorbital series, basicranium, skull roof and cephalic canal pattern. There is little doubt that the Cyprinidae are plesiomorphic within the Cypriniformes but it is not known how well the prototype, when completed; might serve as a hypothetical ancestor for the order.

0747 Poster Session III, Sunday July 27, 2008

Photo Identification of Manta Rays in the Indo-Pacific Ocean

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Mark-recapture (or sight-resight) studies are one of the most prevalent and widely tested methods of estimating demographic parameters such as population size, survival, movement rate, and age/sex structure. This method uses natural skin pigmentation patterns, marks or scars present on animals, which makes it less disruptive to the animal and their environment than conventional tagging techniques. Photo-id libraries from the Maldives, Ningaloo Reef, WA and Yap Islands are being used to study population parameters and migration of manta rays from the Indo-Pacific Ocean. The aim of this study is to identify if there is a "typical" aggregation of manta rays and which size and /or sex is the most common. Cleaning stations and feeding grounds have been identified as the most important aggregation sites in each location but the number of mantas participating in them and the reasons why they are grouping in such places are some of the questions we intend to answer. Using libraries with photos from several years, it is possible to determine residency of individuals and site fidelity, which helps in the understanding of population dynamics and sexual-biased migrations. The understanding of manta ray population traits and migration patterns is essential to 1) maintain the ecotourism industries that these rays support in hot spots like Ningaloo Reef, W.A. or Maldives Islands, and 2) to improve the local management plans and regulations. Moreover, the ongoing long-term project this study is a part of will improve the general understanding of manta ray movement through international waters, allowing the possibility of designing protected areas in international and shared waters.

0246 Poster Session I, Friday July 25, 2008

Abundance, Seasonal Occurrence, and Biological Information of Devil Rays (Batoidea: Mobulidae) in the Gulf Of California, Mexico.

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Devil rays have been harvested to an unsustainable level due to a strong fishery in the Gulf of California. The life strategy of this group, make them very

vulnerable to over fishing, so studies are necessary for management and conservation plans in the area. Two fishery camps were sampled during May to July of 2002 and from February to October of 2004. A total of 356 organisms were caught, 135 of *Mobula japonica* (74 females, 61 males), 112 of *Mobula munkiana* (50 females, 62 males) and 109 of *Mobula thurstoni* (51 females, 58 males). *Mobula japonica* occurs mainly on summer months, we found that the most abundant size was 210 cm disc width (DW) and 61% of the organisms sampled were smaller than the estimated size at maturity (ESM); we also found gravid females. *Mobula munkiana* is known to be a winter species; however, we found it from February to July. The most abundant size was 50 cm DW and we found that 78% of the sample is smaller than the ESM; we also found gravid females and small organisms with the size suggested for birth. *Mobula thurstoni* occurs all year-round with a seasonal size segregation. The most abundant size in this study were 130 and 150 cm DW; 60% of the catch were organisms smaller than the ESM. Also gravid females were found in this species. The presence of juveniles, neonates and/or gravid females of the three species on the nets, make evident not only that this area has been used by these mobulids as mating and nursery ground, but also that the fishery is targeting on juveniles, which may collapse populations in a short period of time as happened with other species of elasmobranchs in the world.

0444 Herp Biogeography, Salon 4&5, Saturday July 26, 2008

Phylogeography of *Necturus beyeri* (Amphibia: Proteidae)

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Necturus beyeri, the Gulf Coast Waterdog, is a paedomorphic salamander inhabiting streams and rivers along the gulf coast region of the southeastern United States from eastern Texas to western Georgia. The complex history of the gulf coast drainages of southeastern North America has led to incongruent patterns among taxa in previous comparative phylogeographic analyses. Because these salamanders are aquatic, the history of the drainages they inhabit likely affects the current genetic diversity of this species. In this study we utilized the mitochondrial encoded ND2 gene to infer the historical relationships of gene lineages within *N. beyeri*. Samples were collected from throughout the range of *N. beyeri*. Because of debated species classification within the genus *Necturus* and the recent distributional changes of *N. beyeri* all currently recognized species of *Necturus* were included in the analysis. This will allow for the understanding of the historical processes that have shaped the current distribution of *N. beyeri*. The overall pattern shows both the influence of historical events as well as contemporary drainages on the phylogeography of this species. Findings show that gene lineages of *N. beyeri* are paraphyletic. The implications of these findings as well as the utility of mtDNA genes will be discussed.

0265 Fish Systematics IV, Salon A&B, Monday July 28, 2008

The Influence of Sexual Selection in the Diversification of Ponyfishes

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The phylogenetic relationships of ponyfishes (Teleostei: Leiognathidae) are reconstructed and morphological shape diversity (disparity) is measured and compared among clades. We test hypotheses suggesting that sexual selection on the light organ system (LOS) has influenced the rate of cladogenesis and morphological diversification within the family. Because of the presence of a sexually dimorphic LOS in the majority of species of leiognathids, it is hypothesized that sexual selection has led to increased rates of diversification. Increased rates of diversification are potentially correlated with changes in morphology associated with the LOS or flashing pattern rather than other systems (e.g., pigmentation pattern or external body shape), given that these other systems vary little among species of ponyfishes. Therefore, we would expect evolution of body shape variation to be limited or outpaced by evolution of variation in the LOS in sexually dimorphic leiognathids. We recover a single origin of sexual dimorphism of the LOS in leiognathids, a pattern consistent with sexual selection increasing rates of cladogenesis given that the vast majority of species are recovered in this clade. We also find that leiognathids that are sexually dimorphic for the LOS are significantly more disparate in body shape than their non-dimorphic counterparts.

0263 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT
PHYSIOLOGY/MORPHOLOGY

Water Quality Parameters Can Influence Baseline Corticosterone Levels in Larval Amphibians

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Anthropogenic disturbances are altering nearly every habitat type on a global scale. In freshwater systems, these changes have resulted in one of the highest extinction rates in the world. In addition to overt extinction, these alterations can generate significant changes in biotic and abiotic components of these systems that can act as stressors upon system inhabitants. Vertebrate organisms possess a highly conserved physiological mechanism for coping with stress – the hormonal stress response. Our study examined stress hormone levels in larval Jefferson Salamanders (*Ambystoma jeffersonianum*) in relation to water quality parameters in eight natural ponds across Maryland, Pennsylvania, and West Virginia. Baseline stress hormone levels were significantly different across all ponds. In addition, we found a significant negative correlation between pH and baseline stress hormone levels. There was also a trend for baseline stress hormone levels to be positively correlated with chloride levels and negatively correlated with conductivity. To supplement our field findings, we manipulated pH in the laboratory to determine the extent of pH influence on stress hormone levels. We used *A. jeffersonianum*, *A. maculatum*, *Rana sylvatica*, and *Hyla versicolor* as models. Reduced pH significantly increased baseline stress hormone levels in all four amphibian species. In addition, reduced pH significantly decreased survivorship in *A. jeffersonianum*, *A. maculatum*, and *R. sylvatica*. Our findings suggest that stress hormone levels can act as a physiological endpoint in assessing freshwater habitat quality. The establishment of a physiological endpoint, such as stress

hormones, will hopefully alert conservation and management practices pertaining to freshwater habitats before irreversible problems arise.

0671 Poster Session II, Saturday July 26, 2008

Form, Function & Fitness—Selection and Performance Gradients for Mosquitofish Exposed to Predatory Sunfish

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Predators exert strong selection on prey traits. However, selection on traits is mediated by contributions of the traits toward enhancing performance. The most complete understanding of selection will take into account both primary traits and performance, and typically is best analyzed by path analysis. We refer to the 'form, function, fitness' concept as the Arnold paradigm after Stevan Arnold's seminal synthesis of selection and performance gradients (*Am. Zool.* 23:347–361). We found strong effects of prey morphology on their swimming speed, effects of predators on prey behavior, and effects of prey traits on survival with predators. Among the most effective prey defensive behaviors was to leap from the water and stick to emergent objects for up to several minutes, before flipping back into the water. Analysis for complex trait relationships, such as trait compensation (*Anim. Behav.* vol:pp-pp) is ongoing. This study documents the utility of analyzing multiple trait effects in a fully-specified path model to understand cause and effect in a multiply-determined selection regime.

0443 Poster Session II, Saturday July 26, 2008

The Occurrence of Large-sized Blueberry Roughy *Gephyroberyx japonicus* off the Southwestern Taiwan Coast

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Nine uncommon Trachichthyidae fish, identified as the blueberry roughy *Gephyroberyx japonicus*, were recently trawled in 280-290 m depth off the southwestern Taiwan coast between September and October 2007. Sizes of the fish ranged 401-525 mm (mean±SD, 482±41 mm) in total length and 939-2735 g (2056±584 g) in body weight, which were the known largest records in comparison with the conspecific specimens. Gonadosomatic indexes of the fish were 0.2-1.5 (0.9±0.9) for two males and 1.3-5.6 (2.9±1.6) for seven females. Preliminary otolith annuli examination and trace elements transect analysis indicated that the fish were of great longevity, slow-growing and might be served as a proxy for the anthropogenic lead pollution sunk in the deep-sea.

0012 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008

Stock Assessment of the Shortfin Mako Shark in the Northwest Pacific - a Demographic Approach

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The shortfin mako shark (*Isurus oxyrinchus*) owns the life history characteristics of large sharks such as grows slowly, matures late, and produces few offsprings. It is vulnerable to overexploitation and has been put on the "Near threatened" category of IUCN Red List. The abundance of shortfin mako reduced 40% during 1986-2000 in the Atlantic. However, the stock status in the Pacific is still unknown. The objective of this study is to assess the stock status of the shortfin mako shark in the Northwest Pacific from 1990 to 2004 based on stochastic stage-based model. The virtual population analysis (VPA) results showed that the age-specific fishing mortality of 3⁺~6⁺ for females and 2⁺~7⁺ for males appear to be increased since 1996. The 20-year projection from stochastic stage-based model indicated that the abundance will decrease seriously under current fishing effort. The above results indicate the population will be collapse under current fishing pressure. The population will maintain equilibrium for the next 20 years if the total allowable catch (TAC) is set at 265 mt, which is equivalent to 57% reduction of current fishing pressure. However, close monitoring and modification of the TAC year by year is a necessary measure to ensure the long-term sustainability of the stock.

0583 AES Systematics & Biogeography I, Jarry/Joyce, Saturday July 26, 2008

Conservation Genetics of the Endangered Smalltooth Sawfish (*Pristis pectinata*)

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Smalltooth sawfish (*Pristis pectinata*) were once common in the southern U.S. Atlantic and Gulf of Mexico but declined by an estimated 95% last century, primarily due to incidental mortality in fisheries. Today, the U.S. range of the species is severely contracted and remnant breeding areas are now primarily located in a handful of sites in Southwest Florida. Now listed under the U.S. Endangered Species Act, it is critical that we develop a comprehensive understanding of the biology and status of smalltooth sawfish so that we will be fully prepared to meet the challenge of facilitating their long-term recovery. Given the magnitude of decline that has taken place and the well established link between genetic diversity and population viability, there is some concern about the genetic health of smalltooth sawfish in Florida. It is also important to understand the level of connectivity between different sawfish breeding grounds in Florida to effectively scale management actions. We

have developed a suite of eleven microsatellite DNA markers (10-46 alleles per locus, average heterozygosity 0.84) that have proven useful for addressing these issues. By genotyping 117 sawfish sampled from Panama City to the Lower Florida Keys, we discovered that robust genetic variation persists in the Florida smalltooth sawfish population and there is only a modest signature of a genetic bottleneck arising from the recent large decline in their numbers. We also show a high degree of genetic connectivity between different Southwest Florida breeding grounds, indicating that they should be managed as a single interbreeding unit. As an interesting side observation on the natural history of smalltooth sawfish we also present evidence that pairs or groups of juvenile sawfish captured together are often composed of siblings, to our knowledge the first evidence of an extended postnatal association of littermates in a batoid elasmobranch.

0562 AES Habitat & Movement I, Jarry/Joyce, Saturday July 26, 2008

“Homebodies”: Extended Natal Philopatry in Immature Lemon Sharks

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Understanding the balance between philopatric (“home-loving”) behavior and dispersal from the natal area is a central issue in marine ecology, yet it has never been robustly examined for any cartilaginous fish. Near-exhaustive sampling and DNA profiling of 0-3 year old lemon sharks (*Negaprion brevirostris*; nearly 1000 individuals) within a tropical nursery (Bimini, Bahamas) over eight years (1995-2002) was followed by another five years (2003-2007) of sampling in adjacent, deeper habitats for immature sharks that originated from the 1995-2002 year classes (90-230 cm total length, N=150). This level of physical and genetic tagging allowed us to confidently identify locally-born individuals among all immature sharks captured adjacent to the nursery and to make an unprecedented estimation of the proportion of philopatric individuals relative to migrants in the juvenile population. We estimate that over 50% of juvenile sharks up to lengths of 150 cm (around six years old) sampled off Bimini were born locally, illustrating the importance of natal philopatry and local recruitment by immature individuals. The proportion of philopatric individuals was significantly higher in females than in males, indicative of possible male-biased dispersal. The proportion of local recruits significantly diminished after age six as sharks began to approach adult sizes, indicating that dispersal predominates during this “subadult” phase. Extended philopatric behavior by immature sharks-especially females-may be a precursor to natal homing later in life for purposes of reproduction, which is suspected to occur in sharks but has never been directly demonstrated. Given their antiquity, growing evidence for natal philopatry in sharks suggests an early origin of this behavior in vertebrates. The strong association of immature lemon sharks with their natal area also indicates that spatial management strategies focused around coastal nursery areas and adjacent juvenile habitat could significantly contribute to much-needed conservation for this and perhaps many other tropical shark species.

0662 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008

Cross-domain Functional Ecological Tradeoffs: Developmental Response of the African Cichlid *Astatoreochromis alluaudi* to Trophic and Oxygen Gradients

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Divergent selection between alternative environments drives adaptive phenotypic diversification. As one might expect, fishes from alternative oxygen environments show strong diversification in gill morphology. But such fish also diverge in other traits such as the size and shape of muscles in the head, suggesting tradeoffs between gill proliferation and non-respiratory traits. In this study, we explore the developmental response of fish to the dual effects of hypoxia and durophagy. The molluscivorous cichlid *Astatoreochromis alluaudi* exhibits plasticity in trophic morphology, developing massive pharyngeal jaws with hypertrophied muscles on a mollusk diet and reduced pharyngeal jaw size and associated musculature on a soft food diet. Molluscivores like *A. alluaudi* in hypoxic waters thus face a dual challenge of developing enlarged respiratory apparatuses to maximize oxygen uptake and producing the trophic architecture to handle hard-bodied prey. We ran a laboratory rearing experiment to test for interactions between oxygen and food in their combined effects on trophic and respiratory morphology. Offspring of 3 sets of parents from each of two field populations (high-oxygen, mixed diet and low-oxygen, insectivorous diet) were split into four groups and reared in a 2x2 factorial design of variation in oxygen (hypoxia versus normoxia) and diet (snails versus flake food). We then measured respiratory (gill filament length, gill surface area), trophic (pharyngeal jaws, muscles), and whole-body morphological traits (geometric morphometrics). We found strong developmental plasticity in all three trait groups in response to rearing environment. We also found interactions between diet and oxygen for some traits, suggesting that nonrespiratory factors may influence the extent of divergence in respiratory characters, and vice versa. Such tradeoffs across ecological domains are not often studied but may be very important factors determining the architecture of adaptation.

0640 Poster Session I, Friday July 25, 2008

A Validation for the Use of Fin Photographs for Individual Identification of White Sharks (*Carcharodon carcharias*) off California and a Comparison between Two Analysis Methods

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One of the most widely used techniques to determine population and demographic information is the mark-recapture method. Non-invasive techniques to identify and mark individuals of rare species provide an easier method to collect these data with minimal impact to the animals. The behavior of the white shark, *Carcharodon carcharias*, and identifying markings on the trailing edge of the dorsal fin permit

individual identification via high-resolution photographs. These photographs can be obtained either above or below water allowing greater probability of identification than other body markings. Here we used fin photographs from a 20 year study period in central California to validate the use of these markings as an individual identifier while comparing the accuracy of manual and computer-assisted identification methods. Manual identification required a reader to visually compare and match all known fins within the database, whereas computer-assisted techniques utilized DARWIN, a program developed to identify dolphin fins, to match the photographs. Results from the two methods were tested against the true matches determined from known secondary traits.

0310 Poster Session I, Friday July 25, 2008

Diet of the Freshwater Stingray *Potamotrygon motoro* (Potamotrygonidae) in the Brazilian Amazon River Channel

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Potamotrygon motoro is a widely distributed species in the Brazilian Amazon Basin. It is polychromatic and valued in the international ornamental trade. This study is a contribution to the feeding biology of this species in the Solimoes / Amazonas River channel. The samples (n = 50) were obtained throughout the Brazilian portion of the Solimoes / Amazonas River, in 2003. Specimens were subject to anesthesia and sacrificed. Stomachs were removed, fixed in formaldehyde solution (10%), preserved in ethanol (70%) and then had its content analyzed in the laboratory. Percentage of Frequency of Occurrence (% FO), Weight (% W), Number (% N) and Index of Relative Importance (IRI and %IRI) were calculated for each food item. Digestion and repletion levels were observed too. Results indicated that these stingrays in the study area feed mainly on bony fish (Siluriformes and Peciformes), crustaceans (Decapoda, Palaemonidae), gastropods (Gastropoda) and insects (Isopoda). Fragments of plant tissue were observed among stomach contents. Repletion level showed that most (59%) stomachs had little content. Digestion level observation indicated that most items (62%) were highly digested (fragments only). Conclusively, *P. motoro* can be considered a piscivorous species that also includes other food items on its diet but on lower proportions.

0106 AES Devil Ray Symposium, Jarry/Joyce, Friday July 25, 2008

Diversity and Conservation of Manta and Mobulid Rays from Brazilian Waters, Southwestern Atlantic

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Mobulidae comprises medium to large size rays that feed on plankton and are found worldwide in tropical and subtropical regions. There are 10 known species and these are among the most vulnerable elasmobranchs to fisheries. Most of these species have a very low fecundity producing a single offspring. Lately there were only three

species known to occur in Brazilian waters (*Manta birostris*, *Mobula hypostoma* and *M. rochebrunei*). As sampling carried out with the fishing fleets increased and with examining of scientific collection specimens, three additional species were confirmed in this region (*Mobula japanica*, *M. tarapacana* and *M. thurstoni*), totalizing six species. The Mobulidae world distribution pattern reveals regional faunas characterized by the presence of large widely distributed oceanic-coastal species (*Manta birostris*, *Mobula japanica*, *M. tarapacana* and *M. thurstoni*) plus an accessory small coastal restricted range species, such as *M. munkiana* (eastern Central Pacific), *M. kuhlii* (western Indian Ocean), *M. eregoodootenkee* (Central Indo-Pacific), *M. rochebrunei* (eastern Central and western South Atlantic) and *M. hypostoma* (western Atlantic). The Brazilian coast is the only region in the world presenting two of these accessory species, which makes it the richest coast in terms of mobulid diversity (60% of all mobulids). In Brazil these elasmobranchs are captured mainly by drift nets and surface longlines. Mobulids are not a target species but most of the specimens caught are landed in fish markets. Occasionally very large individual are released from nets due to their size. The giant mantas (*Manta birostris*) are a highlight for contemplative diving around the world and may contribute to the eco-touristic industry as an important resource in some regions, such as in the Laje de Santos Marine State Park (São Paulo). Public and governmental awareness are needed to provide adequate management and protection for mantas and mobulids in Brazil.

0355 Herp Genetics, Salon A&B, Sunday July 27, 2008; STOYE GENETICS, DEVELOPMENT & MORPHOLOGY

Hybrid Zone Dynamics among Salamanders in the Genus *Plethodon*

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Hybrid zones are active areas of research into the causes of speciation and maintenance of species boundaries. One goal of hybrid zone studies is to identify differential introgression of morphological and molecular markers, which is identified by discordance in marker frequency change across a hybrid zone. This study examines patterns of marker frequency change across hybrid zones among three species of plethodontid salamanders – *Plethodon jordani*, *P. metcalfi* and *P. teyahalee* – in the Southern Appalachian Mountains of North Carolina and Tennessee. Five markers are used to assess hybrid zone shape and width: (1) extent of red cheek pigmentation (diagnostic of *P. jordani*), (2) presence of dorsal and lateral white flecks (diagnostic of *P. teyahalee*), (3) a single nucleotide polymorphism (SNP) located in the mtDNA gene ND2, (4) a SNP in the nuclear DNA gene ILF3, and (5) a SNP in the nuclear DNA gene GAPD. Concordance in frequency change is assessed for all five markers, and reasons for discordance are discussed.

0266 Poster Session I, Friday July 25, 2008

Revision of the *Photoplagios leuciscus* Günther, 1860 Species Complex

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Photoplagios leuciscus traditionally has been considered to be a widespread species, with a range extending from Japan southward to Australia, and eastward to

Madagascar. (The species was originally described from Moluccas, Indonesia.) Males are characterized by an expansive transparent triangular flank patch, which is used for luminescence signaling (i.e., photic communication). Several morphological variations have been identified in this taxon, which exhibit geographically localized distributions, and that may correspond to novel species. Based on data collected using traditional morphometric measurements and landmark based geometric morphometrics, we identify morphologically distinct and geographically disjunct lineages from within the putative range of *Photoplagios leuciscus*.

0460 AES Food & Feeding, Kafka/LeMaratine, Saturday July 26, 2008

Older and Wiser: The Effects of Maturation and Experience on the Predatory Efficiency of Whitespotted Bamboosharks

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Foraging presents a significant challenge for neonatal predators. Adequate predatory skills must initially be present or must quickly develop. Additionally, predatory abilities may change over time. Physical maturation may increase predatory abilities due to improved neuromuscular coordination, increased sensory abilities, or morphological changes. Experience may allow predators to hone existing skills and develop new ones. To tease apart which improvements in predatory abilities were due to increased maturation and which were due to increased experience, three sets of comparisons were made on the predatory efficiencies of hatchling whitespotted bamboosharks: comparisons of sharks before and after 20 days of foraging experience to determine whether predatory efficiency does improve, comparisons of naïve sharks of different ages to determine whether predatory efficiency improves with increases in maturation, and comparisons of naïve and experienced sharks of the same age to determine whether predatory efficiency improves with increases in experience. Sharks of different ages (2 days old or 21 days old) were given 20 days of foraging trials with live prey (either worms only or shrimp only). Predatory efficiency, defined as duration of predatory event, was measured for sharks' initial foraging trials and final foraging trials. Individual sharks improve predatory efficiency after 20 days of foraging experience. Predatory efficiency improves with maturation alone for sharks foraging on shrimp, a highly elusive prey. Predatory efficiency improves with experience alone for sharks foraging on worms, a non-elusive prey. Maturation likely improves sharks' ability to create suction while feeding, a necessary ability when foraging on elusive prey. Experience likely improves predatory abilities through associative learning and search image formation. Both experience and maturation are necessary for sharks to exploit all possible prey.

0142 Fish Systematics II, Salon A&B, Friday July 25, 2008

Descriptions of Five New Species in the Genus *Metriaclima* (Teleostei: Cichlidae) from Lake Malawi, Africa

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Lake Malawi supports an enormous diversity of cichlid species, many of which lack formal descriptions. Five new species of rock-dwelling cichlids from the lake are described. The moderately-sloped vomer, isognathous jaws, and presence of bicuspid teeth in the outer rows of the jaws, among a suite of other morphological characters, place these species in the genus *Metriaclima*. All five species are part of the *M. aurora*-species complex, based on the absence of a black band in the dorsal fin which is congruent with the ecologically similar species *M. aurora* (Burgess). Differences in morphology, in conjunction with assortative mating, distinguish these new species from each other and previously described species of the *M. aurora*-complex.

0343 AES Age & Growth/Reproduction, Kafka/LeMaratine, Saturday July 26, 2008

Age, Growth, and Maturity of the Little Skate, *Leucoraja erinacea*, from the Western Gulf of Maine, USA

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The little skate, *Leucoraja erinacea*, is the most common skate found in near-shore waters of the Gulf of Maine. Despite their high relative abundance, there is limited data describing their biology within this region. Moreover, recent stock assessment in the northeast United States indicated that the little skate's population is declining. In order to gain insight into the life history of little skates, growth rates and sexual maturity were evaluated from 435 specimens, collected within the coastal waters of New Hampshire and Massachusetts. Ages were estimated using vertebral band counts from skates ranging in size from 9.3 to 57 cm total length (TL). The index of average percent error (IAPE) and age-bias plots indicated our aging methods were precise and nonbiased. Growth rates did not differ between male and females and the combined age-at-length data resulted in Von Bertalanffy growth parameters of $L_{\infty} = 59.5$ cm (TL) and $k = 0.16$. In order to validate the annual periodicity of band formation, oxytetracycline was injected into 20 individuals (10 male and 10 female) that were held in captivity for 12 months. Maturity ogives, based on data from shell gland mass, follicle size and circulating estradiol concentrations, suggest that 50% maturity in females occurs at age 9.5 years and 48 cm TL. Maturity ogives for males, based on clasper length, testes mass, circulating testosterone concentrations, and the proportion of mature spermatocysts in the testes, suggest 50% maturity occurs at 7.7 years and 46 cm TL.

**0239 Fish Physiology, Salon 6&7, Sunday July 27, 2008; STOYE
PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY**

**Sausages with Sharp Teeth and Strong Muscles: Jawless Morphology and
Force Production in Hagfishes**

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Hagfish can dismember and ingest large chunks of flesh from marine carcasses without jaws. The hagfish feeding apparatus (HFA) includes a cartilaginous endoskeleton, keratinous teeth, and muscles. I examined the feeding morphology in two species, *Eptatretus stoutii* and *Myxine glutinosa*, representing the two major hagfish lineages. I measured the major skeletal and dental components of the HFA, and calculated physiological cross-sectional area (PCSA) and force production in the deep protractor muscle (DPM, the major dental plate protractor) and the clavatus muscle (CM, the major retractor). *E. stoutii* had larger dental plates, basal plates, and CM PCSA. The DPM in both species can generate 3 N, while the CM, which can generate up to 16 N, averaged 7 N and 10 N in *M. glutinosa* and *E. stoutii*, respectively. For comparative purposes, mean CM force from both hagfish species were plotted with the bite forces of various gnathostomes and scaled to body mass. The fixed pulley system configuration of the HFA minimizes reduction in force transmitted from the muscles to the dental plates and makes CM force a reasonable approximation of dental plate retractile force. Despite similar diets and kinematic profiles, feeding morphology varies between hagfish species. Lacking jaws does not preclude hagfish feeding muscles from generating high forces: the CM in both species generated comparable forces to bite forces of similarly sized gnathostomes. Collectively, morphological and kinematic data on hagfish feeding indicate that neither large gape nor bite force were necessarily an advantage that drove the evolution of jaws. I propose that an important selective advantage of jaws is that geometric variation in levers and linkage systems allow dietary niche diversity and rapid jaw movements for procuring elusive prey.

0025 AES Systematics & Biogeography II, Jarry/Joyce, Sunday July 27, 2008

**A New Species of Swell Shark (Carcharhiniformes: Scyliorhinidae) from
Papua New Guinea with Comments on Clasper Groove/Tube Function in
Sharks**

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A new species of *Cephaloscyllium* is described from five adult specimens (445-660 mm TL) taken in a "nautilus trap" in 240-274 m off the east coast of mainland Papua New Guinea. These are compared to two immature specimens from Rowley Shoals off NW Australia collected in 390-700 m, referred to as *Cephaloscyllium* sp. E by Last and Stevens (1994), that may be the same as, or closely related to, our PNG specimens. Our new species is distinguishable from other congeners by a unique pattern of small white spots, larger in males than females, that shows up especially in the dark large patches on the dorsum. These dark patches form nine irregular saddle-like marks across the head, body, and fins and extend paler onto the ventral surface. A mature female (660 mm TL) had 16 large yellow eggs (8-21 mm diameter). Claspers of the two adult male paratypes have their grooves fused into a closed tube for half

their length. The adaptive function of this fusion into a closed tube on the proximal part of the claspers is discussed. In this and other sharks.

**0165 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008;
STOYE GENERAL ICHTHYOLOGY**

Movement Patterns and Foraging Ecology of the Manta Ray (*Manta birostris*)

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Manta rays (*Manta birostris*) were acoustically tracked in order to determine their daily movement patterns and foraging ecology in Hawaii. A combination of active and passive tracking was used to provide information on both the fine scale, short term and the course scale, long term movement patterns of the manta rays. Manta rays are shown to have site fidelity to specific foraging areas and cleaning stations. Manta rays optimize their foraging through the use of area restricted search patterns, allowing them to remain in dense plankton patches. Preliminary studies in the Gulf of Mexico and the Maldives suggest that foraging strategies may differ between oceanic and coastal areas.

0166 Poster Session I, Friday July 25, 2008

Sixteen Years of Photo-Identification of Hawaiian Manta Rays (*Manta birostris*)

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Manta rays (*Manta birostris*) have been a tourist attraction in Kona, Hawaii for over 25 years, where over 11,000 divers per year observe manta rays feeding at night. However, little is known about their basic biology. Data has been collected from dive instructors on the presence of individual manta rays at two dive sites along the Kona coast in order to investigate their life history, population structure, and site fidelity. One hundred and thirty five individuals have been identified in Kona since 1992. Manta rays in Kona appear to have a high site fidelity to certain feeding areas, long life, and low reproduction.

0596 Poster Session II, Saturday July 26, 2008

The Influence Of Larval Growth History And Exogenous Thyroid Hormone On Life History Allocation Patterns In The Axolotl (*Ambystoma Mexicanum*)

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We tested the hypothesis that variation in growth history and exogenous T₄ affects the vector of allocation variables (i.e., growth, metamorphosis, maturation, and storage) by using a full-factorial 4 X 2 randomized complete block design with four growth treatments (constant rapid growth, constant slow growth, rapid-then-slow growth, slow-then-rapid growth) and two T₄ treatments (no T₄, 5 nM T₄). Adult axolotls were paired and resulting embryos were hatched and larvae were raised individually in plastic container in reverse-osmosis water. Hatchling larvae were fed freshly hatch brine shrimp. As larvae grew, they were fed tubificid worms. We examined growth by periodic weighings (to the nearest mg) using a top-loading balance. Metamorphosis was scored when tail fin and gill resorption were complete. Salamanders were then killed by prolonged immersion in MS-222, fixed in 10% formalin, and stored in 70% ethanol. Gonads and fat bodies were then dissected and weighed to the nearest milligram. Dissection also allowed us to determine sex in order to test the hypothesis that allocation was sex-dependent. Feeding treatments had desired growth effects. Treatment with T₄ resulted in complete metamorphosis of all treated salamanders. In the T₄ treated salamanders, metamorphosis was independent of larval growth rate. Allocation differed among treatments and was dependent on sex. Females stored significantly less than males, while having significantly larger gonads than males. Furthermore, female gonad mass was significantly influenced by feeding treatment whereas male gonad mass was not; this indicates the expensive allocation cost of reproduction in females.

0518 Fish Systematics II, Salon A&B, Friday July 25, 2008

Cypriniformes Tree of Life: Postcranial Characters in Cobitoid Fishes

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As part of the Cypriniformes Tree of Life project, we assessed postcranial characters used by previous investigators for consistency across all cypriniform lineages as well as developing new characters. Among cobitoids, postcranial characters of the vertebral column, intermusculars and pelvic fins support an arrangement of cobitoids as (Catostomidae (Gyrinocheilidae (Botiidae (Cobitidae (Nemacheilidae, Balitoridae))))). Cobitoids, excluding catostomids, share a reduction of the intercalarium and loss of the intercostal ligaments that pass obliquely between the anterior ribs. Within this group, gyrinocheilids lack the platelike expansion of the predorsal neural spines, reduction of supraneurals to 1 or 0, and at least a partially encapsulated swimbladder that are characteristic of the loaches. Cobitids (sensu stricto) possess a series of enlarged epicentral bones associated with vertebrae 4-7. Nemacheilids and balitorids share synapomorphies of the tripus and subdivided swimbladder capsule. In the enigmatic *Ellopostoma* transitional vertebrae extend far anteriorly, to V₉, and the horizontal component of the transverse process of V₂ is

expanded but visibly distinct from the encapsulated swimbladder. We assess these character states relative to balitorids and also examine the recent placement of *Vaillantella* as sister to the clade of cobitids, nemacheilids and balitorids.

0275 Reptile Ecology, Salon 6&7, Friday July 25, 2008

Temporal Use of Rock Ledge Habitat by Six-lined Racerunners (*Aspidoscelis sexlineata*) on Southeast Minnesota Bluffs

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Six-lined racerunners are associated with sandy, open habitats, including "goat prairies" on south- or southwest-facing slopes of bluffs in southeast Minnesota. A remote camera was placed beneath overhanging rock ledges on a bluff in Houston County, Minnesota, to monitor timber rattlesnakes, but it also obtained thirty-three photographs of racerunners. The camera was set to take one photograph per hour but was also sensitive to motion. In addition, recording thermometers were positioned to record substrate temperature beneath an overhanging ledge and on the exposed substrate on the slope outside the ledge. Racerunners apparently used the ledges throughout the entire season that the camera was set (from late May through early September). However, they were photographed beneath ledges only from late morning to mid-afternoon. Frequencies of racerunner photographs during two-hour blocks from 06:00 to 20:00 were significantly different from those expected under the hypothesis that they should be equally likely to be observed during any two-hour block. The hypothesis that racerunners use ledges for overnight refuge can also be rejected because there was no visual evidence of them leaving in the morning or entering in the evening. It would appear instead that racerunners used the shade beneath ledges as a temporary refuge from high temperatures during sunny afternoons, when ground surface temperatures in the sun may exceed 50° C.

0026 AES Age & Growth/Reproduction, Kafka/LeMaratine, Saturday July 26, 2008

Comparing Biological Parameters of the NE Atlantic and Mediterranean Populations of the Deep Water Lantern Shark, *Etmopterus spinax*

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Etmopterus spinax is a small sized deep water lantern shark that occurs in the Eastern Atlantic and the Mediterranean. Differences in depth distribution, catch per unit effort (CPUE), size at maturity and fecundity were compared between a population that has suffered high levels of fishing mortality during the last decades (southern Portugal in the NE Atlantic) and a population where low fishing pressure below 500 m occurs at present or has occurred in the last decades (Alboran Sea in the W Mediterranean). The research survey CPUE in the NE Atlantic is substantially lower than in the Mediterranean throughout the entire depth range. The NE Atlantic population is maturing at smaller sizes than the Mediterranean population and has a lower mean fecundity. Specifically, sizes at maturity for the NE Atlantic and the Mediterranean were respectively 25.39 and 28.31cm TL for males and 30.86 and

34.18cm TL for females, while mean fecundities for the NE Atlantic and the Mediterranean were respectively 9.94 and 11.06 oocytes per mature female. This work evidenced the possible presence of density dependant mechanisms in the NE Atlantic population of *E. spinax* that has lowered the size at maturity as a result of excessive fishing mortality. However, given that this is an aplacentary viviparous shark, where fecundity is dependant on female size, this compensatory mechanism seems to be less efficient than what would be expected.

0124 SSAR Seibert Competition, Salon 4&5, Friday July 25, 2008; SEIBERT ECOLOGY

The Impact of Plant Traits on Larval Amphibian Development

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During spring and summer 2007 we conducted a field assessment of the performance of three larval amphibian species (*Bufo americanus*, *Rana sylvatica*, and *Rana palustris*) in wetlands dominated by nine different native and nonnative plant species in upstate New York (n=4-9 cages per plant species, 61 cages total). We collected egg masses (n=4-5 per species) as they became available and added week-old tadpoles to cages (64 per cage for *Bufo*, 32 for *Rana*). We monitored tadpole survival and environmental conditions (e.g. temperature, %DO) weekly, and weighed all individuals at metamorphosis. In the fall of 2007 we harvested 3 quadrats of plant material from each cage location to assess biomass, leaf C:N and leaf phenolics. We conducted multiple regressions and used Akaike's Information Criterion to select models. Our results indicate that plant biomass tends to improve larval amphibian performance, while certain other qualities, specifically increased C:N and phenolics, are associated with declines in performance. Overall, we find that traits, rather than origin (native vs. nonnative) determine the quality of habitat plants provide for larval amphibians.

0680 Poster Session III, Sunday July 27, 2008

Transient Ontogenetic Expression of Hermaphroditic Gonad Morphology in the *Gobiosoma* Group of the Neotropical Seven Spined Gobies (Gobiosomatini, Gobiidae)

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The Neotropical seven-spined gobies (tribe Gobiosomatini) constitute a speciose, monophyletic gobiid clade exhibiting significant microhabitat specialization which may have played a major role in their rapid evolution. Functional hermaphroditism, which is common among gobiids, can promote exploitation of patchily distributed micro-niches by countering potential reductions in reproductive opportunities. However, the extent of hermaphroditism in the Gobiosomatini is unknown. Many of the speciose Gobiosomatini clades are found within the '*Gobiosoma*' group (*sensu* Ruber et al. 2003). One species within this group, *Elacatinus (Tigrigobius) multifasciatus* is a known hermaphrodite and two others are functionally gonochoric, but exhibit transient hermaphroditic ovarian structure among immatures. In this study, ovarian

morphology among immature and adult *Gobiosoma* group species was examined to see if hermaphroditic gonadal features are present. No evidence of new cases of functional hermaphroditism was found among eight species within the *Gobiosoma* group, but six species exhibited transient expression of hermaphroditic gonadal features associated with the immature ovary. Among 12 species from nine non-*Gobiosomatini* genera which have no record of hermaphroditism, none exhibited similar transient hermaphroditic ovarian features that might otherwise be the norm among gobiid taxa. These findings suggest that hermaphroditism may have been a shared feature early in the evolution of the *Gobiosoma* group within the *Gobiosomatini* and therefore may have played a contributory role in rapid speciation events.

0143 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008

Barcoding Fishes of the Gulf of Maine

Bruce Collette

National Marine Fisheries Service, Washington, DC, United States

As part of the Fish Barcode of Life program (FISHBOL), tissue samples of up to 5 individuals per species were collected, mostly from fishes caught during fishery surveys by the Northeast Fisheries Science Center (NEFSC). Most of the voucher specimens have been deposited at the National Museum of Natural History (USNM). This project will be of direct benefit to NEFSC and NMFS once we have built a COI database of most of the fish species occurring in the region. 1) Barcoding works for all stages in the life cycle so barcoding will assist in identification of larval fishes. This is particularly important because most of the NMFS leaders in "larval fish taxonomy" have retired leaving us with identification problems. 2) Barcoding usually differentiates between closely related species that are difficult to distinguish such as the hakes (*Urophycis*) or silver hakes (*Merluccius*). This is particularly useful for large specimens that are difficult to bring back for identification. 3) Barcoding can positively identify fishery products such as fish fillets. 4) Barcoding can legally verify identifications of fishes caught as by-catch and species under regulation. 5) Barcoding is useful in identifying stomach contents. So far, tissues have been collected and analyzed from 508 specimens representing 162 species, 144 genera, and 90 families. This includes 101 species from the Gulf of Maine out of a fauna of 252 species plus many species from nearby in the western North Atlantic.

0724 Poster Session III, Sunday July 27, 2008

The structure of lizard assemblages in cerrado *sensu stricto*, central Brazil, under different burn regimes

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Fire is a natural disturbance agent in tropical savannas, modifying the structure of animal and plant communities and transforming the landscape. We investigated the effects of fire on the structure of lizard assemblages in the Cerrado of central Brazil, using pit-fall traps. We determined the effects of burn regime upon lizard richness, abundance and evenness and the association between lizard abundance and habitat characteristics induced by fire. We sampled five plots of cerrado *sensu stricto* under

different burn regimes: quadrennial fires, biennial fires at early, modal, and late dry-season, and control, without fire. Lizards were surveyed during five days by month, from December 2005 to November 2006, totaling 600 trap*days by plot. Lizard abundance and evenness were lower under extreme fire regimes, in agreement with the intermediate disturbance hypothesis, but richness was smaller under intermediate regimes. Fourteen lizard species were recorded, six of which occurred under a single fire regime (*Enyalius* aff. *bilineatus*, *Tropidurus torquatus*, *Polychrus acutirostris*, *Mabuya guaporicola*, *Bachia bresslaui*, and *Tupinambis duseni*). Two generalist species (*Tr. itambere* and *Ameiva ameiva*) did not occur under extreme regimes. *Tropidurus itambere* and *Micrablepharus atticolus* dominated under more severe regimes and *Ma. frenata* and *Ma. nigropunctata* prevailed in the absence of the fire. Total lizard abundance did not vary throughout the year, but evenness was higher in the wet season. The effects of fire were significantly related to changes in habitat structure, but had little relation with climate variability throughout the year. Habitat characteristics in plots under different fire regimes and the presence of exclusive lizard species suggest that, if natural burns lead to a heterogeneous landscape, they can drive lizard richness in a regional context. Anthropogenic burns or the complete absence of fire have the opposite effect. This pattern may be shared with other animal taxa and anthropogenic fires, with high-frequency and low periodicity, as well as the complete suppression of burns, must be avoided. The maintenance of these artificial regimes can result in great losses of local and regional diversity.

0159 Fish Ecology II, Salon A&B, Monday July 28, 2008

Unmasking Florida's Hogfish: Habitat, Behavior and Life History of the Hogfish (*Lachnolaimus maximus*)

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Visual transect surveys were performed and hogfish (*Lachnolaimus maximus*) were harvested over a range of depths and habitat types within the central eastern Gulf of Mexico. Hogfish were recorded as present during 73% of all performed dives, and were most common over rugose natural hard bottom habitat. As depth and distance from shore increased, hogfish density decreased; however, mean hogfish size and age showed a positive relationship with depth. A dramatic difference emerged between shallow (<30 m) and deep (>30 m) water collections, with fish transitioning into males at a much smaller size and younger age within shallow water. Furthermore, fish older than 8 years and larger than 559 mm FL were not recorded from shallow water sites, while deep water collections yielded fish as old as 19 and as large as 765 mm FL. Observed sex ratio had a mean value of 1:10 M: F, and showed no change with season or site depth, suggesting that hogfish maintain harem structure throughout the year. Gonad histology and visual observations of courtship behavior support previous accounts that hogfish spawn in the winter and spring, with highest reproductive activity recorded during March and April. Evidence is presented for a more protracted spawning period at greater depths. Growth parameters as well as survival and mortality estimates are similar to those estimated previously for hogfish within the eastern Gulf of Mexico.

0202 AES Reproduction, Kafka/LeMaratine, Saturday July 26, 2008

Reproductive Biology and Gonadal Cycle of the Lesser Guitarfish, *Zapteryx brevirostris*, from the Coastal Southwest Atlantic

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The Lesser guitarfish *Zapteryx brevirostris* (Chondrichthyes: Rhinobatoidea) is a common lecithotrophic viviparous batoid from coastal Southwest Atlantic waters. In order to study the reproductive ecology a total of 656 (334 males and 656 females) individuals of *Z. brevirostris* were captured by bottom trawl in the Southwest Atlantic coastal ecosystem between 34° and 42°S. The size of the smallest mature male was 462 mm and the largest immature female was 572 mm. Male size at maturity was estimated in 502 mm total length (77% of the maximum TL). The range between smallest mature and largest immature female was 460-600 mm and size at maturity was estimated in 505 mm (65% of the maximum TL). An opposite trend was observed between spermatogenesis and gonadosomatic index (GSI) in males. The smallest GSI (Jul-Aug) was related to mature spermatocysts and deferent ducts filled with sperm, while the highest GSI (Feb) was associated with immature spermatocysts and empty deferent ducts. Female reproductive cycle is most likely to be triennial. This conclusion was based on the monthly variation of the GSI and largest ovarian follicles diameter. Ovulation occurs in Oct-Nov and embryos born with 150 mm TL after a gestation period of approximately 10 months. This reproductive information is important for fisheries assessments in order to determine the resilience of each species to fishing pressure.

0685 AES Devil Ray Symposium, Jarry/Joyce, Friday July 25, 2008

***Manta* Systematics and Nomenclature**

Leonard J. V. Compagno¹, Andrea D. Marshall², Tom Kashiwagi², Mike B. Bennett²

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The devilrays (Family Mobulidae, Suborder Myliobatoidei, Order Rajiformes), are currently divided into two distinctive confamilial genera, *Mobula* Rafinesque, 1810 and *Manta* Bancroft, 1828 which rarely have been split into two families. *Manta*, the giant devil rays or mantas (blanket in Spanish) includes one of the largest living cartilaginous fishes reaching a width of 6-7 m. Authors of the late 20th Century and early 21st Century generally consider *Manta* to be monotypic and to include a single species, *M. birostris* (Walbaum, 1792). *Manta* has one of the more extensive generic and species synonymies of any living genus of cartilaginous fish. The genus *Manta* has 10 generic and 25 species synonyms, mostly without type specimens. Recent research on *Manta* off Mozambique, Mexico and Indonesia, conducted by A. Marshall and

involving photographing individuals and groups of animals, has revealed two obvious species of *Manta* that are separable by morphology, size and behaviour. Genetic analyses by T. Kashiwagi provide support for the presence of more than one species of *Manta*. We discuss the systematics and nomenclature of *Manta* including problems with the identity of the original *M. birostris* from 'Carolina', United States of America, and its possible synonyms, the status of regional species of *Manta* with notes on Whitley's 1936 attempt to split *Manta* into three poorly characterized genera and 10 poorly defined geographic species (including three new species), and the applicability of nominal species of *Manta* to the two species from Mozambique. We suggest that a neotype should be designated for *M. birostris* based on an extant specimen cited by Bigelow & Schroeder's 1953 monograph on Western North Atlantic batoids.

0749 Sustainable Harvest Symposium, Drummond, Monday July 28, 2008

How Harvesting Turtles Impacts the Currency of Life-history Evolution

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For 42 of the past 53 years, the life histories of three species of turtles (*Chrysemys picta*, *Emydoidea blandingii*, and *Chelydra serpentina*) were studied on the University of Michigan's E. S. George Reserve in southeastern Michigan. Maximum longevities recorded to date are 75 yr, 60 yr, and 50 yr for Blanding's, Painted, and Snapping turtles, respectively. We examined: 1) the relationship of juvenile growth rates with size and age at maturity, 2) early adult growth on clutch size and frequency in Painted turtles, and 3) indeterminate growth as a mechanism for increasing the proportion of late in life to early births of individuals. In addition, we compared age or age group specific body sizes, reproductive traits and survival for all three species to test the contrasting predictions of the *Relative Reproductive Rate Hypothesis* (that predicts traits that will increase the reproductive output or survival of older compared to younger individuals) and the *Senescence Hypothesis* (that predicts a reduction in reproductive output or survival in older versus younger individuals). Indeterminate growth occurred in all three species, but juvenile growth rates and ages at maturity are a more important determinant of variation in adult body size in the populations. Older females increased parental investment and reproductive frequency, rather than clutch size. Because the value of adult turtles of all three species (in terms of population dynamics) increased with age, sustained increases in adult mortality due to commercial harvests of adults will have inevitable and serious impact on populations.

0085 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008; STOYE GENETICS, DEVELOPMENT & MORPHOLOGY

The Interopercular-preopercular Articulation: A Novel Feature Suggesting a Close Relationship between *Psilorhynchus* and Labeonin Cyprinids (Ostariophysi: Cypriniformes)

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The bones of the opercular series (interopercle, preopercle, opercle and subopercle) vary little in terms of their general appearance and position among members of the

order Cypriniformes. Except for a few characters relating to the shape of particular bones (e.g. the ventral edge of the opercle in cobitid fishes), the opercular series of cypriniform fishes appears to have contributed little to our understanding of their phylogenetic relationships. During recent investigation of the osteology of cypriniform fishes in general, and *Psilorhynchus* in particular, a novel and previously undocumented feature of the opercular series was discovered: an articulation between the anteriormost tip of the interopercle and preopercle. This articulation is achieved through a single, short, nodule-like process on the medial face of the preopercle and the lateral face of the interopercle. The surface of each nodule is covered in a thin meniscus-like coating, which may serve to cushion the articulatory surfaces. Further investigation revealed that an identical articulation is also present between the interopercle and preopercle in all members of the Labeonini (a subgroup of the cyprinid subfamily Cyprininae). This derived character may suggest a close relationship between *Psilorhynchus* and labeonin cyprinids.

0028 AES Physiology/Conservation, Kafka/LeMaratine, Sunday July 27, 2008

Supplemental Feeding for Tourism Radically Alters Movement Patterns and Spatial Distribution of the Southern Stingray, *Dasyatis americana*

Mark Corcoran², Brad Wetherbee¹, Mahmood Shivji², Matt Potenski², Demian Chapman², Guy Harvey²

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Supplemental feeding of southern stingrays, *Dasyatis americana*, has occurred at Stingray City Sandbar (SCS) at Grand Cayman as a tourist attraction since 1986. We investigated the influence of supplemental feeding on the movement patterns of stingrays by actively tracking both fed and non-fed stingrays using acoustic telemetry. Seven wild and seven provisioned stingrays were tracked manually for between 5-72 h, and site fidelity of five mature females at SCS was investigated over the course of one year using automated acoustic receivers anchored to the seafloor. Female stingrays at SCS utilized significantly smaller 24 h activity spaces (0.13 ± 0.08 km²) than wild female stingrays (0.88 ± 0.17 km²). Fed stingrays were highly active over a small area during daytime at the feeding site, but had limited nocturnal activity, whereas wild stingrays were more active during the night with limited activity during the day. Core areas of activity overlapped little among wild stingrays (3%), whereas core activity areas of provisioned stingrays at SCS overlapped much more (72%). Provisioned female stingrays consistently frequented SCS during periods of supplemental feeding and exhibited long term (up to six years) site fidelity to this site. Supplemental feeding has altered diel activity patterns and spatial distribution of stingrays at SCS and has enabled the local density of *D. americana* to increase to atypical levels. Our study suggests that food availability directly influences size and location of core areas of activity as well as population density of southern stingrays. The dramatic shifts in behavior and the altered population structure of stingrays also suggest that the aggregation of stingrays at SCS may alter predator-prey relationships and nutrient cycling, and possibly mating systems within the entire community at this location over long time periods. Supplemental feeding of wild marine animals may potentially alter movement patterns of individuals being fed, modify population structure and may ultimately affect the entire marine ecosystem. Managers charged with regulating existing sites where marine animals are fed by humans and policy makers responsible for

management of similar sites established in the future should recognize potential far-reaching impacts of such activities on the local marine environment and take appropriate measures to monitor and if necessary enact mitigation measures.

0758 Fish Conservation, Drummond, Sunday July 27, 2008; STOYE CONSERVATION

Galaxoid Fishes, Remnants of Pristine Patagonian Lakes, and the Ecological Impacts of Invasive Trout

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Galaxoid fishes are the most speciose fish taxon in the sparse freshwater fish fauna of the cold-temperate southern hemisphere and are amongst the most threatened fishes known. Trout, native to the northern hemisphere, have become naturalized in all temperate countries of the south, where they tend to replace galaxoid fishes. These invaders are thought to be responsible for galaxoid declines based on evidence from stream habitats, where trout abundance is often negatively correlated with galaxoid distributions. The impacts of trout in lake habitats, however, are virtually unexplored, and yet lakes have been postulated to act as possible refugia for native galaxoid fishes. We therefore investigate whether lakes provide effective refugia for galaxoids, how trout influence galaxoids in these ecosystems, and whether uninvaded lakes still exist in Chilean Patagonia. Pilot surveys in the Aysén region revealed several uninvaded isolated lakes and ponds, and a strong decrease in galaxoid abundance as the abundance of trout increased in invaded lakes. The most prevalent galaxoid species (*Galaxias platei*) show morphological variation which correlates with the trout-invasion gradient, suggesting strong natural selection and local adaptation. We also examine hypotheses about behaviour and trophic position of *G. platei*, and explore cascading effects in lower trophic levels of lake ecosystems (*i.e.*, zooplankton composition and size). This research will inform how native species adapt to invasive species (if at all), and the ecosystem-level consequences of such interactions. Furthermore, by identifying causal mechanisms driving galaxoid species decline, we hope to initiate conservation efforts for the protection of Patagonian aquatic diversity.

0149 Poster Session II, Saturday July 26, 2008

Feeding Ecology of an Introduced Generalist Frugivorous Fish: The Fate of Pacu in the Sepik River, Papua New Guinea

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Feeding ecology of the Pacu (*Piaractus brachypomus*), a generalist frugivorous Neotropical fish introduced into the Sepik River, Papua New Guinea is analyzed based on specimens collected over a decade after the introduction. We describe the diet of juvenile and sub-adult Pacu from a populated floodplain lake of the East Sepik River and compare it to that of a natural population from the Orinoco River Basin (South America). As in natural populations, introduced Pacu presented

ontogenetic variability in its diet. Individuals between 100 and 200 mm SL preferentially feed on fruits and seeds, fish remains, and vegetable material (other than fruits and seeds). Individuals between 200 and 300 mm SL feed on similar amounts of aquatic plants and fish remains. Pacu over 300 mm SL feed mostly on fish remains, and, to a lesser extent, on aquatic plants. Interestingly, the fish remains found in the stomachs were scales of variable shape and size, teeth, bone, and fin-ray fragments. Remains of other fish guts were found in the stomachs of two large individuals. The nature of these fish remains suggests that the larger specimens of Pacu are relying heavily on carrion. Pacu from the Sepik showed a different diet than that of individuals from the natural population. Although preliminary, this study shows how a species that has large preference for fruits and seeds, and that possesses morphological adaptations to feed on fruits and seeds, can drastically switch its diet under conditions of limited food availability. The results of this study could be used to make predictions on the future of natural Pacu populations after deforestation. Further studies should focus on the feeding ecology of adult Pacu in the Sepik, on populations upstream in the Sepik where there is still riparian forest, and on the potential impact of introduced Pacu to native species.

0094 AES Student Papers I, Kafka/LeMaratine, Thursday July 24, 2008; GRUBER

Elasmobranch Commercial Landings in Portugal from 1986 to 2006, with Virtual Population Analysis and a Method for Evaluating "Supply and Demand"

Joao Correia

Flying Sharks, Lisboa, Portugal

Portuguese commercial elasmobranch landings were analyzed for the period 1986 - 2006 and totaled 108.671 ton. An average of 5.175 ton were landed yearly, representing 8 orders, 14 families and 44 species. Annual landings for the fishery generally decreased over time, with a corresponding increase in price per kilogram. The most landed group, Skates (*Raja* sp.), accounted for 33% of the landings, or 35.614 ton. They were followed by Catsharks (*Scyliorhinus* sp.), Portuguese dogfish (*Centroscymnus coelolepis*), Leafscale gulper shark (*Centrophorus squamosus*) and Gulper shark (*Centrophorus granulosus*) (accounting for 12%, 12%, 10%, and 9% of the landings, respectively). In the absence of CPUE data, the comparative trends of landings and price were employed as an indicator of the "status" of specific elasmobranch species. *Raja* sp., *Centrophorus granulosus*, Smoothhounds (*Mustelus* sp.), Torpedo rays (*Torpedo* sp.), Kitefin shark (*Dalatias licha*) and Angel sharks (*Squatina* sp.) displayed indications of possible overexploitation, and merit the focus of future research. The pattern shown by fishing effort over time (i.e. number of fishing vessels over time) displayed a marked decrease, although this was substantially lesser than the decrease shown by landings of the species mentioned earlier. It is unlikely, therefore, that such decrease in landings is justified solely by a decrease in number of fishing vessels. Similarly, the increase in price shown by all species was largely superior to the increase in inflation, which would suggest that the increase in inflation alone would not account for the increase in price. All the results and data seem to corroborate the notion that some species are, in fact, under over-exploitation and in need of immediate management. These findings were all substantiated by virtual population analysis, which yielded higher fishing mortalities to those species where previous methods suggested overfishing.

0665 AES Systematics & Biogeography I, Jarry/Joyce, Saturday July 26, 2008

Molecular Phylogenetics and Biogeography of Wobbegong Sharks (Orectolobiformes: Orectolobidae)

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Wobbegong sharks (Orectolobiformes: Orectolobidae) are dorso-ventrally flattened, demersal sharks that are endemic to the western Indian and eastern Pacific Oceans. They are medium to large in size and are harvested as a food source at several locations throughout their distribution including Australia, China, Japan and Malaysia. In Australia, where they are the most speciose, they are commercially targeted in New South Wales and Western Australia and there is evidence to suggest that populations are declining. This, together with considerable taxonomic uncertainty, has stimulated conservation concern for these sharks. Irrespective of this, there are very few management strategies in place for wobbegongs and available biological information is limited. Morphometric and meristic investigations aimed at answering questions of taxonomy constitute a large proportion of wobbegong research effort. Despite such investment, there has been little focus on the study of species interrelationships or Orectolobid evolution. Furthermore, no prior investigations have adopted a molecular approach to studying these sharks. One component of our work, a molecular phylogenetic analysis of the family Orectolobidae functions to fill this void. Samples of all Orectolobid species (and some undescribed taxa) were collected from Australia and the Indo-Pacific. We obtained genetic information from both mitochondrial and nuclear DNA markers and used the data to reconstruct the evolutionary relationships among wobbegong species. Here, we will demonstrate how our molecular data is inconsistent with the current taxonomic arrangement of the family and go on to describe how these results can contribute to resolving taxonomic uncertainties. We will also propose a biogeographic scenario for the wobbegong sharks that begins with a tropical origin, subsequent colonisation of Australian waters followed by re-colonisation of the tropics.

0116 AES Management, Jarry/Joyce, Sunday July 27, 2008

Productivity and Susceptibility Analysis of Coastal Sharks in U.S. Atlantic and Gulf of Mexico Waters

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Productivity and Susceptibility Analysis, or PSA, is a risk assessment approach useful for evaluating the vulnerability of stocks of different species to fisheries. Depending on data availability, PSA can range from simple qualitative assessments to more detailed quantitative evaluations. We applied a quantitative approach to evaluate the biological productivity and susceptibility to different gears of large and small coastal sharks off the U.S. East Coast and Gulf of Mexico. For the productivity component, we used published biological information to develop Leslie matrices, and incorporated uncertainty in age at maturity, lifespan, and annual age-specific fecundity and survival rates through Monte Carlo simulation. The susceptibility of each species or population to different gear types was evaluated as the product of four sub-components or probabilities: availability, encounterability, selectivity, and

post-capture mortality. Availability of the population to the fishery of interest was calculated as the percentage overlap of the range area of the fishery with the range area of the population; encounterability of the population by the gear in question was calculated as the degree of overlap between the population and gear depth ranges; selectivity of the gear was estimated using the mean size at capture and known selectivity curve or the selectivity of a similar species in a similar gear; and post-capture mortality was derived from multiple scientific observer programs that collect information on the status and/or disposition of the shark catch. We plotted productivity and susceptibility paired values to facilitate interpretation, and calculated a risk index based on the Euclidean distance to rank each population or species and help identify those that should receive preferential research and management efforts.

0303 Poster Session I, Friday July 25, 2008

Oceanic Conditions, Chlorophyll-*a* and Zooplankton; Exploring the Reasons for Seasonal Migrations of *Manta birostris* in Southern Queensland Waters.

Lydie Couturier, Kathy Townsend, Scarla Weeks, Mike Bennett

The University of Queensland, Brisbane, Queensland, Australia

Manta rays occur in coastal waters around North Stradbroke Island in southern Queensland in the Austral spring/summer, arriving in October and leaving in March. It is hypothesised that the appearance of *Manta birostris* at this site coincides with rising water temperatures and increases in primary production in the coastal waters, leading to zooplankton blooms that provide a rich source of food for these rays. The departure of manta rays is hypothesised to be due to a significant decline in either the quality or quantity of available zooplankton, and is likely to be correlated with measurable oceanic conditions. We used satellite imaging to map sea surface temperatures and concentrations of chlorophyll-*a* along the Queensland coast and, in particular, around the study sites at North Stradbroke Island throughout the year. Plankton tows were conducted at specific sites where manta rays are known to aggregate seasonally. These tows occurred at the same locations in the months prior to the arrival of manta rays, during their presence and after they had left. Plankton species were identified, counted and the total sample was analysed for lipid content, ash fraction and energetic content on a monthly basis. Information on the presence or absence of manta rays at the study sites was collected to explore possible links with measurable biotic and abiotic environmental factors.

0502 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

How Many Species of Goliath Grouper are There?

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The goliath grouper, *Epinephelus itajara* (Epinephelidae), is an exceptionally large marine fish that inhabits sub-tropical and tropical waters of the Americas and western Africa. Due to a lack of readily observable morphological variation in specimens across its range, goliath grouper have been regarded as a single species, thus challenging paradigms of allopatric speciation. We tested the hypothesis that

Pacific and West Atlantic populations constitute a single species by analyzing nuclear and mitochondrial DNA sequence data. We found numerous fixed genetic differences for mitochondrial loci between Pacific and West Atlantic goliath grouper ($d \approx 3.5\%$ at 16S and $d \approx 6\%$ at cytochrome *b*; $\text{F}_{st} = 0.98$ [$p < 0.001$] for 16S and $\text{F}_{st} = 0.975$ [$p < 0.001$] for cyt *b*.), and the nuclear S7 intron had three fixed nucleotide differences between Pacific and West Atlantic populations. Within the West Atlantic, we found virtually no genetic differences ($d < 0.01$ at 16S and $d < 0.02$ at cytochrome *b*), but statistically significant population structure ($\text{F}_{st} = 0.03$ [$p = 0.07\text{ns}$] at 16S; $\text{F}_{st} = 0.139$ [$p < 0.001$] at cytochrome *b*). These data indicate that: (i) goliath grouper in the West Atlantic are likely subdivided into discrete Caribbean and Brazilian populations, (ii) goliath grouper populations in the Pacific and western Atlantic represent at least two distinct species (we resurrect the species *Epinephelus quinquefasciatus* Bocourt 1868 for Pacific goliath grouper), and (iii) morphological and molecular evolutionary rates may not run in parallel and thus may obscure conventional interpretations of these data.

0063 Fish Phylogeography, Kafka/LeMaratine, Monday July 28, 2008

No Evidence for Ecological Isolation in Relation to Dissolved Oxygen Regime in an African Cichlid Fish: A Possible Role of Phenotypic Plasticity?

Erika Crispo, Lauren Chapman

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Gene flow among environments may be reduced via natural selection if well-adapted residents are favoured over mal-adapted dispersers and dispersing alleles, a process termed ecological isolation. However, phenotypic plasticity in ecologically important traits may permit increased gene flow. Here we test for ecological isolation in a species for which high levels of phenotypic plasticity have been observed in ecologically important traits. *Pseudocrenilabrus multicolor* is an African cichlid fish that is found in a wide range of environments, including high-oxygen lakes and rivers, and low-oxygen swamps. Divergent gill morphology is observed between dissolved oxygen regimes, and previous studies have shown that plasticity in gill morphology is high. We use microsatellite data to test for the effects of dissolved oxygen on population structure while controlling for the effects of geographical variation. Specifically, we compare genetic variation within versus among geographical locations and within versus among dissolved oxygen regimes, and test for isolation-by-distance along the waterway. We document that populations are highly structured according to geographical location and isolation-by-distance, but find no evidence that they are structured according to dissolved oxygen regime. We speculate that high gene flow may be permitted between selective regimes due to phenotypic plasticity.

0602 Poster Session III, Sunday July 27, 2008

An Assessment of Presence of Chytrid Fungal Infection in Tiger Salamanders in North Dakota

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No formal analysis has focused on the presence of chytrid fungus in salamanders in North Dakota. In ongoing attempts to determine amphibian population abundances and xenobiotic influence on amphibians, we analyzed tail tissue and skin swabs (n = 80) for *B. dendrobatidis* from eight tiger salamander (*Ambystoma mavortium*) populations from North Dakota. Tail clips were preserved in 70% ethanol and stored in a -80°C freezer. Populations represent areas in northwest, north-central, southwest and the turtle mountain regions of North Dakota where the Amphibian Growth Project has ongoing life history analyses. At present, at least one individual from each sampling location has been analyzed. Ten individuals from each location will be assessed. Initial results have shown no indication of chytrid presence in analyzed populations.

0095 AES Devil Ray Symposium, Jarry/Joyce, Thursday July 24, 2008

Movement Patterns and Habitat Preferences of Ten *Mobula japonica* Tagged in the Gulf of California, Baja California Sur, Mexico

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Mobulid rays are the subject of an intensive and expanding artisanal fishery in the Gulf of California. Anecdotal reports suggest that populations in the Gulf of California have declined dramatically over the last 20 years. *Mobula japonica* is a pan-tropical species that appears in the Gulf of California seasonally and is listed as near threatened in the 2007 IUCN Red List of Threatened Species. Our research is focused in this region and on this species because they are relatively abundant, can be reliably sampled, and are the subject of directed and bycatch fisheries mortality in artisanal and purse-seine fisheries in the region. *M. japonica* occurrence seems to coincide with the large influx of warm water apparent each spring. However, it is unlikely that this summer increase is caused by migration, as their increase in abundance is simultaneous both in tropical and warm temperate waters. It is more likely that mobulid rays disperse offshore or move to deep waters during the winter in tropical and warm temperate areas but seasonally aggregate in certain locations of high prey density, such as the waters offshore of the Baja California Peninsula, making them highly vulnerable to intensive fisheries in the area. Ten *M. japonica* were tagged with Pop-Up Archival tags near La Paz in the Gulf of California during 2004 – 2006. Preliminary results indicate that *M. japonica* move out of the Gulf and into the Pacific during late summer/early fall. Resolving these seasonal movement patterns and aggregating areas are key to the conservation of this species.

0065 Herp Systematics, Drummond, Friday July 25, 2008

On The SSAR Names List

Brian Crother

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There have been three scientific and standard English names lists published by the SSAR that were additionally endorsed by the HL and ASIH. Criticism and disagreement have been expected with publication of these lists and I have not been disappointed. The purpose of this talk is to try clarify several things about the list, such the charge of the committee, how the list is put together, and how the list is reviewed. Concepts of consensus and authority will also be examined.

0137 Poster Session I, Friday July 25, 2008

Preliminary Study on the Age and Growth of the Spinetail Mobula, *Mobula japanica*, (Müller and Henle, 1941), with Comments on its Vertebral Column Structure

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This study provides the first information on the age and growth of any species of the *Mobula* genus, and contributes to the knowledge of the life history of *Mobula japanica*. We analyzed 55 longitudinal vertebral sections from organism caught in southern Gulf of California. Disc width (organism's size, DW) ranged between 1095 mm to 2400 mm. Using dissection and radiographic analysis of the vertebral column, we found that vertebrae only appeared at the posterior region, being the most adequate for age determinations the vertebrae below the dorsal fin. We found a significant linear relationship between disc width and vertebral size (radius), suggesting a proportional growth. In order to enhance the growth bands in the vertebrae, a modification of the Violet Crystal staining technique was used. The average percent error (APE) and the percent of agreement (PA) between readers were high. The oldest observed age was 14 bands (female with 2300 mm DW), while the youngest was 1 band (female with 1210 mm and a male of 1390 DW size). The preliminary von Bertalanffy growth equation estimated was $DW_t = 2338.07 (1 - e^{-0.2771 (t - 1.676)})$.

0681 Poster Session II, Saturday July 26, 2008

Field Evidence of Unpalatability of Northern Red Salamanders, *Pseudotriton ruber*

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Two separate incidental observations provide evidence that northern red salamanders, *Pseudotriton ruber*, are unpalatable to some predators. In similar instances the salamanders were found lying on a rock beside a creek in Rockcastle Co., KY and had been severely injured. They apparently had been placed on the rock

by predators that were unable to eat them. The first *P. ruber*, found on April 29, 1990, had bite marks over much of the body and part of the right leg had been ripped off with the humerus remaining. Obvious severe injuries were present on the upper left side of the trunk. There were no apparent injuries to the head or tail. The second *P. ruber* was found on September 22, 1994 within the same vicinity in the same creek as the previous animal. Only one bite mark was obvious on the right side of the head, and the cloacal vent and hindlimbs had a deeper red color. Both *P. ruber* ceased all movements and died within five hours of the initial observations. These observations support previous proposals that these salamanders are distasteful to some predators. Predators may learn to avoid such encounters and other red salamanders would benefit.

0363 Poster Session I, Friday July 25, 2008

Management of Skate Fisheries off the Northeastern United States

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A number of skate species (Family Rajidae) are widely distributed across the continental shelf off the northeastern United States, and are subject to fishing mortality in the region's extensive commercial fisheries. Historically, skates were commonly caught as bycatch in trawl and dredge fisheries targeting other, more valuable species, such as cod, flounder, monkfish, and sea scallops. Catches were largely discarded. In recent years, however, the value of skate products has increased in domestic and foreign markets, resulting in increases in landings and the emergence of localized targeted fisheries. In response, the New England Fishery Management Council (Council) drafted the Northeast Skate Complex Fishery Management Plan (FMP) that was implemented by the National Marine Fisheries Service (NMFS) in 2003. The FMP included management measures for seven skate species: winter (*Leucoraja ocellata*), barndoor (*Dipturus laevis*), thorny (*Amblyraja radiata*), smooth (*Malacoraja senta*), little (*Leucoraja erinacea*), clearnose (*Raja eglanteria*), and rosette (*Leucoraja garmani*). Among its measures, the FMP included establishment of an open access Federal permit to possess skates, biological reference points for determining stock status, prohibitions on possession of overfished skates (barndoor, thorny, and smooth skates), possession limits for the skate wing fishery, and an exemption program for vessels targeting small skates for bait markets. In 2007, NMFS declared that winter skate had become overfished, triggering the need to initiate Amendment 3 to the FMP, which would establish a stock rebuilding program for winter skate, and contribute to the rebuilding of other overfished skate stocks. The amendment is currently under development by the Council, but progress has been hampered by a lack of data on skate biology, population dynamics, and species-specific trends in fishing mortality.

**0247 General Ichthyology III, Drummond, Sunday July 27, 2008; STOYE
GENERAL ICHTHYOLOGY**

Genetic Diversity Reveals a Cryptic Evolutionary Lineage in *Sphyræna barracuda*

Toby Daly-Engel

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The management of the world's highly vagile reef predators requires an understanding of population connectivity and the identification of cryptic evolutionary lineages. Current taxonomy indicates a single species of the great barracuda, *Sphyræna barracuda*, but differences in coloration and behavior are apparent between Pacific and Caribbean forms. To evaluate the evolutionary depth of these differences, we conducted a global phylogeographic survey using a 629 base pair fragment of the mitochondrial cytochrome *b* gene. These data indicate two colonization events from the Indo-Pacific to the Atlantic via southern Africa. The samples of East Atlantic barracuda all contain a single unique haplotype nested within a network of Indo-Pacific haplotypes, indicating a recent invasion from the Indian Ocean, possibly after the most recent glacial period. The Caribbean population is distinguished by 1.1-1.9% sequence divergence, indicating an older colonization to the western Atlantic on the order of 500,000 – 900,000 years ago. Both colonization events may have been facilitated by cessation of the cold water upwelling on the Atlantic coast of southern Africa and intrusion of tropical Indian Ocean water into the Atlantic at the end of each Pleistocene glaciation. The highly divergent Western Atlantic population represents a previously unrecognized evolutionary lineage within *S. barracuda*.

0346 Fish Systematics IV, Salon A&B, Monday July 28, 2008

Placement of the Goatfishes (Perciformes: Mullidae) Within an Acanthomorph Context Using RAG1 and a Total Evidence Analysis of Mullid Interrelationships

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The goatfishes (Family Mullidae) comprise a group of tropical and temperate marine perciform fishes characterized by a pair of moveable sensory hyoid barbels used to locate food. Previous investigations of acanthomorph relationships have not been structured to explicitly place Mullidae. We selected the single-copy nuclear gene RAG1 to elucidate the position of Mullidae within Acanthomorpha under parsimony, Bayesian, and maximum likelihood frameworks. In addition, to date, no comprehensive molecular investigation of genera within the family has been performed. Phylogenetic interrelationships among all six genera of goatfishes were reconstructed using a total evidence approach with molecular data from the nuclear genes RAG1, *zic1*, *myh6*, and *ENC1* and the mitochondrial COI gene in combination with previously-published morphological characters. The results of these analyses, performed using both parsimony and Bayesian criteria, were compared with the results of a molecular data-only hypothesis.

0401 Poster Session I, Friday July 25, 2008

A Morphological Investigation into a Potential New Species of *Moxostoma* (Cypriniformes: Catostomidae) from the Kansas River Basin

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Taxonomy of the North American redhorses, particularly the genus *Moxostoma* (Cypriniformes: Catostomidae), has been widely studied and revised numerous times. The observed presence of few morphological differences among several species in the genus *Moxostoma* have previously made the diagnosis of individual species problematic. Specimens of *Moxostoma macrolepidotum* from the Kansas River basin have previously been regarded as hybrids or intergrades between *M. macrolepidotum* and *M. pisolabrum* based on the size of the upper lip, which is described as being developmentally larger than those of *M. macrolepidotum* at the same relative age, but thinner than *M. pisolabrum* and lacking any presence of a pea shaped bulb that characterizes the lips *M. pisolabrum*. Recent work using geometric morphometrics has identified that the putative hybrid specimens represent a distinct morphotype for the lip width character and are potentially a new species (*M. cf. macrolepidotum*). We further examine the morphology of *M. macrolepidotum*, *M. pisolabrum*, and *M. cf. macrolepidotum* in order to evaluate the potential elevation of *M. cf. macrolepidotum* to species level status. Specimens examined included whole alcohol preserved and specimens cleared and stained for bone and cartilage.

0388 General Ichthyology I, Drummond, Saturday July 26, 2008

A Geometric Morphometric Study of Photophore Patterns in Lanternfishes: Species Recognition, Mate Recognition, Neither, or Both? (Scopelomorpha: Myctophidae)

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Lanternfishes (family Myctophidae) comprise approximately 238 species of small mesopelagic and bathypelagic fishes that possess a highly diverse array of light organs. They are among the most abundant and speciose groups of deep sea fishes and play a critical role in the oceanic food web. The complex patterns of photophore and other light organs arranged on the head, ventrolateral body, and caudal region have previously been hypothesized to play a number of evolutionary roles, including species recognition, sexual selection, and camouflage. We use geometric morphometric procedures to quantitatively test three hypotheses as follows: (1) That the position of ventrolateral photophores plays a role in species recognition. (2) Intraspecific variation in ventrolateral photophore pattern is correlated with sex. (3) If variation in ventrolateral photophore pattern is sex-dependent, it is correlated with other sexually dimorphic characteristics. (e.g., caudal luminous organs).

0633 Herp Physiology/Bar Codes, Salon 4&5, Thursday July 24, 2008; STOYE PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY

Long-term Thermal Biology of the Gila Monster in the Sonoran Desert: What A 500,000-Hour Thermal History Tells Us about Thermal Preference and Organism Performance

Jon Davis

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Availability of thermal energy is a physical property of the environment that influences evolution of organisms since nearly all biological processes (from enzyme kinetics to digestion to reproduction) are temperature sensitive. In ectothermic animals, environmental temperatures directly influence body temperatures and thus organism performance. I used radiotelemetry and surgically implanted temperature dataloggers to examine the long-term thermal ecology of the Gila monster (*Heloderma suspectum*), a large desert lizard, in nature. I recorded hourly body temperature of 16 to 40 lizards semi-continuously from 2003-2007 resulting in a thermal profile for this species composed of nearly 500,000 body temperatures. I assessed thermal preference seasonally and during surface activity and inactivity (i.e., when in a refuge) and also conducted a series of laboratory experiments to assess the thermal sensitivity of key processes that affect foraging ability and immune function. I found that walking endurance, olfactory ability, and wound healing rate are temperature sensitive with better performance occurring at 25 and 30 °C, near the species' 29 °C preferred body temperature, and poorer performance occurring well below (20 °C) and above (35 °C) preferred body temperature. Gila monsters live at relatively cool temperatures (<30 °C) 75 % of their lives and strongly avoid body temperatures above 34 °C. Overall, the species spends 50 % of its life near (± 3 °C) preferred body temperature, and thus, performance of many physiological functions is likely optimized.

0639 Poster Session II, Saturday July 26, 2008; STORER HERPETOLOGY

Urbanization and Immunology: Injury Incidence, Wound Healing, and Hematology of Urban And Natural Gila Monsters in The Sonoran Desert

Jon Davis

Arizona State University, Tempe, AZ, United States

Understanding the effects that urbanization has on wildlife populations is a central concern facing contemporary biologists. Most studies have assessed the effects of habitat alteration or introduced competitors and predators on birds and mammals, yet other important issues and taxa have received less attention. I examined the effects that urbanization has on injuries, hemoparasites, and immunocompetence of free-ranging Gila monsters (*Heloderma suspectum*) at natural and urbanized field sites in the Sonoran Desert. I quantified the types of injuries and frequencies of occurrence and measured wound healing rate in the field to determine if differences exist between the populations. I also examined blood smears to determine hemoparasite prevalence and strength of innate immune response of lizards at both sites. Results indicate higher incidence of both injuries and hemoparasite infections in urban animals compared to natural animals despite urban animals being in better overall body condition. The results of this study reveal effects of urbanization on a long-lived lizard that have not previously been reported.

0340 Poster Session I, Friday July 25, 2008

Management of Manta Ray (*M.birostris*) Interactive Tours in the Shallow Lagoonal Waters of Ningaloo Reef, Western Australia – A Global Benchmark for Tourism Interactions

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A comprehensive 'Code of Conduct' for manta ray interactions is being implemented at Ningaloo Reef Western Australia to reduce unnecessary pressures upon manta rays and ensure the long term, year-round sustainability of eco-tourism. In the shallow lagoonal waters of Bateman Bay, interactive snorkelling tours to swim with manta rays have become so popular that they take more people per annum than those targeting the iconic whale shark. Commercial operators use light planes to locate manta rays within the <50km² bay, where they can be observed year-round targeting specific food items, mating and giving birth. Current pressure is significant and potential for further increases in pressure is high. The tourism industry is concerned with current pressures and there have been several incidents where mantas have physically rammed or breached upon swimmers. In response to this, the WA Department of Environment and Conservation with community consultation has formulated a 'Code of Conduct' for manta ray interactions. This follows on from the highly successful Western Australian Closed Season Notice for Whale Sharks (CSNWS), (a legal mechanism to control interaction activities) which has become a global benchmark. The 'code of conduct' for manta ray interactions includes conditions similar to the CSNWS such as minimum distances, time limits, and controls of total passenger and in water numbers. It also has specific clauses to protect 'cleaning stations' and mating aggregations. It is hoped that implementation of this code for manta rays will ensure a sustainable in-water viewing industry and allow manta rays to continue visiting important habitats (such as Bateman Bay in the Ningaloo Reef Marine Park) with minimal interference.

0302 Poster Session I, Friday July 25, 2008

Observation and Sighting Description of the *Manta Birostris*, in BoraBora Island (French Polynesia – South Pacific)

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Manta *Birostris* are permanent resident inside BoraBora's lagoon. In order to know more about its population, an ID program and a sighting survey have been monitored since August 2002 till June 2005. The method: each dive has been done with a digital video equipment to record mantas behaviour. Then the footages are played to identify (when it is possible) the black belly pattern of each individual. Each new manta sighted has its own file and every interesting behaviour is archived on tape. In June 2005, we did formally identified 43 females and 42 males. With this empiric method and recurrent sightings, we discovered that there was a resident colony inside the lagoon, and some mantas cruising the lagoon occasionally, mostly during the mating season. In the same time, as we could regularly sight the same individuals, we could deduce that the pregnancy time does not exceed 12 months.

Other basic biology have been monitored as the growth of a new born manta ray, the healing process (when wounded) and the question of the albinos individuals. Some interrogations have occurred as the presence and use of pheromone mostly during the mating process. Since June 2005, the Mantas have disappeared from the place they used to clean, and the survey has been interrupted. Hotels constructions nearby and tourism activities are probably one explanation. Fortunately, they came back since July 2007 and we hope that we will be able to assist again to the manta's mating dances for the next season.

0129 AES Devil Ray Symposium, Jarry/Joyce, Friday July 25, 2008

Demographics of an Island-Associated Manta Ray (*Manta birostris*) Population in Maui, Hawaii, and Implications for Management

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During 2005 - 2007, 187 individual manta rays were photo-identified from a single cleaning station site in Maui, Hawaii. A discovery curve showed no asymptotic trend, indicating the number of individuals using the site is considerably larger than the total identified. Of these individuals, 58% were observed on more than one occasion within and across years, suggesting philopatry to this area. Males accounted for 47% of the individuals in the population, of which 69% were considered sexually mature based on the claspers extending beyond the pelvic fins. The average encounter rate per dive was 5.50 manta rays per hour. They were habitually absent at first light, with encounter rates increasing throughout the day. No matches were found when compared against 133 individuals photo-identified from a well-studied population off the Big Island (www.mantapacific.org), a distance of only 60 miles. Evidence of shark predation was seen in 12% of the population, and 6% had a missing or non-functional cephalic fin, likely caused by entanglement in monofilament fishing line. During an intensive survey period from September to December 2007, a mean of 140 individuals (95% CI = 119-175) was estimated to be using the area at this time. Estimated annual apparent survival (survival minus emigration) was 0.77 (95% CI = 0.65 - 0.86). These findings are consistent with a population of manta rays moving into and out of the cleaning station vicinity, with a varying portion of the total population temporarily resident at the study site at any given time. These findings add further support to the existence of demographically independent, island-associated populations in Hawaii. The lack of protection for these populations makes them vulnerable to impacts from target and non-target fisheries, and from exploitation of manta ray aggregation sites by commercial scuba diving operations. Management on an island-area basis is recommended.

0128 Poster Session I, Friday July 25, 2008

Using Paired-Laser Photogrammetry for Measuring Manta Ray (*Manta birostris*) Sizes. Are Maui's Mantas Horizontally Challenged?

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Paired-laser photogrammetry was used to measure the disc width (DW) of 78 manta rays (*Manta birostris*) from a nearshore Maui population. The mean ratio of DW to disc length (DL) for 43 of these individuals was 2.30 (N=43, SD=0.10). The mean ratio for mature males (determined by the claspers extending beyond the pelvic fins) was not significantly different than that for immature males ($t(14)=0.59$, $p=0.56$) indicating that the DW to DL proportion remains constant throughout development. DL measurements were more reliable and more easily obtained than DW measurements using paired-laser photogrammetry. Given this, DL measurements were used and converted to the more conventional DW measurement equivalent using the ratio of 2.30. Female DW ranged from 2.42 m to 3.70 m (mean=3.22 m, N=40). The maximum female DW in this population is 25% smaller than the maximum reported for a female in Indonesia (White et al., 2006), and as much as 59% smaller than that reported in other parts of the world (Last & Stevens, 1994). Male DW ranged from 1.98 m to 3.18 m (mean=2.80 m, N=33). The maximum male DW in this population is 22% smaller than the maximum DW reported for a male in Indonesia (White et al., 2006). Males were sexually mature at a DW greater than 2.79 m, (N=20), 26% smaller than what has been reported for males in Indonesia. These results support paired-laser photogrammetry as a non-invasive and precise method for sizing manta rays in the field and suggest that manta rays in Maui mature and grow to a much smaller body size than what is observed in Indonesia and other populations worldwide.

0712 Fish Morphology & Histology I, Salon 6&7, Thursday July 24, 2008

Micro-mechanics and Material Properties of the Tessellated Skeleton of Cartilaginous Fishes

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The natural history of many sharks seems paradoxical: their long lives and swimming styles demand large numbers of cyclic loading cycles on their cartilaginous skeletons and yet cartilage cannot repair. Fatigue damage is proportional to the number of loading cycles and the strain energy in each cycle, so sharks should be subject to large amounts of irreparable fatigue damage. There are several ways that structures can avoid this type of damage: either overbuilding (the excess safety factor decreases strain energy) or having some properties, which allow strain energy to dissipate. The former may well be occurring though we do not know of any evidence that cartilaginous skeletal elements have a larger safety factor than bony ones. We do have evidence, however, that elasmobranch skeletons are inherently fatigue-resistant and that this is a function of the type of calcification of the tissue. The uncalcified hyaline-like cartilage core of each element is overlain by a tessellated bark of abutting mineralized tiles (tesserae), adjoined by a fibrous phase.

Nanoindentation tests show that the mineralized tissue behaves nearly elastically and is more than two orders of magnitude stiffer than the uncalcified layer, which is highly viscoelastic. In comparison with compact bone, which has a damping coefficient of 0.009 and spongy bone (0.0552) tessellated cartilage has a damping coefficient of 0.085. This is the same as unmineralized cartilage (0.085) but the tissue is far stiffer. A Reuss isostress model of a composite beam in bending shows that the compressive side is loaded more than the tensile side shifting the strain energy into a more difficult to damage loading regime. In this way, the tiled and calcified design of tessellated elasmobranch cartilage inherently allows for growth and fatigue-resistance in a skeleton that cannot remodel.

0413 Poster Session I, Friday July 25, 2008

Dentition of the Southern Thorny Skate, *Amblyraja doellojuradoi* (Pozzi, 1935): Qualitative Analysis and Anomalies

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Dentition analysis of cartilaginous fishes is an important tool for determining species, establishing phylogenetic relationships between extinct and living taxa, and describing ontogenetic morphological changes. This work constitutes the first description of *Amblyraja doellojuradoi*'s dentition. The jaws (n = 72) were extracted, cleaned and prepared with two different treatments. Some of them were dried and whitened with 30% diluted hydrogen peroxide; while the tooth plates of others were taken and pasted on a vegetal paper. In the Southern thorny skate the dentition was gradient monognathic heterodonty. In the upper jaw, the symphyseal teeth and approximately the two rows on both sides of them have low cusps, but their size increases in lateral teeth and reduce again in the commissural teeth. In the lower jaw, the cusps from the symphyseal teeth are larger and arched, reducing their size to the commissural teeth. *A. doellojuradoi* presented ontogenetic heterodonty, having the juvenils cusps with little development, while adults have too much developed and sharp-pointed cusps. This ontogenetic change was manifest both in males and females, although in the first one was more conspicuous. Two kind of anomalies were observed in some specimens: (1). an additional incomplete row between two complete rows, and (2) an increasing tooth base size and division of their cusp until the tooth divided completely in the same row. Gradient monognathic heterodonty as well as ontogenetic heterodonty is common in skates' dentition. Indistinct sexual heterodonty observed in *A. doellojuradoi* was also recorded in *A. radiata* and *Dipturus batis* whereas other species exhibit marked sexual heterodonty or absence of heterodonty. Regarding anomalies in tooth arrangement, this is the first record of that kind of malformation in skates' dentition.