Trophic Study of Escolar, Snake Mackerel, Lancetfish, and Oilfish in the South Atlantic Bight and Gulf of Mexico Using Stomach Content Analysis and Carbon and Nitrogen Stable Isotope Analyses

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This species has previously been documented to live solitary as burrow-dwellers, but preliminary observations reveal multiple fish occupying individual burrows. Subcutaneous tags are administered to mark individual fish and monitor movement throughout the colony over time and eventually determine if sex is directly related to location within the colony. Understanding the social structure formed at the onset of reproduction will help determine how many individuals can successfully live in a colony and the space requirements in a laboratory setting for the colony to successfully reproduce.

BIO-27 Geographic morphism and genetic structure of yellowhead jawfish, *Opistognathus aurifrons*. A.L.F.C HO and J. LIN. Department of Biology, Florida Institute of Technology, 150 W. University Blvd, Melbourne, FL 32901. Yellowhead jawfish, *Opistognathus aurifrons*, are a popular marine ornamental species. Although the fish is popular in and commercially harvested for the ornamental trade, very little is known about its abundances, recruitment, and genetic structure. Understanding the genetic structure of a population for a given species is crucial to understanding dispersal patterns, genetic connectivity, and the process of speciation. Furthermore, elucidating genetic structure can give valuable insights into the health of a population and its genetic biodiversity, especially as it pertains to stock management for harvested species. As such, the goals of this study are to characterize the cephalic melanistic structure, the morphological structure, and the genetic structure of four different “populations” (Aruba, Florida, St. Thomas, and Bimini) of *O. aurifrons*, and to determine if there is a correspondence between chromatic, morphological, and genetic variation. Previously noted geographic differences in cephalic melanistic patterning in *O. aurifrons* are supported by current findings. Using Discriminant Function Analysis, 13 parameters of observed cephalic melanistic patterning elucidated clear separation between Bimini and other “populations”. Florida, St. Thomas, and Aruba formed a slightly overlapping continuum in patterning, with St. Thomas between Florida and Aruba. Although Florida lay within the continuum, Florida specimens showed no variability with only St. Thomas specimens overlapping into Florida. Whether genetic subdivision and morphometric subdivision is co-occurring with observed differences in cephalic melanistic patterning remains to be determined.

BIO-28 Performance consequences of diet-induced variation in the sheepshead, *Archosargus probatocephalus*. B.P. MALIAO, R.J. MALIAO and R.G. TURINGAN. Department of Biological Sciences, Florida Institute of Technology, 150 West University Boulevard, Melbourne, FL 32901. Some fishes in the Indian River Lagoon (IRL), Florida settle on different habitats and likely exploit different prey resources. It has been shown that the functional characteristics of the feeding apparatus in widely distributed fish are correlated with food habits. Although it has been shown that diet influences the development of the feeding mechanism in fishes, empirical evidence showing that these diet-induced developmental changes have functional consequences is limited. This study is designed to investigate the effects of durophagous feeding habit on the development of feeding mechanism and feeding performance in the sheepshead, *Archosargus probatocephalus*. Young of the year *A. probatocephalus* from one location in the IRL were reared under two diet regimes: whole clam (hard diet) and crushed clam (soft diet) for about one year. Fish fed hard diet developed more robust jaw-bones and muscles relative to soft-diet fish. Post-rearing performance trials indicated that: (1) soft-diet fish fed on small and medium clams whereas hard-diet fish fed on large clams; (2) soft-diet fish fed relatively less on whole clam relative to hard-diet fish; and (3) soft-diet fish lost interest in whole clams after first exposure to this prey type, whereas hard-diet fish consistently fed on whole clams. It is conceivable that hard-diet fish develop more robust jaw bones and muscles because this phenotype allows them to perform well in durophagous conditions.

BIO-29 Trophic study of esocar, snake mackerel, lancetfish, and oilfish in the South Atlantic Bight and Gulf of Mexico using stomach content analysis and carbon and nitrogen stable isotope analyses. H.R. DA SILVA and D.W. KERSTETTER. Nova Southeastern University Oceanographic Center, 8000 North Ocean Drive, Dania Beach, FL 33004. Stomach content analysis and carbon and nitrogen stable isotope analysis used in combination can provide a robust analysis of the diet and ecological role of organisms not possible for either technique used alone. This combined analysis methodology was applied to four mesopelagic teleost fishes (snake mackerel *Gempylus serpens*, lancetfish *Alepisaurus* spp., oilfish *Ruvettus pretiosus*, and escolar *Lepidocybium flavobrunneum*) collected from the South Atlantic Bight and Gulf of Mexico over a period of two years. These species are diel vertical migrators and the differences in the diets of these organisms is presently unknown. However, understanding their trophic role within the pelagic ecosystem is vital for ongoing pelagic fisheries ecosystem modeling. Combined stomach content and stable isotope analyses were performed on these fishes and compared with species, length, weight, sex, location, and maturity. The results from the stomach content analyses show snake mackerel as having the most diverse diet and escolar having the least diverse diet. The carbon to nitrogen ratios by percent (C/N) for snake mackerel and small oilfish are characteristic of proteinaceous organisms while the higher percent C/N ratios for escolar and large oilfish are characteristic of more lipid-rich tissues. Stable isotope analyses
indicate large snake mackerel may occupy the highest trophic position of the studied species with the highest values for both d13C and d15N. Small oilfish have similar d13C values to the snake mackerel, but have a lower average d15N value. Large oilfish and escolar have similar d15N values as the snake mackerel, with much lower d13C values than the small oilfish and snake mackerel. These preliminary data suggest a similar carbon source for snake mackerel and small oilfish, but with large oilfish and escolar obtaining nutrients and source carbon from a different part of the ecosystem. (Project supported by NOAA Contract #8404-S-006 awarded to Nova Southeastern University).

BIO-30 Visual physiology of the smooth dogfish (Mustelus canis) with implications on behavioral ecology. M. KALINOSKI (1), R.W. BRILL (2) and A.C. HIRONS (1). (1) Nova Southeastern University, Oceanographic Center, 8000 North Ocean Drive, Dania Beach, FL 33008, (2) Cooperative Marine Education and Research Program, Virginia Institute of Marine Science, Rt. 1208 Great Road, Gloucester Point, VA 23062. In the underwater environment, the visual world of many marine organisms is composed of spatial, temporal, and spectral elements. How organisms process these elements depends on the light intensity in their habitats. The visual system of the smooth dogfish (Mustelus canis) was examined using standard corneal electrophysiological methods. Electoretinography (ERG) measures the summed retinal potentials that account for optical filtering of light photons by the ocular media. This method is well suited for determining the fundamental capabilities of the visual system. Recording retinal responses to experimentally manipulated light stimuli allows for quantification of several visual parameters, including spectral range, irradiance sensitivity, and contrast discrimination. \( M. \ canis \) has a maximal spectral response to blue light between 460-480nm, and a low temporal resolution with an ERG response of 14Hz signifying extremely good sight under scotopic (dim light) conditions. This 14Hz ERG response is very low compared to other elasmobranch species such as Carcharhinus plumbeus (54Hz) and Galeocerdo cuvier (38Hz). \( M. \ canis \) is primarily a demersal species, occurring in low light habitats along the inshore seas and estuaries of the western Atlantic Ocean. Understanding how \( M. \ canis \) utilizes its integrated array of visual and sensory structures can contribute to the continued conservation of this species. (Project supported by a grant from the South Florida Chapter of the Explorer’s Club awarded to the senior author).

BIO-31 Biomechanics of spinal deformities in captive Sandtiger sharks Carcharias taurus. D. NOAKER (1), D. HUBER (1), P. ANDERSON (2), and I. BERZINS (3). (1) Department of Biology, The University of Tampa, Tampa, FL 33606, (2) The Florida Aquarium, Tampa, FL 33602, (3) The John G. Shedd Aquarium, Chicago, IL 60605. The Sandtiger shark Carcharias taurus is a popular exhibit specimen in public aquaria. However, captive \( C. \ taurus \) are prone to developing spinal deformities that often result in euthanasia. Biomechanical analyses of sections of vertebral columns and individual vertebrae from healthy and deformed \( C. \ taurus \) were conducted to characterize the mechanical basis of these skeletal deformities. Vertebral sections were subjected to bending tests from all directions, while individual vertebrae were subjected to compression to failure tests, both using an MTS Mini-Bionix 858 material testing system. Mineral content data of individual vertebrae was determined as well. The flexural stiffness (resistance to bending) of vertebral columns from healthy animals was greater than that of deformed animals due to greater second moment of area. Second moment of area is a structural property that measures the distribution of skeletal material away from the central axis of the vertebral column. From these data it was also determined that the force required to buckle the vertebral column was greater in the healthy specimens as well. The compressive stiffness, ultimate strength, and mineral content of individual vertebrae from deformed specimens were lower than those of other healthy species for which data is available in the literature. Analysis of the compressive properties of individual vertebrae from healthy \( C. \ taurus \) is ongoing. Given that \( C. \ taurus \) is under "critically threatened" conservation status, it is critical to determine the causes of spinal deformities in captive specimens so that public aquaria can be educated on better husbandry and management techniques.

BIO-32 Structural and material properties of the jaws of the Lemon shark Negaprion brevirostris and Horn shark Heterodontus francisci. K. JAGNANDAN and D. HUBER. Department of Biology, University of Tampa, Tampa, FL 33606. The Lemon shark Negaprion brevirostris consumes soft-bodied organisms such as teleosts and small elasmobranchs using sharp teeth for tearing through prey. Conversely, the Horn shark Heterodontus francisci consumes hard prey (durophagy) such as molluscs and echinoderms, which are crushed between its powerful jaws. To determine whether jaw biomechanics reflect the ecological differences of these species, the structural properties (determined by jaw shape) and material properties (determined by cartilage composition) of their jaws were investigated. Material properties of the jaws were examined by subjecting cylindrical cores of unmineralized cartilage from the lower jaws of both species to stress-relaxation tests on an MTS Mini-Bionix 858 material testing system. Structural properties of the upper and lower jaws were examined by estimating their second moment of area from digital reconstructions of CT scans. Second moment of area, which estimates the distribution of skeletal material and approximates resistance to bending, was calculated at 10% intervals.