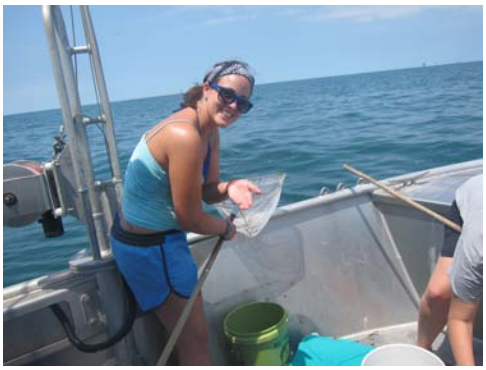
BOSTON UNIVERSITY

BOSTON UNIVERSITY MARINE PROGRAM

First Annual *Honors in Marine Science Symposium*

Showcasing undergraduate research in marine science

Friday, May 3, 2013, 12:00 - 2:30; BRB 113



12:05 A COST EFFECTIVE APPROACH TO OTOLITH ANALYSIS FOR JUVENILE CORAL REEF FISH.
Andrews, S. N.

12:20 HATCHING PLASTICITY IN A CORAL REEF FISH, *Elacatinus colini*, AND THE MORPHOLOGICAL EFFECTS OF EARLY HATCHING ON LARVAE.
Burns, C.M., **Atema, J., Majoris, J. E.**

12:35 THE CTENOPHORE *MNEMIOPSIS LEIDYI* AS A POTENTIALLY IMPORTANT MEMBER OF THE FORAGE GUILD IN THE GULF OF MAINE.
Gossner, H. M., **Kaufman, L.**

12:50 MATCHING THE SOUND TO THE WHALE: IDENTIFYING UNKNOWN CALL TYPES TO IMPROVE MARINE MAMMAL MANAGEMENT AND CONSERVATION.
Luthringer, J. E.

1:05 **BREAK**

1:15 JUVENILE FISH PREDATION EFFICIENCY INFLUENCED BY *SARGASSUM* PATCHES OFFSHORE OF DAUPHIN ISLAND, ALABAMA
McLean, E. L.

1:30 VARIATION IN THE DIET AND FATTY ACID PROFILES OF *A. AMERICANUS* AND OTHER FORAGE SPECIES IN THE GULF OF MAINE.
Papakyrikos, C. N., **Kaufman, L.**

1:45 MANGANESE CYCLING IN A TEMPERATE ESTUARY – TEMPORAL VARIATIONS AND RESPONSE TO HIGH NITROGEN INPUTS.
Rogener, M. K., **Heiss, E. M., Ireland, T., Murray, R. W., Fulweiler, R. W.**

2:00 THE EFFECT OF PHYSICAL AND BIOLOGICAL PROCESSES ON THE EROSION OF COHESIVE SEDIMENTS.
Valentine, K. M., **Fagherazzi, S., Mariotti, G.**

ABSTRACTS

Andrews, S. N., Boston University Marine Program, Honors, *sandrews@bu.edu*

A COST EFFECTIVE APPROACH TO OTOLITH ANALYSIS FOR JUVENILE CORAL REEF FISH

Elacatinus lori is sponge dwelling goby endemic to the Belizean Barrier Reef. Currently, little is known about the juvenile life history for this species. Other studies have used otoliths to explore some of the life history characteristics of reef fish. In this study, I developed cost effective techniques to age individuals and used otolith microstructure and a back-calculation model to describe life history transitions of juvenile *E. lori*. The relationships between otolith diameter, fish standard length and age had significantly positive linear relationships. For n=22 samples, the average time of hatching was after 5.795 days ± 0.427 SD (range: 5-7). The average pelagic larval duration (PDL) time was 20.578 days ± 0.519 SD (range: 19-22). Data was fitted to the Modified Fry back-calculation model (R^2=0.9998, t-test, P<.001). Results indicate these cost effective techniques can successfully age juvenile *E. lori* and fish standard length can be used as a proxy for age.

Burns, C. M., Boston University Marine Program, Honors, *cmburns@bu.edu*
Atema, J., Boston University Marine Program, Advisor, *atema@bu.edu*
Majoris, J.E., Boston University Marine Program, Advisor, *j.e.majoris@gmail.com*

HATCHING PLASTICITY IN A CORAL REEF FISH, *Elacatinus colini*, AND THE MORPHOLOGICAL EFFECTS OF EARLY HATCHING ON LARVAE

Hatching plasticity is the ability of an embryo to adjust its hatching time in response to a cue from the environment. Many species have evolved the ability to alter hatching times in response to predator cues, therefore increasing the odds of survival through the embryonic stage. Hatching plasticity has been studied throughout many taxa, but has yet to be observed in reef fishes. This experiment investigated whether or not the sponge dwelling neon goby, *Elacatinus colini*, exhibits mechanically induced early hatching and the subsequent effects of early hatching on larval morphology. Spawning pairs of *E. colini* were established in the lab, and mechanical disturbance (shaking) of the clutch was applied daily 8-hour intervals. Earliest induced and spontaneous hatching times as well as number of larvae hatched in both experiments were recorded. Larvae were also photographed under a dissection microscope at the time of hatching in order to observe and quantify morphological differences. The results show that *E. colini* hatch early when stimulated, with a modal induced hatch time of 6 days post observation at 6 AM, 16 hours earlier than the modal spontaneous hatching time of 6 days at 9PM. The earliest larvae hatched at 4 days post observation at 6AM after being shaken. Induced larvae also possess more yolk reserves than spontaneously hatched larvae, a morphological representation of less time developing within the egg. In the future, the behavior of induced larvae and survival consequences of early hatching should be investigated.

Gossner, H. M**.**, Boston University Marine Program, Honors, *hmgossner@bu.edu*
Kaufman, L., Boston University Marine Program, Advisor, *lesk@bu.edu*

THE CTENOPHORE *MNEMIOPSIS LEIDYI* AS A POTENTIALLY IMPORTANT MEMBER OF THE FORAGE GUILD IN THE GULF OF MAINE

The marine forage guild is often highly understudied and undervalued. Primarily zooplanktivores, forage species concentrate nutrients for larger, more commercially valuable fish (Purcell & Sturdevant 2001). A combination of overfishing and climate change is, however, changing forage guild composition, and may eventually lead to a low energy food chain system in which the main forage group is of a lower nutritional value, such as gelatinous zooplankton like ctenophores (Cardona et al 2012). This study uses the ctenophore *Mnemiopsis leidyi* as a model organism to look at a worst-case scenario for reduction in forage quality in the Gulf of Maine ecosystem off the coast of the northeast United States. Stable isotope analysis was used to fit *M. leidyi* into its native food chain at the current time. Interestingly, it was found that *M. leidyi* statistically fit better into the forage guild than with its fellow zooplankton. Additionally, certain larger species, such as *Squalus acanthias*, had lower $\Delta^{15}N$ than expected, indicating they may be eating ctenophores. Lipid extraction and analysis by GC-MS were used to determine the nutritional value of *M. leidyi*. It was found that *M. leidyi* contain important lipids that could make them viable nutrition sources. From this, predictions were made of ecological consequences of further shifts in the food web structure. More serious consideration needs to be made of shifts to a gelatinous-dominated food web, as jellyfish are very resilient and do well in disturbed ecosystems; there are already reports all over the world of increases in jellyfish density and its detrimental effects (Bilio & Niermann 2004) (Purcell 2005) (Link & Ford 2006).

Luthringer, J. E., Boston University Marine Program, Honors, *jel2191@bu.edu*

MATCHING THE SOUND TO THE WHALE: IDENTIFYING UNKNOWN CALL TYPES TO IMPROVE MARINE MAMMAL MANAGEMENT AND CONSERVATION

Two previously unidentified marine mammal vocalizations, dubbed Moan Pulse Train (MPT) and Other Moan Pulse Train (OMPT) were identified from Marine Autonomous Recording Units that were continuously recording in and near the Stellwagen Bank National Marine Sanctuary and up to Jeffry's Ledge in the Gulf of Maine. Both calls were described using Raven acoustic software, and were hypothesized to have been made by either humpback or minke whales. Both calls occurred in the summer through the mid- to late-fall (June through October/ November) and occurred most often during dark and twilight hours. The MPT call was heard most frequently in the intermediate depth waters on the slopes between the shallows and deep, while the OMPT occurred most frequently in the shallow waters on the bank. After conducting a detailed association analysis, as well as sifting through numerous DTAG recordings, neither call was able to be identified by species. Further research is needed to identify which species of whale is making each of the calls and the behavior behind the vocalizations. Answers to these questions will provide researchers and legislators the insight necessary to protect the vital marine mammal habitat situated in an area highly impacted by human use.

McLean, E. L., Boston University Marine Program, Honors, *emclean@bu.edu*

JUVENILE FISH PREDATION EFFICIENCY INFLUENCED BY *SARGASSUM* PATCHES OFFSHORE OF DAUPHIN ISLAND, ALABAMA

Pelagic *Sargassum* mats provide valuable habit for fishes and invertebrates in an otherwise featureless open ocean environment. An understanding of trophic dynamics within *Sargassum* faunal assemblages is critical in assessing its value as "nursery" habitat for associated juvenile fishes. We used mesocosm experiments to compare the foraging behavior and success of four fish species commonly associated with *Sargassum* as juveniles: two jack species (*Seriola rivoliana* and *S. dumerili*) and two filefish species (*Stephanolepis hispidus* and *Aluterus scriptus)*. Replicate trials (48 h) with and without *Sargassum* habitat were conducted using a single juvenile fish predator and either *Sargassum* shrimp (*Latreutes fucorum*) or small *S. hispidus* (<1.5 cm) as prey (n=20). Shrimp mortality was significantly higher in trials without *Sargassum* for all predator treatments. Overall, the *Seriola* spp. were more efficient predators in the absence of habitat than the filefishes. However, when *Sargassum* was present, prey consumption was equal for the two groups. Also, the *Seriola* spp. consumed more fish prey than shrimp prey when *Sargassum* was present. These results suggest that species-specific foraging behaviors need to be considered when assessing nursery habitat value and function for *Sargassum*.

Papakyrikos, C. N., Boston University Marine Program, Honors, *cpapkyr@bu.edu*
Kaufman, L., Boston University Marine Program, Advisor, *lesk@bu.edu*

VARIATION IN THE DIET AND FATTY ACID PROFILES OF *A. AMERICANUS* AND OTHER FORAGE SPECIES IN THE GULF OF MAINE

In the Gulf of Maine, the forage community consists of an array of species including Atlantic herring, sand lance, capelin, and Atlantic pollock. Serving as prey to higher trophic level species, this guild functions as an essential energy intermediate between phytoplankton and larger predators (Smith et al., 2011). One emerging concern involves how changes in the forage community due to anthropogenic stressors will manifest higher in the food chain. It has been assumed that the redundancy within feeding guilds will serve as a compensatory mechanism (Auster and Link, 2009). The dominant species within individual guilds changes, however the ramifications are buffered provided that a secondary species occupying a similar niche takes its place (Auster and Link, 2000). However, few species are entirely interchangeable. Discrepancies exist in the forage community in terms of where and what they are eating. Their food value has the potential to vary based on those differences. In this study*, A. americanus* was compared to look at intra and inter species variation in terms of how forage fish are feeding and the potential health implications if such differences are significant. This study has confirmed that significant discrepancies do exist within this guild both intraspecific and

interspecific in terms of del13C and del15N. Based on del13C, *A. americanus* is feeding significantly differently over the years and such changes in diet could easily alter their food value. Similarly, the fatty acid profiles, directly determined by diet, showed a high degree of variation. Subsequently, the food value of *A. americanus* and other forages species has the potential to change significantly in the future as climate changes alters the distribution of their prey species. This rises important management concerns as these shifts may prove detrimental to the health and reproductive success of their economically valuable predators.

Rogener, M. K. **,** Boston University Marine Program, Honors, *mkrog@bu.edu*
Heiss, E. M. , Department of Earth and Environment, Boston University, *emheiss@bu.edu*
Ireland, T., Department of Earth and Environment, Boston University
Murray, R. W., Boston University Marine Program, *rickm@bu.edu*
Fulweiler, R. W., Boston University Marine Program, *rwf@bu.edu*

MANGANESE CYCLING IN A TEMPERATE ESTUARY – TEMPORAL VARIATIONS AND RESPONSE TO HIGH NITROGEN INPUTS

The negative impacts of excess nitrogen (N) on coastal primary production, dissolved oxygen concentrations, and biodiversity are well known. Less well constrained are the effects of N on near shore metal cycling. Here we report manganese (Mn) fluxes and porewater profiles at five stations from high to low N loading in Narragansett Bay and off of the southern coast of Rhode Island (USA) in June and August 2012. Additionally, some of our sites had been studied for Mn fluxes in the 1970s and 1980, allowing for a historical comparison. The net Mn flux ranged from -3 to 33.5µmol m^{-2} hr^{-1}, with an average of 8±1.7 µmol m^{-2} hr^{-1}. There was a significant ($p<0.05$) difference between the Mn fluxes at the five sites in June driven by the high N-impacted site (mean June flux: 25±4.1µmol m^{-2} hr^{-1}). The down bay sites exhibited lower Mn flux in June, which we hypothesized increased in August due to higher rates of sediment respiration as the summer season progressed. In June, we also observed a significant relationship between fluxes of Mn and sediment oxygen demand (SOD), ammonium flux, and a significant exponential relationship with temperature. These relationships suggest that Mn cycling is tightly coupled to a high benthic metabolism. The lack of relationship between Mn, ammonium flux and SOD in August may be the result of a decrease in the pool of particulate Mn left in the sediment at the high N-impacted site due to high respiration rates over the duration of the summer. The porewater profiles from two of the sites, Rhode Island Sound and Mid-Narragansett Bay, measured in June and August were statistically different from each other, but concentrations did not vary over the summer season. We observed no significant changes in Mn cycling over the last thirty years.

Valentine, K.M., Boston University Marine Program, Honors, *kendallv@bu.edu*
Fagherazzi, S., Boston University Marine Program, Advisor, *sergio@bu.edu*
Mariotti, G., Massachusetts Institute of Technology, Secondary Advisor, *giulio.mariotti@gmail.com*

THE EFFECT OF PHYSICAL AND BIOLOGICAL PROCESSES ON THE EROSION OF COHESIVE SEDIMENTS

In this time of sea level rise and global climate change, there has been an increasing importance to understand the mechanisms of erosion in cohesive sediments along the coastline . Typically the processes of erosion have been studied by looking solely at the physical or biological component processes. This study aims to explore the interplay between biology and morphodynamics in coastalcohesive areassediments often found in coastal settings. By understanding the basic mechanisms of erosion from boththe the biological and physical viewpointsprocesses, our resultsthese ideas can be applied to help determine how nutrient enrichment from sources such as urbanization affects sediment erosion and stabilization, and therefore the morphology of tidal flats and salt marshes. This project focused on the role played by diatom-based biofilms growing on the surface of intertidal cohesive sediments and the interactions with different hydrodynamic conditions. Erosion experiments were run in an annular flume with different frequencies (1-12 days) on controlled artificial sediments (bentonite) and natural sediment from a tidal mud flat in Plum Island Estuary, MA. Turbidity of the water column in the flumes was used to determine the erosion of the sediments. and this The erosion was compared to the growth of the biofilms in the natural sediments, which was determined using Pulse-amplitude Modulation (PAM). It was found that the physical processes may drive changes in growth patterns of the diatom-based biofilm in the laboratory setting, but are affected by the presence of biofilm. As expected, in the presence of a healthy biofilm, total erosion decreased. It was found that at after a certain threshold, the total erosion increased independently of the presence of biofilm and led to biofilm death. *In situ* studies of this relationship would be beneficialare needed in order to understand if these mechanisms found in the laboratory are the same as what is observed in the field.