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ABSTRACTS

Alstad*,K.(1), Brannon,E (2) and Moseman-Valtierra, S.(2); Picarro, Inc, Santa Clara, CA. kalstad@picarro.com

SEVERAL GREAT WAYS TO APPLY PICARRO CRDS TECHNOLOGY TO COASTAL ECOSYSTEM STUDIES

Picarro's portfolio of trace gas analyzers enable scientists to characterize coastal biogeochemical processes and quantify gas fluxes from coastal ecosystem. Picarro water Isotopic analyzers have generated significant wetlands related information at various temporally and spatial scales. Discrete isotopic rain water analyses have provided continental-scale mapping of freshwater sources. Continuous isotopic Water Sampling in bay-wide surveys has produced seasonal and spatial mapping of inlet sources. The Picarro carbon isotope analyzer is a power tool for tracking the microbial processes within coastal ecosystems, e.g., the consumption of hydrocarbons from subsurface oil incorporation into the plankton food web have been revealed by carbon-13 analysis using a Picarro system. The Picarro multi-species gas analyzer, which simultaneously measures N2O CH4, CO2, NH3 and H2O concentrations, is recirculation ready for chamber flux analysis. Now, with the addition of the newly available Soil Flux Processor, chamber flux calculations can be quite easy, and can be specified for any size or shape of chamber - including a floating chamber! Thus, another useful tool for characterizing the biogeochemistry of coastal ecosystems is available from Picarro.

Araujo*, A.L. (1) and N.J. O'Connor (2); Department of Biology, University of Massachusetts Dartmouth, North Dartmouth, MA. aaraujo3@umassd.edu

BEHAVIORAL RESPONSES TO CHEMICAL CUES BY MEGALOPAE OF THE NON-NATIVE ASIAN SHORE CRAB *HEMIGRAPSUS SANGUINEUS* AND THE NATIVE MUD CRAB *DYSPANOPEUS SAYI*

Late-stage crab larvae (megalopae) must find a suitable habitat for settlement while avoiding predation. The behaviors of megalopae of the Asian shore crab, *Hemigrapsus sanguineus* and a native mud crab, *Dyspanopeus sayi*, in response to chemical cues from three potential fish predators, cunner, tautog, and mummichog, as well as adult conspecifics, were des access Egg-bearing female crabs were collected from rocky shorelines and larvae were reared to the megalopal stage. A single megalopa was dropped into a stream of flowing, artificial seawater in a clear glass tube. The seawater contained either no cue (control), or chemical cues from one of the three fish species or from adult conspecifics. The behavior(s) of the megalopa, consisting of different types of swimming, walking, rolling, or sliding, were observed. When subjected to the control cue, megalopae of both species swam into the flow significantly more than to any other cue. Both species exhibited the benthic walking behavior in response to cues from adult crabs more than in control seawater. In the presence of cues from cunner, tautog, and mummichog, *D. sayi* megalopae remained inactive (rolling or sliding) significantly more than in the control water. Megalopae of *H. sanguineus* remained inactive significantly more in the presence of cunner and tautog cues than in control water, but showed no significant difference between the control cue and the cue from mummichog. The results demonstrate that megalopae are able to detect chemical cues in their environment as well as distinguish between adult conspecifics and potential predators.

Babson*, A.L. (1), G. Ricci (2), and D. Robadue (2).; (1) National Park Service, Northeast Region, Narragansett RI; (2) University of Rhode Island, Coastal Resources Center, Narragansett RI. amanda_babson@nps.gov

VULNERABILITY ASSESSMENT GUIDANCE AND LESSONS LEARNED FOR COASTAL NATIONAL PARKS IN THE NORTHEAST REGION

What is a climate change vulnerability assessment? What kinds of vulnerability assessments are coastal national parks in the Northeast doing? How are vulnerability assessments being used to plan for climate change adaptation? We are developing coastal park specific vulnerability assessment guidance on scoping, implementing and using vulnerability assessments. This talk will share what we're hearing from natural resource managers on assessments already completed or underway in coastal parks in the Northeast. We'll dig in to examples of the science available for vulnerability assessments, and what is actually being used. Can your research help estimate the components of vulnerability (sensitivity, exposure and adaptive capacity)? What datasets and monitoring are needed for vulnerability assessments to better inform climate adaptation planning and management decisions?

Ballentine*, M. (1), Ariyarathna, T. (1), Smith, R. (1), Vlahos, P. (1), Cooper, C. (1), Bohlke, J.K. (2), Fallis, S. (3), and Tobias, C. (1).; (1)University of Connecticut, Department of Marine Sciences. 1080 Shennocossett Road, Groton, CT 06340. (2)US Geological Survey, National Research Program, Reston, VA 20192.
(3)Naval Air Warfare Center Weapons Division, Chemistry Division, China Lake, CA 93555. mark.ballentine@uconn.edu
UPTAKE AND INCORPORATION OF NITROGEN FROM MUNITIONS IN VARIOUS ESTUARINE SPECIES USING STABLE NITROGEN ISOTOPES
Hexhydro-1,3,5-trinitro-1,3,5-triazine (RDX) is one of the most commonly used explosive at coastal military installations. RDX and its derivatives are Environmental Protection Agency priority pollutants and have known toxicity with a variety of species and are known to persist in freshwater environments and soils. RDX's fate and transport within the system and biota is less understood. Time series incubations spiked with 15N labeled RDX were completed in a closed circulating system containing sandy sediments and 9 different species from various trophic levels. RDX water concentrations were relatively constant allowing for bioconcentration factors (BCFs) to be calculated. BCFs remained low, ranging from 0.26 to 2.7 mL/g dw. The BCF ranges do not show the propensity for bioconcentration in these systems. The mass balance for the 15N indicates that the biota contains approximately 8% of the total 15N added to the mesocosms but only 2% of that 15N could be attributed to intact munitions compounds in the organism. This allocation of 15N tracer between stored munitions compounds and bulk tissue along with the 15N calculated BCF indicate that a much more RDX is processed within biota than previously thought. Nitrogen derived from RDX is being incorporated into the biota. Preliminary results have shown that the 15N tracer was incorporated into amino acids. RDX does not bioconcentrate to toxic levels in biota in most marine systems; however RDX does seem to act as a source of nitrogen that the biota utilize.

Barrett*, D.T. (1), Rajaniemi, T.K. (1), Bucci, V. (1), Silby, M. (1); (1) Department of Biology, University of Massachusetts Dartmouth, North Dartmouth, MA. dbarrett@umassd.edu
EFFECTS OF ABIOTIC STRESSORS AND SOIL MICROBIOTA ON THE ZONATION OF COASTAL DUNE PLANTS
Plant species abundance and distribution vary with distance from the shore on coastal sand dunes. Also differences in soil community composition, as well as gradients of physical stress exist from the shoreline landward. While previous research has mainly focused on one or few of these abiotic and biotic effects on coastal plant communities, it has not definitively explained distribution in terms of these effects, nor have potential factors been presented in realistic combinations of treatments. Therefore, the aim of this study was to illuminate the relationship between coastal dune plants and both the abiotic, as well as biotic aspects of their environment. I will expose seedlings of four key dune plant species to individual tests varying temperature, light, nutrient access, salt spray, soil salinity, and burial, as well as suites of treatments combining those stressors simulating microclimates at both the frontal dune zone and the dune back and flat such as those found on Waquoit Bay National Estuarine Research Reserve on Cape Cod. Additionally, each species will be grown in soils inoculated with either sterile soil, soil from each species' commonly occurring zone or soils from zones where the target plants are not commonly found. Experiments, each lasting two months, began in January 2015 and are projected to continue until Fall 2015. Results to date will be presented.

Bazzano*, M. P & W. H. Elmer; Department of Biology and Environmental Science, University of New Haven, CT and Connecticut Agricultural Experiment Station, New Haven, CT. mbazz1@unh.newhaven.edu
DIMETHYLSULFONIOPROPIONATE (DMSP) IN *SPARTINA ALTERNIFLORA* AT A SALT MARSH AFFECTED BY SUDDEN VEGETATION DIEBACK IN CONNECTICUT
Sudden Vegetation Dieback (SVD) has been affecting salt marshes along the northeastern coast of the United States since at least 2002. Most SVD occurs along creek banks in the low marsh, where the dominant plant species is *Spartina alterniflora* (Smooth Cordgrass). Before signs of SVD are visible, such as yellowing or plant death, it would be useful to be able to identify which marshes are under threat of decline. One potential physiological indicator of stress that has been implicated with health of *S. alterniflora* is dimethylsulfoniopropionate (DMSP). Leaf tissue of *S. alterniflora* plants from both a SVD marsh and a healthy site in Connecticut was assayed for DMSP to determine whether there were statistical differences of DMSP concentration between both marshes. It was hypothesized that lower DMSP concentrations would be found at the SVD marsh and in plants closest to the tidal creek where SVD first appears. It was found that the concentration of DMSP was considerably variable at both sites, yet levels at the SVD site were significantly lower than those at the control site. Ordinary kriging, a geostatistical technique in ArcGIS, was used to explore the data spatially. The geostatistical analysis shows that DMSP behaves as it had been predicted at the healthy site; at the SVD marsh, the spatial pattern of DMSP concentration

gradually increases from south to north. The data in this study support past work conducted with *S. alterniflora* plants subjected to natural and/or experimental stress; however, these results are based on a single season's sampling conducted in two marshes in Connecticut. Further sampling in multiple marshes is necessary to validate these findings.

Berounsky*, V.M. (1,2) and E.J. Peterson (2); (1) Graduate School of Oceanography, University of Rhode Island, Narragansett, RI; (2) Narrow River Preservation Association, Saunderstown, RI. vberounsky@gso.uri.edu
PRELIMINARY ANALYSIS OF THE FIRST LONG TERM TEMPERATURE RECORD FOR THE PETTAQUAMSCUTT ESTUARY IN SOUTHERN RHODE ISLAND

Daily surface water and air temperatures have been taken at one site in the Pettaquamscutt (Narrow River) Estuary, a 9 km estuary in southern Rhode Island since March of 1988 using a hand held thermometer. Other parameters, such as turbidity, salinity, and dissolved oxygen were also measured starting in 2002. Weather observations have also been added since 2002. Recent analysis of seven of those years (1998, 2002, 2003, 2007, 2008, 2012, 2013) has compared years that are a year apart, a decade apart, and 15 years apart and a year with an anoxic water ventilation in one deep (13m) basin in the northern part of the estuary (2007) and years without a ventilation (all others listed above). The lowest and the highest actual water temperatures for the seven years both occurred in 2013: -1.9^{o}C in January and 32.1^{o}C in July. Data was compared by month and by season. For monthly average water temperatures, the coldest temperature for a given month occurred six times in 2003 and the warmest May, June and July were in 2013. Data was also compared by the slope of the increase in temperature in the spring (largest in 2013) and decrease in the fall (largest in 2002). Comparisons are being made with the monthly North Atlantic Oscillation Index and the long term monitoring data sets from Narragansett Bay.

Biegaj, M.; 300 Boston Post Rd. mbieg2@unh.newhaven.edu
ASSESSING THE EXTENT AND DYNAMICS OF NON-VEGETATED PATCHES IN CONNECTICUT SALT MARSHES IN RELATION TO CLIMATE CHANGE RELATED PHENOMENA

New England salt marshes are experiencing changes that appear to be related to climate change driven phenomena, including sea level rise and increasing temperatures. Such changes include salt marsh dieback, erosion and conversion to mudflats, and formation of bare, non-vegetated patches and increased ponding on high marsh areas. This study addresses the spatial and temporal dynamics, and characteristics of non-vegetated patches and ponds on high marsh environments throughout several salt marsh systems in Connecticut. Using a combination of field mapping, GIS based analyses of LiDAR and image data, our initial results suggest several types of changes related to these patch types. Analysis of historical images coupled with field surveys, indicate increases in pond and non-vegetated patches between 2004 and 2014. The locations of non-vegetated patches appear to be associated with local decreases in marsh elevation. These overall patterns may represent an alternative state of high marsh patch structure or are early indicators of marsh collapse and conversion.

Brannon*, E. (1) and Alstad, K. (2); (1) Department of Biological Sciences, University of Rhode Island, Kingston, RI; (2) Picarro, Inc., Santa Clara, CA. ebrannon@my.uri.edu
TAKING THE PICARRO G2508 AND THE NEW SOIL FLUX PROCESSOR TO THE EDGE OF SEWAGE.

Picarro cavity ring-down spectroscopy has been successfully applied in coastal and wetland ecosystem research campaigns as a sensitive and convenient tool for measuring real-time gas flux dynamics (S. Moseman-Valtierra, URI, W. Silver, UCB). The Picarro G2508 analyzer radically simplifies wetland flux studies by providing a complete picture of greenhouse wetland ecosystem emissions by simultaneously measuring five gas species -- N_2O, CH_4, CO_2, NH_3, and H_2O. Most recently, Picarro has released a new ecosystem "Soil Flux Processor" (SFP) which links the power of CRDS technology with an easy-to-use GUI interface. In this study, we demonstrate the ability of the Picarro G2508 and SFP to be applied to practically any system, even one as difficult as a wastewater treatment plant (WWTP). WWTP studies are unique in that they require a floating chamber. This allowed us to demonstrate that the SFP can be used with almost any chamber in any system. The five-species analyzer proved to be critical for capturing some unexpected patterns of gas flux within this wastewater ecosystem. The methods used may be applicable to studies in coastal environments that require unique chambers, such as floating chambers on ponds or tall chambers required for large plants. Come test run the analyzer and software at the poster!

Buckley*, S.B. (1) and R.W. Fulweiler (1,2); (1) Departments of Earth and Environment, Boston University, MA; (2) Department of Biology, Boston University, Boston, MA. sarabeth@bu.edu
GREENHOUSE GAS EMISSIONS IN LONG ISLAND SOUND SALT MARSHES

In the context of climate change, natural greenhouse gas (GHG) emissions in wetlands are particularly important. Currently, salt marshes are potentially experiencing increased stress due to sea level rise and anthropogenic nutrient additions. This is especially relevant along the northeast coast where sea level is increasing at a rate 3-4 times faster than other coastal areas in the US and where there is a high-density human population. In an effort to understand the effect of these stressors on GHG emissions, we are investigating GHG emissions in the salt marshes of Long Island Sound (LIS). To look at the effect of nutrient concentrations, we chose 6 marshes, 3 on the north shore and 3 on the south shore, along a potential nutrient gradient from New York City in the west to Block Island Sound in the east. GHG measurements were collected in the summer and fall of 2014 using a closed static chamber technique. Both emission and uptake of all GHGs were detected over this time period. Carbon dioxide (CO_2) fluxes ranged from -30.1 to 20.5 mmol m-2 hr-1, methane (CH_4) fluxes ranged from -16.0 to 55.2 µmol m-2 hr-1, and nitrous oxide (N_2O) fluxes ranged from -1894.1 to 3330.4 nmol m-2 hr-1. Both CO_2 and N_2O fluxes were higher in the summer than in the fall. No uptake of CH_4 was detected during the summer and overall rates of emission were similar in both seasons. We will discuss these findings in the context of sea level rise, in situ physical characteristics, and position along the nutrient gradient.

Burkhardt*,J., A.Costa, O. Nichols, M. Borrelli.; Center for Coastal Studies, Provincetown, MA. jburkhardt@coastalstudies.org
MONITORING THE EFFECTS OF MECHANICAL BEACH RAKING ON THE PHYSICAL, CHEMICAL AND ECOLOGICAL ENVIRONMENT OF RECREATIONAL BEACHES IN PROVINCETOWN, MA.
A Coastal Beach Environmental Monitoring Program instituted by the Center for Coastal Studies at the request of the Town of Provincetown was conducted from 2012-2014 during the spring, summer and fall. This program examined potential environmental impacts on the two areas selected for the pilot beach raking program and a control site. These areas were assessed for any positive or negative effects to the physical environment (beach contours, sediment compaction, and temperature), biological environment (vegetation, invertebrate population), wrack characterization (percent cover, composition) and water quality (pore water composition, pathogens). Evaluation of the possible impacts were examined by pre- and post- raking assessment of the targeted areas as well as simultaneous monitoring of a nearby, undisturbed beach. The community structure and seasonal trends of the parameters monitored at the three sites showed high variability among the three sites. An analysis to determine if there were any impacts associated with raking was done on data collected in the area of the beach that was consistently raked. Although most of the variability documented during this study appears to result from environmental factors, raking did significantly affect some parameters. The possible ecological and physical impacts on the changes observed in these variables as a result of raking are evaluated.

Cantatore*, N. L., Cooper*, J. R., Crosby, S. C., Fraboni, P. J., and Harris, R. B.; Harbor Watch, Earthplace, the Nature Discovery Center, Westport CT. s.crosby@earthplace.org
AN ANALYSIS OF MULTI-DECADAL RECORDS OF DISSOLVED OXYGEN, TEMPERATURE, AND JUVENILE BENTHIC FISH IN NORWALK HARBOR, CT
Estuaries are highly valued and diverse ecosystems that provide nursery, foraging, and refuge habitat for many species. Water quality can impact the ability of estuaries to provide these functions. Despite its importance, Long Island Sound's water quality has long been threatened by human impacts, particularly bacterial contamination and nutrient pollution. We conducted a multi-decadal study of dissolved oxygen, water temperature, and juvenile benthic fish species composition and abundance in Norwalk Harbor, CT between 1987 and 2014. We sampled each summer for temperature and dissolved oxygen weekly at 7 sites within the Harbor, and conducted benthic fish community sampling monthly at each of 20 stations. We found an increase in water temperature but no clear temporal pattern in dissolved oxygen during the study period. We also found that benthic fish species diversity increased over time despite a decrease in the abundance of fish caught and a substantial decrease in catch per unit effort. Water quality substantially impacts people and the environment, and long-term data sets like these can provide important context in understanding patterns and process in estuarine ecosystems.

Capson, T.L. (1); Cote, M. (2); Gledhill, D. (3); Liebman, M. (2); Mlsna*, I. (2); Morrison, J.R. (4); Salisbury, J. (5); Stancioff, E. (6); Stymiest, C. (4); Thomas, H. (7); Turner, E. (8); (1) capsont@gmail.com, Washington D.C.; (2) U.S. Environmental Protection Agency, Boston, Massachusetts; (3) U.S. NOAA Ocean Acidification Program, Silver Spring, Maryland; (4) Northeast Regional Association of Coastal Ocean Observing Systems, Portsmouth, New Hampshire; (5) University of New Hampshire, Durham, New Hampshire; (6) University of Maine Sea Grant Extension, Orono, Maine; (7) Dalhousie University, Halifax, Nova Scotia; (8) NOAA National Centers for Coastal Ocean Science, Durham, NH. mlsna.ivy@epa.gov

COMMUNICATING OCEAN AND COASTAL ACIDIFICATION TO STAKEHOLDERS AND POLICYMAKERS IN THE NORTHEAST US AND CANADIAN MARITIMES

Public awareness of and concern about ocean acidification (OA) is growing while the scientific understanding of these processes is still forming. Complicating the trend in global OA caused by the general increase in atmospheric carbon dioxide is the modulated acidification of coastal areas influenced by freshwater runoff, nutrient delivery and other climatic trends, including changes in ocean circulation patterns. Moreover, larval stages of commercially important shellfish have been shown to be most vulnerable to the availability of calcium carbonate, which is impacted by OA. Communicating these interacting stresses, their effects on ocean and coastal acidification, and the impacts to coastal resources is complex and challenging, due to the relative scarcity of studies on coastal acidification, the incomplete understanding of the impacts of OA on biologically and economically important marine organisms, and the communication gap between scientists and stakeholders. The Northeast Coastal Acidification Network (NECAN) is a collaboration of representatives from academic institutions, state and federal agencies and industry that seeks to provide relevant information about ocean and coastal acidification to stakeholders in the Gulf of Maine, Long Island Sound, and the Canadian Maritime Provinces. Communication methods to-date have included a series of 16 webinars, a state-of-the-science workshop and resultant publications, web-based translation materials, and face-to-face interactive workshops between scientists, policy-makers, and the stakeholder community. This poster will describe NECAN and the strategies utilized to fill the communication gaps between these groups of people.

Corradino*, G. C (1) and S. P. Grace (1).; (1) Department of Biology, Southern Connecticut State University, CT. gabrielle.corradino@gmail.com

DORMANCY IN INTERTIDAL AND SUBTIDAL POPULATIONS OF ASTRANGIA POCULATA

The temperate scleractinian coral *Astrangia poculata* can be found in local marine waters throughout the Northeastern United States. This study examined the behavior and survival of *A. poculata* during a 15 month period in 2013 and 2014. The research included tagging coral colonies at a subtidal site in Jamestown, Rhode Island and intertidal site in Narragansett, Rhode Island. The colonies were monitored for overgrowth and colony survival. Supplementary laboratory experiments were conducted on coral dormancy in freezing temperatures over various exposure times. Field studies demonstrate no overgrowth by competing invertebrates and both and field and laboratory experiments demonstrated coral dormancy in water temperatures below 9°C. The results of this project culminate with ecological knowledge on *A. poculata* that can help provide better management of temperate coral during a time of global climate change and ocean acidification.

Costa*, A.S.(1), M.S. Costa (1), and J.A. Burkhardt (1); Center for Coastal Studies, 5 Holway Avenue, Provincetown, MA 02657. acosta@coastalstudies.org

A COMPREHENSIVE WATER QUALITY MONITORING PROGRAM FOR CAPE COD AND THE ISLANDS

The Center for Coastal Studies is currently monitoring the water quality of over 150 stations in the coastal and offshore waters of the Cape and Islands. These data provide valuable baseline data against which we can document trends and measure the effectiveness of management decisions that are being put in place to help protect our coastal resources. In addition to monitoring basic water quality parameters (temperature, salinity, dissolved oxygen, nutrients, plant pigments, water clarity) we are also starting to document the presence of other contaminants of emerging concern (pharmaceuticals, personal care products and hormones) in our coastal waters. These data in conjunction with data on water quality are expanding our understanding of how human activities and management actions affect our coastal environment.

Coupland*, C. (1), Oviatt, C.A. (1), Stoffel, H. (1); Graduate School of Oceanography, University of Rhode Island. ccoupland4@gmail.com

ESTIMATING DAILY PRIMARY PRODUCTIVITY AND NIGHTTIME RESPIRATION IN ESTUARINE WATERS USING IN SITU CARBON METHODS

In response to seasonal intermittent hypoxia in Narragansett Bay bottom waters, the Rhode Island Department of Environmental Management has enacted regulations to reduce nutrients entering the Bay through wastewater effluent via tertiary treatment. These upgrades began in 2006 and are ongoing, with the largest facility, which discharges to the Providence River, upgraded in 2013. Previous studies have shown nutrient gradients persistent in Narragansett Bay from north to south as well as a productivity gradient. This study develops a Dawn-Dusk-Dawn Carbon Model that could be used to detect a change in the production of Narragansett Bay due to these changes in nutrient concentrations. The model

utilizes alkalinity, pH, temperature and salinity data collected from July 2013 – March 2015, and is compared against a previously verified Dawn-Dusk-Dawn Oxygen Model for Narragansett Bay. Data from Summer 2013 indicate the two models are highly correlated (surface production r = 0.8). A preliminary comparison of pH sensors shows that the YSI sensor is stable over the Dawn-Dusk-Dawn time period and has an offset from the Satlantic SeaFET pH sensor. Results from sensitivity analyses are also presented.

Dean, C.; Distinguished Lecturer and Writer-In-Residence at Brown University
CONSTITUENCY OF IGNORANCE
There are many obstacles to the effective communication of scientific or technical information to members of the lay public. For one thing, they often don't know enough to understand it. For another, researchers are often unwilling to take the time to explain things in understandable ways. Perhaps the most important -- and the most intractable -- is the unwillingness of many people to absorb and accept scientific information that challenges deeply held beliefs. This problem must be overcome if society are to make progress in environmental protection.

Dolan*, A.S., Rapaglia, J., Mattei, J.H., Beekey, M.,Steele, L.; Department of Biology, Sacred Heart University, 5151 Park Avenue, Fairfield, CT. rapagliaj@sacredheart.edu
WAVE DISSIPATION AND SEDIMENT TRANSPORT: A LIVING SHORELINE PILOT PROJECT
As hard coastal protection structures have fallen out of favor in much of the Atlantic Seaboard, there is a strong impetus to find a functional and more ecological method of coastal protection. In May 2014, our research team installed a set of 60 “Reef Balls” along a 60 meter stretch of coast in Stratford Point, CT, which had been suffering from strong erosion since the removal of a marsh in 2001. These “Reef Balls” 3 ft high x 4 ft wide, hollow molded concrete structures, which are segmented with large holes allowing the passage of water, while, in theory dissipating wave energy. On more than 20 occasions, we deployed 12 Cera Diver pressure sensors in various arrays to measure wave height seaward and landward of the “Reef Balls” at a frequency of two Hz. Pressure sensors were deployed during a range of atmospheric conditions from calm to gale and recorded wave heights from less than 1 cm to over 70 cm. When wind speeds exceeded 10 m s-1 and significant wave heights exceeded 20 cm, there was a 15-20% reduction in significant wave height landward of the “Reef Balls.” In order to test the effect of the reef balls on suspended sediment concentration (SSC), a single stage siphon sampler (SSSS) was deployed on 15 occasions. The SSSS was arranged to collect water samples at multiple tidal heights from multiple inundation depths. SSC was significantly and positively correlated with significant wave height. Evidence suggests that a reduction in wave energy may lead to lower erosion and enhanced accretion of fine-grained sediments at Stratford Pt, CT.

Donovan,* C.; Department of Biology, Salem State University, Salem Ma. c_donovan6@salemstate.edu
MONITORING OF GREEN CRAB DENSITIES AND ACTIVITY USING A REMOTE OPERATED VEHICLE (ROV)
Green crabs *Carcinus maenas*, an invasive species have established themselves in coastal and estuarine habitats. In these areas they present a great threat to many marine organisms, especially bivalves. A study was conducted using a remote operated vehicle (ROV) to monitor green crab densities and activity beginning in the fall and continuing through winter to observe seasonal changes in green crab activity, shifting between active predatory behavior versus over-winter dormancy. This data could be useful in controlling green crab populations, determining the optimal time for trapping activity would maximize the effectiveness of control projects. The monitoring of the green crabs was accomplished by using a Deep Trekker DTG2 Underwater ROV, running and recording transects in a controlled environment. Transects were selected randomly along 4 sites going out 75m from shore, giving a crab density survey area of $75m^2$ per transect. The video record of each transects was analyzed to determine crab density and activity. The hypothesis was that green crab activity would be minimal over the winter due to lower water temperature and that the populations would become active again in early spring. Early data has shown reduced crab activity with decreasing water temperature, averaging of 0-2 crabs per transect. This technique can be applied to other underwater studies and help in monitoring populations of different organisms effectively and efficiently. A comparison with data collected from trapping studies and diver surveys will be presented.

Durant*, D.(1), K. B. Raposa (1) , M. Cole (2), W. Ferguson (2); (1) Narragansett Bay National Estuarine Research Reserve, Prudence Island, RI; (2) Save The Bay, Providence, RI. daisy@nbnerr.org
FORMATION AND RAPID RECOVERY OF VEGETATION DIEBACK PATCHES IN NARRAGANSETT BAY, RI SALT MARSHES
Vegetation dieback events are dynamic, natural features of healthy salt marshes. However, extensive dieback events have been reported over the last decade from multiple regions, including the East and Gulf coasts of the US. In RI, ongoing

Sentinel Site monitoring in the Narragansett Bay National Estuarine Research Reserve (NBNERR) detected a rapid increase in distribution and extent of vegetation dieback in two mid-Bay marshes beginning in 2009-2010 during periods of extreme increases in sea level. Complementary spatial surveys conducted by Save The Bay in 2012-2013 showed that dieback areas are pervasive across coastal RI, particularly in lower elevation marshes near the mouth of Narragansett Bay and southern coastal ponds. To better understand the temporal dynamics of marsh dieback, we began additional monitoring of six dieback patches in the two NBNERR marshes. From 2011-2014, percent cover of all vegetation species and bare ground was estimated using visual and nearest-neighbour surveys. Results showed rapid vegetation recovery in both marshes beginning one year after dieback onset (ANOSIM $p<0.05$). Dieback patches were revegetated mainly by *Spartina alterniflora*, which remained dominant across all subsequent years. While vegetation fully recovered in one marsh, substantial bare ground (33%) remained in the other, four years after dieback occurred. These results were confirmed with nearest-neighbour surveys, which showed differential recover rates between marshes. Our data show while *S. alterniflora* can quickly revegetate some dieback patches, others remained bare or covered with shallow water even after four years, suggesting they may be on a trajectory towards permanent pool formation.

Egan*, K. (1), S. Moseman-Valtierra (1), O. Abdul-Aziz (2), K.S. Ishtiaq (2); (1) Department of Biological Sciences, University of Rhode Island, Kingston, RI 02881 (2) Department of Civil and Environmental Engineering, Florida International University, Miami, FL 33174. katharine_egan@my.uri.edu

GREENHOUSE GAS EMISSIONS ACROSS SALT MARSH ZONES IN WAQUOIT BAY, MASSACHUSETTS, USA: TESTING RELATIONSHIPS TO PLANT AND ENVIRONMENTAL PROPERTIES

Salt marshes naturally store carbon at high rates, but in these dynamic ecosystems, greenhouse gas (GHG) fluxes can substantially vary between major plant-defined ecological zones. Soil environmental variables co-vary with plants along these zonation gradients. We measured GHG fluxes (CO_2, CH_4) from mixed Juncus gerardii–dominated high marsh and Spartina alterniflora–dominated low marsh from Sage Lot Pond in Waquoit Bay (MA) on several dates throughout the 2012 and 2013 growing seasons. Additional data were collected from unvegetated salt marsh ponds and invasive Phragmites australis zones in 2013 and 2014. GHG fluxes were measured in situ with infrared-based gas analyzers and transparent static flux chambers. Low marsh zones had significantly higher rates of CO_2 uptake ($p<0.01$) but not significantly different methane emissions than high marsh zones. Gas fluxes from unvegetated ponds were similar to the vegetated marsh zones. Relationships of GHG fluxes to plant properties and soil environmental characteristics are being tested via non-linear multivariate regression modeling. These results contribute much needed data regarding GHG fluxes from coastal ecosystems and may help to guide emerging methodologies for connecting coastal marsh restoration to global carbon markets.

Elliott* J. A., A. M. Young, M. L. Taylor and J. M. Incatasciato; Biology Department, Salem State University, Salem, MA 01970 USA. j_elliott4@salemstate.edu

A NEW OUTLOOK TO SOLVE AN OLD PROBLEM: USING HORMONES AND VENTRAL COLORATION TO ANTICIPATE ECDYSIS IN THE EUROPEAN GREEN CRAB (*CARCINUS MAENUS*)

The European green crab (*Carcinus maenus*) is a universal problem for the New England shellfish industry. Ways to decrease the green crab population throughout New England are being considered and one suggestion proposes to create a soft-shell crab market for human consumption, an option that is preferred due to the economic advantage. For a soft-shell market to be economically feasible, there must be a way to observe and accurately predict molting. A recent trapping survey that measured the natural variability of ventral coloration in green crabs from Salem Sound, MA has prompted a new study that focuses on molting patterns, physiology, and the feasibility of keeping this invasive crustacean in a closed aquaculture system. This study explores the possibility that ventral coloration can assist as a bioindicator for molting. Crabs are currently being monitored biweekly for color changes and the temperature of the water is being manipulated to stimulate molting. Hemolymph samples will be analyzed via high performance liquid chromatography for molt inhibiting hormone (MIH), methyl farnesoate (MF), and 20-hydroxyecdysone (20H). It is hypothesized that red-pigmented crabs will have higher levels of MF and MIH with low 20H because these crabs prioritize molting only for reproduction rather than for growth, whereas crabs without red pigment will have lower levels of MF and MIH and higher levels of 20H. The results will then determine whether it is possible to use ventral coloration as a bioindicator for either an extended intermolt or terminal anecdysis.

Fehon*, M. and D. Taylor; 1 Old Ferry Road Bristol, Rhode Island. mfehon618@g.rwu.edu
FORAGING ECOLOGY OF BLUE CRABS (CALLINECTES SAPIDUS) AND THEIR POTENTIAL IMPACT ON RHODE ISLAND BENTHIC COMMUNITIES

The blue crab, Callinectes sapidus, is a temperate species that is expanding its geographic range northward, thus possibly altering benthic community structure in Southern New England coastal habitats. This study examined the potential impact of blue crabs on local fauna by analyzing blue crab diet and overall abundance and size structure. Potential predation of blue crabs on winter flounder (Pseudopleuronectes americanus) was of particular interest due to locally declining populations of this species. The Rhode Island Department of Environmental Management and Roger Williams University seine surveys recorded spatial and temporal dynamics in blue crab abundance and size frequency in Narragansett Bay and its tidal rivers and coastal ponds. Stomach contents were extracted, visually analyzed, and prey were identified to lowest practical taxa with aid of stereomicroscopes. Prey importance was quantified by volumetric contribution to total stomach contents. Primary prey items in all three habitats were crustaceans, crabs, and bivalves. Size frequency was consistent across habitats. Crabs were much more abundant in the tidal rivers than the other two habitats. Future research will further examine the foraging ecology of blue crabs via genetic analysis of stomach contents and analysis of stable Carbon and Nitrogen isotopes in crab muscle tissues.

Foster*, S.Q. (1) and R.W. Fulweiler (1, 2); (1) Earth and Environment Department, Boston University, Boston, MA; (2) Department of Biology, Boston University, Boston, MA. sqfoster@bu.edu
ENVIRONMENTAL CONTROLS ON SEDIMENT NITROUS OXIDE FLUXES IN AN ANTHROPOGENICALLY IMPACTED COASTAL ECOSYSTEM

Aquatic production of nitrous oxide (N_2O) accounts for approximately one third of total global emissions and over 90% of emissions from rivers, estuaries, and continental shelves are considered anthropogenic. This has been attributed to nitrogen (N) inputs from fertilizer use, wastewater, runoff, and atmospheric deposition. Although the correlation between N loading and N_2O production appears to make coastal ecosystems areas of potentially high N_2O emissions, the effect of altered environmental conditions due to excess N (e.g. enhanced macroalgae growth, loss of eelgrass, decreased oxygen availability) and larger-scale climate change (e.g. increasing sea surface temperatures, changes in precipitation and cloud cover) are not clear. Here we examine three years (2012-2014) of sediment N_2O flux data in Waquoit Bay (East Falmouth, MA) across a gradient of anthropogenic N loading and compare to historic rates (1992-1994). In 70% of the cores measured N_2O was consumed, with sediment fluxes ranging from (-83 to 22 nmol N_2O-N m^{-2} hr^{-1}), although on one occasion the rate was an order of magnitude greater (-566 nmol N_2O-N m^{-2} hr^{-1}). These recent uptake rates (mean -20 nmol N_2O-N m^{-2} hr^{-1}) are lower than historic rates (mean -83 nmol N_2O-N m^{-2} hr^{-1}), however they do not differ between stations, indicating that environmental parameters other than N load are driving flux rates.

Hollister, J. W.; US EPA, Atlantic Ecology Division, Narragansett, RI. hollister.jeff@epa.gov
OPEN SCIENCE: A ZEALOT'S VIEW

Open science encompasses many concepts, but most agree that for science to be open four things must be true. First, all components of the scientific project must be freely available including manuscripts, code, and data. Second, others must be able to repeat your work and reproduce the results. Third, open science is a product of the internet age and thus needs to be web enabled. Lastly, open science happens as part of a process, not an event. In this talk, I will address each of these components, but will do so from my own perspective. I will discuss how I have progressively opened up my science, the benefits to doing that, and describe the tools I have used. In this last part, I will focus on the importance of the web, in particular social media, and how I have used open source geospatial tools. My goals for this talk are to use my evolution into an open science zealot as a means to motivate others to begin utilizing these same tools in their own research.

Jakuba*, R. W. (1), Costa, J. E. (2), Williams, T. (1), Rasmussen, M. P. (1), Neill, C. (3); (1) Buzzards Bay Coalition, New Bedford, MA; (2) Buzzards Bay National Estuary Program, Massachusetts Office of Coastal Zone Management, Wareham, MA (3) Marine Biological Laboratory, Woods Hole, MA. jakuba@savebuzzardsbay.org
TRENDS IN THE HEALTH OF BUZZARDS BAY OVER THE LAST 23 YEARS

Water quality has been monitored annually in Buzzards Bay, in Southeastern Massachusetts, over the past 23 years. In an effort involving more than 700 citizen scientist volunteers, nutrient-related water quality was monitored during the summer months. Focusing in the 30 shallow harbors and coves around Buzzards Bay, the following parameters were measured at

approximately 200 sites each year: temperature, salinity, dissolved oxygen, secchi disk depth, chlorophyll a, total dissolved nitrogen, ammonium, nitrate+nitrite, particulate organic nitrogen, and phosphate. The sampling regime is designed to be able to discern the negative impacts of nutrient pollution. The data collected has been used to generate a Bay Health Index that scores embayments on a scale of 0 to 100. Five parameters, generally at multiple stations, are integrated into the Bay Health Index score. The Bay Health Index is an effective tool for communicating the relative health of water bodies around Buzzards Bay and is capable of tracking changes in water quality based both on long-term general trends in nitrogen loading and on discrete changes in local nutrient management. A general trend of gradually declining Bay Health Index scores is evident across many embayments. However, Bay Health Index scores demonstrate improvements where investments to wastewater infrastructure have been made.

Jesse*, J.A., A. Araujo, and N. O'Connor; Department of Biology, University of Massachusetts Dartmouth, Dartmouth, MA. jjesse@umassd.edu

BEHAVIORAL RESPONSE OF MUD CRABS TO CHEMICAL CUES FROM FISH SPECIES

Biological invasions of new species can change the habitat for native species and affect predator /prey dynamics. In southeastern Massachusetts the invasive Asian shore crabs, *Hemigrapsus sanguineus*, has become abundant compared to the indigenous mud crabs, *Dyspanopeus sayi* and *Eurypanopeus depressus*. One aspect that may enhance the crabs' chance of survival is displaying antipredator strategies even as young as the megalopa stage, the final larval stage of a crab before becoming a juvenile. The purpose of this study was to better understand the way mud crab megalopae respond to chemical cues from fish predators and shed light on how an invasive species can become successful. The three fish species used were cunner, tautog, and mummichog In this experiment, individual megalopae were dropped into a tube with the chemical cue from the fish present in a flowing water system. Their behavioral responses to fish cues as well as cues from adult crabs and a control (artificial seawater) were described. The data were analyzed using generalized linear modeling, specifically a Poisson regression. The results indicate that there is no difference between the two mud crab species. However, significantly more rolling behaviors were seen for the mummichog cue, while significantly less rolling behavior was seen for the cunner cue. Also, significantly more walking on the bottom behavior was seen for the mummichog cue. The mud crab behavioral responses vary from those seen in the Asian shore crab suggesting different behavioral responses to fish predators by native and non-native crabs.

Kennedy*, C.G. and K.D. Malakhoff*; Marine Geology Department, Center for Coastal Studies, Provincetown, MA. crisgabken@gmail.com

COUNTING SEASHELLS ON THE SEASHORE: MAPPING MARINE BENTHIC MACROINVERTEBRATE COMMUNITIES IN CAPE COD, MA

Benthic habitat mapping provides a valuable tool for ecosystem-based management by integrating physical, biological and anthropogenic features of the seafloor. Advances in acoustic technology have made it possible to map the shallow coastal waters that are heavily used and valued by humans. Highly accurate bathymetry and sonar images of the seafloor are combined with ground-truth information (sediment grain size and organic content, and macroinvertebrate communities) to create a spatial representation of distinct biotic communities and their associated physical environment. In the summer of 2014 we sampled 73 stations in the Cape Cod National Seashore (CCNS) as part of a larger effort to map submerged marine habitat in National Seashores. Approximately 40% of CCNS is submerged coastal habitat, yet there is little detailed information about these marine resources. We collected benthic grabs for sediment and marine invertebrates in the Pleasant Bay and Nauset Marsh systems. Here we present preliminary results from a biological assessment of 33 stations in Pleasant Bay. We find that by following the Coastal and Marine Ecological Classification Standard (CMECS), distinct biological communities can be identified on the basis of substrate type in conjunction with the presence or absence of certain dominant species, including *Gemma gemma* bivalves, *Ampelisca* amphipods, and *Caprellidae* amphipods. Combined with concurrently measured bathymetry and back-scatter data, these maps will provide a highly detailed baseline in the event of major changes to our vulnerable coastlines, including the increasing frequency of major storm events, sea level rise, and pollution events affecting water quality.

Kreakie, B.J.; 27 Tarzwell Drive, Narragansett, RI 02882. kreakie.betty@epa.gov

THE COMPUTATIONAL ECOLOGIST'S TOOLBOX

Computational ecology, nestled in the broader field of data science, is an interdisciplinary field that attempts to improve our understanding of complex ecological systems through the use of modern computational methods. Computational ecology is based on a union of competence in software programming, advanced mathematical/statistical methods, and ecological subject-specific expertise. Typically, this research relies heavily on large data sets that often cover large spatial extents and can also be expansive in temporal coverage. The data are also commonly assembled from several diverse data sources which adds complexity to uncertainty predictions. This field fundamentally embraces the culture of open science and reproducible research. During the course of my talk, I will present a general introduction to the field of computational ecology. I will use examples from my research to illustrate how computational methods can be used to address complex ecological questions. These case studies will cover a wide range of topics, from waterfowl migration modeling to social network analysis. The second half of my talk will focus on specific tools that computational ecologists use and that can be directly applied to other research fields. I will primarily focus on data management, because this will be most applicable to a wide range of research areas. However, this talk will also briefly cover tools and resources for statistics, coding, and version control.

Lamb*, A.L. (1)(2) and Branco, B.F. (2)(3); (1) Department of Earth and Environmental Sciences, The Graduate Center, City University of New York (2) Aquatic Research and Environmental Assessment Center, Brooklyn College, City University of New York. (3) Department of Earth and Environmental Sciences, Brooklyn College, City University of New York. alamb@gc.cuny.edu

ECOSYSTEM RESPONSE TO WASTEWATER TREATMENT CHANGES IN JAMAICA BAY, NEW YORK

Nitrogen pollution remains a major cause of eutrophication and drives primary production. Water quality data is collected in eutrophic estuaries to understand shifts in ecosystem drivers, responses, and sources of pollution. Jamaica Bay, NY receives combined sewer wastewater from densely populated Brooklyn and Queens. Treated wastewater effluent contains nitrogen and Jamaica Bay has the highest load in the Eastern U.S. at greater than 15,000 kg N/day. We created two groups of data and used interpolation techniques in the geospatial program ArcGIS to identify ecosystem states before and after a major change in disposal of wastewater treatment sludge. Water quality data was collected weekly during the summer in years 1990-2011 by the National Park Service (NPS) at Gateway National Recreation Area. Averages show an increase in dissolved inorganic nitrogen (DIN) and chlorophyll-a after the wastewater treatment change. This suggests an algal response to the increased nitrogen in effluent discharge. Dissolved oxygen and pH declined and are visible as hotspots in close proximity to wastewater outfalls. Reintroduction of native organisms that once thrived such as oysters and seagrass are not recommended because of the current algal domination. Future resilience of Jamaica Bay's ecosystem should be focused on continued reduction of DIN loads, acidification, and monitoring of bloom forming algae. To improve our ability to understand ecosystem resiliency and change, we suggest close communication between the agencies that use and collect water quality data in Jamaica Bay.

Liebman*, M. and Integrated Sentinel Monitoring Network Steering Committee; US EPA Region 1 – New England, Boston, MA. liebman.matt@epa.gov

AN INTEGRATED SENTINEL MONITORING NETWORK (ISMN) FOR ECOSYSTEM CHANGE IN THE NORTHEASTERN US OCEAN AND COASTAL WATERS

Population growth, climate change, and resource extraction are among the drivers changing the New England coastal ecosystem. Commercial and invasive species ranges are changing (lobster are moving northward); biodiversity is declining (rare species have been lost in Cobscook Bay in Maine); community structure is changing (zooplankton in Long Island Sound are smaller); and ecosystem functions are changing (estuaries are becoming more eutrophic). Observations indicate gelatinous zooplankton are increasing in pelagic ecosystems. Despite such obvious signals, we do not fully understand if fundamental changes are occurring to the ecosystem that will lead to more dramatic shifts. Scientists and managers from over 50 government agencies, academic research institutions and non-profit organizations organized by the Northeast Region Ocean Council and NERACOOS have called for an Integrated Sentinel Monitoring Network (ISMN). The ISMN is a coordinated sentinel monitoring program that measures, tracks and integrates key stressors (e.g. sea level, nutrients) and indicators across regional monitoring efforts to help link cause to effect. With data from a sentinel monitoring network, governments and communities may be better positioned to respond and adapt more effectively to a changing ecosystem.

The ISMN Plan will be ready for distribution in spring 2015. The plan identifies sentinel indicators based on many factors including availability of long term records, and responsiveness to climate change drivers. It identifies gaps in the present observing system and makes recommendations for additional measurements and geographic sites. The plan also outlines a process for archiving and managing data and for updating monitoring protocols.

Logan*, J.M. (1), Bean, S. (2) and A. Myers (3); (1) Massachusetts Division of Marine Fisheries, New Bedford, MA; (2) Buttonwood Park Zoo, New Bedford, MA; (3) The Derryfield School, Manchester, NH. john.logan@state.ma.us
AUTHORSHIP IN ECOLOGICAL PUBLICATIONS: WHAT IT MEANS TO BE A CO-AUTHOR
Authorship is central to scientific research for both philosophical and pragmatic reasons, but consensus within the scientific community on its definition remains elusive. We distributed a survey regarding co-author contributions to a random selection of 996 lead authors of manuscripts published in ecological journals in 2010. We also assessed historical trends in the number of co-authors of studies published in eight ecological journals from 1950 to 2010. We obtained useable responses from 45% of surveyed authors. Nearly half (48%) of all studies had some level of non-compliance with Ecological Society of America (ESA) authorship guidelines. Incidence of non-compliance varied with author position. Among studies with > 2 co-authors, all lead authors met ESA guidelines. Middle (24.3%) and last (37.0%) authors had higher rates of non-compliance. The mean and maximum number of co-authors per study increased historically from the 1950s to 2010 for all journals that we assessed. The probability of a study containing a co-author that did not meet ESA requirements increased significantly with number of co-authors per study. Reported lead author contributions in ecological studies consistently included conception of the project idea, data collection, analysis, and writing. Middle and last author contributions instead showed a high level of individual variability. Lead authorship in ecology is well-defined while secondary authorship is more ambiguous. A byline approach may not alter author contributions but would better define individual contributions and reduce existing ambiguity regarding the meaning of authorship in modern ecological research.

Long* M.H. (1) Charette M.A. (1) Martin W.R. (1) and M.C. McCorkle (2); (1) Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA;
(2) Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA. mlong@whoi.edu
OXYGEN METABOLISM AND PH IN COASTAL ECOSYSTEMS: EDDY COVARIANCE HYDROGEN ION AND OXYGEN EXCHANGE SYSTEM (ECHOES)
An aquatic eddy covariance (EC) system was developed to measure the exchange of oxygen and hydrogen ions (H+) across the sediment-water interface. The system employs oxygen optodes and a newly developed micro-flow cell H+ ion selective field effect transistor; these sensors displayed sufficient precision and response times required for measuring turbulent fluctuations. Discrete samples of total alkalinity and dissolved inorganic carbon (DIC) were used to determine the carbonate equilibria of the water column and relate the oxygen and H+ fluxes to benthic processes. The ECOHES system was deployed in a eutrophic estuary (Waquoit Bay, Massachusetts, USA), and revealed that the benthic processes were a sink for acidity during the day and a source of acidity during the night. H+ and oxygen fluxes were also determined using benthic flux chambers, for comparison with the EC rates. Benthic chamber measurements co-varied with EC measurements but were of ~4 times lower magnitude, likely due to chamber artifacts on hydrodynamics, and the depletion or elevation of DIC and oxygen within the enclosed chamber. The individual H+ and oxygen fluxes were highly correlated in each data set (EC and chambers), and both methods yielded H+ fluxes that were not explained by oxygen metabolism alone. This ECHOES system provides a new tool for the determining the influence of benthic biogeochemical cycling on coastal ocean acidification and carbon cycling.

Maguire*, T. J.(1) and R. W. Fulweiler (1,2); (1)Department of Biology, Boston University, Boston, MA; (2)Earth and Environment, Boston University, Boston, MA. tmaguire@bu.edu
URBAN RUNOFF – AN OVERLOOKED YET SIGNIFICANT SOURCE OF SILICA TO COASTAL HABITATS
Quantifying the impact of cities on coastal ecosystems is an important challenge in biogeochemistry. The link between urbanization and excess nitrogen (N) and phosphorus (P) loading is well established. But to date, the direct and indirect impact of cities on silica (Si) availability is underappreciated. Si is a key macronutrient of productive estuarine food webs. Historically, Si export was thought to be primarily driven by chemical weathering of the lithosphere. However, recent work has shown the terrestrial biosphere and land use and land cover change play an important role in altering the timing and

magnitude of Si export. A key question in understanding human impacts on Si biogeochemistry is whether or not cities act as sources of Si. Boston, Massachusetts, is ideally suited to answer this question. Boston is serviced by a combined sewer – storm water system which, collects urban runoff and comingles it with sewage before being sent to the sewage treatment facility. We sampled the sewage treatment facility influent for one year and estimated a Si flux carried by the influent. We partitioned this Si flux between Si attributed to sewage or to runoff, and found that urban runoff is a significant source of Si. Additionally, the Massachusetts Water Resource Authority has amassed a surface water Si dataset from urban rivers in Boston. Yearly variability in Si flux from the urban rivers was correlated to runoff discharge from opening combined sewer – storm water system overflows during storm events, providing support that urban runoff is a source of Si. If Boston behaves similarly to other cities then this research highlights the potential for urban runoff to be a significant source of Si to downstream coastal habitats.

Martin*, R.M. and G.T. Ober; Department of Biological Sciences, University of Rhode Island, Kingston, RI. rose.m.martin.31@gmail.com
AGAINST THE TIDE: HOW WILL SALT MARSH PLANT COMMUNITIES RESPOND TO SYNERGISMS OF SEA LEVEL RISE AND ALGAL BLOOMS?
Under conditions of global change, seemingly distinct stressors of coastal ecosystems may interact. In Rhode Island's Narragansett Bay, human impacts drive sea level rise (SLR) and macroalgal blooms, phenomena that may act synergistically to impact marsh vegetation. As sea level rises, deposition of algal biomass up to higher marsh elevations may join increased inundation and soil salinities associated with SLR to alter plant communities and associated ecosystem processes. However, while research has focused on effects of projected SLR on salt marsh plant communities, no published studies have investigated possible impacts of macroalgal deposition on salt marsh vegetation. To address this gap in knowledge, we tested independent and interactive effects of simulated SLR and macroalgal blooms on marsh vegetation survival and productivity. We conducted a multifactorial mesocosm experiment using 3 SLR scenarios (present-day, 50 years and 100 years), 2 macroalgal bloom scenarios (bloom and no bloom) and 2 vegetation types (low marsh Spartina alterniflora and high marsh Spartina patens) during the 2014 growing season. Findings indicate that extreme (100-year) SLR simulation had clear negative impacts on stem density and average height for both plant species, but responses to macroalgal deposition differed. *S. patens* experienced significantly greater mortality with macroalgal deposition under the 100 year SLR simulation, and S. alterniflora saw significant decreases in stem height with macroalgal deposition under the 0- and 50-year SLR scenarios. These findings suggest that SLR and macroalgal blooms may interactively drive impacts to coastal vegetation, and that effects will not be uniform across marsh zones.

Matso*, K.,(1) Leonard, D.(1), Stadler, J.(1), Riley, C.(2), Langan, R.(1); (1) University of New Hampshire, NERRS Science Collaborative
(2) Great Bay National Estuarine Research Reserve. kalle.matso@unh.edu
INCREASING HOW MUCH SCIENCE INFLUENCES DECISION MAKING: IS IT A SCIENCE OR AN ART?
Many reports and studies have noted that a significant portion of problem-oriented coastal science does not actually link to decisions. A few studies and reports have offered valuable but general advice on what the funders of this science can do to better link science with decisions, most of them culminating with the exhortation to ''foster more interactions between scientists and users,'' but very few documents provide details or assign responsibility to drive the interactions that most agree should happen. The NERRS Science Collaborative, a partnership between NOAA and the University of New Hampshire, has been testing and evaluating innovative strategies for better integration of science and decision making throughout a research project. These studies confirm earlier work that the issue of "trust" is central in linking science to decisions. Our experiences also illuminate the many challenges that this kind of collaborative science entails. In this talk, we highlight some of these lessons learned and provide some provocative recommendations as well as questions, especially for scientists and program officers.

Mattei*, J.H.; M. Beekey, J. Rapaglia, L. Steele,; Department of Biology, Sacred Heart University, 5151 Park Avenue, Fairfield, CT. matteij@sacredheart.edu
URBAN ESTUARIES: IN NEED OF REMEDIATION, RESTORATION AND CONSERVATION
Urban estuarine areas, are vulnerable to pollution, compaction, invasion, and, in turn, have lost their primary ecosystem functions. The mouth of the Housatonic River, particularly at Stratford Point, Connecticut was subject to intense human

degradation of the natural system over the last century. Here we are testing a pilot project to restore a living shoreline after intensive remediation during the removal of many metric tons of lead shot, which was deposited at the site over a 50 year period. We will use the procedure and results as a model for other living shorelines in degraded coastal areas. Instead of boulders and rip-rap, we have utilized Geotubes at the base of the coastal dune to, prevent erosion and enhance sand deposition. We have installed upland woody plants, implemented a controlled burn in 2012, and in the spring of 2014 we installed over 49 meters of shellfish reef structure using Reef Balls-concrete, molded domes with holes on the sides and top. Reef Balls have been successfully implemented to restore marsh areas in several low energy sites and in at least five southern states, placed deeper in the water to act as an oyster reef. At Stratford Pt., we are testing the use of this structure for the dissipation of wave energy and enhance sediment deposition as well as oyster reef and fish habitat. Beyond its role in coastal protection, the reef ball structure may also provide a promising habitat for the recruitment of shellfish; in its first season, over 1800 oysters naturally settled on the reef structure. We are also examining how the reef protects a newly planted salt marsh.

Moore*, G.E. (1,2) Burdick, D.M. (1,3), Peter, C.R. (1) and D. R. Keirstead (4); (1) University of New Hampshire, Jackson Estuarine Laboratory, 85 Adams Point Road, Durham, NH 03824; (2) Department of Biological Sciences; 3Department of Natural Resources and the Environment; and 4United States Department of Agriculture Natural Resources Conservation Service, Main Street, Durham, NH 03824. gregg.moore@unh.edu

ELECTROMAGNETIC INDUCTION AS A TOOL TO MAP SOIL PORE WATER SALINITY ACROSS TIDAL MARSHES

Electromagnetic induction was used to measure soil pore water conductivity within fifteen oligohaline to polyhaline tidal marshes of the Great Bay Estuary in New Hampshire, USA using a Geonics™ EM38-Mk2. The EM38 was linked to a differential global positioning system via a hand-held field computer so that conductivity values could be geo-referenced in the field. Resulting conductivity values were converted to salinity units using a regression derived from extensive field data and then mapped to show detailed salinity patterns and gradients across these varied marshes. Broadly-defined plant communities occurring at the study sites included typical low marsh, high marsh, and brackish tidal riverbank marsh, as well as native and non-native stands of common reed, Phragmites australis. Data were also collected in soils of unvegetated pools. Each of these five habitat types were used as a category for comparison of salinity conditions. Results revealed mean salinity values were significantly different between each community category sampled within the Estuary. Due to management concerns over expansion of Phragmites, we mapped the salinity range observed for this community and provided graphic and numerical estimates of potential Phragmites habitat based on salinity alone and found that 26.2% of the total acreage surveyed may be suitable for expansion of this aggressive colonizer based on soil pore water conditions observed. This study found that electromagnetic induction is an efficient tool for rapid reconnaissance of detailed soil water conductivity and salinity patterns that can be visualized using GIS and aerial imagery to better understand spatial and temporal patterns that influence invasive species success.

Mora, J.W.; Waquoit Bay National Estuarine Research Reserve, Waquoit, MA. jordan.mora@state.ma.us

IDENTIFYING EVIDENCE OF CHANGE: TRACKING VEGETATION SHIFTS IN A MICRO-TIDAL SALT MARSH SYSTEM

In 2011, the Waquoit Bay National Estuarine Research Reserve (NERR) Salt Marsh Observatory (SMO) was established in accordance with the NERR Salt Marsh Sentinel Site Program. This national scale monitoring program, which requires annual vegetation and surface elevation data collection, was designed to better inform coastal zone management as it relates to climate change and sea level rise. One year after the development of the SMO, aerial photographs were obtained of the area to compare habitat change from earlier aerials flown in 2004. There was clear change overtime in the salt marsh habitats; pool development in the mid to high marsh zones was unmistakably evident. While a more thorough analysis of the magnitude and possible causes of the pool development are forthcoming, the trend provoked an investigation into the vegetation survey results from the past four years. Our findings indicate that within the high marsh zone, a rare habitat in our micro-tidal estuarine system, we are seeing shifts in the density and percent cover of *Distichlis spicata*, a species adapted to early colonization of disturbed marsh areas but less tolerant of saltwater flooding relative to *Spartina alterniflora*, a dominant low marsh species. Although the relationship (if it exists) between the pool development and shift in *D. spicata* remains unclear at this point, the examination has highlighted the importance of the annual vegetation survey especially as it pertains to the high marsh zone, which is particularly vulnerable to sea level rise impacts.

Morgan, P.A.; Environmental Studies, University of New England, Biddeford, ME. pmorgan@une.edu
DOES SHORELINE DEVELOPMENT AFFECT TIDAL MARSH PLANT COMMUNITIES ACROSS A SALINITY GRADIENT?
Human development in coastal watersheds and along shorelines has been linked to changes in salt marsh plant communities, with nitrogen runoff from uplands being identified as a causal factor. The Saco River estuary, located in southern Maine, includes tidal marshes where average porewater salinities in July range from 0.2 to19 ppt. We investigated whether the level of shoreline development might impact marsh plant communities even along such a range of salinities. We also looked at nitrogen in marsh soils using resin bags, a technique that measures available nitrate and ammonium. Nitrogen levels were low (0.03-0.19 mg nitrate/g resin and 0.2–1.6 mg ammonium/g resin) and did not correlate with the extent of shoreline development or with marsh plant community composition. However ordination analysis revealed that marsh plant community composition did correlate with the extent of shoreline development. These results point to the importance of maintaining and strengthening shoreland zoning policies that restrict development in upland areas adjacent to tidal marshes.

O'Connell*, J.K. and S.C. Anisfeld; Yale School of Forestry and Environmental Studies, 195 Prospect Street, New Haven, CT 06511. jamie.oconnell@yale.edu
QUANTIFYING RATES OF SALT MARSH MIGRATION INTO UPLAND HABITAT IN LONG ISLAND SOUND
When sea level rises, salt marshes can avoid habitat loss from drowning through two mechanisms: vertical accretion and landward migration. Projected rates of sea level rise are likely to cause substantial marsh drowning in Long Island Sound. Therefore, it is critical to know whether landward migration can occur quickly enough to compensate for this loss, but few estimates of landward marsh migration rates exist.
This study investigated the historical landward migration of salt marsh peat over upland soil along five transects at two salt marsh sites in Connecticut. Each transect extended from the high marsh to the upland; upland land cover varied from mowed lawn (1 transect) to scrub vegetation (1 transect) to wooded (3 transects). Elevation, tidal hydrology, and vegetation type were collected along each transect, and sediment cores were extracted at regular intervals in an attempt to reconstruct the history of marsh migration. We found that measurements of organic matter and plant macrofossils in cores were not useful for reconstructing that history. However, we were able to use the variation with depth in the total number of foraminifera as a means to differentiate between marsh peat and upland soil, and thus to delineate the past profile of marsh migration. Radiometric dating of a subset of cores could then be used to provide migration rates over time.

Payne, J.* and Dr. S. Wainright; U.S. Coast Guard Academy, 27 Mohegan Ave., New London, CT 06320. sam.c.wainright@uscga.edu
DETECTION OF ANTHROPOGENIC NITROGEN IN NEW ENGLAND COASTAL WATERS USING STABLE NITROGEN ISOTOPES, PART 2
We measured stable nitrogen isotope ratios of macroalgae (principally *Fucus* and *Ascophyllum*) collected in situ to elucidate patterns of anthropogenic nitrogen in New England coastal waters. We sampled from Portland, ME to Westport, CT, including some sites in close proximity to sewage treatment plants and other sites far away. The delta^{15}N values ranged from 3.9 to 12.3 per mil. Macroalgae from sites near sewage treatment plants tended to have higher delta ^{15}N values than samples collected at paired sites far away. At last year's conference, we presented 2013 results showing higher delta ^{15}N at southern sites as compared to northern sites. However, the north vs. south geographic effect was confounded with a seasonal effect. This year we present data from 2014 that isolates both geographic and seasonal variation. The new data confirms the trend of higher delta ^{15}N values to the south and lower delta ^{15}N values at northern sampling sites, and also the seasonal shift from lower delta ^{15}N values in May to higher delta ^{15}N values in August-September.

Pelletier*, M.C. (1), Gutierrez, M.N (1), McKinney R.M. (1), Slocum C. (2); (1) U.S. EPA Office of Research and Development, NHEERL, Atlantic Ecology Division, Narragansett, RI; (2) St Marys College, St Marys City, MD. pelletier.peg@epa.gov
IMPACTS OF SALINITY AND NUTRIENT STRESS TO RUPPIA MARITIMA AND ZOSTERA MARINA: A MESOCOSM EXPERIMENT
Healthy seagrass beds were once found throughout the shallow areas of Narragansett Bay, R.I. but have disappeared due to infilling, pollution and disease. In Greenwich Bay, a highly developed embayment within Narragansett Bay, *Ruppia maritima* has colonized an area on the northern shore once dominated by *Zostera marina*. This area is sandy, which may allow groundwater seepage. *Ruppia* is extremely salinity tolerant, and may also be more nutrient tolerant than *Zostera*. We ran a preliminary six week mesocosm experiment at two salinity (20 and 30 ppt) and 4 nutrient (0, 5, 10, and 30 µM inorganic N)

levels to test their tolerance. The treatments were renewed daily to simulate tidal flushing and the exposure water was dosed with 15N for the first week of the experiment. Of the two species, *Ruppia* had significant structural responses to both nutrients and salinity. With increasing nutrient levels, there was a slight decline in root weight, and a decrease in the total number of shoots. *Ruppia* also had an increase in the number of blades per shoot, which was more apparent at 30 ppt. Average *Ruppia* blade length decreased with increasing nutrients and this decrease was more evident at 30 ppt. *Ruppia* epiphyte cover was greater at 30 ppt than 20 ppt. *Zostera* showed no significant structural differences due to either salinity or nutrients. For both species, there were no differences in shoot or root/rhizome weights in any treatment, nor were there differences in isotopic results due to salinity. For both species, d15N in the tissue increased with increasing nutrient levels. For *Zostera*, %N also increased in the root and rhizomes.

Perry*, R.A. and J.M.P Vaudrey; Department of Marine Sciences, University of Connecticut. rachel.a.perry@uconn.edu
BIOAVAILABILITY OF ORGANIC NITROGEN ENTERING A SMALL, SHALLOW EMBAYMENT.
Freshwater input of nitrogen (N) supports production of primary producers in estuaries, including submerged vegetation, macroalgae, and phytoplankton. While organic N constitutes a large fraction of the N pool in estuaries, primary producers prefer to uptake the inorganic form of N. The question for estuarine scientists and managers is how much of the organic N entering from fresh water is converted to inorganic N and thus made available to the primary producers, i.e. how labile is the organic N over time frames relevant to estuarine primary producers. Relevant time frames were determined using estimates of embayment flushing times, which is how quickly a parcel of freshwater exits the embayment and enters Long Island Sound. Little work on the lability of freshwater organic N has been conducted in small shallow embayments, the bays and harbors first receiving freshwater entering Long Island Sound. The type and lability of organic N will vary with season and watershed. In this study, water was collected during a time of peak primary production, when inorganic N is limiting and estuarine primary producers may thus assimilate organic N at a greater rate. We assessed the lability of organic N entering the Niantic River estuary from a prominent fresh water source, Latimer Brook. The water was incubated in triplicate for three treatments; fresh water from Latimer Brook, salt water from the Niantic River mouth, and a roughly equal mixture of the two. Incubations were sampled over 23 days, the estimated maximum freshwater flushing time of Niantic River. Lability of organic N was assessed by looking at the change in N species (nitrate, nitrite, ammonium, particulate N, and dissolved organic N).

Plunket, J.(1), K. Stanzel (2), R. Weber*(3), and S. Lerberg (4).; (1) North Inlet-Winyah Bay National Estuarine Research Reserve, Georgetown, SC; (2) Mission-Aransas National Estuarine Research Reserve, Port Aransas, TX; (3) Narragansett Bay National Estuarine Research Reserve, Prudence Island, RI; (4) Chesapeake Bay National Estuarine Research Reserve, Gloucester Point, VA. robin@nbnerr.org
INTRODUCING CCVATCH: THE CLIMATE CHANGE VULNERABILITY ASSESSMENT TOOL FOR COASTAL HABITATS
The National Estuarine Research Reserve System uses its living laboratories to find solutions to crucial issues facing America's coasts, including climate change and resilience. The input of land managers, decision-makers, and researchers across agencies was sought to ensure that the Climate Change Vulnerability Assessment Tool for Coastal Habitats (CCVATCH) would provide results that could be directly applied to current management and conservation decisions. Changes in climate have direct effects on ecosystems and also interact with current stressors to impact vital coastal habitats. Adaptive capacity, either natural traits of the system or potential management actions, can lessen the impacts of climate change. The CCVATCH utilizes a facilitated expert elicitation process to assign numerical scores for the potential impact of climate change (e.g. change in CO_2, temperature, precipitation, sea level, and extreme climate events) and environmental stressors (e.g. invasive and pest species, nutrients, sedimentation/erosion, and environmental contaminants) on the habitat and adaptive capacity potential into a spreadsheet-based decision support tool. Tool design and facilitation process was tested on multiple habitats at each of two pilot sites (e.g. Chesapeake Bay Virginia and North Inlet-Winyah Bay South Carolina NERRs). The pilot project helped the development team to refine the CCVATCH so that it can be used nationally by coastal resource managers as a tool for completing vulnerability assessments in coastal habitats. Locally, the application of CCVATCH to salt marsh habitat within the state will support on-going coastal resiliency and restoration project planning efforts.

Quintal, S. N. D.; Department of Watershed Protection, Buzzards Bay Coalition, New Bedford, MA.
quintal@savebuzzardsbay.org
RESTORING AN URBAN RIVER: THE ACUSHNET SAWMILL ECOLOGICAL RESTORATION PROJECT
The Buzzards Bay Coalition is restoring a 19-acre former industrial property that straddles the Acushnet River at the head of New Bedford Harbor in Southeastern Massachusetts. The site was purchased in 2007 because of its potential for conservation, restoration and public access. Phased restoration began with dam removal and installation of a nature-like fishway in 2007 through partnership with NOAA and the MA Department of Marine Fisheries. As a result, the River's herring population has increased 27x since pre-restoration conditions. Further demolition continued over several years, including dismantling several buildings, removing more than 3 acres of impervious surface, taking down concrete river bank revetments and eliminating a bridge crossing. During 2014, the natural river bank and floodplain was restored, more than one acre of additional red maple swamp and freshwater marsh was created, buffering upland habitats were planted and invasive species have been managed. Drought and storm events proved challenging during construction, but informed critical design modifications that resulted in a more resilient restored channel and floodplain. The final design reconnects wildlife from the freshwater and estuarine portions of the river, and is tolerant of rapid fluctuations in water level. To enable the community's exploration of the restored habitats, several amenities were constructed, including a canoe launch, board walks, wildlife overlooks, small visitor center and one mile of walking trails (nearly half of which are handicap-accessible). The site will open to the public upon completion in summer 2015, reconnecting the surrounding urban communities with the River in a way that has never before been possible.

Racine*, S., Buchanan, R., Travis, S., and Zogg, G.; Department of Biology, University of New England, Biddeford, ME.
sracine@une.edu
EFFECTS OF GLOBAL WARMING, NUTRIENT ADDITION, AND SNAIL HERBIVORY ON PLANT PRODUCTION AND MICROBIAL DECOMPOSITION.
Salt marshes are important ecosystems that act as a transitional habitat between land and sea. They provide protection from storms and erosion, regulate pollutants, accumulate carbon, and also act as a nursery for mammals, fish, and invertebrates. Salt marshes are threatened by an assortment of anthropogenic threats, such as global warming, nutrient loading, and herbivory by an introduced snail species. In order to determine how these threats impact primary production and decomposition, we conducted a field experiment in 2014 in a smooth cordgrass (*Spartina alterniflora*) dominated salt marsh at the Wells National Estuarine Research Reserve (Wells, Maine). Plant production was determined by measuring stem heights over the summer months and the oven-dried mass at the end of the growing season. Litterbags were used to determine plant mass loss due to microbial decomposition in the middle and the end of the growing season. At mid-season, we found that nutrients increased the number of live stems, but the presence of snails tended to reduce the positive effect of the nutrients. We also found evidence at the end of the growing season for an interactive effect of nutrients and snails on plant biomass. Decomposition was unaffected by any treatment at mid-season, but was increased by temperature by the end of the experiment. These results illustrate the importance of examining the potential for interactions between multiple anthropogenic factors impacting marshes, as well as considering their distinctive influence on plant production versus microbial decomposition- the balance of which determines surface elevation of the marsh.

Ramsay-Newton*, C. (1), M.E.S. Bracken (2), C.S. Thornber (3), and A. Claros (3); (1) Marine Science Center, Northeastern University, Nahant, MA; (2) University of California – Irvine, Irvine, CA; (3) University of Rhode Island, Kingston, RI.
newton.c@husky.neu.edu
IMPACTS OF THE RECENT ALGAL INVADER, *DASYSIPHONIA JAPONICA* TO NEW ENGLAND COASTAL COMMUNITIES
Drifting macroalgal blooms can have severe impacts on coastal systems, with effects beyond the subtidal and intertidal communities in which these seaweeds grow. The recent red algal invader *Dasysiphonia* (formerly, *Heterosiphonia*) *japonica* to the New England coast has been shown to have substantial impacts on community structure and ecosystem functioning. While the species is a subtidal red alga, *Dasysiphonia* washes up on shores forming large wrack mats on local beaches, rocky shores and estuaries. These wrack mats subsequently decompose and release noxious odors, potentially leading to decreased recreation and tourism, along with headaches for coastal municipalities faced with beach clean up efforts, as these wrack mats occur during the New England beach season. Through monthly compositional beach surveys in Massachusetts and Rhode Island, we found *Dasysiphonia* becomes increasingly abundant in wrack mats from June-August and can comprise up to 65% of these mats, although there is high variability among sites. In situ decomposition experiments

revealed *Dasysiphonia* decomposed faster than of any native species tested, suggesting the high abundance of *Dasysiphonia* is accelerating the decomposition of these wrack mats, *Dasysiphonia* also had the lowest C:N ratio of any species tested, which may be useful to mitigation efforts to utilize this alga as a natural compost or fertilizer.

Raposa*, K. (1), C. Bradley (1), C. Wigand (2), R. McKinney (2), K. Szura (2), E. Watson (2), and J. Gurek (2); (1) Narragansett Bay NERR, Prudence Island, RI; (2) USEPA Atlantic Ecology Division, Narragansett, RI. kenny@nbnerr.org

WHY ARE THERE SO MANY CRABS? STRATEGIES FOR QUANTIFYING SALT MARSH CRAB ABUNDANCE

Dramatic increases in crab populations are being reported from across the New England region. Early research identifies a loss of predators and sea-level rise as potential factors driving these increases, but the relative impact of these and other potential factors remains unclear and may differ among individual marshes. Exacerbating the problem is that field methods for quantitatively sampling marsh crabs remain untested, thereby limiting the value of existing data. Our team conducted a field study to 1) identify environmental factors affecting crab abundance in Rhode Island salt marshes, and 2) evaluate pit traps and burrow counts for sampling marsh crabs. Crabs were sampled with both methods from four habitat types in four RI salt marshes across a gradient in elevation. We also collected companion environmental data, including elevation, inundation, edaphic conditions, and vegetation. We encountered issues that call into question the accuracy of data collected with both methods. Burrow counts were easy to conduct, but it is difficult to know whether they reflect actual crab abundance or to differentiate between species unless peat excavations or visual counts are also conducted. In contrast, pit traps yield species-specific data, but they are highly inefficient and their accuracy can be compromised by multiple factors. Despite these issues, data from both methods show an inverse relationship between marsh elevation and crab abundance. This suggests that wetter conditions associated with sea-level rise may be one factor driving crab abundances higher. We will build on these pilot data in 2015 to better understand changes in crab abundance over time and quantify spatial patterns across a broader region.

Rasmussen*, S. A. (1), Neil, A. J. (1), Bradley, M. P. (1), LaBash, C. (1), August, P. V. (1), Lynch, J. C. (2) Stevens, S. (2); (1) Environmental Data Center, Department of Natural Resources Science, University of Rhode Island, RI; (2) Department of the Interior, National Parks Service, Northeast Coastal and Barrier Network, RI. scottrasmussen@edc.uri.edu

COLLECTING ELEVATION DATA FOR NATIONAL PARK SERVICE SALT MARSHES IN RESPONSE TO SEA LEVEL RISE AND POST- AND FUTURE STORM EVALUATION

In response to the effects of Superstorm Sandy, The University of Rhode Island and the National Parks Service's (NPS) Inventory and Monitoring Program for the Northeast Coastal and Barrier Network have collaborated to develop comprehensive storm response strategies. One of these core strategies is the acquisition of more accurate elevation data that can be used to predict changes in the coastal environment. While Light Detection and Ranging (LiDAR) data exists for the majority of coastal parks, its elevation accuracy can vary from 5-30cm. In salt marshes, the error range maybe even greater and is mainly due to the inability of the LiDAR laser pulse to reach the marsh platform. In salt marsh environments, vegetation zones are typically based on elevation and sometimes differ by only a few centimeters. LiDAR data therefore, is not accurate enough for evaluation of critical ecosystem functions. To better measure the elevation of the salt marsh surface, we used survey grade GPS equipment.

We present our field methods and initial results from salt marsh sites at Assateague Island National Seashore collected in the fall of 2014. We collected comprehensive elevation data from the low to high marsh using 20m grid spacing. Water level loggers were deployed to better understand the tidal dynamics influencing these marshes. These intensive on-the-ground kinematic GPS elevation data (along with water level data) will be used to tie all of these data to the North American Vertical Datum of 1988 and to calculate tidal datums specific to each salt marsh site. Thus, all of our data will be comparable which will help with the identification and prioritization of sites for management or conservation planning.

Reynolds*, J.M.; B.N. Rudnicky; K.M. Smith; and J.A. Sulikowski; Department of Marine Biology, University of New England, Biddeford, ME. jreynolds8@une.edu

ELUCIDATING POTENTIAL SPAWNING PERIODS AND RESIDENCY TIMES OF FISH WITHIN THE SACO RIVER ESTUARY SYSTEM

Coastal estuaries serve as vital nursery grounds for many commercially valuable fish species and species of concern despite the variability in abiotic conditions. In order for these ecosystems to be properly managed, ecological aspects such as trends in growth, spawning periods, and residency times of individual species need to be known. Size classes, determined from

total lengths, can be used to elucidate these important factors. Unfortunately, this information is lacking for the Saco River estuary system (SRES) in the state of Maine. Although previous studies have shown the importance of this system as a nursery ground, additional research was needed to determine factors such as spawning periods and residency times. Thus, this study aimed to build off these past studies and provide new information related to how fish species are using the SRES. In order to obtain this data, larval and juvenile fish surveys consisting of ichthyoplankton tows and beach seines were conducted to obtain total lengths for multiple species between 2007-2014. Over the course of this sampling period, 48 species were discovered with 75% being present in larval, 71% in juvenile, and 46% in both stages. Size frequency charts constructed from the total lengths of these species revealed several use the SRES as a spawning ground. Additionally, size classes deduced from total lengths allowed for an average residency time of 1.5 years to be determined for approximately half of the 48 species. The substantial residency time, the occurrence of spawning, and the high occurrence of species in both larval and juvenile stages further reinforces the use of the system as a nursery and fortifies it's use as a spawning ground.

Rheuban*, J. E. (1), S. Williamson (1), J. E. Costa (2), D. M. Glover (1), R. W. Jakuba (3), D. C. McCorkle (4), C. Neill (5), and S. C. Doney (1); 266 Woods Hole Rd, MS #25. jrheuban@whoi.edu

LONG-TERM TRENDS IN SUMMERTIME CLIMATE AND WATER QUALITY INDICATORS IN THE COASTAL AND ESTUARINE WATERS OF BUZZARDS BAY, MASSACHUSETTS

Eutrophication, largely driven by elevated nutrient levels in runoff from land and groundwater, can degrade coastal ecosystems, but the extent of this problem can vary in both space and time due to changing short- and long-term trends. Through a citizen science monitoring program, the Buzzards Bay Coalition has collected water quality data from 340 sampling stations across Buzzards Bay, MA (USA) since 1992. Data were consolidated into 27 groups of stations representing the individual embayments of Buzzards Bay. For embayments with sufficient data, a linear regression analysis of water quality variables through time revealed statistically significant increases in temperature (19 of 23), total nitrogen (TN, 7 of 17), and chlorophyll *a* (Chl*a*, 15 of 17) and no embayments had decreasing trends. Of the 15 embayments where Chl*a* increased over time, 8 had no significant change in TN concentration. We used a principle component and factor analysis to develop a combined water quality indicator, and found that most embayments had declining or consistently poor water quality over time. We also found a strong correlation between average summertime TN and Chl*a*, which increased in magnitude with time, suggesting that the same amount of nitrogen supported greater phytoplankton biomass at the end of the time series. These trends suggest that the estuarine response to nutrient loading changed, potentially because of because of other stressors such as warming or altered precipitation patterns. In managing water quality of Buzzards Bay and similar coastal systems, it will be important to consider climate-related stressors because a changing climate may mask improvements resulting from efforts to reduce nitrogen loading.

Robinson C. (1), R. Weber*(2), N. Herold (3), and K. Raposa (2); (1) The Baldwin Group, NOAA Office for Coastal Management, Charleston, SC; (2) Narragansett Bay National Estuarine Research Reserve, Prudence Island, RI; (3) NOAA Office for Coastal Management, Charleston, SC. robin@nbnerr.org

BASELINE MAPPING OF RHODE ISLAND'S COASTAL SALT MARSH AND HIGH/LOW MARSH RATE OF CHANGE

Evidence from NERR Sentinel Site and RI Salt Marsh Assessment (RISMA) monitoring efforts indicate a rapid change in salt marsh vegetation communities in response to accelerated sea level rise however the degree to which randomly placed vegetation plots and belt transects captures conditions across the complete marsh surface and the condition of salt marsh occurring outside selected study sites is not known. RI salt marshes will be classified into a minimum of three classes (high, low, and transitional [high/low] marsh) using object-based classification methodologies and techniques developed and tested by the NOAA Office for Coastal Management for a variety of applications. The procedure consists of semi-automated classification of image segments derived from high spatial resolution imagery using Classification and Regression Tree Analysis (CART). The overall mapping process is iterative, requiring multiple analyses of the multispectral imagery and lidar to extract salt marsh habitats based on spectral and topographic characteristics. Interim map products will be generated and reviewed for poor fit and class confusion. Additional spatial modeling and manual editing will be applied as needed to meet target class accuracies. In addition to supplemental field data, RISMA data from multiple sites will be used as necessary to train the classification process and to provide final classification accuracy assessments. A baseline of current salt marsh extent and composition will serve as a resource for coastal wetland restoration and coastal resiliency planning. Maps developed for multiple time periods as future imagery is acquired will allow for high resolution change detection analysis.

Rudnicky*, B.N.; J.M. Reynolds; K.M. Smith; and J.A. Sulikowski; Department of Marine Science, University of New England, ME. brudnicky@une.edu

ABIOTIC INFLUENCES ON THE JUVENILE FISH ASSEMBLAGE OF THE SACO RIVER ESTUARY, ME

Considered among the most productive marine environments within the Gulf of Maine (GOM), estuaries are known to provide habitat, resources, and shelter for diverse fish communities. These complex coastal ecosystems are physiologically challenging habitats due to large variations in abiotic parameters, such as temperature, salinity, dissolved oxygen, and pH. Although the fish community has been well studied in the Saco River estuary (SRE), no study to date has attempted to correlate seasonal fluctuations in fish abundance to environmental factors. The results suggest that the SRE exhibits large fluctuations in surface water temperatures (8-30°C), relative salinity (0-30ppt), and dissolved oxygen concentrations (4-12mg/L). In addition, the data suggests that abundance and diversity of juvenile fish species in the SRE fluctuates on relatively short (month) and long (annual) temporal scales. For example, throughout 2010-14, American sand lance (*Ammodytes americanus*) abundance was consistent throughout the study, while other species, such as large and smallmouth bass (*Micropterus* sp.), were only present during or directly after periods of increased river discharge. Furthermore, fresh and oligohaline (0-5ppt) sampling events yielded 61% freshwater, 33% estuarine, and 6% marine fish species while mesohaline (5-18ppt) sampling events yielded 10%, 33%, and 56%, respectively, suggesting that salinity has the most influence on fish abundance. When this knowledge is combined with the idea that current threats to this region (e.g. climate change, overfishing, and pollution) can affect recruitment, understanding the dynamics of the SRE fish community is crucial to proper conservation and management.

Russell*, K. and R. Konisky; The Nature Conservancy, Great Bay Office, Newmarket, NH. kara.russell@tnc.org

A KEY TO ACTIVATING NEW HAMPSHIRE'S OYSTER RESTORATION PROJECT: NINE YEARS OF BUILDING A COMMUNITY ENGAGEMENT PROGRAM THAT GENERATES USEFUL SCIENCE AND SOCIAL SUPPORT

The need to restore diminished services of the native oyster, Crassostrea Virginica, to Great Bay Estuary has been increasing media awareness among New Hampshire's coastal residents due in part to the Oyster Conservationist (OC) Program. The Nature Conservancy's OC program is a volunteer program that relies on citizens to grow native oysters off their private docks for local restoration. The program serves as an important outreach component by directly engaging the local community in NH's oyster restoration project. Launched in 2006 by the University of New Hampshire with 14 volunteers, the OC program has been operated by The Nature Conservancy of New Hampshire (TNC NH) over the past seven years and has reached 94 different homes and produced nearly 120K oysters for seeding on newly constructed restoration reefs with a clamshell base. Together in partnership, TNC and UNH have restored 18 acres of oyster reef and added about 4M oysters to the Great Bay system to help improve filtration of the bay. The OC program not only helps produce healthy oysters, it has proven to be a critical first step in preparing communities and regulators for oyster habitat restoration projects. Based on results from a post-program survey conducted in 2014, participating volunteers increased their awareness about water quality issues, increased skills in identifying marine invasive species, are concerned with water resource issues, and are making lifestyle changes to help protect the local estuary. This presentation shares the science and social outcomes of a unique community engagement program that has rapidly expanded into NH's coastal community and has now extended into Maine, gaining public support for the larger oyster restoration effor

S. Moseman-Valtierra*(1), K. Kroeger(2), J. Tang(3), O. Abdul-Aziz(4), T. Walker(5), S.Emmett-Mattox(6), S. Crooks(7), N. Ganju (8), T. Surgeon- Rogers(9), K. S. Ishtiaq(4), C. Weidman(9), K. Morkeski(3), K. Egan(1), R. Martin(1), E. Brannon(1); (1) Department of Biological Sciences, University of Rhode Island; Kingston, R(2) USGS Coastal and Marine Science Center; Woods Hole, (3) Ecosystems Center, Ma Biological Laboratory; Woods Hole, MA (4) Ecological and Water Resources Engineering, Florida International University; Miami, F (5) Manomet Conservation Center, Lincoln, MA (6) Restore America's Estuaries (7) ESA PWA; San Francisco, CA (8) Waquoit Bay National Estuarine Research Reserve; Falmouth, MA. smoseman@uri.edu

BRINGING WETLANDS TO MARKET: AN INTERDISCIPLINARY COLLABORATION TO RESTORE BLUE CARBON

Coastal wetlands span a critical interface between land and sea where human activities exert growing demands on limited ecological resources. Coastal wetlands have long been valued for multiple ecosystem services. However, their exceptionally high rates of carbon sequestration (among the highest on earth) have recently presented exciting opportunities to potentially link coastal wetland restoration to carbon market financing. The term "Blue Carbon" refers to that carbon which is biologically sequestered in coastal wetlands, including salt marshes, mangroves, and seagrass beds. Our interdisciplinary team in Waquoit Bay, MA is translating cutting-edge "Blue Carbon" science into tools for coastal wetland restoration.

Products from this collaboration include the first methodology in the U.S. to estimate the reduction of net greenhouse gas emissions resulting from tidal wetland and sea grass restoration. State-of-the-art technology for greenhouse gas flux measurements and innovative modeling approaches are also being applied to help managers make cost-effective predictions of greenhouse gas emissions and carbon sequestration across ecological and anthropogenic gradients. Finally, economic analyses of potential transaction costs for restoration projects relative to their carbon market and societal benefits is being used to offer guidance regarding project scale and feasibility. This work offers one example of interdisciplinary approaches that are needed to advance coastal restoration and potentially ameliorate human impacts on global climate change.

Schmidt*, S.R. (1) and Whitney, M.M. (1); (1) Marine Sciences Department, University of Connecticut, Groton, CT. steven.r.schmidt@uconn.edu

DISTRIBUTION OF RIVER WATER AND ITS INFLUENCE ON STRATIFICATION IN LONG ISLAND SOUND

River water is an important factor in estuarine dynamics and water quality. River plumes can enhance vertical stratification and transport nutrients and pollutants within a receiving estuary. This study focuses on river influences in the Long Island Sound (LIS). The three largest rivers that flow into LIS are the Connecticut, Housatonic, and Thames Rivers. In addition to these, there is also input from the Hudson, and input from tens of smaller coastal rivers who's combined basin area is comparable to that of the Thames. The unique characteristics of each river's watershed and discharge as well as their overlapping areas of influence poses a challenge in isolating their spatial and temporal effects on stratification. Numerical modeling offers a way to establish the relative importance of each river system. The distribution of river water in LIS and their individual influence on maximum vertical stratification are therefore investigated for June of 2013 using the Regional Ocean Modeling System (ROMS). Connecticut River water was found to make up the largest fraction of freshwater and to be the most widely distributed in LIS. The Connecticut was the chief influence leading to stratification in the eastern LIS, but it reduced stratification near the mouths of other rivers. The Housatonic River enhanced stratification in western parts of central LIS. Smaller coastal rivers were found to be a large contributor to the maximum stratification along the southwestern Connecticut shoreline. Stratification in LIS's far western and narrow portions, meanwhile, was credited to the Hudson River. Each river’s influence on stratification, along with thermal contributions, has implications for the development of hypoxia in western LIS.

Schotte*, P. M. (1), Röse, U. S. R. (2), Frederich, M. (1), Zeeman, S. I. (1); (1) Department of Marine Sciences, University of New England, Biddeford, ME; (2) Department of Biological Sciences, University of New England, Biddeford, ME. pschotte@une.edu

INDUCIBILITY OF VOLATILE AND NON-VOLATILE ORGANIC COMPOUNDS IN *FUCUS VESICULOSUS* IN RESPONSE TO METHYL JASMONATE

The brown algae *Fucus vesiculosus* is found ubiquitously throughout the rocky intertidal zone of New England’s coastline, despite apparent grazing pressures from herbivores such as gastropods and isopods. Chemical defense mechanisms as a response to stress have been widely studied in terrestrial plants, yet marine plants remain largely understudied. Jasmonic acid is a well-known organic compound produced by higher plants involved in the induction of defense compounds. Methyl jasmonate, the volatile form of jasmonic acid, was used in this study to determine if a volatile organic compound from distantly related terrestrial plants can produce an induced defensive response. Samples were treated on the rocky shores of Biddeford Pool during low tide as well as in the lab to compare external factors. Collection and analysis of volatile and non-volatile compounds were carried out 3-6 hours and 24 hours after initial treatments. Gas chromatography-mass spectrometry was used to identify volatile and non-volatile compounds produced. Diiodomethane and tribromomethane, two volatile halocarbons thought to be involved in antimicrobial activity, were found in the volatile collection samples. Polyunsaturated fatty acids were found within the algae tissue, including arachidonic acid, a known compound involved in the signaling cascade of animals. Molecular techniques are being developed to determine if compounds are being up-regulated in response to the methyl jasmonate treatment.

Scro*, A.K.(1) Cribari, K.J.(1) Markey, K.R.(2) Taylor, D.L.(1); (1)Department of Marine Biology, Roger Williams University, Bristol, RI; (2) Aquatic Diagnostic Laboratory, Roger Williams University, Bristol, RI. ascro520@g.rwu.edu

SPECIFICITY AND SENSITIVITY OF A PCR-BASED APPROACH FOR DETECTING WINTER FLOUNDER IN BLUE CRAB STOMACHS

Increasing water temperatures in the Northwest Atlantic have resulted in blue crabs (Callinectes sapidus) extending their

geographic range northward to Southern New England coastal habitats, including the Narragansett Bay Estuary (RI, USA). The increased abundance of blue crabs in this area may have important consequences to resident biota. For example, blue crabs may adversely affect juvenile winter flounder (Pseudopleuronectes americanus) populations via trophic interactions. In this study, Polymerase Chain Reaction (PCR)-based methods were used to detect blue crab predation on juvenile winter flounder. To evaluate the sensitivity and specificity of the approach, a winter flounder-specific (WF208) primer set was tested against winter flounder, blue crab, and alternative prey items. The effect of digestion time on detecting flounder DNA in crab stomachs was also determined in laboratory feeding experiments (0-10 hr post-feeding). DNA extractions of tissue and gut contents were carried out using a Qiagen DNeasy Blood and Tissue Kit and the 208 base-pair primer set. WF208 primers successfully and exclusively amplified winter flounder tissue (high sensitivity and specificity). The DNA concentration and quality of digested flounder tissue consistently declined as digestion time increased. PCR results were more variable, however, with flounder DNA being positively detected in 50-100% of crab stomachs examined between 0 and 10 hr post-feeding. In the future, this protocol will be tested with field collected blue crab stomach samples.

Sharif, R.; Department of Natural Resource Science, University of Rhode Island, RI. rahatsharif@gmail.com
VISUALIZING WATER QUALITY DATA USING REACTIVE PROGRAMMING: EXAMINING TWENTY YEARS OF MONITORING DATA USING SHINY

For over twenty years volunteers with the University of Rhode Island Watershed Watch Program have been collecting water quality data in the Pettaquamscutt (Narrow River) Estuary, located in southern Rhode Island. The ability to do this allows watershed watch organizations to monitor the status of their rivers and gain important field experience. This leads to invaluable data that can be used to reveal informative trends across sites and over years. However the large size of these datasets presents multiple problems, such as how they should be managed, visualized, and communicated. Sizable datasets make it unwieldy to handle and can create barriers to those volunteers who collected them in the first place. The creation o an easy to use interface that allows anyone to visualize the data in the and would further connect people to their watershed. With the use of the programming language “R” and its package “Shiny”, dynamic interfaces can be created to allow persons with different levels of technical skill to create customizable graphs depicting multiple stations across many parameters along a variety of temporal scales. This poster will demonstrate some uses of “Shiny” using data collected by watershed watch volunteers along the Pettaquamscutt River Estuary; and will demonstrate a possible way for anyone to access and visualize water quality data.

Smith, S.M.; Cape Cod National Seashore, 99 Marconi Site Road, Wellfleet, MA 02667. stephen_m_smith@nps.gov
VEGETATION CHANGE IN SALT MARSHES OF CAPE COD NATIONAL SEASHORE (MASSACHUSETTS, USA) BETWEEN 1984 AND 2013

Vegetation patterns in salt marshes are largely based on elevation in relation to tidal flooding. In New England salt marshes, vegetation is distinctly zoned into species that occur in the high marsh (elevations above mean high tide) vs. those that reside in the low marsh (elevations below mean high tide). The extent and distribution of these species is responsive to changes in hydrology, particularly sea level rise. In this study, six salt marshes within Cape Cod National Seashore (CCNS) were analyzed using a GIS-based mapping approach that utilized aerial images from 1984 and 2013. The results indicate that there have been highly variable amounts of change among marshes. There have been substantial losses of high marsh vegetation (>190 acres in total), while low marsh vegetation has exhibited large gains in some marshes and relatively minor losses in others with a total net gain of >131 acres. Because sea level rise appears to be outpacing vertical accretion, higher water levels in the near future could result in large vegetation shifts, which would translate to significant changes in marsh structure and function.

Spencer, L. T.; Dept. of Biology, Plymouth State University, Plymouth, NH 03264. lts@plymouth.edu
AN ANALYSIS OF THE SHANNON RIVER AND ESTUARY FLOOD IN THE FALL OF 2009: NATURE AT ITS WORST.

In the fall of 2009, the Shannon River and Estuary reached flood stage. Strong winds and tide forced water up the estuary to Limerick, while rains pelted the Shannon River watershed and sent of slug of freshwater down the stream-bed to Limerick. I will examine the outcomes through photos and maps and indicate how changes in the patterns of flow of the Shannon River acerbated the situation in Limerick and the surrounding countryside.

Stacey, P.E.; Great Bay National Estuarine Research Reserve, New Hampshire Fish & Game Dept., Greenland, NH. paul.stacey@wildlife.nh.gov

ECOSYSTEM-BASED MANAGEMENT - TOASTING MARSHMALLOWS IN THE FIRES OF ANTHROPOCENTRISM

Interest in ecosystem-based management (EBM) and its goal of sustainable, and shared, ecosystem services has been growing, boosted by the landmark Millennium Ecosystem Assessment (MEA) published a decade ago. MEA provided a reasonable management path for increasingly scarce natural resources and services once provided by healthy ecosystems but no longer available in sufficient quantity to sustain human economies and lifestyles. Depletion of this natural "capital" in the face of burgeoning populations and lifestyle demands has been at the expense of balancing a healthy environment with social and economic needs and desires. Parallels between biodiversity and a full market basket of ecosystem services were quickly drawn by environmental scientists, a group arguably predisposed to an eco-centric "Environment – Society – Economy" paradigm. In the business world, with leanings towards an anthropocentric "corporate" ecosystem, the concept has morphed into the triple-bottom-line "People – Planet – Profit" paradigm. Clearly, EBM in both models engenders ecosystem-human trade-offs as it vacillates between the hard-facts of ecological limitations and increasing human demands. A recent discourse by De Lucia (2014) described ecosystem management as "…an Elusive and Contested Concept" limited by "conflicting values; a confusing ensemble of labels and terminologies; [and] the contestations over the underlying concept of ecosystem (De Lucia, 2014). As estuarine researchers and managers, how do we overcome these obstacles and navigate the pressures of law, society and economy to effectively implement an EBM framework? Especially with the burdens of uncertainty a world of rapidly-changing and compromised ecosystems presents.

Steven, B.; Department of Environmental Sciences, Connecticut Agricultural Experiment Station, New Haven, CT. blaire.steven@ct.gov

A MICROBIAL ECOLOGICAL VIEW OF SUDDEN VEGETATION DIEBACK IN A CONNECTICUT WETLAND

Located on the coast of the Long Island Sound, the wetlands of Hammonasset State Park are experiencing a relatively recent development of Sudden Vegetation Dieback (SVD). The cause of this die back remains elusive, but affects the dominant vegetation type *Spartina alterniflora*. The result of this dieback is a release of a large contribution of above and below ground plant material back to the soil. We are employing a combination of microbial ecology and process measurements to characterize the effects of SVD of wetland carbon cycling. The loss of plants, shutting down the dominant source of photosynthesis, and the input of plant biomass has the potential to shift these areas of wetlands from small carbon sinks to large sources of carbon to the atmosphere.

Our preliminary data indicates that SVD affected soils harbor a lower microbial biomass and culturable cell counts than healthy soils. Chlorophyll a, the structural pigment for photosynthesis in the cyanobacteria, was also significantly lower in concentration in the SVD affected soils. These results indicate that there is no compensatory photosynthesis provided by soil phototrophs in SVD affected soils to offset the loss of plants. In this regard, there is little to no carbon fixation occurring in the SVD affected soils. We have recently submitted DNA for sequencing of bacterial and fungal small subunit rRNA genes from healthy and SVD affected soils to gain a deeper understanding of how SVD affects the structure of soil microbial communities. This study will offer a new perspective of the potential causes and effects of SVD as well as a deeper understanding of soil carbon processing in wetlands

Stoffel*, H. (1), Oviatt, C. (1), Kiernan, S. (2), and Requintina, E. (1); (1) University of Rhode Island's Graduate School of Oceanography (UIR-GSO), (2) Rhode Island Department of Environmental Management's Office of Water Resources (RIDEM-OWR). stoffelh@hotmail.com

RIVER FLOW FORCING FACTOR THRESHOLDS ON SEASONAL HYPOXIA IN NARRAGANSETT BAY, RI

About 32.5% of Narragansett Bay is impaired for hypoxia. The Narragansett Bay Fixed-Site Monitoring Network (NBFSMN) provides managers with data and assessment tools to characterize and evaluate low oxygen in Narragansett Bay. Bay hypoxia can be characterized as seasonally intermittent events (May-October) with inter-annual variability that has the potential to threaten ecological health. Based on previous work, the inter-annual variability in the seasonal low oxygen events (daily average oxygen < 2.9 mg O^2/L) are linked with river flow. Years with higher than average number of hypoxic days in a summer season have anomalously large summer seasonal river runoff and/or high spring/summer temperatures. All years, from 2001-2014, were examined using time-series records from the NBFSMN along with all available flow data to determine flow thresholds on seasonal hypoxia. Threshold analysis examined the daily flow rates compared to the mean. The most severe hypoxic years corresponded with the at least one day over the threshold flow rate during the summer

season. Since 1978, there have been an increasing number of extreme flow events occurring in early summer. This increase leads to the potential for an increase in the number seasons with severe hypoxia over the past 35 years.

Tilburg*, C.M. (1), Latimer, J.S. (2), Anderson, R. (3), Elskus, A. (4), Hyland, J. (5), Page, D. (6), ten Brink, M. (2), Stacey, P. (7), Sterling, S. (8); (1) Gulf of Maine Council, Buxton, ME; (2) Environmental Protection Agency, Narragansett, RI; (3) Department of Fisheries and Oceans, St. John's, Newfoundland; (4) USGS/University of Maine, Orono, ME; (5) NOAA, Charleston, South Carolina; (6) Bowdoin College, Brunswick, ME; (7) Great Bay NERR, Durham, NH; Dalhousie University, Halifax, NS. ctilburg@securespeed.us

THE ECOSYSTEM INDICATOR PARTNERSHIP SHIFTS FROM ESIP 1.0 TO ESIP 2.0

The Gulf of Maine Council's EcoSystem Indicator Partnership (ESIP) was formed in 2006 to look at change in the Gulf of Maine ecosystem through the use of indicators. To date, ESIP has published 6 fact sheets on: aquaculture, aquatic habitats, climate change, coastal development, contaminants, and eutrophication. The most recent fact sheet (April 2015) describes the impacts of coastal development on the Gulf of Maine based on indicators of impervious surface and population along with locations of point sources. Other ESIP efforts include developing a webtool that provides access to monitoring locations and data for the indicators as well as building a mobile app to help users locate monitoring information for locations in their watershed. In an exciting development, ESIP is now advancing from ESIP 1.0 to ESIP 2.0 to further integrate the ecological and human dimensions of the Gulf of Maine ecosystem. With guidance from an interdisciplinary Directional Committee, ESIP 2.0 will use an ecosystem services framework that builds upon the initial ESIP 1.0 indicators and provides information on the ecosystem's provisioning, regulating, and cultural services.

Vaughan*, K. L., S. E. Fox, K. C. Medeiros, and M. Tanis; National Park Service, Cape Cod National Seashore, Wellfleet, MA. sophia_fox@nps.gov

PRE-RESTORATION OF THE HERRING RIVER ESTUARY: UNDERSTANDING THE EFFECTS OF TIDAL RESTRICTION

Monitoring and research are essential for understanding the Herring River system in Wellfleet, MA, and for informing the efforts to restore tidal flow by removing the restrictive dike which was put in place in 1909. Limits to tidal flow and flushing have caused an 1100-acre loss of a salt marsh estuary, high mosquito production, increased coverage by invasive plant species, and water quality degradation, including oxygen depletion, acidification, metal toxicity, and high nutrient concentrations. To understand the pre-restoration spatial distribution and movement of sediments, particulate organic matter, and nutrients, water quality studies, bioassay experiments, and benthic invertebrate survey were performed. The upstream portion of the Herring River has low salinities and total suspended solids, and the downstream (tidally-flushed) portion of the river has high salinities and suspended solids. High upstream dissolved nitrogen concentrations decline rapidly with tidal mixing to low concentrations near the dike. Stable isotopic analysis showed clear integration of chemical signals along a salinity gradient into the tissues of suspended particulates, oysters and algae. The benthic invertebrate community also differs between the upstream and downstream portions of the river. The highest diversity was found around the dike where there is an abrupt and artificial salinity gradient. As the Herring River tidal flow is restored, the high nutrient concentrations and degraded water quality in upstream waters will be improved and invasive plants will dieback allowing the native marsh grasses to thrive and the recovery of estuarine fauna, including the economically important Wellfleet oyster.

Verrill, S.A.; 9 Fore Street, Apt. #3. shri.verrill@gmail.com

INTERACTING GRADIENTS INFLUENCING VEGETATION RESPONSE TO TIDAL RESTORATION IN A HYDROLOGICALLY DISTINCT NORTHERN NEW ENGLAND SALT MARSH, HARPSWELL MAINE.

Vegetation changes along the high marsh brackish transitional zone of a Harpswell, Maine tidal marsh were monitored before and after a culvert replacement project in 2014. Tidal flux was restricted on the high marsh upstream from Long Reach Lane, a road which was built somewhere between 1910 and 1945 and bisects Long Marsh. Variations in vegetation were evaluated with special attention given to the aboveground standing biomass of *Typha angustifolia*, a key indicator species for anthropocentric hydrology alteration. During the first growing season, pore water salinity was assessed along surveyed elevation gradients within brackish vegetation zones dominated by *T. angustifolia* established in 2013.Vegetative species were classified as halophytic, brackish, or glycophytic based on their salinity tolerance and assigned to one of these three plant community vegetation zones. Transitions between plant communities were not influenced by elevation changes, suggesting that underlying substrate layers and availability of fresh water from adjacent uplands contributes to root zone salinity. *T. angustifolia* mortality significantly decreased the brackish vegetation zone after the first growing season following

restoration. Reference pore water salinity levels downstream from Long Reach Lane indicate that post restoration salinity increased from oligohaline to mesohaline conditions at the site furthest upstream, and to polyhaline conditions at the remaining four upstream sites. Mortality of the broad brackish zone is making way for halophytic species to expand their footprint on the marsh surface, possibly returning to salt marsh vegetation zones that pre-date restrictions caused by Long Reach Lane.

Walsh*, E.S.(1), Cantwell, M.G.(1), Kreakie, B.J.(1), Nacci, D.(1).; (1) US Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, RI, USA. walsh.eric@epa.gov

PREDICTING THE SPATIAL DISTRIBUTION OF ORGANIC CONTAMINANTS IN AN ESTUARINE SYSTEM USING A RANDOM FOREST APPROACH

We tested a modeling process using Random Forest to predict sediment concentration classes of low, medium, or high of a representative emerging contaminant, triclosan, primarily sourced from wastewater treatment plant (WWTP) and combined sewer overflow (CSO) discharges, in subestuaries of Narragansett Bay. We built the models using a limited number and non-random distribution of sediment triclosan measurements. The explanatory variables were accessible and commonly measured data on site features, such as bathymetry, sediment composition, distance to point source, and the sample coordinates. We found that our models were sensitive to class binning, and model fit based on the model's comparison between predicted and actual class designations improved from 0.66 to 0.88 as the data extremes were marginalized, e.g., predictions of very high and medium concentrations improved. The importance ranks of the explanatory variables as measured by the Random Forest algorithm differed among the three models tested; however, the best-fit model identified the expected variables of top importance, which were distance to WWTP and CSO, and sediment composition, but did not include longitude, which is a poor proxy for Narragansett Bay's urbanization gradient compared to latitude. Some of our results suggested the small number of contaminant measurements was limiting our models predictions. Overall, the process we tested appears to be a promising option to extrapolate distribution information from limited spatial concentration data. Further studies are necessary to evaluate the robustness of the predictions and test the transferability to other estuarine systems.

Williamson*, S.C. (1), Rheuban, J.E. (1), Glover, D.M. (1), Costa, J.E. (2), Doney, S.C. (1); (1) Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; (2) The Buzzards Bay National Estuary Program. swilliamson@whoi.edu

THE EFFECT OF LAND USE CHANGE ON NITROGEN LOAD INTO THE BUZZARDS BAY, MA WATERSHED

Land use change within coastal watersheds may alter nutrient loads into receiving waters, which can increase primary productivity, induce eutrophic conditions, and degrade water quality. As a result, monitoring changes to land use and nitrogen load is essential for water quality assessment. Here, we simultaneously assess changes to land use within the Buzzards Bay, MA watershed, and the impact of such changes on nitrogen load over several decades. We utilize a previously verified nitrogen load model (NLM) requiring land use, atmospherically deposited nitrogen, and wastewater disposal data to determine the effects of changing land use mosaics on nitrogen input into Buzzards Bay. Land cover classifications derived from the NOAA Coastal Change Analysis Program (C-CAP) and Massachusetts land use (MassGIS) databases allowed us to develop a time series of land use mosaics from 1985, 1996, 1999, 2001, 2006, and 2010. A preliminary investigation of changes to land use in the Buzzards Bay watershed reveal that about half of the embayments had a statistically significant change to land use mosaics over the past thirty years which influenced nitrogen load. Two major nitrogen sources in the NLM include human wastewater and runoff from impervious surfaces suggesting that the embayments with increases in urbanized areas and populations will have increases in nitrogen load. Declines in atmospherically deposited nitrogen suggest that embayments with no change in land mosaics will have declining nitrogen loads. This analysis will inform future development of the Buzzards Bay watershed by highlighting embayments susceptible to declines in water quality from changing land use and the resulting nitrogen load.

Wilson*, K.R. (1), J. Aman (1), and B. Johnson (2).; (1) Wells National Estuarine Research Reserve, Wells, ME; (2) Department of Geology, Bates College, Lewiston, ME. kwilson@wellsnerr.org
MEASURING USE OF A RESTORED FISH LADDER IN SOUTHERN MAINE AND DOCUMENTING ANADROMY IN TARGET SPECIES
Restoring habitat connectivity for diadromous fish is a priority goal in Maine streams. On Branch Brook in Wells, ME, the Wells National Estuarine Research Reserve and the Kennebunk, Kennebunkport, and Wells Water District worked cooperatively to restore a non-operable fish ladder, completed in 2014. Prior monitoring identified four species that could benefit from renewed upstream passage: *Alosa aestivalis*, *Anguilla rostrata*, *Petromyzon marinus*, and *Salvelinus fontinalis*. This project focuses on: (1) establishing fish use of the restored fish ladder using trapping and passive integrated transponder (PIT) tags, and (2) understanding potential diadromous behavior of *S. fontinalis* using stable carbon and nitrogen isotopes. Fyke netting from May to June 2014, below the ladder revealed 16 fish species, including the 4 target species. Thirty-five fish were tagged with PIT tags; no tagged fish used the ladder in 2014. Trapping at the top of the ladder occurred from May-Jul, Oct-early Nov, and late Nov-Dec; 56 fish were trapped. Most of these (28) were *Catostomus commersonii*, but also caught were 13 *S. fontinalis*, 8 *S. trutta*, and 7 *P. marinus*. Most fish used the ladder in the spring/summer; only 4 used it in the fall. All 7 *P. marinus* arrived in a single pulse in June. Preliminary analyses of stable isotopes from adipose fins of 9 *S. fontinalis*, and 15 *S. trutta* reveal variation in carbon to nitrogen ratios by species, date, and site of capture. Together, these data inform ongoing restoration efforts and contribute to new understanding of fish species of important ecological and recreational value to the State of Maine.

Yurkevicius*, M. (1), Jacques, J. (1), Breen N.E. (2), and Taylor, D.L. (1); Roger Williams University, Department of (1) Marine Biology and (2) Chemistry, One Old Ferry Rd, Bristol, RI, 02809. myurkeicius061@g.rwu.edu
FATTY ACID PROFILES OF MARINE FISHES FROM RHODE ISLAND COSTAL WATERS
In this study, fatty acids were analyzed in Rhode Island coastal fishes, including summer flounder, Paralichthys dentatus (n=15); black sea bass, Centropristis striata (n=17); and striped bass, Morone saxatilis (n=15). Fatty acid profiles of fish muscle tissue were determined by esterification and gas chromatography. Data were categorized as saturated, mono-saturated, omega-3 and omega-6 fatty acids, and results were expressed as concentrations (mg/100g wet weight; [FA]) and percent of total fatty acid content (%FA). Irrespective of fish species, saturated fatty acids had consistently higher concentrations relative to the other measured profiles (mean saturated [FA] = 15.6 mg/100 g; %FA = 47.6%), whereas omega-6 fatty acids were in lesser concentration (mean omega-6 [FA] = 1.5 mg/100 g; %FA = 3.4%). Inter-species comparisons further revealed that omega-3 fatty acids were lower in black sea bass relative to striped bass and summer flounder (BSB: [FA] = 3.9 mg/100 g; %FA = 13.9%, SB and SF: [FA] = 10-15 mg/100 g; %FA = 21-28%); suggesting the latter species provides greater health benefits for human consumers. Lastly, the fatty acid profiles of the coastal fishes examined in this study were qualitatively compared to measurements made on store bought (aquaculture and wild) Atlantic salmon (Salmo salar) and sockeye salmon (Oncorhynchus nerka). Future research will examine total mercury and selenium concentrations of each fish species to further evaluate their respective health risks and benefits to human health.

Zajac*, R.N. (1); Espinosa,I.(1,2) Kelly, E.(1,3; Perry, D. (1); (1) Department of Biology and Environmental Science, University of New Haven, West Haven, CT 06516; (2) Marine Sciences Research Institute, Jacksonville Univ., Jacksonville FL; (3)Marine Science Program, Hawaii Pacific University, Honolulu HI. rzajac@newhaven.edu
POPULATION ECOLOGY OF THE COFFEE BEAN *MELAMPUS BIDENTATUS* IN RELATION TO CHANGING PATCH STRUCTURE IN SALT MARSH LANDSCAPES
As salt marsh landscapes in New England change, a critical question is how such changes are affecting both resident and transient marsh fauna. We have been studying the population ecology of *Melampus bidentatus* in different vegetation patch types on several marsh systems that have undergone significant change over the past 80 years. Abundances varied considerably within and among patches of *Spartina patens*, remnant *S. patens*, hummocked *S. patens*, and short *S. alterniflora*, suggesting that maintenance of snail populations may not be affected by significant shifts in salt marsh patch structure. However, assessment of abundances in patches relative to marsh location and levels of tidal inundation coupled with field experiments indicate increased predation pressure on snails in all patch types relative to larger *S. patens* patches. There were significant differences in population size-structure among patch types, indicating greater numbers of large individuals in marsh locations that still had larger *S. patens* patches within the local mix of patch types. The number of egg capsules found in *S. patens* and short *S. alterniflora* patches were higher than in hummock patches, and the highest number of eggs per egg capsule was found in short *S. alterniflora* patches. These patterns are discussed relative to future population

maintenance of *Melampus* in salt marshes undergoing changes in patch structure and shifts in other environmental factors such as temperature.