



College of Charleston
Graduate Program in Marine Biology

**21st ANNUAL
STUDENT RESEARCH COLLOQUIUM**

Sept. 23, 2017

Fort Johnson Marine Resources Center
Marine Resources Research Institute Auditorium

PROGRAM & ABSTRACTS

PURPOSE AND HISTORY

The Student Research Colloquium of the Graduate Program in Marine Biology (GPMB) was established in 1998, to increase awareness of research activities by students and faculty affiliated with GPMB; to provide graduate students with experience in making scientific presentations; and to promote interactions among faculty and students conducting research in marine biology. The Colloquium Committee looks forward to your comments regarding ways to improve and enhance this annual event, and thanks all the sponsors for their support.

Previous Keynote Speakers

- 1999 **Dr. Ken Tenore**, Chesapeake Biological Laboratory, University of Maryland
- 2000 **Dr. John Pearse**, Institute of Marine Science, Univ. of California, Santa Cruz
- 2001 **Dr. Lauren Mullineaux**, Woods Hole Oceanographic Institute
- 2002 **Dr. Larry Crowder**, Duke Marine Laboratory, Duke University
- 2003 **Dr. Walter Boynton**, Chesapeake Biological Laboratory, Univ. of Maryland
- 2004 **Dr. Malcolm Shick**, School of Marine Sciences, University of Maine
- 2005 **Dr. Margaret McFall-Ngai**, University of Wisconsin-Madison Medical School
- 2006 **Dr. Jeffrey Levinton**, State University of New York at Stony Brook
- 2007 **Dr. Peter Wainwright**, University of California, Davis
- 2008 **Dr. James T. Carlton**, Williams College & Williams-Mystic Program
- 2009 **Dr. Steve Palumbi**, Hopkins Marine Station & Stanford University
- 2009 **Dr. Erik Sotka**, CofC & **Dr. Geoff Scott**, Hollings Marine Laboratory
- 2010 **Dr. Win Watson**, University of New Hampshire
- 2011 **Dr. John Bruno**, University of North Carolina
- 2012 **Dr. Thomas Near**, Yale University
- 2013 **Dr. Felicia Coleman**, Florida State University & Coastal Marine Laboratory
- 2014 **Dr. Dean Grubbs**, Florida State University & Coastal Marine Laboratory
- 2015 **Dr. Daniel Huber**, University of Tampa
- 2016 **Dr. David Hastings**, Eckerd College

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STUDENT RESEARCH COLLOQUIUM 2017

PROGRAM

Oral and poster presentations will be held at the Marine Resources Research Institute, at Fort Johnson and the Lowcountry Boil will be at the outdoor classroom (adjacent to the Marshlands House). Posters will be on display prior to the poster session in the Marine Resources Research Institute hallway, beginning Friday, 9/22 at noon. Poster presenters will attend their posters in two shifts, from 10:15am - 12:00pm (odd numbered posters) and from 2:45 – 4:15pm (even numbered posters).

SATURDAY, 23 SEPTEMBER

8:45 Introduction and Opening Remarks

Dr. Wally Bublely, Chair of the Colloquium Committee
South Carolina Department of Natural Resources

SESSION 1 – ORAL PRESENTATIONS

- 9:00 1.1 CHARACTERIZATION OF GROWTH ANOMALIES IN *PORITES COMPRESSA* USING METABOLOMICS AND TRACE ELEMENTAL ANALYSIS.** Andersson, E (GPMB, The University of Charleston, SC), Stewart, J (NIST), Work, T (US Geological Survey), Woodley, C (NOAA), Anderson, P (College of Charleston), Schock, T (NIST) and Day, R (NIST)
- 9:15 1.2 TEMPORAL CHANGES IN SOUTH ATLANTIC OCEAN FISH BIODIVERSITY.** Baker, N (GPMB, The University of Charleston, SC), McGlenn, D (College of Charleston), Ballenger, J (SCDNR), Plante, C (College of Charleston) and Strand, A (College of Charleston)
- 9:30 1.3 QUANTIFYING MICROPLASTICS IN THE GUT OF STRANDED COMMON BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) FROM SOUTH CAROLINA, USA.** Battaglia, FM (GPMB, The University of Charleston, SC)
- 9:45 1.4 A SURVEY OF SERUM VANIN-1 CONCENTRATION ACROSS SPECIES OF DIVING MARINE MAMMALS AND TERRESTRIAL MAMMALS USING MASS SPECTROMETRY.** Boxall, B (GPMB, The University of Charleston, SC), Neely, B (NIST), Van Dolah, F (NOAA), McFee, W (NOAA), Naylor, G (College of Charleston) and Janech, M (MUSC)
- 10:00 1.5 ESTIMATING THE AGE AND SIZE DEPENDENCY OF SPAWNING FREQUENCY IN GAG AND SCAMP GROUPER OFF THE SOUTHEASTERN U.S. TO IMPROVE POPULATION MODELS.** Gamboa Salazar, KR (GPMB, The University of Charleston, SC), Wyanski, DM (SCDNR), Bublely, WJ (SCDNR), Klibansky, N (NOAA) and Sancho, G (College of Charleston)
- 10:15 – 12:00 POSTER PRESENTATIONS.** Presenters at odd-numbered posters.
- 12:00 – 1:00 LUNCH**

SESSION 2 – ORAL PRESENTATIONS

- 1:15 2.1 EVERY INVASION TELLS A DIFFERENT STORY: CRYPTIC LINEAGES AND HYBRIDIZATION IN A COSMOPOLITAN MARINE INVERTEBRATE.** Harper, K (GPMB, The University of Charleston, SC), Scheinberg, L (San Francisco State University), Boyer, K (San Francisco State University) and Sotka, E (College of Charleston)
- 1:30 2.2 DETERMINING THE ELEVATIONAL RANGE AND INUNDATION PERIOD OF THE RIBBED MUSSEL (*GEUKENSIA DEMISSA*) ALONG A SALINITY GRADIENT IN SOUTH CAROLINA, U.S.A.** Julien, A. (GPMB, The University of Charleston, SC), A. Tweel (SCDNR), N. Hadley (SCDNR), D. McGlenn (College of Charleston), and P. Kingsley-Smith (SCDNR)
- 1:45 2.3 CIRRAL MORPHOLOGY, ACTIVITY, AND PARTICLE SIZE CAPTURE OF A COMMENSAL BARNACLE, *CHELONIBIA TESTUDINARIA*, RAISED IN CAPTIVITY.** Lane, Z (GPMB, The University of Charleston, SC), DiTullio, J (College of Charleston), Fair, P (NOAA), Van Dolah, F (NOAA) and Zardus, J (The Citadel)
- 2:00 2.4 OCCURRENCE, FATE, AND EFFECTS OF MICROPLASTICS IN THE CHARLESTON HARBOR ESTUARY, SOUTH CAROLINA.** Leads, R. (GPMB, The University of Charleston, SC) and Weinstein, J. (The Citadel)
- 2:15 2.5 OPTIMAL FORMATION OF ACCURATE JUVENILE ABUNDANCE INDICES IN STOCK ASSESSMENTS OF SOUTH ATLANTIC FISHERIES: A CASE STUDY.** Reynolds, J (GPMB, The University of Charleston, SC) and Smart, T (SCDNR)
- 2:30 2.6 INVESTIGATION OF THE SALINITY TOLERANCE OF THE INVASIVE ISLAND APPLE SNAIL IN SOUTH CAROLINA.** Underwood, EB (GPMB, The University of Charleston, SC), Darden, TL (SCDNR), Plante, CJ (College of Charleston), Fowler, AE (George Mason Univ), Knott, DM (Poseidon Taxonomic Services, LLC) & Kingsley-Smith, PR (SCDNR)
- 2:45 – 4:15 POSTER PRESENTATIONS.** Presenters at even-numbered posters.

KEYNOTE PRESENTATION

- 4:15 Introduction of Keynote Speaker**
Dr. Christine Byrum, College of Charleston
- 4:30 Keynote Address**
ORIGIN, EVOLUTION AND DEVELOPMENT OF THE CHORDATES
Dr. Billie Swalla, University of Washington
- 5:30 Closing remarks and award presentation**
Dr. Mike Auerbach, Dean, School of Science and Mathematics
- 6:00 Lowcountry Boil and introduction of new students, Outdoor Classroom**

POSTER PRESENTATIONS

Poster

- 1 **WARM-WATER TOLERANCE OF THE DEEP-WATER GORGONIAN CORAL *ADELOGORGIA PHYLLOSCLERA* WITH IMPLICATIONS FROM THE 2015-2016 EL NIÑO EVENT.** Gugliotti, E (GPMB, The University of Charleston, SC), DeLorenzo, M (NOAA), and Etnoyer, P (NOAA)
- 2 **POTENTIAL SKIN-ASSOCIATED CHEMICAL CUES FOR CYPRID SETTLEMENT OF THE EPIZOOTIC CETACEAN TASSEL BARNACLE, *XENOBALANUS GLOBICIPITUS*.** Hall, A (GPMB, The University of Charleston, SC)
- 3 **IDENTIFYING SOURCES OF MICROPLASTIC TIRE WEAR PARTICLES IN CHARLESTON.** Kell, SE (GPMB, The University of Charleston, SC) and Weinstein, JE (The Citadel)
- 4 **ASSESSMENT OF ATLANTIC HORSESHOE CRAB (*LIMULUS POLYPHEMUS*) NESTING BEACHES AND EGG DENSITIES AVAILABLE TO FEDERALLY THREATENED SHOREBIRDS IN THE ACE BASIN, SOUTH CAROLINA.** Kimelblatt, A (GPMB, The University of Charleston, SC), Kendrick, M (SCDNR), Podolsky, R (College of Charleston), Sanger, D (SCDNR), Brunson, J (SCDNR) and Kingsley-Smith, PR (SCDNR)
- 5 **THE REPRODUCTIVE BIOLOGY AND ECOLOGICAL IMPACTS OF AN INVASIVE CRAB, *PETROLISTHES ARMATUS*.** Popp, TE (GPMB, The University of Charleston, SC) and Wilber, D (College of Charleston)
- 6 **STRUCTURE-FORMING DEEP-SEA CORAL DIVERSITY ON THE WEST FLORIDA SHELF AND HABITAT SUITABILITY MODELS FOR *LOPHELIA* AND *LEIOPATHES*.** Proux, Z (GPMB, The University of Charleston, SC), Sautter, L (College of Charleston), Etnoyer, P (NOAA), Ballenger, J (SCDNR) and Wilber, P (NOAA)
- 7 **LIFE HISTORY OF COMPLEMENTAL MALES IN THE COMMENSAL BARNACLE *CHELONIBIA TESTUDINARIA* AND THE INFLUENCE OF SUBSTRATUM ON SEX.** Reilly, ME (GPMB, The University of Charleston, SC), Zardus, JD (The Citadel), Podolsky, RD (College of Charleston), Strand, AE (College of Charleston) and Burnett, LE (College of Charleston)
- 8 **DETERMINING TOXICOLOGICAL EFFECTS OF INORGANIC PHOSPHATE ON CORAL REEF SPECIES.** Slone, A (GPMB, The University of Charleston, SC) and Woodley, CM (NOAA)
- 9 **IMPROVING DIET RESOLUTION IN THE U.S. SOUTH ATLANTIC USING MOLECULAR TECHNIQUES.** Spanik, K (GPMB, The University of Charleston, SC) and Smart, T (SCDNR)
- 10 **DETECTION OF MULTIPLE PATERNITY IN DIAMONDBACK TERRAPIN (*MALACLEMYS TERRAPIN*) EGG CLUTCHES FROM CHARLESTON, SC THROUGH THE USE OF NOVEL MOLECULAR TECHNIQUES.** Sporre, M (GPMB, The University of Charleston, SC) and Strand, A (College of Charleston)

- 11 HISTOLOGICAL STUDY OF THE LIFE HISTORY OF THE GOBIID FISH GOBIOSOMA BOSCH.** Taylor, MA (GPMB, The University of Charleston, SC), Harold, AS (College of Charleston), Roumillat, WA (College of Charleston), Wyanski, DM (SCDNR) and Smart, T (SCDNR)
- 12 DYNAMIC COLOR IN A BLACK-AND-WHITE WORLD: PENGUIN BEAK SPOTS AS BIOSENTINELS IN THE ANTARCTIC.** Van Skoik, B (The Citadel), Hart, T (University of Oxford) and Nolan, PM (The Citadel)
- 13 AGE, GROWTH, AND REPRODUCTIVE LIFE HISTORY OF TWO DATA-DEFICIENT PARROTFISH SPECIES IN THE CARIBBEAN.** Wagner, G (GPMB, The University of Charleston, SC)
- 14 STRESS RESPONSE AND POST-RELEASE SURVIVAL OF BLACKTIP SHARKS, *CARCHARHINUS LIMBATUS*, CAPTURED IN SHORE-BASED AND CHARTER RECREATIONAL FISHERIES.** Weber, N (GPMB, The University of Charleston, SC), Frazier, B (SCDNR), Burnett, L (College of Charleston), Janech, M (MUSC) and Sancho, G (College of Charleston)
- 15 ENERGETIC RESPONSE TO FEEDING AND TEMPERATURE IN JUVENILE RED DRUM, *SCIAENOPS OCELLATUS*.** Welling, E (GPMB, The University of Charleston, SC), Burnett, L (College of Charleston), Denson, M (SCDNR), Watson, A (SCDNR) and McElroy, E (College of Charleston)

Keynote Speaker

Billie J. Swalla, Ph.D.

Director, Friday Harbor Laboratories
University of Washington

BIOGRAPHY

Billie J. Swalla is the Director of Friday Harbor Laboratories in the College of the Environment and also Professor of Biology in the College of Arts and Sciences at the University of Washington. She is an expert in Invertebrate Development and Marine Genomics. She moved to the University of Washington from Penn State University in 1999 in order to work on the diversity of marine invertebrates that inhabit Puget Sound and the Salish Sea. Professor Swalla began her career at the University of Iowa, working on cartilage and muscle differentiation and limb patterning in chicken embryos with Professor Michael Solursh for her M.S. and Ph.D. A summer taking Embryology at the Marine Biological Laboratory in 1983 changed her life and she moved to Postdoctoral studies with Professor William R. Jeffery at the University of Texas at Austin and Bodega Marine Lab at the University of California at Davis. During Postdoctoral research made possible from a grant from the American Association of University Women, Billie became interested in the role that gender, race and cultures play in science and society. The Swalla lab uses transcriptomics and genomics to investigate the evolution of animal body plans by comparing gene expression between different animal embryos. Specific interests are the Evolution and Development of ctenophores, tunicates and hemichordates.



PRESENTATION AWARDS

Awards are given to two graduate students for the best oral presentation and the best poster presentation. Presentations will be judged on 1) scientific content based on the articulation of the problem, soundness of hypothesis testing, methodologies, and analyses; 2) oral and visual quality of the delivery; and 3) demonstration of confidence and depth of understanding of the material.

A panel of judges will evaluate oral presentations and provide feedback to those participating after the colloquium. A second panel will judge poster presentations and also provide feedback after the colloquium. Audience members will be invited to provide feedback as well.

Following the colloquium, the award for best oral presentation will be presented and the winner will receive a personalized certificate of recognition and a cash award sponsored by Sigma Xi, The Scientific Research Society. The award for best poster presentation will be presented next and the winner will receive a personalized certificate of recognition and a cash award sponsored by The Charleston Natural History Society.

Past Oral Presentation Award Winners:

2016 Kevin Mack	2009 (Feb.) Megan Kent
2015 Robin Frede	2008 Tom Baird
2014 Alyssa Demko	2007 Courtney Arthur
2013 David Coles	2006 Deb Zdankiewicz
2012 Tim O'Donnell	2005 Eric Pante
2011 Kristin Stover	2004 Stephanie Brunelle
2010 David Shiffmann	2003 David Couillard
2009 (Sept.) Melanie Hedgespeth	2002 Bob Grant

Past Poster Presentation Award Winners:

2016 Francesca Battaglia	2011 Tim O'Donnell
2015 Victoria Ruddle	2010 Cameron Doll
2014 Mark Lehtonen	2009 Ryan Joyce & Tessa Bricker
2013 Liz Duermit	2008 Lindsey Parent & Joy Gerhard
2012 Amanda Kelly	

ABSTRACTS

POSTER PRESENTATIONS

- 1 WARM-WATER TOLERANCE OF THE DEEP-WATER GORGONIAN CORAL *ADELOGORGIA PHYLLOSCLERA* WITH IMPLICATIONS FROM THE 2015-2016 EL NIÑO EVENT.** Gugliotti, E (GPMB, The University of Charleston, SC), DeLorenzo, M (NOAA), and Etnoyer, P (NOAA)

Warm-water anomalies associated with El Niño-Southern Oscillation (ENSO) events have had major impacts on the health of marine ecosystems, particularly coral reefs. While such thermal anomalies are more pronounced on shallow-water coral reefs, few studies have examined their occurrence and impacts on adjacent deep-water coral reefs. Deep-water corals are stenothermal organisms and are thus particularly vulnerable to exposures to high temperatures. This study assessed the upper thermal limits of *Adelogorgia phyllosclera*, a deep-water gorgonian coral found at depths between 9-595 m off the California coast. For this purpose, several colonies of *A. phyllosclera* were collected at depths between 50-100 m using a remotely operated vehicle (ROV) and maintained alive in aquaria. Experiments exposed fragments from the colonies to temperatures ranging from 5-25°C over 7 d in the laboratory. The health scores of coral fragments exposed to 25°C were significantly different ($p < 0.05$) than those kept at 5°C and 10°C. Historical temperature records from 1949-2016 indicate that the average temperatures experienced off the California Coast from 20-100 m are between 15°C ($\pm 0.98^\circ\text{C}$) and 10°C ($\pm 0.44^\circ\text{C}$). The historical records also indicate that the 2015-2016 ENSO event involved particularly strong temperature anomalies (temperatures exceeding two standard deviations) at depths between 20-100 m where *A. phyllosclera* populations can occur. These preliminary results represent the first study to understand the effects of warming temperatures on deep-water corals in Southern California, and are imperative in developing management strategies to conserve these crucial, yet vulnerable species.

- 2 POTENTIAL SKIN-ASSOCIATED CHEMICAL CUES FOR CYPRID SETTLEMENT OF THE EPIZOOTIC CETACEAN TASSEL BARNACLE, *XENOBALANUS GLOBICIPITUS*.** Hall, A (GPMB, The University of Charleston, SC)

The pseudo-stalked tassel barnacle, *Xenobalanus globicipitus*, is an obligate ceatacean epibiont found predominantly on the fins of dolphins and small whales in tropical and subtropical waters around the world. The life cycle and behavior of this species is relatively unknown as they are only found on cetacean hosts and are uncommon, making them difficult to study. This research will explore the potential chemical cues associated with cetacean skin that may induce or inhibit settlement of exploring cyprids. Frozen dolphin skin will be cryo-homogenized and both protein and lipid fractions will be extracted and resuspended in separate clear gel casting tubes. These gel lollipops will then be used for settlement assays performed in a large flume using *X. globicipitus* larvae reared in lab from eggs collected from gravid adults. Using tandem liquid chromatography mass spectrometry, the lipidomes of various cetaceans will be examined and compared by body location, demographic, and presence of *X. globicipitus*. The potential

influence of microbial cues will be examined by swabbing host and non-host wild dolphins and characterizing the microbe community using high throughput DNA sequencing. Additional swabs will be used to inoculate sterile tanks containing gel pops and settlement will again be assayed to determine any inhibitory or excitatory effects on cyprid attachment.

3 IDENTIFYING SOURCES OF MICROPLASTIC TIRE WEAR PARTICLES IN CHARLESTON. Kell, SE (GPMB, The University of Charleston, SC) and Weinstein, JE (The Citadel)

Plastic is ubiquitous in the environment today and can be found in fresh and marine waters worldwide. It is estimated that if current production rates continue by 2050, there will be more plastic in the ocean than fish. Recent investigations have found the majority of plastic debris in the pelagic ocean are microplastics (<5 mm diameter). Microplastics can easily be ingested by a wide range of marine species and can serve as both a source of contaminants and act as a vector for contaminants sorbed to them from the environment. Studies conducted within the Charleston Harbor watershed have found a high abundance of black polybutadiene (synthetic rubber) fragments believed to be tire wear particles based on Fourier Transform Infrared Spectroscopy analysis. Tire wear particles are generated by the interaction of tires with road surfaces. The objective of this study is to determine the pathways that tire wear particles enter Charleston Harbor by sampling nonpoint stormwater outfalls, stormwater detention ponds and adjacent receiving tidal waterbodies. Limited data exists on tire wear particles in the marine environment and the results of this study will help fill in existing knowledge gaps as well as help make better informed stormwater management decisions.

4 ASSESSMENT OF ATLANTIC HORSESHOE CRAB (*LIMULUS POLYPHEMUS*) NESTING BEACHES AND EGG DENSITIES AVAILABLE TO FEDERALLY THREATENED SHOREBIRDS IN THE ACE BASIN, SOUTH CAROLINA. Kimelblatt, A (GPMB, The University of Charleston, SC), Kendrick, M (SCDNR), Podolsky, R (College of Charleston), Sanger, D (SCDNR), Brunson, J (SCDNR) and Kingsley-Smith, PR (SCDNR)

The Atlantic horseshoe crab, *Limulus polyphemus*, has played important economic and ecological roles in South Carolina, both historically and presently. The species was harvested as bait for whelk and eel fisheries up until 1991, and is currently harvested by the biomedical industry to be bled in order to derive *Limulus amoebocyte lysate* (LAL), which acts as a sterilization agent for medical instruments and pharmaceutical drugs. Also important is the ecological role of *L. polyphemus* as a food source for migratory shorebirds, including the federally threatened red knot (*Calidris canutus rufa*), which annually consume horseshoe crab eggs as a critical nutritional resource at migratory staging sites. Each spring, horseshoe crabs arrive at beaches to spawn around the new and full moons during high tide. Though their mass spawning events are iconic, little is known about spatial or temporal patterns in their use of shorelines for spawning. This project aims to identify preferential spawning habitat, establish a relationship between productive spawning beaches and egg availability, and assess temporal patterns among crabs, eggs, and migratory shorebirds. To determine preferred nesting shoreline characteristics, spawning surveys were conducted along marked transects around the new and full moons from April 2017 to June 2017 along 14 shorelines in the ACE Basin that

varied in orientation and accretional/erosional status. Abundances of crabs ranged from zero to 1,390 per transect; data analyses are ongoing. Documenting nesting and egg density hotspots will facilitate direct management and conservation of high priority habitat that is crucial to both horseshoe crabs and migratory shorebirds.

5 THE REPRODUCTIVE BIOLOGY AND ECOLOGICAL IMPACTS OF AN INVASIVE CRAB, *PETROLISTHES ARMATUS*. Popp, TE (GPMB, The University of Charleston, SC) and Wilber, D (College of Charleston)

Although the invasive green porcelain crab, *Petrolisthes armatus*, has been established on intertidal oyster reefs in South Carolina for decades, its life history characteristics and potential ecological impacts are poorly understood. To investigate a population in the invasive range, I have been collecting intertidal crabs bi-weekly and noting ovigery status and size over the reproductive season. I will also be conducting two laboratory experiments. In the first experiment, I am determining the length of time females go between clutches in a reproductive season, by holding both male and female *P. armatus* in tanks and following individual females, noting their ovigery status over time. Female size is a factor in this experiment because it is not known if crab size affects frequency of brood production in this species. A second experiment will investigate how this crab affects oyster behavior. This crab species is highly abundant on oyster reefs, occurring at densities as high as thousands of crabs per square meter. I will test how varying densities of crabs may potentially affect gape width in oysters. Oysters protect themselves from predation, irritation, and disease by closing their valves. High crab densities may reduce the amount of time an oyster opens its shells, thus impacting its ability to feed, grow, and survive. The goal of this study is to determine whether oysters shut their shells longer as crab densities increase. Together, these experiments will help us better understand the role and impact of this non-native species in its invasive range.

6 STRUCTURE-FORMING DEEP-SEA CORAL ABUNDANCE AND DIVERSITY ON THE WEST FLORIDA SHELF. Proux, Z (GPMB, The University of Charleston, SC), Sautter, L (College of Charleston), Etnoyer, P (NOAA), Ballenger, J (SCDNR) and Wilber, P (NOAA)

Structure forming deep-sea corals are a foundational ecological group in the deep-sea; *Lophelia* and *Leiopathes* are ecosystem engineers common in deep-sea habitats on the West Florida Shelf. The distribution of structure-forming deep-sea corals depends primarily on depth, presence of hard substrate, and vertical relief on the seafloor, but less is known about how deep-sea coral assemblages vary with different geomorphologic features. The primary goal of this study is to compare diversity and abundance of deep-sea coral assemblages as they relate to three geomorphologic features (i.e. flats, mounds, and ridges). The secondary goal is to produce the first presence-absence mesoscale models for *Lophelia* and *Leiopathes* in four or five Habitat Areas of Particular Concern (HAPC) proposed by the Gulf of Mexico Fishery Management Council for the West Florida Shelf at depths of 200-1000m. High-resolution multibeam sonar data from two surveys (2008, 2012) in concert with coral presence data from NOAA's deep-sea coral database, presence-absence data from ROV dives planned for NOAA

Ship Nancy Foster in 2017, and NOAA Ship Okeanos Explorer's in 2018. The image data will be used to enumerate and identify deep-sea coral assemblages on flats, mounds, and ridges, and then to evaluate existing habitat suitability models for *Lophelia* and *Leiopathes*. Understanding the relationship between common geomorphology and deep-sea coral distribution will better inform biologists and managers about where to find and protect these animals. The models will also shed light on if *Lophelia* and *Leiopathes* presence data is dense enough for accurate mesoscale predictive modeling yet.

7 LIFE HISTORY OF COMPLEMENTAL MALES IN THE COMMENSAL BARNACLE *CHELONIBIA TESTUDINARIA* AND THE INFLUENCE OF SUBSTRATUM ON SEX. Reilly, ME (GPMB, The University of Charleston, SC), Zardus, JD (The Citadel), Podolsky, RD (College of Charleston), Strand, AE (College of Charleston) and Burnett, LE (College of Charleston)

Chelonibia testudinaria is an epibiotic acorn barnacle that attaches to sea turtles, manatees, and crabs. Its sexual system is androdioecy, which includes both hermaphrodites and males. Males are classified as "complemental" because they are smaller and attach to the shell of the hermaphrodite, often in the crevices between the shell plates of the hermaphrodite. The focus of this project is to describe life history characteristics of complemental males and examine the impact of substratum type on sex determination in *C. testudinaria*. The first objective will estimate the size of males at sexual maturity. Males will be sampled periodically, their rostro-carinal length measured, and sexual maturity assessed by the presence or absence of sperm. In addition, male attachment locations will be mapped to determine if settlement patterns are random or skewed toward shell crevices. The second objective will determine if the substratum on which a cyprid settles influences the sex of the individual. To test this hypothesis, settlement chambers will be created containing varying numbers of hermaphrodites attached to PVC. Then, 25-30 cyprids will be added to the chambers and allowed to attach, and resulting sex ratios will be calculated after a period of growth. If more cyprids develop into males in the chambers relative to the number of hermaphrodites available, the conclusion will be that substratum influences sex determination. Further description of the sexual system of *C. testudinaria* and complemental males could expand knowledge of androdioecy and the evolution of sexual systems.

8 DETERMINING TOXICOLOGICAL EFFECTS OF INORGANIC PHOSPHATE ON CORAL REEF SPECIES. Slone, A (GPMB, The University of Charleston, SC) and Woodley, CM (NOAA)

Coral reefs provide nutrients and habitats for diverse marine life, protect the coastline from erosion and are economically valuable, but coral health, reproduction and survival continue to decline. This study investigates the toxicity of inorganic phosphate on tropical marine species foundational for coral reefs. Excess phosphate concentrations have been reported to weaken skeletal structure, decrease fertilization rates and increase disease severity in coral. In previous work, measured porewater phosphorus concentrations at 8 out of 12 sites in St. Croix, U.S. Virgin Islands ranged from 51.2 – 367 µg/L, which were well above the total phosphorus water quality criteria (<50 µg/L). In addition, *Acropora palmata*, a critically endangered coral species, was shown to have exceedingly low reproductive effort near the locations with high

phosphorus levels. Based on these findings, the present study tested the effects of phosphorus ranging in concentration from 0.1 mg/L to 2.0 mg/L (over 5 times greater than reported in the environment) on early life stages of the sea urchin (*Lytechinus variegatus*) and coral (*Acropora palmata* and *Orbicella faveolata*). Sea urchin trials were conducted at 25°C resulting in no adverse effect observed on embryo development. Fertilization and larval survivorship were examined for both coral species at 29°C and at 31°C. The results indicated no observable adverse effect on either fertilization rate or survivorship for either *A. palmata* or *O. faveolata*. Information garnered from quantifying the impacts of elevated phosphate concentrations on coral reef species may aid in setting appropriate nutrient water quality criteria for protected coral species.

9 IMPROVING DIET RESOLUTION IN THE U.S. SOUTH ATLANTIC USING MOLECULAR TECHNIQUES. Spanik, K (GPMB, The University of Charleston, SC) and Smart, T (SCDNR)

With growing research and support for Ecosystem-Based Fisheries Management (EBFM) approaches, incorporation of ecological interactions into fishery management plans is becoming more realistic, and is even mandated in some cases. Diet studies in particular provide valuable insight on competition for resources, habitat use, energy flow, natural mortality, and seasonal variability that are not considered in single-species stock assessment models. This type of information is especially important in South-Atlantic reef ecosystems, where many species exhibit high site-fidelity and co-occurrence is common. Many grouper/hind species (family Serranidae) exhibit high metabolic rates, and consequently their prey items are commonly in advanced stages of digestion and cannot be visually confirmed through traditional morphological analysis techniques. This study will aim to increase resolution for both inter- and intra-specific diet composition for several species of grouper from the U.S. South Atlantic by combining both visual and molecular diet analysis techniques. Since genomic DNA of prey items from stomach contents can be highly degraded, a portion of mitochondrial gene cytochrome oxidase subunit I will be chosen as a target amplicon because of its abundance within cells, and publicly available primers and reference sequences that can be used to achieve species-level resolution.

10 DETECTION OF MULTIPLE PATERNITY IN DIAMONDBACK TERRAPIN (*MALACLEMYS TERRAPIN*) EGG CLUTCHES FROM CHARLESTON, SC THROUGH THE USE OF NOVEL MOLECULAR TECHNIQUES. Sporre, M (GPMB, The University of Charleston, SC) and Strand, A (College of Charleston)

Egg clutches sired by more than one male are common in turtles even though females do not receive direct benefits from mating with multiple males and turtles do not display strong social interactions that give rise to multiple mating. Indirect benefits of multiple paternity include sperm competition and increased genetic diversity of offspring. Past studies of diamondback terrapins have shown variation in the occurrence of multiple paternity under a range of female dominated sex-ratios. *Malaclemys terrapin* in the Charleston area provide a good system to investigate the relationship between population sex-ratio and multiple paternity because of a high male to female sex-ratio. The objectives of the proposed project are to (1) develop both a

microsatellite panel and SNP panel for *M. terrapin*, (2) develop a maximum likelihood statistics program to compare mating system hypotheses, and (3) determine incidence of multiple paternity, male clutch contribution and genetic diversity in diamondback terrapin egg clutches collected from a male dominated system using microsatellite and SNP markers. I hypothesize that the degree of multiple paternity and genetic diversity are directly correlated to the probability of male encounters, which is driven by sex-ratios in the field. Results of this study will identify mating behaviors and effective population size of diamondback terrapins in the Charleston area while shedding light on the effects that sex-ratios have on the frequency of multiple paternity within conspecifics. In addition, the methodology developed in this project will have far reaching applications to future questions about conservation and mating strategies.

- 11 HISTOLOGICAL STUDY OF THE LIFE HISTORY OF THE GOBIID FISH GOBIOSOMA BOSCI.** Taylor, MA (GPMB, The University of Charleston, SC), Harold, AS (College of Charleston), Roumillat, WA (College of Charleston), Wyanski, DM (SCDNR) and Smart, T (SCDNR)

Gobiosoma bosc is a cryptic, short-lived goby abundant in shallow coastal habitats, oyster reefs, and estuaries throughout the northwestern Atlantic from New York south to southern Florida, excluding the southern tip of Florida, and along the coast of the Gulf of Mexico to Campeche, Mexico. Previous studies on the life history of *G. bosc* failed to include age determination or histological analysis of gonadal tissues, therefore basic knowledge of its population demographics and reproductive biology remain nearly unknown. The aim of the current study is 1) to determine the age and growth rates for individuals of all size classes for both sexes of *G. bosc*; 2) determine the duration of the spawning season and spawning periodicity for populations within the Charleston Harbor; and 3) histologically describe their sexuality and reproductive biology. Specimens will be collected monthly using oyster shell trays, seine nets, dip nets, and hand collections from three sites within the Charleston Harbor beginning May 2017 until August 2018. Prior to fixation, sagittal otoliths will be removed for aging and growth analyses. Formalin-fixed dissected gonad tissue and surrounding viscera will be sectioned and sequentially mounted to obtain a full cross-sectional series of the gonad and accessory gonadal structures. Histological study of mounted sections will provide information about sexuality and gonadal stages and general reproductive biology of *G. bosc* populations in the Charleston Harbor. Results from the study will provide data necessary for population assessments of *G. bosc* and their ecological role within oyster reefs and estuarine ecosystems.

- 12 DYNAMIC COLOR IN A BLACK-AND-WHITE WORLD: PENGUIN BEAK SPOTS AS BIOSENTINELS IN THE ANTARCTIC.** Van Skoik, B (The Citadel), Hart, T (University of Oxford) and Nolan, PM (The Citadel)

Animals' external characteristics, including behaviors, sexually-selected ornaments, and integumentary colors, reveal details of their age, physiology, and/or body condition. Ornamental coloration of the beak and feet, in particular, signal health status that can vary dynamically on a time frame of minutes or hours. Gentoo penguins (*Pygoscelis papua*) display a deep red beak spot, with substantial variation between individuals shown experimentally to

reflect concentration of carotenoid pigments. Carotenoid pigments may be used in mating displays or in the immune system, meaning that birds showing the deepest red are in the best condition. We sampled 50+ birds at each of 10 breeding colonies on the Antarctic peninsula, taking care not to sample the same bird twice. Using a color standard placed next to the bird in each photo, we standardized light levels of the photos before measuring hue, saturation, and brightness. We calculated colony-wide mean values along each of those parameters, and found substantial variation between the colonies. We compare those means with other publicly-available data to assess possible causes of the variation, considering prey availability, tourism visits, latitude, and ambient temperature changes as possible correlates. Our work will not only allow better management of human activities such as tourism and fishing in the Antarctic, it may help us predict future changes on the Antarctic peninsula.

13 AGE, GROWTH, AND REPRODUCTIVE LIFE HISTORY OF TWO DATA-DEFICIENT PARROTFISH SPECIES IN THE CARIBBEAN. Wagner, G (GPMB, The University of Charleston, SC)

Parrotfish's grazing behavior helps control algal growth and prevents coral reefs from becoming algae-dominated. No other organism provides this service; therefore the presence of parrotfish is crucial to coral reef health. In the Caribbean, snapper and grouper species are commercially targeted, while parrotfish have historically constituted a small, subsistence based fishery. In recent years, snappers and groupers have become heavily overfished, resulting in parrotfish experiencing intense increases in fishing pressures. In 2011, the SouthEast Data, Assessment, and Review (SEDAR) stock assessment indicated severe data deficiencies regarding age, growth and reproductive life histories of several species of parrotfish, including redtail parrotfish (*Sparisoma chrysopterum*) and stoplight parrotfish (*Sparisoma viride*), the two most heavily targeted parrotfish species in the Caribbean. Due to the severe lack of data, responsible management decisions were not possible. This study aims to fill these data gaps by determining and comparing growth rates, population age structure, sex ratios, reproductive seasonality, and size and age at maturity for redtail and stoplight parrotfish in U.S. Caribbean waters. Lengths and weights will be coupled with age determined from otoliths and sexual maturity determined from reproductive histology to shed light on the life histories of redtail and stoplight parrotfish in Puerto Rico, St. Thomas, and St. Croix. The results of this study can influence management decisions such as catch limits, size and seasonality restrictions, as well as gear restrictions in order to maintain healthy parrotfish populations, and in return, allow coral reefs to continue benefiting from the grazing control that parrotfish provide.

14 STRESS RESPONSE AND POST-RELEASE SURVIVAL OF BLACKTIP SHARKS, *CARCHARHINUS LIMBATUS*, CAPTURED IN SHORE-BASED AND CHARTER RECREATIONAL FISHERIES. Weber, N (GPMB, The University of Charleston, SC), Frazier, B (SCDNR), Burnett, L (College of Charleston), Janech, M (MUSC) and Sancho, G (College of Charleston)

In recent decades, the number of recreational fishermen has increased, including those participating in shore-based and charter fishing. The stress imposed on a fish through capture, and associated post-release survival rates, are poorly understood for most marine species. In the U.S. south Atlantic, the blacktip shark (*Carcharhinus limbatus*) is the most commonly landed

large coastal shark species, and is targeted by shore-based and charter fishermen. Despite its popularity, the effects of recreational capture and release on the blacktip shark are unknown. The present study aims to: (1) assess post-release survival rates of blacktip sharks captured in shore-based and charter fisheries; (2) quantify the stress response associated with both capture modes; and (3) investigate use of a heat shock protein (Hsp70) as an indicator of the stress response. To monitor post-release survival, sharks are fitted with acoustic transmitters and pop-up satellite tags. To quantify the stress response, blood is drawn via caudal venipuncture and analyzed using a portable blood analyzer. Comparisons of Hsp70 in the red blood cells will be assessed by semi-quantitative western blotting. Preliminary data indicate that pH, lactate, and hematocrit do not differ between the two capture modes ($p > 0.05$). However, as fight time increases, lactate (mmol/L) increases for sharks caught from charter boats ($p < 0.05$), and hematocrit (%) increases for sharks caught from shore ($p < 0.05$). The present study will enhance our understanding of the blacktip shark's physiological response to two different capture modes and will provide post-release survival estimates critical to the upcoming stock assessment of the blacktip shark.

15 ENERGETIC RESPONSE TO FEEDING AND TEMPERATURE IN JUVENILE RED DRUM, *SCIAENOPS OCELLATUS*. Welling, E (GPMB, The University of Charleston, SC), Burnett, L (College of Charleston), Denson, M (SCDNR), Watson, A (SCDNR) and McElroy, E (College of Charleston)

Fish metabolic rates depend on environmental temperatures. Standard metabolic rate (SMR) and the cost of processing a meal (specific dynamic action or SDA) both change with temperature. Increased temperature normally shortens the total duration of SDA but also amplifies the peak oxygen consumption rate. High temperatures may result in a greater overall oxygen demand, or magnitude, of SDA. Fish SDA response to higher temperatures has been found to vary by species, increasing in magnitude in species such as Atlantic cod and decreasing in others such as the common minnow. A common estuarine fish in South Carolina, red drum, *Sciaenops ocellatus*, is frequently exposed to elevated temperatures. This project will test the hypotheses that 1) higher temperature will shorten red drum SDA duration while increasing the peak oxygen consumption rate, and 2) high temperature will increase the magnitude of SDA. Juvenile red drum (N=40) will be randomly assigned to one of two temperature treatments that mimic natural conditions in Charleston Harbor: 25°C and 28°C. After a two-week period, metabolic rates will be measured using respirometry. SMR will be measured after a 24-hour starvation period. Then, fish will be fed *ad libitum* and then monitored as metabolism increases during digestion and returns to SMR. Increased oxygen demand of SDA in red drum could limit the animal's digestion in an estuarine habitat known to frequently exhibit high temperatures and hypoxic conditions.

ORAL PRESENTATIONS

- 1.1 CHARACTERIZATION OF GROWTH ANOMALIES IN *PORITES COMPRESSA* USING METABOLOMICS AND TRACE ELEMENTAL ANALYSIS.** Andersson, E (GPMB, The University of Charleston, SC), Stewart, J (NIST), Work, T (US Geological Survey), Woodley, C (NOAA), Anderson, P (College of Charleston), Schock, T (NIST) and Day, R (NIST)

Coral growth anomalies (GAs) are tumor-like coral lesions, generally characterized by localized increased skeletal growth resulting in an abnormal protuberant mass on a coral colony. There are competing hypotheses of causative factors, including pathogens, UV radiation, and water quality stressors. Although GAs have been characterized in multiple coral species using field surveys and laboratory techniques, the mechanisms responsible for the disruption of the skeletal morphology and associated impacts to coral soft tissues remain unknown. The current study utilizes a combination of ^1H NMR metabolomics and ICP-MS trace element analysis to further characterize these anomalies.

Paired fragments comprising lesion (GA) and healthy *Porites compressa* were collected (n=15) from Coconut Island (Oahu, Hawaii) where prevalence of GAs is high. Significant increases were detected in skeletal V/Ca, Mo/Ca, Sb/Ca, U/Ca, and Sr/Ca ratios, as well as a significant decrease in the skeletal Mg/Ca ratio, in GA samples relative to healthy samples (paired sample T-test; FDR adjusted p-value <0.05). Potential geochemical and physiological implications of the trace elemental differences between GA and healthy samples will be discussed. Metabolomics data analyses revealed 89 peaks important for discriminating between GA and healthy metabolic signatures. Metabolite identification and possible physiological implications of these metabolites will be discussed. Evaluating the metabolome of the disease state in conjunction with complementary ICP-mass spectrometry trace element data on the skeletal anomalies will provide novel and diverse insight into the biochemistry associated with the disease.

- 1.2 TEMPORAL CHANGES IN SOUTH ATLANTIC OCEAN FISH BIODIVERSITY.** Baker, N (GPMB, The University of Charleston, SC), McGlenn, D (College of Charleston), Ballenger, J (SCDNR), Plante, C (College of Charleston) and Strand, A (College of Charleston)

Due to pressures from anthropological activities and environmental changes, large decreases in the number of species have been reported across the globe. This “global biodiversity crisis” has become a topic of much interest, with studies noting declines of species numbers and individuals and increased homogenization of communities. However, there is much ambiguity on the extent and nature of these changes, due to the fact that the scale of the sampling studies affects the observed results. This study used a scale-dependent approach to measure changes the fish community has undergone in the south Atlantic Ocean over the past three decades. Using coastal trawl data provided by the SCDNR Southeast Area Monitoring and Assessment Program – South Atlantic, we analyzed various facets of biodiversity for the historic (1990-1995) and modern (2010-2015) fish assemblages. We found that there have been no significant changes in the species richness, though the modern assemblage has a much higher number of individuals. The modern community is also patchier, and has a slightly higher spatial

turnover of both rare and common species. These results provide a better understanding of the changes occurring in the south Atlantic fish community across multiple spatial scales, and demonstrate the importance of scale in the analysis when conducting studies of biodiversity.

1.3 QUANTIFYING MICROPLASTICS IN THE GUT OF STRANDED COMMON BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) FROM SOUTH CAROLINA, USA. Battaglia, FM (GPMB, The University of Charleston, SC)

Plastic pollution is one of the most common and persistent problems impacting marine ecosystems to date. An increasing number of studies focus on the potential for microplastics (< 5 mm) to negatively impact marine biota, such as by hindering nutritional uptake or as a possible route for toxin transfer. Ingestion of microplastics has been reported for a variety of lower trophic level organisms in both field and laboratory studies, including zooplankton, polychaetes, bivalves, crustaceans, and fish. Conversely, ingestion by higher trophic levels remains largely unexplored. The common bottlenose dolphin (*Tursiops truncatus*) is a long-lived resident and apex predator in coastal and estuarine ecosystems along the southeastern United States and as such, can be a sensitive gauge for environmental quality within its range. The aim of the present study is to provide the first measure for microplastic ingestion in *T. truncatus* by analyzing the gut contents of stranded dolphins recovered in South Carolina, USA. It is hypothesized that *T. truncatus* may be exposed to microplastics through its prey. The gastrointestinal tract of stranded dolphins is removed and the contents washed into glass containers. Intact prey items and otoliths are stored for separate prey analysis while the remaining gut contents are sieved to separate into size fractions. A 1M KOH solution is added to eliminate organic material and facilitate the visual identification of microplastics in samples. Findings from this investigation will aid future studies examining microplastics as a possible route for the transfer of toxins to marine apex predators like *T. truncatus*.

1.4 A SURVEY OF SERUM VANIN-1 CONCENTRATION ACROSS SPECIES OF DIVING MARINE MAMMALS AND TERRESTRIAL MAMMALS USING MASS SPECTROMETRY. Boxall, B (GPMB, The University of Charleston, SC), Neely, B (NIST), Van Dolah, F (NOAA), McFee, W (NOAA), Naylor, G (College of Charleston) and Janech, M (MUSC)

A proteomic study of bottlenose dolphin serum identified and measured the highest concentration of pantetheinase (Vanin-1) for any mammal. Vanin-1 is known to catalyze the formation of the free-thiol antioxidant cysteamine, from the vitamin B5 precursor, pantetheine. Because diving marine mammals have a high antioxidant capacity in their tissues and blood to counter dive-induced oxidative stress; we hypothesized that elevated levels of Vanin-1 in diving marine mammals may represent an adaptation or response to diving. To test this hypothesis, serum Vanin-1 concentrations were measured across closely related mammalian taxonomic groups of terrestrial and marine mammals. Serum Vanin-1 concentrations were estimated by parallel reaction monitoring using species-specific stable isotopic peptide standards. In members of Carnivora, serum Vanin-1 concentrations were high (greater than 1.0 ug/mL) in sea lions (mean=9.16 ug/mL, ± 1.0), but not detectable in dogs. In members belonging to Paenungulata, which includes hyraxes and manatees, Vanin-1 levels were high in manatees

(mean=24.21 ug/mL, \pm 8.46), but not detectable in hyraxes. In members belonging to Euungulata, Vanin-1 levels were high in 9 out of 10 cetacean species surveyed (range=2.87-106.38 ug/mL). A high Vanin-1 phenotype appears to be characteristic of nearly all other members of Euungulata, which includes hippos (15.75 ug/mL, n=1), ruminants (range=2.32-45.60 ug/mL), and horses (mean=45.02 ug/mL, \pm 18.38). Interestingly, Vanin-1 was not detectable in pigs. In conclusion, a high serum Vanin-1 phenotype appears to be unique to diving marine mammals in Carnivora and Paenungulata, but not in Euungulata. In Euungulata, a high serum Vanin-1 phenotype appears to be an ancestral state that was retained in cetaceans.

1.5 ESTIMATING THE AGE AND SIZE DEPENDENCY OF SPAWNING FREQUENCY IN GAG AND SCAMP GROUPER OFF THE SOUTHEASTERN U.S. TO IMPROVE POPULATION MODELS. Gamboa Salazar, KR (GPMB, The University of Charleston, SC), Wyanski, DM (SCDNR), Bubley, WJ (SCDNR), Klibansky, N (NOAA) and Sancho, G (College of Charleston)

The productivity of a fish stock can be measured by the relationship between reproductive output and recruitment into the stock. Spawning stock biomass (SSB), the total weight of mature females, is used to calculate reproductive output, but it assumes a consistent relationship between number of oocytes and fish weight. Increases in spawning frequency with size have been documented in marine fishes, invalidating this assumption. Parameters calculated from SSB-based assessments can therefore lead to inaccurate estimates of productivity and ineffective management regulations. To remove the assumption, assessments have begun to quantify reproductive output as total egg production (TEP). However, when information on spawning frequency variability is lacking, a constant spawning frequency is assumed for calculation of TEP. This study investigated the relationships between spawning frequency and both age and size in two reef fish species off the southeastern United States: Gag (*Mycteroperca microlepis*) and Scamp (*Mycteroperca phenax*). Archived gonad samples (n=7,177) were histologically examined for determination of reproductive phase and presence of spawning indicators. Regressions indicate that spawning frequency is parabolically related to both age ($R^2=0.807$) and size ($R^2=0.842$) for Gag, and to size for Scamp ($R^2=0.901$). Further, an estimate of Gag TEP is 34.7% lower when calculated with an age-based spawning frequency than with a constant one. These analyses will be used to generate more accurate, age- and size-based models of reproductive output. Incorporating these models into TEP estimates should lead to more accurate calculations of stock productivity, thus providing better estimates of harvest rates to ensure stock sustainability.

2.1 EVERY INVASION TELLS A DIFFERENT STORY: CRYPTIC LINEAGES AND HYBRIDIZATION IN A COSMOPOLITAN MARINE INVERTEBRATE. Harper, K (GPMB, The University of Charleston, SC), Scheinberg, L (San Francisco State University), Boyer, K (San Francisco State University) and Sotka, E (College of Charleston)

Marine biological invasions are accelerating in number and impacts. To understand and manage such invasions, it is important to both accurately identify invasive species and identify their introduction sources and pathways. This effort is complicated by the rampant speciation and potential hybridization of invertebrates. As one case study, we collected 349 individuals of the

estuarine amphipod *Ampithoe valida* from across native and introduced populations, Sanger sequenced mitochondrial COI and genotyped ~10K nuclear single-nucleotide-polymorphisms (or SNPs) using RADseq. Across the native range of *A. valida*, we found both mitochondrial and nuclear divergence between Pacific and northwestern Atlantic populations, indicating two subspecies or species. In contrast, three introduction events generated distinct genetic outcomes. An introduced population in Argentina has both Atlantic mitochondrial and nuclear genotypes. However, two California populations show varying levels of mito-nuclear discordance: San Francisco Bay populations have Pacific mitochondria and a mix of Atlantic-and-Pacific SNPs, while Humboldt Bay has Atlantic mitochondria and a mix of Atlantic-and-Pacific SNPs. The mito-nuclear discordance among introduced populations suggests recent hybridization of Atlantic and Pacific sources in these estuaries and possibly adaptive introgression of mitochondrial loci, nuclear loci, or both. More generally, we find that mitochondrial loci alone generate a mistaken demographic and evolutionary history that can be resolved with nuclear SNPs.

2.2 DETERMINING THE ELEVATIONAL RANGE AND INUNDATION PERIOD OF THE RIBBED MUSSEL (*GEUKENSIA DEMISSA*) ALONG A SALINITY GRADIENT IN SOUTH CAROLINA, U.S.A. Julien, A. (GPMB, The University of Charleston, SC), A. Tweel (SCDNR), N. Hadley (SCDNR), D. McGlenn (College of Charleston) and P. Kingsley-Smith (SCDNR)

The ribbed mussel, *Geukensia demissa*, is an ecosystem engineer that promotes salt marsh functioning throughout its range along the eastern coast of North America. Over the past 5 years, commercial landings of *G. demissa* in South Carolina have increased considerably, yet the fishery lacks species-specific regulations. While habitat characterization is commonly used as a management tool for other commercially important bivalves (e.g., the eastern oyster, *Crassostrea virginica*), such information for *G. demissa* in South Carolina is currently lacking. As part of a broader study to improve understanding of the ecological role of *G. demissa* in the salt marsh community, its elevational range and inundation period were characterized along a salinity gradient in Charleston, S.C. In Spring 2017, transects were established at 8 sites along the Ashley River. At each site, 6 transects consisting of 5 sampling points were established, and *G. demissa* presence or absence was recorded. Elevation was determined using survey-grade GNSS equipment. Temperature sensors were placed at 3 of the sites for 1 month, and inundation period was inferred from changes in the temperature profile during night-time high tides, when water and air temperatures could be distinguished. A logistic regression model was developed to determine the probability of *G. demissa* occurrence, which was greatest at elevations slightly below mean high water and at intermediate salinities (18 ppt). The model is relevant to managing the emerging fishery, as it may help in mapping *G. demissa* habitat, but has yet to be tested in systems outside of the Ashley River.

2.3 CIRRAL MORPHOLOGY, ACTIVITY, AND PARTICLE SIZE CAPTURE OF A COMMENSAL BARNACLE, *CHELONIBIA TESTUDINARIA*, RAISED IN CAPTIVITY. Lane, Z (GPMB, The University of Charleston, SC), DiTullio, J (College of Charleston), Fair, P (NOAA), Van Dolah, F (NOAA) and Zardus, J (The Citadel)

Using a novel rearing technique, the epibiotic barnacle *Chelonibia testudinaria* has been raised under laboratory conditions for the first time. An evolutionary history which specifically shaped this species for a commensal life on the shells of sea turtles and crabs had, in the past, made *C. testudinaria* difficult to cultivate in the lab. New methodology and mechanical innovation now provides an opportunity to investigate basic life history and behavioral traits of this species that were previously a challenge to address experimentally. This study aims to confirm via scanning electron and light microscopy that the cirral morphology of lab-raised individuals is comparable to that of wild conspecifics, as well as to characterize through video analysis how flow rate affects the feeding behavior of this species in slowly accelerating flume flow. Additionally, adult barnacles will be exposed to a spectrum of differently sized food particles during ninety minute feeding trials. Water samples will be collected at intervals from the experimental flume throughout each trial and the change in concentration of various sizes will be quantified with a Coulter Counter. By recoding shifts in particle size concentrations, a minimum food size can be established along with potential size-based feeding selectivity in this species.

2.4 OCCURRENCE, FATE, AND EFFECTS OF MICROPLASTICS IN THE CHARLESTON HARBOR ESTUARY, SOUTH CAROLINA. Leads, R. (GPMB, The University of Charleston, SC) and Weinstein, J. (The Citadel)

Microplastics are ubiquitous in the environment, occurring at concentrations as high as thousands of particles/m². Charleston Harbor contains an average of 414±77 microplastic particles/m² in intertidal sediments, with black fragments suspected to be tire wear particles (TWP) constituting >90% of the particles at some sites. The present study further characterized the abundance and distribution of microplastics in an effort to identify sources in Charleston Harbor. As rivers are a contributor of non-point and point source microplastics, three tributaries of Charleston Harbor—the Ashley, Cooper, and Wando Rivers—were surveyed. Intertidal sediment, subtidal sediment, and sea surface microlayer (SML) samples were collected from three sites (upstream, midstream, downstream) along each river and were analyzed for microplastics (63-500 µm). Microplastic abundance in intertidal sediments, subtidal sediments, and the SML did not differ significantly among upstream, midstream, or downstream sites. Microplastic abundance in intertidal sediments (p<0.0001) and the SML (p=0.003) differed significantly among rivers, with the Cooper River containing the fewest microplastics (63±13 particles/m², 5±1 particles/L). Blue fibers and black TWP were the most abundant microplastics observed, constituting 26% and 28%, respectively, of total microplastics collected. The Cooper River contained the fewest microplastics but the greatest number of point source discharges, suggesting that non-point sources are a significant contributor of microplastics in Charleston Harbor. Data regarding the acute toxicity of TWP, including their effect on immune function, in grass shrimp (*Palaemonetes pugio*) will be presented. These results are the first to report the prevalence of TWP in the microplastic litter of a southeastern estuary and their potential effects on an ecologically important species.

2.5 OPTIMAL FORMATION OF ACCURATE JUVENILE ABUNDANCE INDICES IN STOCK ASSESSMENTS OF SOUTH ATLANTIC FISHERIES: A CASE STUDY. Reynolds, J (GPMB, The University of Charleston, SC) and Smart, T (SCDNR)

As growing human populations put an increasing demand on finite ocean resources, fisheries management tools rely ever more on high quality input data and a comprehensive understanding of model factors. Stock assessment modeling for South Atlantic (SA) king mackerel, *Scomberomorus cavalla*, uses inputs such as abundance indices, growth parameters, and fisheries landings. However, one underlying assumption in this modeling system is there are measurable connections among life stages. A juvenile abundance index developed from the SEAMAP-SA Coastal Trawl Survey (CTS) is presumed to represent ecological recruitment. Very weak correlations to other life stage proxies suggested a deficiency with the juvenile abundance index accuracy and indicated a more optimal formation of the index should be considered. Examination of CTS juvenile length frequencies support that the smallest juveniles appear in the summer and spring juveniles are from overwintering of the previous year class, in concert with previous observations of spawning season. Juvenile abundance indices developed using year class rather than year of sampling (as done for previous assessments) showed substantial differences, in particular reducing annual variation compared to the previous formulation. Temperature, season, and sampling region have also been found to have significant effects on the development of this index.

2.6 INVESTIGATION OF THE SALINITY TOLERANCE OF THE INVASIVE ISLAND APPLE SNAIL IN SOUTH CAROLINA. Underwood, EB (GPMB, The University of Charleston, SC), Darden, TL (SCDNR), Plante, CJ (College of Charleston), Fowler, AE (George Mason University), Knott, DM (Poseidon Taxonomic Services, LLC) and Kingsley-Smith, PR (SCDNR)

The Island apple snail (*Pomacea maculata*), native to South America, is an invasive freshwater gastropod currently established in several southeastern states, including South Carolina. *Pomacea maculata* is considered an invasive species due to the negative impacts of its intense grazing, high fecundity, ability to out-compete native species, and potential to serve as a host for the rat lungworm nematode parasite (*Angiostrongylus cantonensis*), which can cause eosinophilic meningitis in humans. Despite these impacts, knowledge of *P. maculata* specific to South Carolina is limited.

The primary aim of this study is to determine the salinity tolerance of *P. maculata* hatchlings. By determining the survival of *P. maculata* in varying salinities, resource managers can improve predictions of the capability for this species to invade brackish habitats in South Carolina. Ten hatchlings, obtained from egg clutches deposited by adult snails in a biosecure laboratory, were placed in each of five treatment salinities (0, 4, 8, 12, and 16 psu) replicated 16 times and mortality was assessed daily for 14 days. Kaplan-Meier survival analysis was conducted to determine median survival probabilities, while differences in mean survival were determined using Kruskal-Wallis tests with post-hoc Dunn's tests. 100% survival was observed at 0 psu, and 0% survival was observed at both 12 psu and 16 psu. Median survival probabilities at 4 psu and 8 psu were 87% and 22%, respectively. These results demonstrate the capability of this species to survive in upstream estuary habitats with salinities as high as 8 psu in South Carolina.

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