Gulf Coast Graduate Student Symposium

Scientific Program

April 19-21, 2024

Hosted by DISL's Marine Science Graduate Student Organization

Welcome to the 2024 Gulf Coast Graduate Student Symposium!

The organizing committee would like to thank all attendees, volunteers, and our sponsors - the symposium would not be possible without your support!

The Graduate Student Symposium (GSS) is an annual regional conference that is alternately hosted by the Dauphin Island Sea Lab (DISL), University of Southern Mississippi (GCRL), and Louisiana Universities Marine Consortium (LUMCON). This short, informal conference is an opportunity for graduate students from schools across the Gulf Coast whose research relates to coastal, marine, and environmental sciences (and other similar fields) to showcase their research in a supportive environment and meet peers from different schools.

The hallmark of GSS is that the meeting is completely student led. GSS provides students the experience of organizing a meeting, as well as a platform to disseminate their research. GSS is a welcoming environment for students, interns, and technicians to communicate their work, whether at a conceptual stage or a completed dissertation. This symposium enables the gathering of young scientists from around the Gulf of Mexico, in the hopes of fostering multidisciplinary collaborations. There is much we can learn from each other!

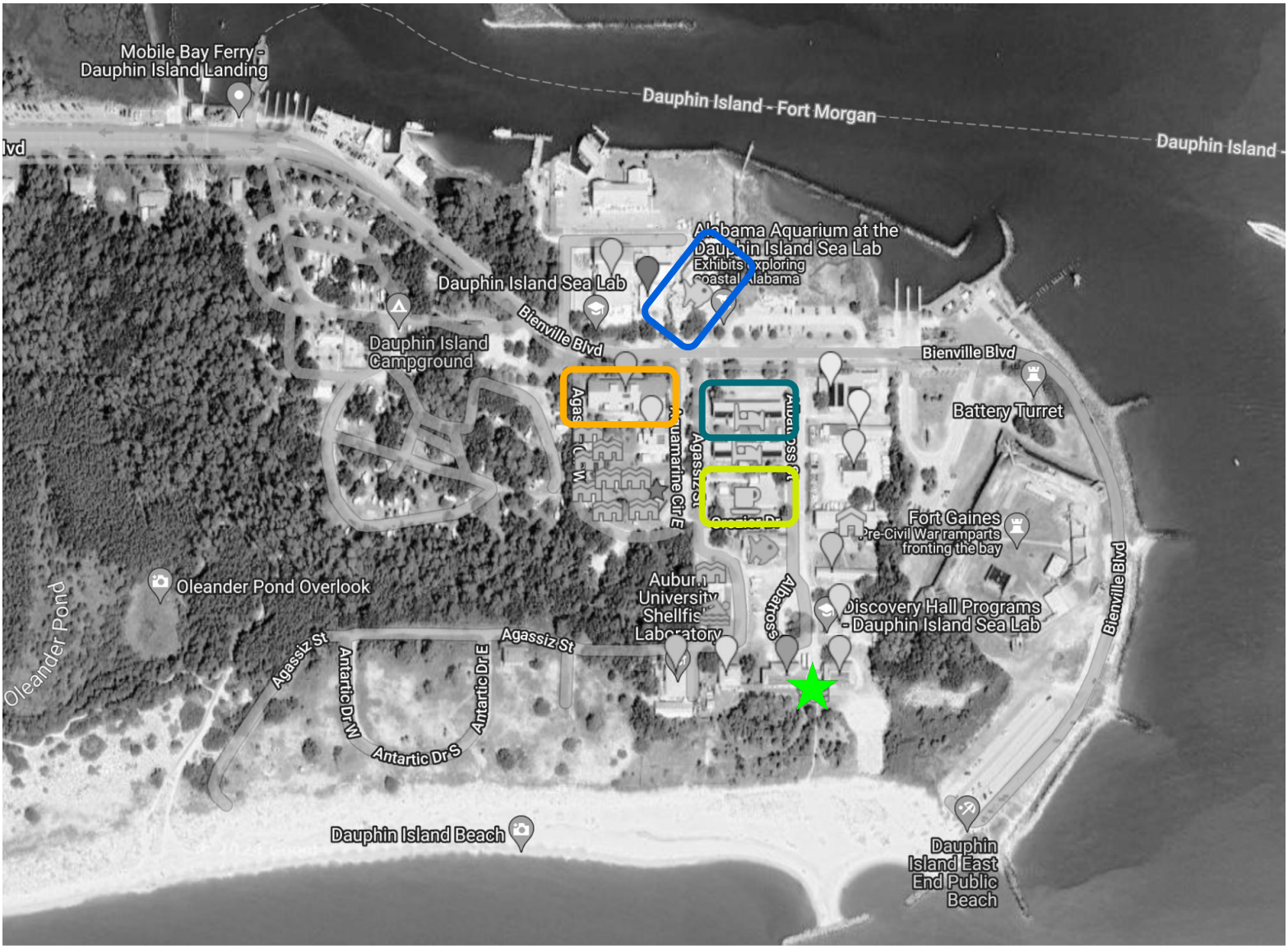
We hope you enjoy the symposium and your time on Dauphin Island.

The MSGSO GSS Committee,

Penny Demetriades	Ali Siersma	Randi Cannon
Lydia Hayes	Caleb Wilson	Jicayla Johnson-Rosemond
Christa Russell	Allie Smith	Devanarayana Rao
Sophie Wong	Harikrishnan Sreeshylam	Jessica Hilliker
Shannon Dalessandri	Hannah Ehrmann	Jenny Duncan
Zoey Hendrickson	Anna Reimer	Bethany Kiley

We would also like to thank our judges, our keynote speaker Dr. Jason Sylvan, and the staff and faculty at the Dauphin Island Sea Lab and Alabama Aquarium for their support and assistance in hosting this conference.

Dauphin Island Sea Lab - Campus Map



★ Alabama Aquarium

★ Shelby Auditorium

★ Beagle Dorm

★ May's Cafe

★ Beach access

On Sunday, the kayak launch spot is at Blue Heron Park and the nature walk is at the Audubon Bird Sanctuary trail on Dauphin Island.

GSS 2024 Schedule of Events

Friday April 19 2024

Beagle Dorm check in (17:00-18:45)
Poster session and banquet at the Alabama Aquarium (19:00-21:30)
Beach social activity (22:00)

Saturday April 20 2024

Breakfast at May's cafe (08:00-08:45)
Conference check-in in Shelby (08:00-08:50)
Keynote speaker - Dr. Jason Sylvan (09:00-10:00)
Coffee break (10:00-10:10)
Morning session (10:10-12:20)
- Restoration and Conservation (10:10-11:10)
- Break (11:10-11:20)
- Understanding a Unique Environment (11:20-12:20)

Lunch in Shelby (12:30-13:30)
Afternoon session I (13:30-15:40)
- Unseen Diversity (13:30-14:30)
- Break (14:30-14:40)
- Human Interactions (14:40-15:40)

Raffle in Shelby (15:45-16:45)
Afternoon session II (16:45-18:30)
- Changing Communities (16:45-17:45)
- Break (17:45-17:55)
- Lightning talks (17:55-18:30)

Dinner in Shelby (19:00)
Ice cream and Marine Science trivia in Shelby (20:00)

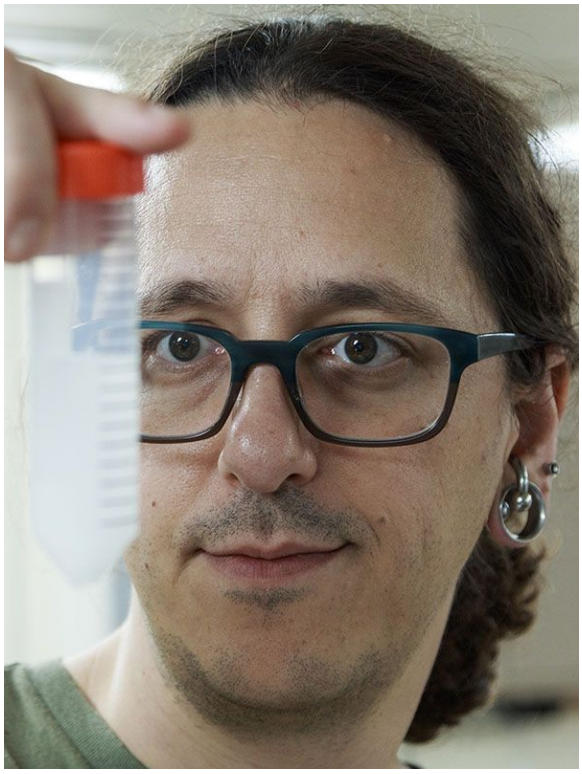
Sunday April 21 2024

Nature walk or kayak activity (09:00)
Awards brunch in Shelby (11:00)

Dr. Jason Sylvan

Texas A&M

GSS 2024 Keynote speaker



Jason B. Sylvan is an Associate Professor in the Department of Oceanography at Texas A&M University. The Sylvan lab studies the geomicrobiology and biogeochemistry of deep ocean hydrothermal ecosystems and the deep biosphere in below the seafloor. His research addresses fundamental questions about the biology, chemistry and geology of the Earth through the study of interactions between the seafloor and the marine biosphere. He is also interested in the microbiology and biogeochemistry of the Gulf of Mexico, where different projects have focused on eutrophication, interactions between oil, dispersants and microbial populations, and impacts of freshwater runoff on coral reefs. Jason received his BS in Biology from Brandeis University in 1999, a MS in Biological Oceanography from Rutgers University in 2004, and his PhD in Biological Oceanography, also from Rutgers University, in 2008. He conducted postdoctoral research from 2008-2013 at University of Southern California, after which he joined the faculty there as Assistant Professor (Research). Sylvan joined the Department of Oceanography at Texas A&M University in Fall 2015.

Dr. Sylvan will be discussing his ongoing work studying inactive hydrothermal sulfide deposits.

Poster Session - April 19 2024

1. SNAPPER LIFE STAGE DISTRIBUTION IN MANGROVES RELATED TO REEF DISTANCE
Ella Absher*, Coleman Braddock, and Dylan Kiene

The distribution of snapper species in fringing mangroves is thought to be variable based on their proximity to reefs. Snapper species show strong habitat shifts throughout their lives. Early life stages are typically found in seagrass beds or mangroves, and as snappers grow and mature, they move offshore to reef habitats. We examined the distribution of different snapper species and life stages in relation to distance to coral reef across Turneffe Atoll, Belize. We used underwater video cameras to record the fish species in fringing mangroves at sites spanning from 0.5km-8km from the fringing barrier reef. Despite our predictions, we found no clear patterns related to distance from the main reef. During our research we discovered a surprising amount of patch reef and coral throughout the inner lagoon area of Turneffe Atoll. This complex seascape may explain why the distribution of snapper species ranged through all life stages in each of our study sites.

2. ASSESSING THE ABILITY OF A CITIZEN SCIENCE NETWORK TO QUANTIFY HUMAN-WILDLIFE INTERACTION POTENTIAL
Sophia Corde*, Ruth H. Carmichael, Steven Scyphers

Climate change has caused shifts in habitat viability and resource availability, affecting migration patterns and species distributions, and leading to a higher frequency of human-wildlife interactions (HWIs) globally. One region experiencing such effects is the northern Gulf of Mexico (nGoM), where West Indian manatee (*Trichechus manatus*) sightings have increased in recent years. There is new evidence that manatees may select habitats that overlap with human activities, increasing the likelihood of HWI. These observations suggest there may be key habitats of concern for HWI in the nGoM and other areas affected by manatee range shifts, which have not been defined. Citizen science is increasingly recognized as an approach to engage the public and gather ecological monitoring data, however, the reach and reliability of citizen-sourced data must be defined to enable confident use. The main objective of this study is to determine the reach and reliability of citizen science for use in identifying potential HWI hotspots for manatees in Alabama waters. The Dauphin Island Sea Lab's Manatee Sighting Network (DISL/MSN) will be used as a model citizen science network for this study. Public intercept and email surveys targeting the general public and people who have interacted with the DISL/MSN in the past will be used to quantitatively and qualitatively assess network reach. To determine reliability, DISL/MSN opportunistic sighting reports (2007-present) will be compared to real-time manatee location data from aerial and drone survey and tag data. The location and timing of citizen sighting reports will also be compared to the locations of manatee dock signs, timing of news and outreach distribution, and timing of surveys. In addition, decoy manatees will be used in combination with camera traps to quantify potential bias in the frequency of manatee detection and subsequent reporting. Finally, to assess if the DISL/MSN can be used to identify potential HWI hotspots, manatee occurrence data from DISL/MSN opportunistic sighting reports and tagging databases will be overlayed with maps of known human shoreline and watershed uses. With the ongoing and future projected urbanization and tropicalization of the nGoM, proactive measures may be needed to limit HWI. This study will help reduce uncertainty in citizen science data, increase trust in data applications, and support active engagement and investment in conservation-based activities by local residents.

3. MOLECULAR MICROBIAL SOURCE TRACKING FOR SOURCE-SPECIFIC MANAGEMENT OF WATER QUALITY ON THE MISSISSIPPI-ALABAMA COAST
Penny Demetriades*, Ania Brown, Brianna Janssen, Ruth H. Carmichael, Jessica Jones, Sinéad Ní Chadhain, Brandi Kiel Reese

Coastal waters can experience elevated levels of fecal contamination from human populations, unsupported infrastructure, and terrestrial watershed drainage. Pathogens can be conveyed to waterways from human (e.g., septic systems, wastewater treatment plants) and non-human (e.g., wildlife, livestock) sources, posing health risks through contaminated fisheries and recreational waters. Water quality degradation, therefore, poses a significant threat to human health, coastal resources, and coastal economies on the Mississippi-Alabama coast. Microbial sources to Alabama waters are largely undefined, and a better understanding of these sources can inform system-scale management to improve community and ecosystem health. This study aims to identify and quantify potential fecal sources from subwatersheds along the Mississippi-Alabama coast via microbial source tracking that will align traditional microbial indicators with environmental DNA (eDNA) and quantitative PCR (qPCR); molecular technologies that can identify human and non-human sources of contamination to aquatic systems. Genetically different groups of *Bacteroidales* bacteria will be targeted for source identification (due to their high host specificity), and metagenetic eDNA analyses will be incorporated in tandem to provide valuable ecological context to specific field sites and refine geographic locations of contamination sources for management. Over the course of one year, monthly sample collection occurred at each of 13 sites identified to be key potential entry points of contamination to Alabama's coastal waters. Total DNA was extracted and 6X metagenomic sequencing was conducted at Integrated Microbiome Resources, Canada, with an aliquot reserved for quantitative PCR. Data will support shellfish aquaculture and seafood safety, tourism, and ecosystem health across state borders.

4. LINKING HIGH-FREQUENCY GEOACOUSTIC PROPERTIES OF MARINE SEDIMENTS TO SMALL-SCALE GEOTECHNICAL PROPERTIES
Jennifer L. Duncan*, Kelly M. Dorgan, and Grant Lockridge

Marine infauna mix sediments through bioturbation and build burrows and tubes that impact sediment structure and compaction. These impacts can be quantified and characterized through changes in small-scale geotechnical properties and high frequency acoustical signals. Specifically, increased heterogeneity generated through infaunal activities may result in increased attenuation of high-frequency sound. Compaction of burrow walls and localized dewatering may increase bulk density and therefore sound speed, or excavation of burrows may decrease density. Sediment cores collected from Mobile Bay, AL, were analyzed for sound speed and attenuation (100-600 kHz), geotechnical properties on similar spatial scales, and infaunal community structure. Specifically, stiffness was measured with a custom-built instrument to measure force and displacement while pushing a 6-mm diameter spherical tip of the probe into the side of a sediment core. Fracture toughness was then measured through bubble injection. Air is injected into sediment through a needle, and measured pressure drops when a crack forms in the cohesive mud. Measurements of grain size and porosity were also collected. Acoustical attenuation is predicted to be higher when more active burrowers create heterogeneity and more variable stiffness and fracture toughness. These impacts are expected to be greatest near the sediment surface where burrowing infauna are more abundant and active.

Poster Session - April 19 2024

5. SUITABILITY OF RECYCLED GLASS SAND IN DUNE PLANT RESTORATION
   T. Getty Hammer*, Emily D. Newman, Jacob Dixon, Peyton Goings, Paul Richardson, Bek Markel, Keith Clay, Jeremiah A. Henning

   Transitional ecosystems such as coastal dunes and beaches face the first impacts of global change such as erosion, rising temperatures, increasing hurricane intensity and frequency, and sea level rise. While dunes and beaches are valued for their aesthetics, commercial potential, flood mitigation, storm protection, and refuge for specialized organisms, they are widely overdeveloped and overexploited. Following major storm events, beach and dune nourishment is typically achieved by importing sand dredged from offshore (Davison, Nicholls and Leatherman 1992). This method of renourishment is destructive to marine life, expensive, pollutes water quality, and lacks the native microbiome of replaced beach soil (Davison, Nicholls and Leatherman 1992; Sylvia and Burks 1988). Glass sand made from recycled glass bottles has been proposed as replacement for dredged beach sediment, however its efficacy as a restoration tool in-situ is not widely studied. Recycled glass sand has the advantages of being widely available, having custom angularity for different restoration uses, relatively low production effort and costs, removes glass waste from landfills, as well as avoiding the environmental damage caused by dredging. However, sand substrates made from recycled glass sand may lack soil microbial communities that contribute to nutrition, salinity stress, and drought stress of dune plants. Our experiment tested the feasibility of using recycled glass sand as a growth substrate for three important Gulf Coast dune plants (*Ipomoea imperati, Ipomoea pes-caprae, and Uniola paniculata*) in the dunes of Dauphin Island, AL. Plugs of each species were planted in pots of either uninoculated glass sand, glass sand with native microbe amendments, and live beach sand and buried on a Dauphin Island dune. Plant growth, survivorship, and reproduction were monitored biweekly for five months, after which remaining biomass was collected and weighed. We found that plants showed no difference in survival, growth, or reproduction between substrates, indicating that glass sand performs similarly to live beach sand and is likely suitable replacement for dredged sediment.

6. THE ROLE OF FUNGI IN CARBON CYCLING IN OLIGOTROPHIC SUBSURFACE SEDIMENT OF THE SOUTH ATLANTIC TRANSECT
   Lydia Hayes-Guastella*, Jessica M. Labonté, Jason B. Sylvan, Tim D'Angelo, and Brandi Kiel Reese

   The marine deep subsurface hosts a high quantity of life capable of unique metabolisms and survival mechanisms. Deeply buried sediments collected during International Ocean Discovery Program Expeditions 390 and 393 provide a unique opportunity to explore the microbial community structure, and functional involvement in biogeochemical cycling. Five sites were targeted during the South Atlantic Transect (SAT) expeditions, which was an age transect as well as an organic carbon gradient beneath the oligotrophic waters of the South Atlantic Gyre. The objectives of this expedition were to investigate microbial community variation with substrate composition, age, and energy availability. This project addresses these goals while aiming to elucidate the synergy between prokaryotes and eukaryotes within the microbial community, and fungi's role in sediment carbon cycling. A total of 45 sediment samples were enriched in 25% potato dextrose broth in triplicate. An estimated 15% of the cultivations were positive for fungal growth.

7. QUANTIFYING CARBON SEQUESTRATION IN SEAGRASS HABITATS IN THE NORTHERN GULF OF MEXICO TIFYING CARBON SEQUESTRATION IN SEAGRASS HABITATS IN THE NORTHERN GULF OF MEXICO
   Devan Hildebrand*, Melissa Baustain, Kelly Darnell

   Commonly found along coastlines, seagrasses are known to benefit ecosystems. With increases in atmospheric CO_2, it is important to understand how marine primary producers such as seagrasses cycle and store carbon, thus removing it from the global carbon cycle. This project will examine the standing stock of sediment carbon and accumulation rates within areas historically dominated by seagrass beds and paired historically unvegetated areas the Mississippi Sound, Mississippi. Deep (1m) cores collected in Spring 2024 through vibracoring will be analyzed for sediment grain size, seagrass species composition and biomass, total organic and inorganic carbon, carbon and nitrogen ratios, and sediment age. These data will collectively be used to quantify and assess carbon accumulation and sequestration for a ubiquitous seagrass that grows throughout the Gulf of Mexico, and the potential for carbon mitigation in the northern Gulf of Mexico. Results from this study will be provided to local natural resource managers for use in decision-making.

8. AN ANALYSIS OF MICROBIAL SOURCE TRACKING METADATA IN COASTAL ALABAMA
   Brianna Janssen*, Dakota Bilbrey, Brandi Kiel Reese, Ruth Carmichael

   Microbial source tracking (MST) is increasingly in demand to define water quality and associated seafood safety and public health risks. While MST-related data have been collected for decades, the data have not been collated and made readily available to define spatial and temporal or other research gaps, inform policy decisions, and ultimately protect natural resources and public health. To address these needs, we established a publicly accessible MST metadata clearinghouse (https://www.disl.edu/research/wastewaterfootprint/alabama-mst-meta data-clearinghouse/) for coastal Alabama to compile and share information about existing or in-progress MST and other monitoring-related datasets. Additionally, the clearinghouse provides a model for similar historical data collation in other coastal areas where microbial source tracking is of interest. The clearinghouse currently includes 30 metadata entries from a wide diversity of participating organizations and researchers, with an opportunity for those with relevant data to contribute through the website's questionnaire. Data related to eight major indicators (*Clostridium* spp., *E. coli*, fecal coliform that is not specifically *E. coli*, *Enterococci*, nutrients, DNA markers, male-specific coliphage, and stable isotope analysis) and their associated methodologies can be accessed using the clearinghouse, among other search parameters. With data dating back to 1953, the clearinghouse boasts an impressive timescale of indicators and methodologies within southern Alabama. A temporal analysis of the metadata found nutrients as the most consistently available indicator, with classical indicators such as *E. coli* and fecal coliforms rising to prominence after 1990 and newer indicators such as DNA markers and stable isotope analysis gaining traction in the mid-2000s. A spatiotemporal analysis of the metadata showed an apparent shift in monitoring sites from primarily eastern Mobile Bay to include both east and west Mobile Bay. Such analyses can hopefully help researchers identify data gaps to fill and assist practitioners in locating applicable data.

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9. PHENOTYPIC CHANGES IN *VALLISNERIA AMERICANA* IN RESPONSE TO ENVIRONMENTAL CONDITIONS ACROSS THE MOBILE-TENSAW DELTA

Bethany Kiley*, Charlie Martin, Dottie Byron

Anthropogenic processes, such as climate change, have altered biotic and abiotic factors within fresh and marine systems in the northern Gulf of Mexico. *Vallisneria americana*, a submerged aquatic vegetation (SAV) species, exhibits high plasticity that is influenced by water quality and hydrologic changes. This SAV provides essential ecosystem services (e.g., fisheries nursery, sediment stabilization, improved water quality). SAV loss could thus lead to the decline of valuable commercial and recreational fisheries as well as promote increased shoreline erosion and eutrophication. We aim to quantify relationships among abiotic parameters and *V. americana* morphological variability and traits. To determine phenotypic changes across abiotic gradients in the Mobile Tensaw River Delta, field observations and sample collections will take place at sites with historically successful *V. americana* beds and documented abiotic and hydrologic differences. Cores will be used to collect individual plants which then will be measured to determine metrics such as average height, leaf width, shoot density, rhizome diameter, number of leaves, and biomass. Abiotic measures, such as light availability, depth, pH, dissolved oxygen, and temperature will also be measured at each site to determine correlations between morphological traits and abiotic factors. This research will explore how *V. americana* changes phenotypically to various abiotic conditions, with implications for the conservation of this critical habitat. Understanding which morphological traits are being expressed under certain conditions will provide useful indicators of historical environmental conditions and may influence habitat value, coastal infrastructure, and habitat stability. Thus, these findings have direct, practical applications for SAV conservation and restoration.

10. OMIC INSIGHTS INTO DECOMPOSITION: A SHRIMP STORY

Marlee Hayes-Mims*, Jessica L. Jones, Ronald A. Benner, Jr., and Brandi Kiel-Reese

Introduction: Chemical compounds produced by bacteria contribute to decomposition and ultimately spoilage of seafood during storage. The bacterial community composition changes during decomposition, affected by time and temperature of storage. Understanding the environmental factors that determine initial community structure and how it evolves during storage, along with in-depth knowledge of the decomposition related genes and their functions will provide valuable insights into identifying biomarkers for decomposition. *Purpose*: The overall study objective is to understand bacterial community structure and function in decomposing shrimp. Furthermore, the goal of this work is to evaluate the impact of shrimp species, wild versus aquacultured shrimp, collection location, season, and the microbial community structure of associated water and sediment on the evolution of decomposition. This research will work toward the ultimate goal of developing microbial/molecular methods for detecting decomposition that can stand alone and/or complement chemical/sensory methods. *Methods*: We will collect brown and white shrimp, plus associated water and sediment, monthly during harvesting season (approximately May – Nov), for a period of two years. Additionally, aquacultured shrimp will be collected by working with local partners. Shrimp will be stored at various time and temperature conditions, and samples will be collected throughout storage. Metagenomics, transcriptomics, and proteomics will be performed to assess microbial community structure and function. Whole genome sequencing and metagenome assembled genomes may provide further insight into understanding these communities by identifying which species are expressing possible precursors or biomarkers of decomposition. Furthermore, combining these data with environmental data may also help us identify the drivers of gene expression. *Previous Results*: Previous research at the Food and Drug Administration illustrated that culture independent methods can yield more information about the microbial community than traditional techniques. It also suggested some potential genus level indicators of decomposition; however, the findings were variable across seafood species, storage temperatures, and evaluated only one shrimp species, *Litopenaeus setiferus*. Therefore, performing further research using molecular methods, additional shrimp species, and environmental variables (storage temperature, season, collection site, environmental drivers) will provide better understanding of the microbial communities and the dynamics within. *Significance*: By understanding the structure and functions of microbial communities during the decomposition of shrimp species, and how that community composition changes during temperature-controlled storage, we will be able to develop effective, rapid, and reliable methods to monitor biomarkers of seafood decomposition.

11. VARIATION IN SPECIES COMPOSITION OF FISH ACROSS SPATIAL GRADIENTS IN MANGROVES

Emily Drinkard, Vanessa Neve*, and Adam Jung

Studies support that coral reefs in the Indo-Pacific are a determining factor in the species richness found in fringing mangrove habitats. Our main objective was to conduct species richness analysis on fringing mangroves in relative distance to the Turneffe Atoll. We used unbaited, underwater video cameras to quantify fish communities in fringing mangroves by analyzing twelve videos from each location. Sample site distances ranged from 0.5km to 8km from the main barrier reef. The data collected did not support our hypothesis, because we found that species richness increased as we moved further away from the main reef. There is an understanding that the seascape at Turneffe Atoll is unique and complex, along with the fringing mangroves relative to coral reefs which the Indo-Pacific is known for. We did unexpectedly discover isolated coral heads throughout the lagoon. This may explain the wide distribution of coral reef fishes, even at sites in the mid-lagoon, furthest from the main barrier reef. There are more factors to consider, which may further explain why our data demonstrated increased species richness towards the middle of the Atoll.

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12. GHOSTS IN GLASS: GHOST CRABS AS JUDGES OF GLASS SAND FOR COASTAL RESTORATION

Emily Parrish*, Jeremiah Henning

Coastal erosion impacts ecosystems worldwide. For instance, the State of Louisiana loses nearly a football field worth of land every 100 minutes, which has resulted in thousands of miles of lost coastline over the last 100 years. This drastic loss of coastal land highlights the dire need for coastal restoration across the Northern Gulf Coast. An unexpected solution to this sediment loss may solve two major environmental issues at once. Millions of tons of glass waste enter America's landfills each year. Rather than routing glass to a landfill, it can be crushed to create sand and gravel for coastal restoration sediment. Our goal is to determine whether glass sand is a viable option for coastal restoration by testing the impact on a critical indicator organism in coastal dune ecosystems, the Atlantic Ghost Crab, *Ocypode quadrata*. Ghost crabs were live-trapped from Dauphin Island, Alabama and reared in sand environments containing full beach sand, half beach sand and half glass sand, and full glass sand for 8 weeks. In order to compare the stress responses of each treatment, the crab's initial and final stress hormone levels (Crustacean Hyperglycemic Hormone), carapace widths, weights, and claw dimensions were collected. The preliminary growth and survival data indicates that the crabs were not more stressed in glass sand relative to beach sand. Although preliminary, our results suggest that glass sand may be a viable option for large-scale restoration efforts both locally and globally.

13. INTERANNUAL VARIABILITY IN DISSOLVED OXYGEN DYNAMICS WITH PHYSICAL DRIVERS ON MISSISSIPPI BIGHT

A. Puzhankara*, B. Dzwonkowski, J. Lehrter, Z. Liu, and G. Lockridge

Coastal shelf regions are experiencing more frequent and widespread hypoxia events. Such events are often associated with terrestrial nutrient loading on seasonally stratified regions. However, the interplay between physical and biogeochemical processes that couple to produce hypoxia can be complicated. This study examines a 5-year (2019-2023) time series of hourly bottom temperature, salinity, and dissolved oxygen (DO) concentration with CTD profiling data in the Mississippi Bight to elucidate the mechanisms driving hypoxia events. The DO data reveal significant interannual variability, including extensive hypoxia in 2019 and subsequent years with near-hypoxic conditions. To begin understanding the pattern in this data ensemble statistics for over a calendar year were produced. The ensemble mean and standard deviation showed clear seasonal patterns. During the late fall through winter, there were high mean values, typically at or near saturation, and low variance. In contrast, spring through early fall shows lower mean values and higher variance. Further exploration of the monthly frequency of hypoxia or near-hypoxia conditions showed biological activity and stratification. Interestingly, high variance in spring suggests a potential interplay between oxygen-depleting biological processes and wind-driven mixing events that can replenish oxygen. September emerges as a critical month for hypoxic conditions with the highest percentage, highlighting the importance of considering periods beyond summer for water quality management. Additionally, short-lived intense hypoxia events suggest the potential influence of advection in this location. Further investigation will focus on the Bonnet Carre Spillway opening and associated processes in 2019 and the impact of storm re-stratification and marine heatwave events that may also change bottom dissolved oxygen. Consequently, this work identifies key physical drivers controlling the interannual variability in dissolved oxygen dynamics over river-dominant shelf regions.

15. PHENOLOGICAL CHANGES IN SEAGRASS-ASSOCIATED FISHES IN AN ALTERED CLIMATE: EVIDENCE THAT RISING TEMPERATURES ALTERS SEASONALITY OF FISH MIGRATION PATTERNS

Ari Siegel*, Adam Searles, Charles Martin

Globally, a changing climate is altering the distribution, behavior, and seasonality of organisms in foundation species such as seagrass beds. In Clearwater Harbor, FL, seagrasses (primarily turtlegrass *Thalassia testudinum*) comprise one of the most widespread habitats for fishes, providing refuge from predators and abundant food resources. Typically, abundance of seagrass-associated organisms varies seasonally with offshore emigration in winter and inshore transport to seagrass beds occurring as temperatures rise. However, local meteorological data from this area indicates a clear pattern of warming from 2009-2019, with annual increases in both air (0.18°C) and water (0.25°C) temperatures. Using a temporally comprehensive trawl dataset, we assessed the phenological changes over this period for five abundant inshore fishes in seagrasses: pigfish, pinfish, mojarra, planehead filefish, and silver perch. Preliminary analyses showed that the date of 50% of cumulative yearly pigfish, pinfish, planehead filefish, and silver perch abundance all shifted earlier by 4.28, 2.12, 2.78, and 7.1 d y^{-1}, respectively, but later for mojarra; 0.75 d y^{-1}. Maximum catch similarly peaked earlier with pigfish, mojarra, and silver perch occurring sooner by 7.14, 6.0, and 15.1 d y^{-1}, respectively, while pinfish and planehead filefish peaked later by 10.0 and 0.73 d y-1, respectively. Compared to other ecosystems, the shifts documented here are extreme, with typical phenological changes estimated at 2.3-2.8 days per decade on land, and 11.2 days per decade for larval boney fish. This research highlights the importance of future conservation efforts for inshore seagrass beds, given that many species documented here are using these grassbeds more frequently throughout the year.

16. SYNERGISTIC pCO_2 AND LIGHT EFFECTS ON PRIMARY PRODUCTIVITY AND SILICON METABOLISM FOR A GULF OF MEXICO COASTAL ALABAMA DIATOM

Alison Siersma*, Shannon Dalessandri, Alison Robertson, Kenneth Hoadley, Jeffrey W. Krause

Diatoms play a critical role within marine phytoplankton communities, possessing a distinctive silica shell which contributes to their ecosystem success. Their important contribution to coastal primary production and their obligate use of Si for their shell (which helps transport carbon to ocean depths), displays their indispensable role in linking the silicon and carbon cycles in the surface ocean. Changes in their shell formation and/or primary production can alter their contributions to these cycles, subsequently impacting their effectiveness as a carbon sink. In the face of ongoing climate change, the functional plasticity of diatoms isolated from specific regions requires evaluation to predict their response to future stressors, e.g., 1000 ppm predicted pCO_2 levels by 2100 for the Gulf of Mexico. We exposed a regional isolate of *Thalassiosira* sp. to projected pCO_2 levels alongside various light intensities using a photobioreactor system. Growth rate, cell size, biomass (chlorophyll, organic matter, and biogenic silica) and primary productivity were quantified in response to these two perturbations. Among the perturbations, high light appeared to elicit an increase in maximum photosynthesis, but the confluence of high light and high pCO_2 levels decreased the optimum photosynthesis level. These results support a growing body of literature which demonstrates that multi-stressor approaches and relevant model species are necessary to better predict the response of regional diatoms to climate change scenarios.

Poster Session - April 19 2024

17. MAPPING SHORE-BASED FISHING ALONG MOBILE BAY, ALABAMA
Hailey Smith*, Sarah Gibbs, Savannah Swinea, Katie Waring, Steven Scyphers

Shore-based fishing is important socially, culturally, and economically, yet is among the more understudied aspects of fisheries. The Mobile Causeway, also known as Battleship Parkway, is a 7-mile long highway that connects the east and west shores of Mobile Bay. The highway sits on the water and has public beaches, piers, and seawalls along the shoulders. The north side requires a freshwater fishing license while the south side requires a saltwater license, as the highway acts as a water divide. Due to its history, accessibility, and geography, the Causeway is a hotspot for shore-based recreational fishing in coastal Alabama. However, very little is known about the spatial distribution of fishing activities or the underlying social drivers (i.e., shoreline accessibility, fisher demographics). This poster describes a pilot study focused on mapping the spatial and temporal distribution of fishing activities and documenting the social and demographic characteristics of fishers. Specifically, we coupled high-resolution mapping surveys of fishing activity with intercept surveys of fishers that measured: target species, species caught, consumption patterns, fishing tackle, fishing experience, demographics, and social motivations. Our results highlight the unique importance of the Causeway for shore-based fishing, particularly among low-income and subsistence fishers. Considering that shore-based fishing represents a large proportion of some fisheries, our study demonstrates a methodological approach to simultaneously characterize fishing activity and the socioeconomic dimensions.

18. INFLUENCE OF A NARROW, DEEP SHIP CHANNEL AND WIDE, SHALLOW SHOALS ON THE DYNAMICS OF MOBILE BAY, ALABAMA
Harikrishnan Sreeshylam*, Zhilong Liu, Brian Dzwonkowski, John Lehrter, Lisa L. Lowe, Jeff Coogan

Mobile Bay in the Northern Gulf of Mexico is a shallow (average depth of 3 m) and broad (~10-30 km) estuary with a deep (12-14 m), relatively narrow (120 m) ship channel along its length providing an example of a ‘channel-shoal’ estuary. This type of geomorphology is common in the shallow estuaries of the Gulf of Mexico, where channels may be essential conduits of salt and other materials from deeper coastal waters. This numerical modeling study based on the Regional Ocean Modeling System (ROMS) will investigate the lateral circulation and associated forcing dynamics in this channel-shoal estuary, where the influence of the ship channel is poorly understood. Specifically, this study seeks to answer the question: How does the estuarine bathymetry affect the lateral exchange between the channel and shoals? A cross-section in the mid-bay region of the estuary was examined with the model to quantify the channel-shoal interaction in this system. As expected, the depth-averaged longitudinal estuary saltwater intrusion is strongest in deeper channels and weakest in shallow channels. The resulting differential advection from the channel to shoals sets up a strong lateral salinity gradient, which provides a baroclinic driving force that may generate significant lateral circulation in this channel-shoal system. The shallower shoals are expected to limit the amount of lateral baroclinic forcing to the channel-flank transition zone. This study suggests that the lateral scale associated with the transition from channel to shoals, rather than the overall width of the channel-shoal estuary, affects the relative relevance of channel-shoal interaction.

19. INVESTIGATING THE RESILIENCE CAPACITY OF SEAGRASSES IN THE NORTHERN GULF OF MEXICO TO INFORM BARRIER ISLAND RESTORATION
Caitlin M. Young*, Kelly Darnell

Seagrass habitat is declining globally, resulting in increased effort to develop effective conservation and restoration strategies whose success requires knowledge of the target ecosystem to inform site-specific approaches. The Chandeleur Islands, LA, a chain of barrier islands located off the Mississippi Delta, are the site for an upcoming large-scale restoration effort to mitigate island erosion and land loss. The Islands are a designated National Wildlife Refuge, an overwintering location for a diverse assemblage of birds, and adjacent waters support high secondary production, in large part due to the diverse seagrass ecosystem present along the leeward side of the Islands. This project will inform restoration approaches for the Islands and associated seagrass meadows by investigating spatial and temporal variability in seagrass community composition, allometry, and distribution; the role of hydrological flow as a driver of seagrass distribution and condition; and effects of sediment biogeochemical parameters on seagrass health. Collectively, this will define ecosystem criteria for determining seagrass condition and resilience capacity to restoration scenarios. This project presents a unique opportunity to establish baselines of seagrass community composition and environmental condition variability at the Chandeleur Islands and assess their resilience capacity and potential response to a suite of restoration scenarios.

20. RELATIONSHIPS BETWEEN FRESHWATER DISCHARGE AND ORGANIC MATTER MOVEMENT THROUGH THE MOBILE BAY ESTUARY
Akela Yuhl*, Christopher J. Anderson, Latif Kalin, Ruth H. Carmichael

To determine the function of the Mobile-Tensaw River (MTR) Delta in the export of organic matter from different sources to Mobile Bay, we will distinguish terrestrial/freshwater from marine sources to the system by measuring organic carbon (C) and nitrogen (N) stable isotope ratios in suspended and sediment particulate matter and biota. To define long-term spatial and seasonal patterns in organic matter flow through the MTR-fed estuary system relative to variation in discharge and salinity, we will compare stable isotope values through time in a historical data set (2008-present). Based on a previous study, we expect to find important trophic links between inland and near shore open water ecosystems. Freshwater discharge is expected to have short-term effects on trophic structure and movements of estuarine species. From this study, we can apply the variability of organic matter distribution down bay relative to seasonal river discharge to predict future responses of the system to changes in seasonal precipitation and sea level rise that may accompany long-term climate variation.

Morning Session - April 20 2024

Restoration and Conservation

1. SCARY JUICE: USING FEAR TO RESTORE AN INTERTIDAL OYSTER REEF
   Christa M. Russell*, Benjamin A. Belgrad, Kenslie Boyd, Grace Shelby, Delbert L. Smee

   Raising juvenile oysters in the presence of predator cues can enhance survivorship by prompting individuals to develop stronger shells. This induced response has been indicated as a beneficial tool for oyster aquaculture and restoration, but the practicality and efficacy of utilizing this method remain unclear at the range of spatial and temporal scales relevant to restoration activities. We cultured diploid spat on shell Eastern Oysters (*Crassotrea virginica*) with and without Blue Crab (*Calinectes sapidus*) predator cues following established restoration-scale hatchery techniques. 12 million eyed larvae were set and cultured for 4-weeks before deployment onto an intertidal restoration reef in Bayou la Batre, AL. Oyster survival, shell characteristics, and reef development were measured periodically over a one-year period. Results indicate that predator cue induction significantly increased survival of intertidally restored oysters, including during summer months when oyster predator populations are at their peak. Our observations suggest that induction can be used as a technique to improve restoration outcomes for intertidal oyster reefs.

2. LIMITS TO OYSTER DEVELOPMENT ON BREAKWATER STRUCTURES
   Aaron Bland*, Ronald Baker

   Nature-based coastal protection often involves building structures intended to reduce erosive wave activity and seed oyster reefs. Once established, oysters improve water quality and habitat value, and continue to protect the shoreline by growing in pace with sea level rise. In practice, oyster reef development on constructed breakwaters is highly variable, and in coastal Alabama there has been limited success in establishing oyster populations on these structures. It is often unclear which ecological factors prevent oysters from settling and surviving on structures, so our aim was to identify factors limiting oyster development on breakwater structures through a field experiment at two Alabama Living Shoreline sites. Specifically, we focused on the importance of (1) wild larval availability, (2) water quality, (3) predation, and (4) aerial exposure period. We deployed settlement tiles to observe patterns of in situ oyster settlement and mortality across a gradient of tidal inundation levels. Seeded oyster spat experienced very high rates of mortality, especially on more frequently inundated tiles, and wild oyster settlement was negligible. Water temperature, dissolved oxygen, and salinity were favorable for oysters during the period of rapid mortalities, but much of the mortality could be explained by predation, especially from the oyster drill (Stramonita haemastoma). Increasing the heights of breakwaters may situationally improve oyster survival, but the conditions observed during this monitoring period are likely not suitable for sustainable oyster reef development on breakwaters. By identifying ecological factors that limit oyster reef development, we can inform future breakwater design and siting for more effective coastal restoration.

3. ONE CRAWL DOESN'T FIT ALL: VARIABLE ROLES OF APPENDAGES DURING ANNELID BURROWING
   Moey Rojas*, Madeleine Frey, Kelly Dorgan

   Annelids possess “foot-like” appendages called parapodia that are used in swimming and walking on the sediment surface. Burrowing differs from crawling on a surface in that worms must create a burrow, move through the confined space of the burrow and irrigate the burrow. How parapodia are utilized during burrowing has not been explored due to the challenges of visualizing burrowing animals. To observe how parapodia are involved in burrowing, we developed an “Ant Farm” tank that reduces wall effects while allowing visualization of burrowing animals. A vertical layer of mud is held between two layers of clear gelatin that mimic the soft elastic properties of muddy sediments. At slower speeds, the annelid, *Allita virens*, “walks” forward via the sequential action of the lateral parapodia along the body. To “gallop” forward more quickly, worms utilize a combination of parapodial movement and longitudinal muscle contraction. Via tracking of individual parapodia and points along the body wall, we characterize the parapodial movements during both the “walk” and “gallop” gaits. Our observations suggest that during burrowing, parapodial movements associated with the “walk” gait also serve to expand and compact the burrow walls. During irrigation, parapodia are oriented to increase the exposure of the worm’s vascularized dorsal lamellae to the ventilatory current. Parapodia align themselves parallel and flush to the body wall during quick locomotion, which likely serves to reduce drag. Our work indicates that parapodia are dynamic appendages with roles in burrowing and irrigation. Better understanding of the movements and function of parapodia in burrowing and irrigation will aid roboticists in developing soft, burrowing robots.

4. OYSTER REEF COMMUNITY DEVELOPMENT OVER TIME
   Gabrielle Davis*, Lee Smee, Jessica Lunt, Benjamin Belgrad, Randi Cannon, Christa Russell, Jessica Hilliker

   Oysters are ecosystem engineers which provide many ecosystem services. Oysters filter water and thus improve water quality and clarity, act as a buffer for erosion and storm surge thus protecting coastlines, and serve as a valuable commercial resource with just U.S. oyster fishery valued at more than $250 million in just 2019. Oyster reefs also provide important nursery and refuge habitat for other commercially and environmentally important species such as blue crabs and flounder. However, due to overharvesting, pollution, and land use development, 85% of oyster reefs have been lost worldwide. Furthermore, oyster reef restoration practices often fail due to high levels of predation on the newly deployed reefs as predators can easily consume the younger, weaker, oyster spat. To better improve upon oyster reef restoration strategies, it is necessary to know what predators are responsible for oyster mortality, as well as where, and when they become most prevalent. An intertidal oyster reef was constructed, and the associated fauna and numbers of surviving oysters were monitored at different tidal elevations. The study is ongoing, but preliminary findings indicate that predators are most prevalent during summer months compared to winter months. These colder months may provide relief from certain predation pressures and provide oysters with time to reach a size refuge. Furthermore, tidal elevation is a significant factor determining the distribution of organisms along oyster reefs throughout reef colonization.

Morning Session - April 20 2024

Understanding a Unique Environment

1. COMPARISON BETWEEN SPHERICAL BAITED REMOTE UNDERWATER VIDEO (SBRUV) AND REMOTELY OPERATED VEHICLE (ROV) SURVEYS IN OFFSHORE ALABAMA

   Adam W. Jung*, Sean P. Powers, Crystal L. Hightower, Mark A. Albins, Grant R. Lockridge

   Fishery-independent video surveys are widely used to gather data on relative abundance and species composition of reef-associated fish. Video gears have advantages over traditional fisheries gears (e.g. trawls, longlines, gillnets) as they can be used over a wider range of habitat, are less selective of particular species and size-classes, are non-extractive, and are archival. As the use of video survey data in stock assessments is becoming more common, it is increasingly important to assess the merits and biases of different video gears. Mobile single-camera systems have a limited field of view, but are capable of maneuvering to focus on specific habitat patches. Whereas, stationary 360-degree camera systems benefit from a wider field of view, but are constrained to sample only the immediate area where they are deployed. Because of these discrepancies, abundance data generated from each gear could vary in terms of accuracy and precision across a range fish abundance. We compare measures of relative abundance (max N counts) and species richness between a single-camera video system mounted on a remotely-operated-vehicle (ROV) and a multi-camera, 360-degree, stationary, spherical baited remote underwater video system (SBRUV). These data will be used to assess relative merits and biases, estimate calibration factors, evaluate the behavioral response of fish, and assess alternative methods of analyzing data from these two gear types. Preliminary data indicates that SBRUV max N counts have a stronger correlation to ROV max N counts when the SBRUV video analysis includes the whole deployment (rather than excluding an initial acclimation period) and when bait is used to attract fish to the SBRUV. This demonstrates that certain methods of collecting data increase the ability to compare counts between the ROV and the SBRUV.

2. INFLUENCE OF MARINE PHYTOPLANKTON IN SURFACE WATER CHROMIUM CYCLING

   Debbrota Mallick*, Xiangli Wang, Jeffrey W. Krause

   The chromium (Cr) stable isotope system has been developed as a redox proxy to study Earth's oxygenation history. However, knowledge necessary for the use of Cr in such a manner hinges on understanding how it cycles in the modern ocean. In oceanic environments, Cr shows a nutrient-type distribution despite being a non-essential element for productivity. Recent work also has shown that behavior of Cr in estuaries is non-conservative, highlighting the potential for biologic and abiotic processes, especially at the land-sea interface, to affect the delivery of Cr to the ocean. The reduction of Cr(VI) to Cr(III) by phytoplankton has been examined previously; however, whether this affects Cr isotope fractionation is unknown. This study aims to investigate the influence of coastal phytoplankton on Cr(VI) reduction and potential isotope fractionation. Laboratory experiments were conducted using locally isolated diatoms (*Thalassiosira sp., Leptocylindrus sp.*) grown in f/2 media doped with Cr(VI). Results showed that total dissolved Cr concentration did not change substantially over time, but dissolved Cr(III) concentration increased during each diatom's stationary/decline phases. An increase of Cr(III) after peak productivity indicates that Cr(VI) reduction was unlikely induced by actively growing diatoms, thus implying a secondary influence of growth-related reductants (e.g. organic matter, NADPH, and Fe-Mn complexes). Our work shows that the broad correlation of Cr(III) with phytoplankton activity in the open ocean revealed by prior work is relevant to coastal phytoplankton, which can accumulate 1–2 orders of magnitude more biomass compared to open-ocean phytoplankton, thus filling the knowledge gap regarding biological transformation of Cr at the land-sea interface.

3. PREDICTED IMPAIRMENT OF RESERVOIR ENVIRONMENTS IN THE UNITED STATES UNDER THREE CLIMATE CHANGE SCENARIOS

   Darren J. Shoemaker*, Leandro E. Miranda

   Reservoir environments across the United States are anticipated to degrade throughout the 21st century due to aging and climate change. Reservoirs are important for ecological, economic, and social reasons, so maintaining the function of these systems is a high priority for government agencies. Influences from climate change are highly variable through both spatial and temporal spaces, so anticipating the most urgent climate impacts is difficult at the individual reservoir, basin, and watershed levels. Despite this uncertainty, most reservoir surveys are only conducted at the local scale due to logistical and financial constraints. In a previous study, we constructed a series of models using historic climate normals reported by WorldClim for 19 bioclimatic indicators and 45 reservoir impairment scores reported by reservoir managers in a human dimensions study to identify relationships between reservoir impairment and climate indicators. Three philosophical modeling frameworks were considered: conventional statistical analysis, shallow machine learning, and deep machine learning. We evaluated each model framework and selected the best performing model for each impairment metric. Shallow machine learning algorithms were shown to be the most robust framework to address our research objectives. Here, we apply those models to predict reservoir impairment scores under three shared socioeconomic pathways (SSPs) using the same scale as the human dimensions study throughout the 21 st century. Low emissions (SSP170), moderate emissions (SSP370), and high emissions (SSP585) scenarios were considered. By incorporating both spatial and temporal components in predictions, we were able to characterize reservoir impairment across the contiguous United States, providing reservoir managers insight into how impairment in their systems will change by end of century. This study empowers natural resources agencies to make more informed conservation and management decisions and more efficiently allocate limited resources with consideration to future reservoir conditions.

4. TRAPPING A COASTAL MARINE HEATWAVE AT DEPTH THROUGH A HURRICANE SEASON HEAT PUMP

   Devanarayana R.M. Rao*, Brian Dzwonkowski, Severine Fournier, and Grant Lockridge

   Marine heatwaves (MHWs) during peak hurricane season can impact storm intensification, posing a significant threat to coasts and ecosystems. In coastal regions, often, the full water column evolution of marine heatwaves is required to anticipate potential impacts on storm intensity. However, such an understanding of coastal MHW is limited. Using satellite data, a rare 16-year time series of full water column hydrographic data, and the GLORYS ocean reanalysis product, the vertical progression and decay of a coastal MHW during September and October of 2019 is connected with the physical processes driving this chain of events. The region where this event occurred, the northern Gulf of Mexico, and more importantly, the time period of this event, peak hurricane season, is of particular interest due to the potential interaction between landfalling hurricanes, marine heatwaves, and river discharge. The event begins as a surface MHW that is caused by a persistent atmospheric heatwave and reduced surface heat dissipation. However, this initial heatwave was temporarily disrupted by high winds associated with the remote effects of a tropical storm. Intriguingly, following the passage of the storm, the atmospheric heatwave reemerged, consequently reinstating the surface marine heatwave. However, the mixing of surface heat from the passing tropical storm in conjunction with subsequent coastal downwelling conditions facilitated the subsurface delivery of heat, resulting in an anomalously warm vertical water column and the consequent development of a bottom marine heatwave. The mechanistic perspective of the evolution of this MHW has significant implications for understanding tropical cyclone risks in the coastal zone.

Afternoon Session I - April 20 2024

Unseen Diversity

1. UNCOVERING THE HIDDEN DIVERSITY OF *ENTACMAEA QUADRICOLOR*
Tommaso Chiodo*, Aurélien DeJode, Randi Gibson, Takuma Fuji, Kensuke Yanagi, James Reimer, Estefanía Rodríguez, Benjamin M. Titus

Of the tropical sea anemones that host anemonefish symbionts, the bubble-tip sea anemone *Entacmaea quadricolor* hosts the greatest number of anemonefish species and has a large geographic range that spans from the Red Sea to the Central Pacific Ocean. It is described as a single species, but exhibits extensive phenotypic and ecological variation, making it an ideal candidate to study how geography and symbiosis can influence diversification. This is especially important in marine habitats where sympatric and parapatric speciation events are more common than on terrestrial systems. Here, we present a comprehensive summary of the genetic diversity across the Japanese archipelago for *E. quadricolor.* Using a SNP dataset generated from Restriction site. Associated DNA sequencing (RADseq), we were able to show three highly differentiated lineages across the archipelago - two of which co-occur in mainland Japan. We recover a third genetically distinct lineage from the Ogasawaran Islands, isolated from the main Japanese Archipelago by ~1400km. Interestingly, the two co-occurring lineages can be differentiated by the fish symbiont they hosts: one lineage hosts *Amphiprion clarkii* while the other hosts *Amphiprion frenatus*. To determine whether this diversity evolved in situ, we expanded our biogeographic sampling and used bait-capture sequencing and included *E. quadricolor* samples from the Maldives, Australia, and Singapore. Our results show that the *E. quadricolor* lineage that hosts *A. frenatus* is more closely related to individuals from Singapore than the co-occurring anemones in Japan that host *A. clarkii*. Thus differentiation between these lineages did not occur within the Japanese archipelago, but instead is representative of a secondary contact of divergent lineages that line up with the clownfish symbiont living with the anemone.

2. eDNA SURVEILLANCE OF THE POND LOACH (*MISGURNUS ANGUILLICAUDATUS*) IN THE TENNESSEE-TOMBIGBEE WATERWAY
Tobin J. Davidson*, Kayla M. Fast, Michael W. Sandel

Invasive species represent a growing threat to the ecosystems and economies of the United States. The southeastern United States represents an aquatic biodiversity hotspot, and a rapidly growing number of nonindigenous freshwater fishes are attributed to the decline of multiple native species already facing extinction. Presidential order 13751 describes the need for rapid and cost-effective tools to detect invasive species during the earliest stages of introduction, when mitigation and control efforts are most effective. This study includes development of noninvasive environmental DNA (eDNA) protocols designed for early detection of invasive freshwater fishes, specifically the Pond Loach (*Misgurnus anguillicaudatus*) in the southeastern United States. The Pond Loach is an escaped species from the aquarium trade with native origins from East Asia, ranging from Siberia to Japan. Established populations in the Southeast United States provide a large threat of invasion into the Tennessee-Tombigbee waterways, thus, threatening the populations of native species in the region. Results of controlled trial experiments provide proof of concept for effective deployment of this pipeline in real-world situations where traditional sampling methods are inadequate for development of "rapid, cost-effective, noninvasive tools to monitor the geographic range of invasive species" (Presidential order 13751). Thus, the deliverables of this study represent a rapid and cost-effective alternative to traditional sampling methods that allow an early detection and rapid response to the invasion of the Pond Loach in the Tennessee-Tombigbee waterways, contributing to the preservation of one of the world's most biodiverse temperate freshwater ecosystems.

3. GENETIC ISOLATION OF THE STARLET SEA ANEMONE *NEMATOSTELLA VECTENSIS*: A MODEL ORGANISM REEMERGES AFTER 40 YEARS
Miranda Gibson*, Benjamin Titus

The starlet sea anemone, *Nematostella vectensis*, has become one of the most diverse model organisms over the past 30 years. This small intertidal salt marsh species is used to answer questions from a broad range of fields – evolutionary biology, functional genomics, neuroscience, developmental and cellular biology and more. In addition, it was the first member of the Cnidaria to have its genome fully sequenced. This model organism's origins come from populations along the eastern coast of the United States, which have been sampled countless times to maintain lab specimens and to aide in a variety of research projects. *N. vectensis* has not been documented in the Gulf of Mexico in more than 40 years, but in February of 2023, my lab rediscovered the starlet anemone on Dauphin Island, AL. The salt marshes of the Northern Gulf of Mexico and the Atlantic coast have been separated for more than 2 million years following the closure of the Suwannee seaway. This previously unstudied Gulf population of *N. vectensis* therefore has a strong possibility of divergence from its Atlantic counterparts. Early results from shallow genomic sequencing have revealed promising evidence for such divergence. This presentation details how the biogeographic history of the Suwannee seaway closure influenced the genetic isolation of the Gulf population of *Nematostella vectensis* from the Atlantic.

4. DETECTION OF WALLEYE IN EASTERN MISSISSIPPI STREAMS USING eDNA
Kevin W. Jones*, Peter J. Allen, Sandra B. Correa, Michael W. Sandel, J. Wesley Neal

The Gulf Coast strain of Walleye (*Sander vitreus*) is a genetically unique strain native to the Mobile River Basin and adjacent Gulf of Mexico watersheds. This strain has been threatened by the construction of the Tennessee-Tombigbee Waterway, which resulted in habitat loss, isolation of tributaries, and created the potential for introgression from northern Walleye by connection to the Tennessee River Basin. Historical stocking of northern strain Walleye into the Mobile Basin created further potential for introgression. Populations are now maintained with hatchery-produced Gulf Coast strain Walleye. The efficacy of stocking efforts and the status of remaining wild populations are poorly understood, in part because Gulf Coast strain Walleye habitats can be difficult to sample using traditional gears. During the spring of 2024, tributaries of the Tombigbee River will be sampled for environmental DNA (eDNA) to identify potential remnant populations of Gulf Coast Walleye. This presentation will discuss this upcoming project, as well as evidence for the genetic distinctiveness of the Gulf Coast strain and past and ongoing efforts to restore Walleye populations in Mississippi. By investigating the status of this unique and imperiled Walleye population, this project aims to contribute vital information towards future conservation efforts.

Afternoon Session I - April 20 2024

Human Interactions

1. SEABIRDS AND OYSTER AQUACULTURE: A BACTERIAL REVIEW
   Luke Matvey*, Andrea Tarnecki, Scott Rikard

   Campylobacteriosis, caused by bacteria in the genus *Campylobacter*, is the most common source of human bacterial gastroenteritis worldwide. A department of health investigation traced a 2021 outbreak in Rhode Island to the consumption of raw oysters. Indigenous to the gastrointestinal tract of birds, indirect transfer of *Campylobacter* to oysters during bird interactions with commercial oyster farming gear may be responsible. Due to these concerns, oyster farmers must maintain an operational plan describing mitigation strategies to minimize risks associated with bird interactions. However, data on *Campylobacter* transfer from seabirds to oysters is lacking. Goals of this study include 1) test the effectiveness of a non-lethal bird deterrent, 2) enumerate *Campylobacter* in seabird species found in the northern Gulf of Mexico, and 3) survey oysters for *Campylobacter* and describe the similarity between isolated strains from oysters and seabirds. Six experimental floating cages were deployed at a farm site in coastal Alabama, three equipped with bird deterrents (zip ties) and three controls. Cameras monitored the efficacy of the deterrents. *Campylobacter* incidence in seabird fecal matter was determined using a selective and differential media. An enrichment procedure was used to detect *Campylobacter* in oysters. Deterrents decreased bird interactions with gear 8-fold. Approximately 7.5% of bird feces were positive for *Campylobacter*. Sequencing of the 16S rDNA identified the isolates as *C. lari* subsp. *concheus*. This species has not been confirmed as a human pathogen.

2. FISHING FOR FOOD: DIVERSE MOTIVATIONS IMPACT SUBSISTENCE FISHING ACROSS A COASTAL ALABAMA LANDSCAPE
   Savannah H. Swinea* and Steven B. Scyphers

   The practice of subsistence fishing is culturally important and contributes locally caught seafood into the diets of fishermen and their social networks, which fills nutritional needs and contributes to food security but could unintentionally expose these groups to contamination. Fishing is an economically and culturally important practice in Alabama that faces threats from anthropogenic fish contamination. The characterization of subsistence fishing in combination with social and environmental drivers of this practice constitutes a major research gap in the Alabama coastal system. The goal of this study was to conduct intercept surveys of shore-based fishermen to characterize their subsistence fishing practice. Survey instruments were deployed in-person at public access, shore-based fishing sites along Mobile Bay from May 2023 to February 2024 (N = 264 responses). The survey instrument measured fishing behaviors, landscape values, subsistence fishing practices (including sociocultural facets), and demographic characteristics. Consumption of local seafood, values attributed to the landscape, and the community with which fishermen share their catch were tested for differences across social, environmental, and demographic variables. Consumption of local seafood was better predicted by fishing behavior than demographic variables, and the landscape values reported by respondents varied by site, but not in relation to any demographic characteristics. However, the communities with which fishermen share their catch were significantly different only by race, with people of color sharing their catch outside of their household more than white people. The impact of sharing local catch among people of color was not evident from understanding direct fishermen consumption rates alone; thus, it is important to investigate the complex impacts of subsistence fishing to the social networks of these fishermen. Because fishing for food is not only a means for survival, but reinforces social networks and contributes to cultural identity, research products from this effort stand to benefit citizens across the Mobile Bay system.

3. LONG TERM IMPACTS OF THE DEEPWATER HORIZON OIL SPILL ON HARD SUBSTRATE COMMUNITIES
   Sydney McDermott*, Mark Benfield, Granger Hanks, Craig McClain

   Each year an excess of millions of tons of anthropogenic waste finds its way into the Earth's oceans. These man-made structures have the capacity to attract species that prefer or depend on hard substrates, in stark contrast to the predominantly prevalent soft sediment which blankets over 90% of the abyssal seafloor. Certain items, such as the remnants of the Deepwater Horizon oil rig, are capable of releasing oil and toxins into the surrounding aquatic environment. This phenomenon poses a protracted threat to deep-sea ecosystems and the communities that may take root on these structures, imparting enduring harm. However, even substrates lacking toxicity, such as shipwrecks, act as atypical hard substrates, possessing surface properties that can engender distinctive patterns of colonization and ecological succession, distinct from those observed on natural hard substrates. We investigate how artificial hard substrates impact deep-sea ecosystems, specifically examining three artificial substrates within the Gulf of Mexico: the wreckage of the Deepwater Horizon oil platform, the wreck of the SS Robert E. Lee, and the wreckage of the USS Peterson shipwreck. The Deepwater Horizon wreckage has been surveyed multiple times since its sinking in 2010, while the shipwrecks were surveyed once in 2014 (72 and 10 years after sinking, respectively). Preliminary analysis suggests elevated organism abundance and diversity on the two shipwrecks compared to the Deepwater Horizon. This intriguing observation prompts the hypothesis that the presence of oil at the Deepwater Horizon site might be a key factor contributing to this contrast in abundance and diversity.

4. HERBICIDE EFFECTS OF SECONDARY METABOLITE PRODUCTION IN EURASIAN MILFOIL (*MYRIOPHYLLUM SPICATUM*)
   Anna Reimer*, Charles Martin

   Myriophyllum spicatum, commonly known as Eurasian milfoil, is among the most prolific invasive aquatic plants in North America, with positive reporting in 48 U.S. states and parts of Canada. Milfoil is easily transported through waterways by fragmentation and can effectively dominate new bodies of water, overwhelming the native species within the ecosystem. This has led to an abundant local population in the Mobile Tensaw Delta and surrounding waterways. In many aquatic plants, chemical defenses and secondary metabolites such as polyphenols increase an individual’s chance of survival by providing protection against herbivory, pathogens, parasites, and ultraviolet radiation. The production of these metabolites facilitates competition among individuals and species by inducing more favorable characteristics, potentially furthering the establishment and expansion of invasive species such as Eurasian milfoil. Active management of milfoil frequently involves the application of the systemic herbicide 2, 4-D, which stimulates the meristematic tissue of a broadleaf plant inducing uncontrolled growth ultimately causing plant death. Thus, under a regulated application of the 2, 4-D, resources and energy will be directed towards the stimulation of tissue growth of the affected population of Eurasian milfoil. However, the effect it this herbicide on secondary defenses such as polyphenol concentrations remains unknown. Here, we propose to test the effect of 2, 4-D on milfoil polyphenol production and explore the food web implications that may result from its application.

Afternoon Session II - April 20 2024

Changing Communities

1. DIFFERENCES IN TOLERANCE AND RESPONSES TO THERMAL STRESS BETWEEN DIPLOID AND TRIPLOID EASTERN OYSTERS (*CRASSOSTREA VIRGINICA*) FROM THE NORTHERN GULF OF MEXICO
   Kayla Boyd*, Hisham Abdelrahman, Scott Rikard, Andrea Tarnecki, Jim Stoeckel

   Most eastern oysters (*Crassostrea virginica*) harvested from aquaculture production for the half-shell market are triploid, single-set oysters. Oyster growers typically prefer triploids due to their faster growth rates and superior meat quality during the spawning season compared to diploid oysters. However, triploid oysters experience higher mortality rates compared to diploids potentially related to a lower tolerance to environmental stressors. To investigate links to temperature, we compared physiological and behavioral responses of diploid and triploid oysters to acute thermal stress, their ability to recover from sublethal stress, and their upper thermal limits. Diploid and triploid half-sibling oysters were subjected to increasing temperatures from a baseline of 25℃ at a rate of 2℃/h. As temperatures increased, physiological response was measured via intermittent respirometry, and behavioral responses were measured via observations of closing, gaping (sublethal), and mantle retraction (lethal). There were no significant differences observed between ploidies in metabolic peak temperature(~33°C) and onset of sublethal (~43°C) and lethal (~44.5°C) behavioral reactions. Diploids showed a significantly higher metabolic demand compared to triploid oysters at peak metabolic temperature but at no other time during the temperature ramp. Both ploidies exhibited 100% recovery from sublethal stress. Our study suggests that, while thermal stress may play a role, it is unlikely the sole factor contributing to the observed mortality differences between diploid and triploid oysters in the nGOM.

2. THE RELATIONSHIP BETWEEN MUD WORM INFESTATION AND OYSTER PLOIDY
   Jessica Hilliker*, Randi Cannon, Ben Belgrad, Jessica Lunt, Lee Smee

   The mud blister worm, *Polydora websteri*, burrows into the shells of oysters, *Crassostrea virginica*, creating distinct patterns and bumps on the inside of the shell. These parasites are not harmful to humans but instead compete with oysters for resources and reduce their growth. The detection of mud blister worms leads to allocating more energy towards the secretion of shell and removing energy from other potential important processes. The shell damage from mud blister worms also lowers the oyster's commercial value. We examined how salinity and oyster ploidy influenced the prevalence of blister worms in oysters by collaborating with oyster farmers. Across all sites, salinity was similar, however in the third site, mud blister worms were an order of magnitude more abundant with a distinct split between triploid and diploid oysters. Triploid oysters have thinner shells than diploids, and we attributed the higher infection rates to shell thickness. Triploid oysters in the area experience higher mortality overall than diploid oysters, and these findings provide insight into parasite infection in triploid oysters.

3. SHIFTING MACROPHYTES: *THALASSIA* AND *CAULERPA* SUPPORT UNIQUE ECOLOGICAL COMMUNITIES
   Adam R. Searles*, Laura K. Reynolds, Charles W. Martin

   Macroalgae are replacing seagrasses in marine ecosystems across the globe. Macroalgae beds can support unique faunal assemblages compared to seagrasses and can therefore drive changes in community structure and ecological function as they increase in abundance. However, large changes in the relative abundance of marine macrophytes often occur as a result of anthropogenic impacts such as eutrophication and associated light limitation. These background environmental conditions often hamper attempts at isolating the effects of seagrass replacement by macroalgae on ecological communities. To understand how changes in macrophyte abundance may affect ecological communities, we sampled *Thalassia testudinum*, *Caulerpa prolifera*, and *Caulerpa paspaloides* monocultures as well as mixed habitats for benthic invertebrates and fishes in a low-nutrient and minimally-impacted system: Crystal Bay, Florida. Species composition and diversity differed significantly among habitats and sampling times. Temporal changes in species composition reflected seasonal shifts in macrophyte relative abundance. Differences among habitats and seasons were driven primarily by differences in the abundance of several numerically dominant species and, to a lesser extent, species turnover. The results of our sampling efforts suggest that seagrasses and macroalgae support complex, yet unique communities, in Floridian waters.

4. MUTANT POOP: UNDERSTANDING THE RELATIONSHIP BETWEEN OYSTER PLOIDY AND FEEDING BEHAVIOR
   Randi Cannon*, Jillian Lunt, Jessica Lunt, Lee Smee

   Eastern oysters (*Crassostrea virginica*) are a major fishery in the south, where the genetically altered triploid oysters are favored for aquaculture production due to their sterility and faster growth rates, though little is known about potential trade-off's. In an attempt to understand the relationship between oyster ploidy and physiology, in situ feeding assays were conducted in Mobile Bay during March and April on diploid and triploid oysters. The filter feeding devices and biodeposition collection allowed for measurement of individual oysters' clearance rate, filtration rate, rejection rate, and absorption efficiency in relation to organic and inorganic content of the water source. These characteristics allowed for comparison of overall in situ feeding efficiency amongst triploid and diploid oysters.

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Lightning Talks

1. DRIVERS OF INTER-ANNUAL VARIATION IN *CYNOSCION NEBULOSUS* GROWTH IN MOBILE BAY, AL

   Hannah Ehrmann*, Zoë Porter, Ronald Baker

   The speckled sea trout, *Cynoscion nebulosus,* is one of the most important inshore sportfish across the U.S. Gulf coast and contributes significantly to coastal economies. Understanding the factors regulating productivity of speckled sea trout populations can help us anticipate their likely responses to climate change. In this study we aim to identify the drivers of inter-annual variation in *C. nebulosus* growth in Mobile Bay, Alabama. We used an archive of sectioned otolith images, collected by the state's fisheries assessment and monitoring program (FAMP), as well as otoliths collected from the Alabama Deep Sea Fishing Rodeo to calculate indices of growth based on annual otolith increment widths. Preliminary results from 2000-2023 indicate substantial differences in size at age of 3+ fish in Mobile Bay, AL. We are using contemporary and published gut content analysis to identify key prey items for *C. nebulosus*, allowing us to develop indices of abundance of these prey in Mobile Bay from the states historic FAMP data. Together with environmental parameters (water temperature, salinity, dissolved oxygen, and nutrient concentrations), we aim to create an explanatory model quantifying the importance of these factors in regulating trout growth and hence stock productivity. The model will allow us to predict stock responses to future environmental conditions in the bay, supporting informed fisheries management and identifying environmental covariates for future stock assessments.

2. A REVIEW OF METHODS FOR MEASURING STRUCTURAL COMPLEXITY OF SUBMERGED AQUATIC VEGETATION

   Zoey Hendrickson*, Charles Martin, and Wesley Daniel

   Habitat structural complexity refers to the three-dimensional abiotic and biotic physical structures in an ecosystem. Higher levels of structural complexity (i.e., increased plant cover) have been associated with higher biodiversity in both terrestrial and aquatic environments. Habitat structural complexity in aquatic environments is often influenced by the presence and species composition of submerged aquatic vegetation (SAV) communities. Structural complexity of SAV can be measured at the community level or at a finer-scale by examining the characteristics ("metrics") of individual plants of a given species. However, previous studies have used a variety of metrics and methods for individual plant measurements. This study will quantify how structural complexity has been measured at the individual plant-scale in the past and present. Our objectives are to: 1) identify and categorize what types of research questions are being asked concerning SAV structural complexity at the individual or species level, 2) quantify specific metrics and approaches used to measure individual SAV structural complexity, and 3) evaluate whether a standardized process for measuring SAV structural complexity exists or could be developed using established metrics. We will execute a comprehensive review of the scientific literature to achieve these objectives. This research will increase our understanding of the role of individual SAV species complexity in providing ecosystem services (e.g., habitat provision and associated biodiversity) at the individual plant-scale. In addition, evaluation and standardization of structural complexity measurements will allow for more uniform comparison among SAV communities when evaluating ecosystem function, particularly between communities containing invasive or native SAV.

3. ANTHROPOGENIC DISTURBANCES AND THEIR EFFECT ON GHOST CRAB (*OCYPODE QUADRATA*) BURROW ARCHITECTURE

   Aaron Wiggs*, Chelsea Thornton, Justin Puckett, Jeremiah Henning

   Atlantic Ghost Crabs, Ocypode quadrata, are environmental engineers that serve as bioindicators of human impact on coastal beach ecosystems. *O. quadrata* is a common and abundant species ranging from Rhode Island to Brazil that serves as a crucial prey item for coastal birds and mammals. This semi-terrestrial invertebrate excavates burrows as a means for shelter in sandy environments. Burrow construction is an energetically costly process that is affected by different environmental stressors such as predation, beach morphology, and human disturbance. To better understand how *O. quadrata* burrow architecture responds to increased coastal urbanization and tourism, we collected plaster casts of burrows from seven beaches across the Northern Gulf Coast region that differ in intensity of human impact. Sites selected ranged from secluded sites with limited access to heavily impacted sites in tourist heavy areas such as Destin, Fl. Casts were measured for volume, angle of inclination, complexity, and depth, which can be impacted by human disturbance. Overall, we found relationships between the collected ghost crab burrows' volume, number of openings, depth, and branching among sites in relation to level of human impact. Further, at three sites experiencing extreme levels of impact in coastal Mississippi, we struggled to find enough burrows to sample burrow architecture, thus highlighting the precarious position of this ecologically significant species in a rapidly urbanized landscape. By analyzing how the burrowing behavior of *O. quadrata* varies in relation to anthropogenic disturbance along the Gulf Coast we hope to determine a predictable response in conjunction with related studies to support the efficacy of this method in evaluating the role of human impact in disrupting these coastal habitats. This study highlights the critical role that *O. quadrata* serves in assessing the impact of anthropogenic disturbance can and will continue to have on coastal dune beach ecosystems.

4. COMBINED SEASONAL EFFECT OF PH, SALINITY, AND TEMPERATURE ON THE CLEARANCE RATE AND SELECTIVE FEEDING OF OYSTERS ON MICROBIAL COMMUNITY ASSEMBLAGES IN THE NORTHERN GULF OF MEXICO

   Jicayla Johnson-Rosemond*, Randi Cannon, Jessica Lunt, Sean Lowry, Dustin Kemp, Kenneth Hoadley, Delbert L. Smee

   Oysters are organisms of commercial and ecological importance, with reef management and rehabilitation efforts directed towards addressing the degradation of their populations. An important source of nutrition for these benthic, filter feeding organisms are microbial communities, whose assemblages are prone to spatial and seasonal changes that can alter the nutritional value they offer. The selective nature of oyster filter feeding behavior further complicates our understanding of oyster feeding behavior as a function of environmental conditions such as nutrients, pH, temperature and salinity as these factors are known to fluctuate at spatial and seasonal scales along the Northern Gulf of Mexico, where many natural oyster reefs and oyster farms are found. This study explores how spatial patterns of microbial community assemblages found across three sites in Mobile Bay impact oyster feeding rates and prey selection. Utilizing a combination of clearance rate assays and flow cytometry, spatial and seasonal variability in pH, salinity, and temperature were characterized across all three sites and lead to differences in microbial community compositions, feeding rates and prey selection of the oysters. As restoration efforts and oyster aquaculture continues to grow in the region, a better understanding of how environmental parameters impact feeding rates could help prioritize certain areas inhabited by oysters and improve overall efficacy of rehabilitation endeavors.

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5. INVASIVE HITCHHIKERS ON IMPORTED AQUATIC PLANTS: EXPLORING THE ROLE OF PLANT METRICS IN FACILITATING INTRODUCTIONS

Samantha Smith*, Katie O'Shaughnessy, Wesley Daniel, Zoey Hendrickson, Charles Martin

The unintended transport of exotic species alongside imported aquatic plants, algae, and their packaging ("hitchhiking") represents an underappreciated invasion pathway. The high structural complexity of many common aquarium and ornamental aquatic macrophytes may support fauna that reside within interstitial spaces and thus go undetected. This potentially problematic pathway was highlighted in the recent Marimo moss ball (*Aegagropila linnaei*) contamination incident carrying live hitchhiker zebra mussels (*Dreissena polymorpha*) and a multitude of other exotic taxa in the spring of 2021. Given that introductions of exotic aquatic species contribute to millions of dollars of damage and management costs for the U.S., the identification of potential aquatic plants, algae, and associated packaging with a high potential of serving as a vector for unintended hitchhikers will aid in managing this group of organisms in trade. Here, we describe proposed methods to evaluate imported aquatic plants and algae for their hitchhiking taxa and determine plant metrics (e.g., plant/algae species and their structural complexity, packaging, country of origin, vendor, etc.) influencing the unintended importation of non-native species. We also report on a review of existing information highlighting gaps in knowledge as it relates to non-native hitchhiking taxa through the aquarium trade and include a list of hitchhikers on the common aquatic plants and algae. This project will provide vital information that will assist in the prevention of invasive species introduction on a nation-wide scale.

6. CANARIES ON THE COASTLINE: GHOST CRABS AS BIOINDICATORS TO INVESTIGATE HUMAN DISTURBANCE OF COASTAL DUNES

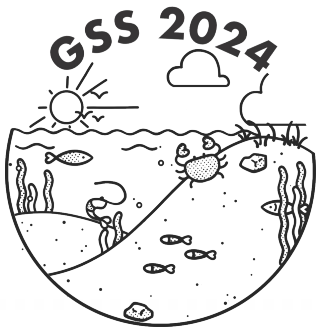
Chelsea Thornton*, Taylor Clay, Aaron Wiggs, Jeremiah Henning

Within the past century, anthropogenic impacts have become the strongest force altering ecosystems worldwide, and the strength of these disturbances are primarily connected to human population size and intensity of land-use. Coastal ecosystems are experiencing the highest rates of population growth and sea level rise to other coastal regions in the country. Coastal dunes are dynamic ecosystems that receive intense natural disturbances of sand accretion and erosion necessary to maintain ecosystem function; however, there has been an increase in anthropogenic disturbances such as urbanization, tourism, trampling, sea-level rise, and habitat destruction. Indicator species are often used to accurately identify ecosystem-level responses to ongoing disturbance. For instance, the Atlantic Ghost Crab (*Ocypode quadrata*) is a common indicator species on the Eastern Atlantic and Gulf of Mexico coasts because of its widespread distribution and sensitivity to natural and anthropogenic disturbances. We studied ghost crab density, burrow diameter, energy storage, reproductive success, stress hormone levels, and claw sizes to understand population dynamics in the face of human disturbance in 1) a mechanical disturbance x resource addition experiment established on Dauphin Island, AL, and 2) collecting ghost crab metrics across several beach locations along the Northern Gulf of Mexico. Based on our preliminary results on Dauphin Island, we found that there was little change in the burrow sizes across all treatment types, however, the average number of burrows were highest in the disturbed and disturbed + NPK plots, suggesting that the crabs preferred more open plots with less vegetation. These findings suggest that ghost crabs can potentially tolerate intermittently low-level physical disturbance and rebound quickly when in an ideal micro-habitat.

7. MARINE MICROBIAL DEGRADATION OF ^{35}S-DMSP

Alexandra M. Smith*, Brandi Kiel Reese, Naomi M. Levine, Jeffrey W. Krause

Dimethylsulfoniopropionate (DMSP) is a labile organosulfur compound that accounts for a significant fraction of global phytoplankton production. Marine microbes are the primary consumers of DMSP and process DMSP-derived S via two competing pathways: lyase cleavage (producing the climatically important gas dimethyl sulfide, DMS) and demethylation (assimilating S into biomass). Surface concentrations of dissolved DMSP are kept low, and pools are turned over rapidly. However, there is a lack of understanding regarding the factors determining which pathway is used. ^{35}S-DMSP was used to trace these pathways in two *Roseobacter* species, *R. denitrificans* (OCh 114) and *R. nubinhibens* (ISM), that have the genes for both degradation pathways. ^{35}S fate was quantified was quantified into three pools: labelled cellular material, primarily protein (sulfur assimilation yield); DMS (DMS yield); and unprocessed DMSP. The yields were then standardized to bacterial production, as measured using the ^{3}H-Leucine method. On average, ISM (vs. OCh) grew to higher densities, $1.5x10^{6}$ ($1.9x10^{4}$), consumed a significantly higher fraction of added DMSP, 0.998 (0.487), and had a higher bulk DMS yield, $6.21x10^{-3}$ ($4.92x10^{-3}$ h^{-1}). When broken into "high producers" and "low producers" by the median DMS yield, there were no significant differences between the groups. The ratio of DMS yield to sulfur assimilation yield was 0.08 indicating that the ISM strain in bulk uses the assimilation pathway 12.5 times as much as the cleavage pathway. The OCh strain consumed a much wider range of the added DMSP (0.149-0.999 vs. 0.995-1.0, respectively), and the low producers were characterized by a significantly higher fraction of DMSP consumed and bacterial production. The high producers had a significantly higher average ratio of DMS yield to assimilation yield than the low-producing counterparts (0.13 vs. 0.028, respectively), indicating that the allotment of sulfur from DMSP changes, seemingly based on the remaining amount of DMSP. Thus bacterial community composition and physiological state impact the processing of DMSP in the ocean; future studies need to quantify the relative use of these pathways in other consumers to better understand and model how these compounds are cycled.



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