# Abstracts of Presentations


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**Keynote Address**

**From Science to Action: Meaningfully Addressing Climate Change in Conventional Management Paradigms for Estuaries of National Significance**

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Climate change is perhaps the greatest existential threat to the long-term sustainability of our planet's natural resources. Despite this grand challenge, meaningful actions at the local scale can be taken once the regional effects of global climate stressors are understood and considered relative to existing management paradigms. Tampa Bay is one example where efforts are being made to quantitatively assess how climate change is affecting the bay's ecology. Multiple long-term datasets have demonstrated that Tampa Bay is getting hotter and fresher, coinciding with recent losses in seagrasses. Management paradigms conceived over thirty years ago may not be as effective given the increasing role of these stressors. This talk will describe how the Tampa Bay Estuary Program is addressing the regional effects of climate change to restore the bay's resources. Lessons learned may be applied to other estuaries of national significance facing similar challenges.

**Contributed Oral and Poster Presentations**
(The presenting author is the first author, unless indicated by underlining.)

**Ecological Indicators of Trace Metal Exposure: Bioaccumulation in Indian River Lagoon Fishes**
Douglas H. Adams[1], Luana H. Bauer[2], Benjamin D. Barst[3], Marc Amyot[4], and Maikel Rosabal[2]
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The Indian River Lagoon (IRL) hosts ecologically important fish species, serving as indicators of ecosystem health in response to trace metal contamination. This study quantifies bioaccumulation of trace elements (THg, MeHg, As, Se, Cd, Cu) across multiple trophic levels in key fish species (red drum, gray snapper, hardhead catfish, silver perch, common snook, spotted seatrout, sheepshead, and bonnethead shark) using ICP-QQQ analysis of liver and muscle. These metal concentrations were linked to their trophic dynamics and feeding behavior: benthic-feeding hardhead catfish and bonnethead sharks had higher metal levels, and the often-herbivorous sheepshead had the highest Cu concentrations, whereas top predators such as common snook and spotted seatrout experienced metal biodilution for most elements. One exception in these two predators included higher muscle Hg concentrations resulting from bioaccumulation. These findings aim to support environmental awareness and inform IRL management practices.

**Vegetative Survey of a Salt Marsh and Hydric Forest Ahead of Restoration Efforts (STUDENT PRESENTATION)**
Isabelle Ardizzone[1,4], Kendal Arnold[2,4], Sophie Denninger[1,4], Eliza Dinenberg[1,4], and Kennedy Wile[3,4]
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Salt marshes along the Indian River Lagoon are valuable for their contribution to biodiversity, nutrient cycling, and water filtration. These habitats are increasingly threatened by human activities as well as by the invasive Brazilian pepper tree which dominates hydric hammocks and suppresses the growth of native species. As part of the FAU Harbor Branch and Indian River Land Trust's Junior Scientist Program, students conducted a pre-restoration vegetation survey at the Coastal Oaks Preserve from September to December 2024. During the study, 16 plots were evaluated within a hydric forest and adjacent salt marsh, noting the species present as well as their abundance, height, diameter, and overall cover. Preliminary results have shown that the plant diversity and abundance is higher in the salt marsh than the Brazilian pepper-dominated areas. This information will guide restoration efforts and provide a baseline for future monitoring, with an overall goal of preserving natural habitats.

**A Look at Offshore Snook in Southeast Florida: The "New" Reef Fish in Town**
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A species' ability to adapt to changing environmental conditions brought about by either natural or anthropogenic factors can significantly affect its level of resilience to these types of disturbances. One such tactic to potentially mitigate for severe events that could negatively impact a species' survivability is the occurrence of behavioral contingents. These are portions of a population that exhibit alternate life history

strategies or habitat preferences. This study investigated the presence of the estuarine-dependent common snook *Centropomus undecimalis* at offshore coastal reef areas to determine whether they represented a unique behavioral contingent for this species. A three-part strategy that included underwater visual observations, specimen collections, and acoustic telemetry was employed to document and describe common snook that utilize offshore habitat. Additionally, efforts were made to evaluate movement patterns, habitat usage, and their ability to contribute to the overall population.

**Weeding Out the Competition for Restoration: Testing Effects of Nearby Macroalgal (*Caulerpa prolifera*) Bed Density on Planted Seagrass (*Halodule wrightii*)**
**(STUDENT PRESENTATION)**

Luciana Banquero[1], Jennifer Hansen[2], Olivia Escandell[2], Lori Morris[3], Lauren Hall[4], and Linda Walters[1]
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Restoration of seagrass in the Indian River Lagoon (IRL) has been motivated by widespread declines in coverage. During this time, the abundance of the macroalga *Caulerpa prolifera* has increased in areas that formerly contained seagrasses. We tested the effect of varying densities of *C. prolifera* on growth of planted fragments of the seagrass *Halodule wrightii* to understand potential negative impacts of *C. prolifera* on restoration of seagrass. Recirculating-water mesocosms contained replicate containers, each planted with two fragments of *H. wrightii* within 2%, 25%, or 85% cover patches of *C. prolifera*. To characterize the relationship between the two species, responses of seagrass growth metrics were analyzed. Highest growth of *H. wrightii* was observed in the lowest density (2% cover) of *C. prolifera* (GLMM: $p<0.0001$). This project aims to improve selection of restoration sites in areas with *C. prolifera* and to better understand its role in IRL ecology.

**An *In Situ* Stereo Imaging System for Zooplankton Behavioral Studies in the Indian River Lagoon**
**(STUDENT PRESENTATION)**

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The Indian River Lagoon (IRL) is an important economic and environmental component of Florida's ecosystems. While there have been numerous studies published examining organism communities across the size spectrum in the IRL, relatively fewer studies on zooplankton behavior and community composition exist. Zooplankton form an important link between phytoplankton and higher trophic levels. Thus, characterizing their spatial distributions, patterns and behavior are important to understanding aquatic ecosystem health. This project consists of the development, field testing and validation of an in situ stereoimaging system for zooplankton observations in the complex IRL optical environment. This system, consisting of two synchronized monochrome 5MP cameras, has a modular configuration allowing for adaptable deployments based on the application. Sample results from successful IRL field tests of this system, characterizing individual and group traits of zooplankton and micronekton will be presented, highlighting the usefulness of this approach for behavioral ecological studies in the near future.

**Developing a Capacity for High-Frequency Benthic Flux Monitoring in the Indian River Lagoon**

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Benthic fluxes are established as an important nutrient source in the Indian River Lagoon, particularly from organic-rich fine grained muddy sediments. However, approaches for monitoring benthic fluxes remain

laborious. While they are moderately well-constrained spatially, over seasonal timescales, obtaining higher-frequency resolution (e.g. sub-weekly) is not realistic within typical monitoring frameworks due to cost and effort prohibitions. Given the possibility for coupled dynamics between sediment nutrient fluxes and, for example, harmful algal bloom growth and decay cycles, it is important to monitor short-term variability in dissolved oxygen and nutrient fluxes to capture potential feedbacks. Temporal benthic flux data should also be achieved during restoration monitoring, e.g., for dredging or aeration nutrient mitigation activities. Here we present progress and plans for the application of a novel seafloor lander platform in Indian River Lagoon monitoring: the Chamber Array for Observing Sediment Exchanges Long-term (CAROSEL), that will allow collection of in situ benthic flux data at sub-daily resolution. The system also allows monitoring of ambient water column conditions and fluxes over time, unraveling benthic boundary layer versus true sediment contributions. Combined with other more conventional water quality monitoring systems, we envision the CAROSEL in providing unparalleled insights into the dynamics of benthic fluxes as a function of ecosystem dynamics, enabling improved IRL management decision making.

**Using Non-Invasive eDNA and Autonomous Reef Monitoring Structures (ARMS) for Improved Management and Restoration of the Indian River Lagoon**

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The Indian River Lagoon (IRL) has recently faced unprecedented challenges due to poor water quality and recurring harmful algal blooms, which have led to widespread seagrass habitat loss and mass animal mortalities. Seagrasses provide valuable ecosystem services including shelter and provisioning for a diverse range of species. To improve understanding of the current state of IRL benthic biodiversity we collected environmental DNA (eDNA) sediment samples at 20 seagrass restoration sites and 16 paired seagrass and adjacent unvegetated sites across the IRL, complimented by the deployment of Autonomous Reef Monitoring Structures (ARMS) at the 16 paired sites. The data from ARMS and sediment metabarcoding enable effective data collection from understudied benthic communities and will provide insight into the dynamic relationship between bottom water, sediment quality and benthic biodiversity in both seagrass and unvegetated habitats to inform lagoon management and restoration.

**Mapping the Distribution of Seagrass Seeds in the Indian River Lagoon (STUDENT PRESENTATION)**

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The abundance of seagrasses in the Indian River Lagoon (IRL) has declined significantly due to environmental stressors such as poor water quality and algal blooms. Recently, some areas have shown signs of recovery, prompting questions about the mechanisms driving this resurgence. Natural recovery through sexual reproduction is likely, but limited information exists about the distribution of seagrass seeds in the IRL. This study aims to map the spatial distribution of seagrass seeds, particularly in locations with historically persistent seagrass, and to survey conditions in the sediment to evaluate the potential influence of environmental factors on viability and establishment of seeds. Better understanding of where and why recovery is occurring will help provide valuable information for restoration partners in the IRL.

**Examining Oyster Reef Fragmentation and Reconnection Methods in the Indian River Lagoon (STUDENT PRESENTATION)**

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Marine habitats around the globe, such as oyster reefs, seagrass beds, and saltmarshes, are increasingly threatened by fragmentation, which divides large, continuous habitat areas into smaller, isolated patches. Fragmentation has significant ecological consequences, including reduced habitat size, limited gene flow between patches, and increased vulnerability to physical and anthropogenic disturbances. In Mosquito Lagoon, FL, 9% of intertidal oyster reefs fragmented between 2009 and 2021. However, the mechanisms driving this fragmentation and strategies for restoring these habitats to their historical extent are unknown. This project aims to identify fragmented oyster reef sites and design restoration methods to reconnect them. Remote and field monitoring will be used to measure the depth of water and distance between oyster reef patches and develop detailed reef profiles. A better understanding of the causes and extent of oyster reef fragmentation will help prioritize restoration and conservation efforts to enhance the resilience of oyster reef ecosystems.

**Leveraging IRLON Data and PyCO2SYS to Track Post-Storm Ocean Acidification**

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Ocean acidification, primarily driven by human-induced increases in atmospheric CO2, poses a growing threat to coastal ecosystems. As CO2 is absorbed by ocean surface waters, it leads to a decrease in pH levels and aragonite saturation state, particularly affecting calcifying organisms that rely on carbonate ions for shell formation. Heavy rainfall and the subsequent freshwater runoff from major storm events intensify ocean acidification, particularly in the short term. We calculated aragonite saturation, a measure of the carbonate ion concentration, using the Python PyCO2SYS library with inputs from the IRLON network from two carbonate parameters, CO2 and pH, as well as temperature, salinity and water pressure. Preliminary results show that aragonite saturation spiked immediately at all stations following the storm.

**Modelling Light Attenuation in Lake Worth Lagoon Using Water Quality Parameters**

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Submerged aquatic vegetation (SAV) are vital to healthy aquatic ecosystems, providing nursery habitats and foraging grounds for a variety of species. For these reasons, SAV has been central to many estuarine restoration efforts. Light availability is a limiting factor for SAV health, making the ability to assess light attenuation important to SAV and water quality management, especially in light-limited systems, such as estuaries. Monthly depth profiles of several water quality parameters and photosynthetically available radiation (PAR) were conducted at ten stations in Lake Worth Lagoon from October 2023 to September 2024.With these data, a predictive model was developed to calculate light attenuation coefficients in the absence of direct PAR measurements. This model could be used to create waterbody wide light availability maps, using frequently measured water quality parameters. Furthermore, it can help water managers ensure water quality requirements for SAV are met.

**Determination of the Contribution of Marine Sediments to the Carbon Storage in the IRL (STUDENT PRESENTATION)**

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Marine sediments store Carbon (C) as Particulate Organic Carbon (POC), Dissolved Organic Carbon (DOC), and Inorganic Carbon (IC). Characteristics of sediments in the IRL likely impact C storage with implications from a sequestration perspective. Here, we present how sediment type impacts C storage by comparing how sediment characteristics impact C storage at two sites in the IRL. Sandy sediments had larger grain size, less detrital content, and less evidence of bioturbation compared to muddy sediments. There was greater DOC, OC, and IC content in muddy sites, suggesting that mud is more valuable from a C storage perspective. Understanding sediment characteristics favorable for C storage is crucial for managing marine carbon reservoirs, as C in marine sediments is more beneficial than C in water or the atmosphere, where excess C contributes to ocean acidification and global temperature change.

**Using Water Quality to Infer Seagrass Recovery in the North Indian River Lagoon**

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Over the past decade, the Indian River Lagoon has experienced a significant loss of seagrass extent due to prolonged algal blooms, threatening the stability of the ecosystem. While some recovery of seagrass has been observed recently in the North Indian River Lagoon (NIRL), heavily urbanized southern areas have not seen similar improvement. We analyzed 27 years of ambient water quality (WQ) monitoring data to compare nutrient trends across the NIRL sublagoon with differing levels of urbanization. Despite more than a decade of interventions aimed at reducing runoff, trends across these areas have shown no net improvement. Restoration strategies often underestimate the lag time between interventions and measurable outcomes, relying heavily on modeling. However, the timing of intervention implementation and landscape-scale changes are critical to understanding the varied responses in WQ and seagrass recovery across the NIRL. Understanding the temporal mismatch between intervention and ecosystem recovery can guide successful restoration strategies.

**Leveraging Mosquito Impoundments to Treat Eutrophic Waters in the Indian River Lagoon, FL (STUDENT PRESENTATION)**

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Littoral wetlands throughout the Indian River Lagoon have been impounded to control mosquitoes, which has reduced their ability to buffer nutrient loading. The unique structure of mosquito impoundments can be potentially leveraged to provide an effective estuarine treatment wetland. Herein, we are conducting a pilot study to determine the nutrient removing potential of varying hydrologic regimes within a mosquito impoundment. The initial phase of this project characterizes seasonal biogeochemical conditions throughout a selected mosquito impoundment. Surface water samples were tested for total nitrogen, ammonium, nitrate-nitrite, and total phosphorus. Furthermore, YSI EXO2 multiparameter water quality sondes were placed *in-situ* at the inflow and outflow sites to measure dissolved oxygen, pH, turbidity, temperature, salinity, chlorophyll-*a*, and fluorescent dissolved organic matter at 15-minute intervals. This preliminary data will guide subsequent project phases to understand the overall ability for these systems to mitigate the nutrient loading situation occurring in the IRL.

**Effects of Lake Okeechobee Discharge on Bottlenose Dolphins (*Tursiops truncatus*) in the St. Lucie Estuary and Southern Indian River Lagoon**

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Prolonged exposure to freshwater negatively impacts bottlenose dolphin (*Tursiops truncatus*) health. To prevent flooding, dams at Lake Okeechobee, Florida are opened, discharging large volumes of freshwater into marine environments inhabited by dolphins. Data from photo-identification surveys conducted from June 2021-2024 were used to evaluate dolphin movement patterns in the St. Lucie Estuary and the Indian River Lagoon before, during and after openings of the St. Lucie Canal spillway. Dates and flow rates of spillway openings were obtained from the South Florida Water Management District. In some years, less dolphins were observed in the southern Indian River Lagoon Estuarine System, following periods of discharge, and increased in the months after spillways were closed. This study contributes to research on the effects of freshwater on dolphin health. With the potential for increased precipitation and storms, investigating negative impacts of freshwater exposure is necessary for the conservation of marine animals and their ecosystems.

**Benthic Infaunal Responses to Mangrove Restoration (STUDENT PRESENTATION)**

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Benthic infauna are small animals that live in sediments beneath bodies of water like the Indian River Lagoon. Taxa include polychaete worms, nematodes, mollusks, and arthropods which provide the estuary with valuable ecosystem services such as water filtration, sediment bioturbation, and nutrient cycling. They act as primary consumers at the base of many benthic food webs. This study focuses on an experimental shoreline installation located in Palm Bay, Florida, and seeks to use the community dynamics of infaunal species to evaluate the restoration success of various hybrid and living shoreline techniques. The 400 ft. site includes deployments of red mangroves, concrete breakwaters, combinations of the two, and blank control areas for comparison. The study's goals are to curb local coastal erosion issues, assess the biotic responses to restoration, monitor local changes in the estuarine sediments, and assess the effectiveness of living shoreline techniques in comparison to other shoreline hardening methods.

**Spatially Nested Bayesian Models as a Tool for Understanding Fish Habitat Use and Community Structure (STUDENT PRESENTATION)**

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The Indian River Lagoon (IRL) provides essential habitat for many coastal fishes. Across the mosaic of benthic habitats in the IRL, the distribution and abundance of fish are influenced by abiotic and biotic habitat characteristics as well as their prey. However, the ultimate drivers of fish distribution and abundance are influenced by myriad factors in addition to those observed and measured at the time of capture. To identify and quantify the relative importance of these hidden drivers of fish community dynamics, here I develop and apply a Bayesian modeling approach, where multiple biotic and abiotic datasets are analyzed across nested spatial scales. By binning data over multiple spatial scales, this Bayesian framework provides greater insight into the relative importance of multiple interacting factors, including prey abundance, on the distribution and abundance of higher trophic level fishes. This tool will advance our understanding of fish communities within shifting habitat mosaics.

**Oyster Spat Monitoring in the Southern Indian Lagoon and St. Lucie Estuary: 2020-2024 (STUDENT PRESENTATION)**

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FOS has monitored oyster spat recruitment in the southern Indian River Lagoon (IRL) and St. Lucie Estuary (SLE) since 2020, to assess temporal and spatial trends along a salinity gradient. Salinity is critical for oyster survival and recruitment and is generally above the optimal threshold in the IRL relative to the SLE, which likely affects oyster health and reproduction. To quantify spat recruitment, oysters were strung in pairs onto PVC T-bars and positioned at the same elevation as adjacent live oyster reefs and monitored monthly. We hypothesized that the SLE would have higher spat numbers than the IRL due to historically optimal salinity conditions. However, we found fewer spat in the SLE than the IRL. The variability of salinity within the SLE due to freshwater runoff likely impacted recruitment. Oyster monitoring is used as an indicator of estuarine health and freshwater runoff likely has deleterious effects on spat recruitment.

**Escaping the IRL: The First Evidence of a Climate-Driven Range Shift in a Top Predator**

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Understanding how populations will adapt to climate change is crucial for conservation, especially in inshore nursery habitats like the Indian River Lagoon (IRL). Sharks play a vital role in preserving ocean health, but their numbers have plummeted in recent years. Bull sharks (*Carcharhinus leucas*) are coastal predators that birth young in nurseries, the extent of which defines their permanent range. In 2018, Atlantic bull sharks were shown to have expanded this range from the IRL, their northernmost nursery, into North Carolina (NC) due to warming water. We investigated the evolutionary mechanisms underlying this shift by measuring genetic connectivity between the historic and contemporary IRL, NC, and South Florida. We found significant differences between historic and contemporary IRL populations, with the historic IRL grouping with NC and the modern IRL with South Florida. These results support a recent climate-driven poleward shift among bull sharks, the first documentation of such a response.

**Investigating Direct Feeding Competition Between Two Sympatric Pipefish Species Using High-Speed Video (STUDENT PRESENTATION)**

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*Syngnathus louisianae* (chain pipefish) and *Syngnathus scovelli* (Gulf pipefish) coexist in the Indian River Lagoon (IRL), relying on similar prey resources in shared habitats. Persistent environmental disturbances, such as seagrass decline, threaten prey availability and biodiversity within the IRL, potentially intensifying interspecific competition between these two species of pipefish. This study will use high-speed videography to investigate the rapid feeding mechanisms and performance of both species by analyzing key kinematic variables, such as mouth gape and strike speed, in the presence of one another. By evaluating their feeding performance in the context of direct competition, we aim to elucidate the extent of their interactions and identify which species may demonstrate a competitive advantage under these conditions.

**Nanoformulation-based Intervention for Mitigating *Pestalotiopsis* spp. in Mangrove Die-off: A Sustainable Approach for Ecosystem Conservation (STUDENT PRESENTATION)**

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Mangrove ecosystems along Florida's coastlines are rapidly declining, with fungal pathogens playing a critical but underexplored role. This study focuses on Red Mangroves (*Rhizophora mangle*), identifying fungal pathogens such as *Curvularia lunata*, *Pestalotiopsis microspora*, and *Neopestalotiopsis* spp. through surveys and ITS sequencing. These pathogens, found for the first time in Floridian mangroves, cause necrosis, chlorosis, and stomatal damage. To address this, we developed MagSuN, a nanoformulation combining Nano-Magnesium Hydroxide (MgSoL) and Sodium Polysulfide (NaPs). MagSuN inhibited up to 95% of fungal mycelial growth and reduced pathogen proliferation by 87% in lab assays. Toxicity tests confirmed its safety for non-target species like brine shrimp, algae, and duckweed. Preliminary seed treatment trials demonstrated significant fungal inhibition, highlighting MagSuN's potential for pathogen control. This eco-friendly solution not only manages fungal diseases but also enhances mangrove resilience, offering a sustainable strategy for protecting vital coastal ecosystems.

**Beyond the Unknown: Revealing Microturbellarian Biodiversity in the Indian River Lagoon**

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Small organisms inhabiting sand and algae, known as meiofauna, are primarily composed of nematodes, crustaceans, and microturbellarian flatworms. Among these, microturbellarians play an essential role in ecosystems, acting as predators and contributing to biomass. However, only 20% of existing species have been documented, highlighting a considerable gap in our knowledge of these organisms. The marine microturbellarian fauna of Florida is still largely unexplored, with six species recorded, compared to 165 documented across the United States. Microturbellarians serve as excellent models for studying meiofaunal ecology, yet the ecological drivers behind their diversity remain poorly understood. Therefore, conducting spatial and temporal studies on microturbellarian diversity in critical areas, such as the Indian River Lagoon, could greatly improve our understanding of benthic community dynamics. This work aims to introduce a comprehensive project designed to study the microturbellarians of the IRL, filling gaps in knowledge about their diversity, distribution, and ecological roles.

**Improving Shoreline Resiliency through Robust Design of Green Infrastructure**

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Extensive alterations to shorelines and adjacent lands throughout the Indian River Lagoon caused loss of habitats and ecosystem services, declines in water quality, and reduced resiliency to current and future environmental changes. Resource managers are working to reverse these trends through habitat restoration and shoreline stabilization. To support these efforts, we developed data-driven tools to guide shoreline restoration based on high-resolution field-based shoreline assessments and hydrodynamic modeling of 900 km of shoreline from Ponce Inlet to Jupiter Inlet. Shoreline assessments were completed in November 2024 and included collection of the following data at 30-300 m intervals: presence of hard-armoring, extent of natural habitats, erosion severity, intertidal width, and shoreline slope. Hydrodynamic modeling characterized erosive hydrodynamic forces of shorelines from wind and boat wakes. Datasets were utilized to identify hydrodynamic thresholds of shoreline species and develop restoration prioritization and living shoreline suitability models to support restoration efforts in the Lagoon.

**Changing Lands of Martin County: Sea Level Rise Impacts to Habitat**

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As part of Martin County's Vulnerability Assessment update, Martin County evaluated habitat changes projected due to future sea level rise within the County, which includes the Indian River Lagoon South area within Martin County. The evaluation utilized the Sea Level Affecting Marshes Model (SLAMM), which is an advanced tool that integrates long-term hydrologic functions and ecosystem parameters to simulate the dominant processes involved in wetland conversions and shoreline modifications during long-term sea level rise for tidal habitat types, such as saltwater marshes, mangroves, and other coastal wetlands. Results show that Martin County will be experiencing declines in swamp and cypress swamp area, expansion of marshes and open water, changes with increasing estuarine open water and transitional salt marshes, and reductions in developed and undeveloped dry lands. This presentation will show the results of these transitions with discussions of possible adaptation solutions.

**Using Photo-identification to Aid in Bottlenose Dolphins (*Tursiops truncatus*) Disentanglements: A Case Study of an Entangled Mother and Calf Pair in the Indian River Lagoon, Florida.**

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Entanglement in marine debris is one of many anthropogenic threats faced by bottlenose dolphins (*Tursiops truncatus*) inhabiting the Indian River Lagoon (IRL) estuary system. On November 11, 2022, a dolphin calf was observed with fishing gear around its thorax during a vessel-based photo-identification (photo-ID) survey (NOAA NMFS LOC. 23069-01). Consistent photo-ID efforts documented the extent and severity of the calf's entanglement over time, and it was ultimately deemed life-threatening. During the multi-agency disentanglement effort on March 1, 2023, the mother of the calf was also found to have fishing gear around one of her pectoral flippers. Both dolphins were successfully disentangled and released in the IRL. Through routine photo-ID surveys, their healing and overall health were monitored closely post-rescue. This successful rescue highlights the importance of photo-ID for identifying and tracking entanglements, determining intervention efforts, and monitoring health following disentanglements.

**Moving the Needle on Living Shorelines – Florida Sea Grant and UF IFAS Extension Programs**

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Several extension programs in the IRL and throughout Florida to educate professionals and the public about living shorelines. The Living Shorelines Training for Marine Contractors provides workforce training in shoreline restoration, resulting in hundreds of trained participants using this new knowledge to design and build living shoreline projects. Workshops directed solely towards permitting living shorelines further expanded upon practitioners' knowledge. The key to the success of these efforts was building a network of regionally and locally based instructors representing federal and state agencies, local governments, industry, universities, and non-profits. The FMNP Coastal Shoreline Restoration course focuses on reaching Florida residents and visitors, teaching them about the biology, ecology, and restoration of estuarine habitats. Teaching both courses enable reaching a wide audience, from homeowners, habitat restoration professionals, and local government staff. Site visits and consultations with homeowners and residential communities also provide guidance on nature-based solutions (NbS) to address coastal erosion.

**Sediment Iron Concentrations and the Impact on Phosphorus Sorption Capacity (STUDENT PRESENTATION)**

Rebecca English and Austin Fox
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Eutrophic conditions in the Indian River Lagoon (IRL) have led to increased harmful algal blooms (HABs), fueled by high concentrations of nitrogen and phosphorus in the water column. Unlike nitrogen, which can be removed from the system through bacterial processes, phosphorus can be sequestered in the sediments by sorbing to iron particles, decreasing the availability to fuel HABs. Sediments were collected at >70 sites throughout the IRL and analyzed for iron, organic matter, and grain size. These characteristics allow inferences to be drawn regarding the lagoon's ability to sorb phosphorus by using sorption capacity data from recent versus historic sediments from IRL. Furthermore, phosphorus sorption capacity can be permanently diminished following hypoxic events due to the production of sulfides that bind iron and prevent further sorption of phosphorus. A better understanding of the iron-phosphorus relationship will assist in making informed management decisions for restoration and mitigation in a changing climate.

**The Center for Coastal and Marine Ecosystems-II: A NOAA EPP/MSI Cooperative Science Center (STUDENT PRESENTATION)**

Jackson Evans, Samantha Houser, Kelly San Antonio, and Hyun Cho
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The National Oceanic Atmospheric Administration (NOAA)-Center for Coastal and Marine Ecosystems (CCME-II) was established in 2021 as a Cooperative Science Center through an award funded by the NOAA Educational Partnership Program with Minority Serving Institutions (EPP/MSI). The goal of the NOAA Center for Coastal and Marine Ecosystems-II (CCME-II) cooperative agreement is to recruit, educate, train, and graduate a new generation of scientists, particularly from underserved and underrepresented communities, in a variety of NOAA-mission aligned STEM fields, equipped to utilize interdisciplinary approaches to address issues currently faced by marine and coastal communities. CCME-II research spans areas of Place-Based Conservation, Coastal Intelligence and Coastal Resilience. Through NOAA-mission aligned research and social science integration, the CCME-II student, faculty, and staff produce applied-science that can be used for better understanding and resolution of short-term and long-term science and policy issues related to coastal and marine ecosystems. Building on the success of the Environmental Cooperative Science Center (ECSC), the overall mission of the CCME-II program is to educate and train the next generation of scientists while also working to make science a more inclusive community towards underrepresented communities. Center-Wide Core Curriculum (CWCC) activities ensure that all CCME-II Scholars achieve a minimum set of competencies related to the Center's research and education programs, while also allowing students the freedom to conduct their own research as a graduate thesis.

**Water Quality and Anatomy of Selected Plants Growing at Tomoka State Park and Riverbend Nature Park (STUDENT PRESENTATION)**

JDeja Evans, Mackenzi Thompson, Phara Jean Baptiste, Tiye Gallagher, and Anna B. Ponce
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Coastal freshwater habitats are increasingly affected by anthropogenic pollutants and salinity changes. This study investigates water quality differences between an urbanized site (Ormond Oaks) and a preserved site (Tomoka State Park) along the Halifax/Tomoka River and its impact on the anatomy of selected aquatic or shoreline plants. Preliminary results suggest higher salinity levels in Tomoka State Park. Water quality

parameters will be assessed at the two sites, and three to five plant species growing at both sites (five specimens per species, per site) will be collected. Collected samples will be fixed, dehydrated (ethanol), embedded (paraffin), sectioned, stained (PAS), and mounted. Vascular bundle diameter and density, epidermis and cuticle thickness, and vessel element diameter will be measured. The results will enhance the understanding of how varying water quality impacts plant development. Identifying sensitive species as bioindicators and tolerant species for restoration is crucial for effective ecosystem management planning.

**The Reign of Microplastics: Atmospheric Deposition of Plastics and Anthropogenically-Modified Materials in Mosquito Lagoon, Florida (STUDENT PRESENTATION)**

Madison Serrate[1], Stephanie Fletcher[1], Tanelisse Gonzalez[1], Paul. Sacks[1], J. Fnu[1], S. Kim[1], L. Zhai[1], A. Frey[2], J. Kruger[1], T. Blanchard[1], and Linda Walters[1]
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Over 300 million tons of plastic is produced globally each year, that eventually degrade into microplastics (MP; < 5 mm long). The role that atmospheric deposition, associated with rain and wind, plays in increasing MP in Mosquito Lagoon is not known. Atmospheric deposition samples were collected from 3 regions in/surrounding Mosquito Lagoon (on oyster reefs, national park parking lots, citizen-scientist's yards). Replicate sterile collection jars were deployed, filtered, and processed via microscopy and FTIR spectroscopy to determine chemical compositions of collected materials (plastics, anthropogenically-modified materials). Initial results found an average of 5.1 particles per 0.95-liter jar per hour. FTIR results indicated 23% of particles from national park parking lots were polystyrene or a derivative. The EPA is currently determining if MP should be classified as an air pollutant; our results will help bring this issue to the public as a serious ecological and health concern.

**Assessment of Urban Stormwater Systems for Improved Urban Habitat and Estuarine Ecosystems (STUDENT PRESENTATION)**

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Water pollution caused by urban stormwater is a significant issue, transporting pollutants like chemicals, oils, and trash into water bodies, including the Halifax River. Urbanization has increased untreated stormwater flow, contributing to harmful algae growth. This study focuses on the Halifax River, an estuarine lagoon on Florida's east coast, which is impaired but lacks sufficient water quality monitoring of stormwater canals. Precipitation, water quality, tide, historical data, and stormwater management plans were analyzed to support municipal decision-making. GIS maps for five municipalities depict flood areas, census data, and critical infrastructure to identify those affected by coastal inundation. Results indicate a significant decrease in TKN-T over time. Critical infrastructure in Daytona Beach, with a 49% minority population and a median income of $41,200, is highly vulnerable. A Category 4 hurricane storm surge would impact eight healthcare facilities, 18 schools, 61% of businesses in Daytona Beach, and 91% in South Daytona.

**Spatial and Temporal Trends for Chronic, Short-Duration Hypoxia in Indian River Lagoon**

Austin Fox, Mary MacDonald, Rebecca English, and Sean Crowley
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Hypoxia resulting from the combined impacts of eutrophication from urbanization and climate change contribute towards a number of ecosystem level impacts including a diminished ability to assimilate external nutrients. Using a high-resolution network of dissolved oxygen monitoring stations, we have

idented physical features and variations in substrate that contribute towards more frequent diel hypoxia and wider ranges for dissolved oxygen. Quantifying the spatial and temporal extent of hypoxia and identifying physical and biogeochemical controls are helping to explain increased phosphorus concentrations and altered nitrogen speciation since about 2010. These data also provide a single metric that integrates the impacts of other variables including chlorophyll, nutrients, and turbidity, thereby providing a simple and relatively low-cost metric for evaluation of water quality.

**Incorporating Multidisciplinary Approaches to Community Outreach and Education (STUDENT PRESENTATION)**

Katherine Harris and Linda Walters
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Community awareness and support are vital to conservation success. Multidisciplinary outreach can foster new perspectives, engaging community members in conservation. We incorporated multidisciplinary approaches using virtual reality and location-based history to teach different community groups about coastal issues impacting Mosquito Lagoon. Virtual reality was used as an artistic medium to increase access to oyster reef habitats and restoration through immersive, 360-degree videos. This VR experience was incorporated into restoration events, allowing volunteers to see the long-term, positive restoration impact. Additionally, in connection with the National Park Service initiative "Park for Every Classroom," we created a teacher workshop that focused on the history of Canaveral National Seashore to teach educators about climate resiliency. At the restoration events and teacher workshop, these approaches improved understanding and engagement in coastal conservation. During the Symposium we will share lesson plans created for the teacher workshop and ideas for incorporating multidisciplinary methods into coastal education.

**Effects of Herbivory Exclusion Devices on Irradiance, Water Flow, and Sedimentation for Seagrass Restoration**

Faith Hill[1,2], Nate Winn[1], and Krista McCoy[1]
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Herbivory has been a continued barrier to seagrass restoration in the Indian River Lagoon. Herbivory exclusion devices (HEDs), can reduce grazing pressure; however, they may generate additional stress factors for seagrass transplants such as light limitation, burial, and water stagnation. To test whether exclusion structures affect these environmental parameters, we deployed light pendants, sediment traps, and clod cards in 6 HED and 6 non-HED IRL restoration sites. We hypothesized that there would be a significant caging effect on light availability, sedimentation, and water flow between treatment types due to macroalgae biofouling. We found that HEDs significantly impacted both light availability and distribution throughout the day; however, this effect differed with proximity to the caging structure. Similarly, our data showed that sedimentation may vary for HED and non-HED sites. Differences in water flow were not observed between treatment types.

**Plastic for Dinner? Understanding Microplastic Abundances in Oysters Purchased for Consumption (STUDENT PRESENTATION)**

Jenna Hodgson, Katherine Harris, Madison Serrate, Advanced Marine Biology Undergraduate Students, Paul Sacks, and Linda Walters
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The Indian River Lagoon (IRL) has high concentrations of microplastics (MP) in surface waters (mean density: 1.47 MP/L), with an estimated 1.4 trillion total MP lagoon-wide. Oysters, as filter-feeding organisms, consume and either egest or retain MP in their soft tissues. In a lagoon-wide study, the overall abundance of MP in the soft tissues of oysters was 1.5 MP/adult oyster. To understand if oysters that are harvested from the IRL for consumption contain large volumes of MP, we purchased live oysters from multiple IRL distributors during multiple months. A subset of these oysters was placed in individual glass vessels for 48 hours. During this time, the feces and pseudofeces were collected separately for each individual oyster and processed for MP. The numbers/types of MP in egested materials vs the "to-be-consumed" oyster soft tissues were compared to assist consumers in understanding this food product.

**Investigating the Indian River Lagoon's Response to Storm Events Using the Indian River Lagoon Observatory Network of Environmental Sensors (IRLON)**

Christopher Hoey, Scott Hurley, Samantha Banakos, Colin Kane, Kristen Davis, and Timothy Moore
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The Indian River Lagoon (IRL) is a complex estuarine ecosystem characterized by dynamic physical and biological processes that cycle over daily, monthly and yearly intervals. Storm events, such as hurricanes, tropical storms, and cold fronts temporarily disrupt these processes, affecting water quality parameters like salinity, dissolved oxygen, pH, pCO2, turbidity and nutrients. The Indian River Lagoon Observatory Network of Environmental Sensors (IRLON) provides continuous real-time data to monitor the lagoon's response to storm events, offering valuable insights into the extent and duration of storm-related disruptions. While storms can broadly impact water quality, examining data from individual sites reveals spatial and temporal variations in recovery to pre-storm conditions, shaped by local factors such as proximity to freshwater inputs and tidal dynamics.

**Physical and Biological Characterization of Indian River Lagoon Sediments Near the Coastal Oaks Preserve (STUDENT PRESENTATION)**

Joniah Holson[1,2], Veronica Kostan[1,2], Matthew Mintel[1,2], Emma Prescott[1,2], and Alexa Spalding[1,2]
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As part of the FAU Harbor Branch and Indian River Land Trust's Junior Scientist Program, students investigated the physical and biological attributes of submerged sediments adjacent to the Coastal Oaks Preserve. Core sampling took place from September to December 2024, at two shallow sites, one 10m from a FDOT drainage relief canal, and the other 30m north. Physical characterization of the sediment samples consisted of wet-sieving for grain size analysis, as well as organic and carbonate content determination via muffle furnace combustion. Separate core samples were fixed and stained, then infaunal organisms sorted using stereo microscopes. The largest fraction of sediments at both locations were in the medium sand (0.125mm-0.5mm) and fine sand (0.063mm-0.125mm) size categories. The diversity and abundance of infaunal organisms was low at both sites, with polychaete worms as the dominant group. Such information is important for assessing habitat quality and overall marine ecosystem health.

**Recruitment Preference of Larval Barnacles at Varying Depths and Substrate Orientations (STUDENT PRESENTATION)**

Calista Huff[1,4], Ashley Lara[2,4], Charlotte Muller[3,4], Nate Pagan[2,4], Asela Ripley[3,4], Kendall Sparks[2,4], Brenton Sturgis[3,4], and Jasmyne Williams[3,4]
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Larval recruitment of marine invertebrates varies spatially and temporally, with water depth, substrate composition, and substrate orientation being important environmental factors. As part of the FAU Harbor Branch and Indian River Land Trust's Junior Scientist Program, students examined the recruitment dynamics of larval acorn barnacles (*Balanus* spp.) using 15cm x 15cm acrylic settling plates that were suspended in the water column from PVC arrays. Arrays were positioned in the shallows of the Indian River Lagoon, approximately 10m offshore from the Coastal Oaks Preserve. Plates were deployed between September and December 2024 at two different depths (10cm and 50cm) and in two different orientations (horizontal and vertical), for a soak time of two weeks. Barnacle recruitment density varied from few to no animals, to densities exceeding 80 barnacles/cm^2. This information provides insight into population dynamics, including how benthic invertebrates colonize habitats, supply recruits, and interact with other organisms.

**Zinc or Swim: Investigating Zinc Pollution from Restoration Materials (STUDENT PRESENTATION)**

Megan Jensik, Lisa Chambers, and Melanie Beazley
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Zinc is an essential nutrient, but can be toxic at high concentrations, negatively affecting various biological functions. Galvanized metals coated in zinc are used for human purposes including restoration, often because of their resistance to degradation. However, in marine environments, these materials can degrade, potentially leaching metal into the water and soil. A recent controlled laboratory study found that galvanized wire used in oyster reef restoration in the Indian River Lagoon (IRL) can release zinc into the water at high concentrations (2110 ± 571 ppb). There is currently a knowledge gap regarding the occurrence and impacts of zinc pollution in the IRL. To address this, sediment samples were collected from the lagoon and will be analyzed by inductively coupled plasma mass spectrometry to quantify zinc. A physiochemical analysis of the soil will also be conducted. Results can help inform restoration practitioners of the best materials to use in the IRL.

**A Regime Shift Is Reflected in the Fish Community Structure of the Indian River Lagoon (IRL) (STUDENT PRESENTATION)**

Arthur C. Jones[1], Andrew J. Pyryt[1], Vincent J. Lovko[2], M. Toufiq Reza[1], and Ralph G. Turingan[1]
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In 2011, the IRL underwent a regime shift because of an intense harmful algae bloom (HAB) that fundamentally changed ecosystem conditions to favor phytoplankton over seagrass. We wanted to determine if this regime shift is reflected in fish community dynamics, including mass mortality events, in the IRL. We analyzed long-term data sets of fish kills and of population fluctuations of 10 fish species of interest. HAB events correlate with the frequency of fish mortality events, perhaps caused by hypoxia and exposure to toxins produced by certain algal species. It is conceivable that the 2011 regime shift may coincide with a decline in young-of-the-year (YOY) abundance and distribution for the fish species of interest, perhaps due to the loss of essential nursery habitat because of the regime shift. This situation underscores the impacts of human activity on the IRL and the importance of proactive environmental management to protect this vital ecosystem.

**Tides of Change: Investigating the Role of Mangroves on Oyster Declines in Mosquito Lagoon (STUDENT PRESENTATION)**

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Mosquito Lagoon experienced a 51% decline in oyster reef area between 2009 and 2021. This decline coincides with the spread of mangroves onto intertidal oyster reefs in Mosquito Lagoon. While previous studies have assessed decreases in oyster density from boating activities and fragmentation, the role of mangroves in this decline has not been explored. Our study addressed this gap by examining 15 reefs in Mosquito Lagoon, each with an established red mangrove stand. Oyster density and the pH of porewater (water within the sediment) were measured at 1-meter intervals across each reef and extending into the middle of each stand. Under the mangrove stands, oyster density was reduced by 62%, and porewater was 97% more acidic than on the open reef. These results highlight significant mangrove-oyster interactions essential for successful future oyster reef restoration and management.

**Investigating the Efficacy of Non-Plastic Zip Tyes for Living Docks: A IRL Benthic Restoration Program (STUDENT PRESENTATION)**

Kelli Hunsucker[1], Michelle Krumholz[1], Jasmin Pugh[1], Cameron Berglund[1], Philip Wince[1], Morgan Gilligan[2], Loraé T. Simpson[3], and Robert Weaver[1]
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The Living Docks program, a benthic restoration effort, is aimed at restoring oysters and other natural filter feeding organisms to the Indian River Lagoon (IRL). To achieve this, oyster shells are attached to mats via zip tyes, and the whole mat is then attached to dock pilings to promote growth. A study was designed to investigate alternatives to the traditionally used UV resistant plastic zip tye material, including: BESE, coconut coir, jute, and stainless steel. The materials were used to attach oyster shells to mini oyster mats and deployed at four locations in the IRL with varying environmental conditions for over one year. The mats were assessed to determine the overall structural integrity of the zip tye material as well as benthic growth. This poster will discuss the efficacy of each zip tye material, as well as how spatial and temporal variations influenced the results.

**Establishing Methods to Track Short-Term, Diel Hypoxia in Shallow, Well Mixed Estuaries (STUDENT PRESENTATION)**

Mary MacDonald, Rebecca English, and Austin Fox
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Seasonal, spatial, and temporal variability in dissolved oxygen (DO) concentrations, as well as changes in the biogeochemistry of the water column and sediments have contributed to chronic, short duration hypoxia in the Indian River Lagoon (IRL). To track variations in DO concentrations, Florida Tech has established a network of DO sensors throughout the Banana River Lagoon, deploying and maintaining >90 cost-effective monitoring stations. Standard operating procedures (SOPs) were developed for the maintenance, deployment, and quality control of the extended monitoring network. These efforts will enable operations to be expanded to include other partners in compiling broader, high-resolution data throughout the complete IRL system. Developing and expanding this network will provide greater understanding of trends in a changing climate and help managers to adapt management strategies to account for the impacts of hypoxia and altered nutrient cycling.

**Investigating the Impacts of Herbivory Exclusion and Hard Clam (*Mercenaria mercenaria*) Presence on Subtropical Seagrass Restoration**

Conor MacDonnell[1,2], Loraé T. Simpson[3], Nathaniel Winn[2], Nicholas Curto[2], Faith Hill[2], Connor Ramming[4], and Todd Osborne[1]

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Seagrass restoration is difficult and expensive relative to other coastal ecosystems, partially due to herbivory and transplantation stress. To help ameliorate these variables, the applications of fencing (excluding large herbivores) and hard clams (which provide nutrients and bioturbation) were tested at two seagrass restoration sites in the southern Indian River Lagoon (Fort Pierce and Stuart) from March to October 2024. Seagrass cover at both sites peaked in July, then declined in August at Fort Pierce, consistent with temperature spikes (~35°C), and in September at Stuart, likely driven by freshwater runoff. Seagrass within plots that were fenced or were co-restored with clams generally possessed greater percent cover, shoot count, and canopy height, however the data were much more variable at the Fort Pierce site. The results from both sites indicate the effectiveness of fencing and co-planting with clams, however, restoration success greatly depends on ecosystem dynamics occurring in the local region.

**Coupled Physical-Biogeochemical Modeling to Understand Cyanobacterial Bloom Dynamics in St. Lucie Estuary (STUDENT PRESENTATION)**

Mohammad Masudur Rahman
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The Saint Lucie Estuary is vital for aquatic life and local communities, but its health is threatened by water quality issues and increasingly frequent harmful algal blooms, notably cyanobacteria bloom in the last decades. Such blooms, driven by nutrient pollution and exacerbated by climate change and human activities, deteriorate water quality by affecting dissolved oxygen, pH, and turbidity. Moreover, *Microcystis aeruginosa*, a freshwater cyanobacteria species, can produce harmful toxins. Despite extensive field research and monitoring efforts, the factors and processes driving cyanobacteria blooms in this estuary remain poorly understood. For example, strong cyanobacteria blooms took place in 2016 and 2018, but not in other recent years for unclear reasons. To address this, a coupled hydrodynamic-biogeochemical model has been developed. One year (2018) simulation has been completed and calibrated with available data. An analysis of the model results will be presented to understand the drivers influencing cyanobacteria blooms in this estuary.

**Parasite Diversity of Crustaceans and Fishes in the Indian River Lagoon, Florida: A Meta-Analysis Across Intertidal Systems and Taxa**

Christopher Moore[1], Krista McCoy[1,2], Michael McCoy[1]
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Parasite diversity is often used as an indicator of ecosystem health. We surveyed parasite diversity to assess the trophic complexity of seagrass-associated food webs in the Indian River Lagoon (IRL) and used meta-analysis to provide context for our results. Overall, parasite prevalence in the IRL was roughly 11% lower than that documented in other coastal and estuarine systems. Of note, the prevalence of larval-stage trophically transmitted parasites requiring two or more hosts to complete life cycles was approximately 17% lower in the IRL, suggesting that food web complexity is reduced or unstable in our system. Seagrass coverage in the IRL is often ephemeral and fragmented, which likely restricts the movement of hosts and contributes to lower parasite prevalence in remnant habitat patches. Data from our study will serve as a benchmark for assessing the re-establishment of trophic complexity in the IRL following decades of seagrass loss.

**Assessment of Bio-Optical Inversion Model Retrievals, Including Benthic Contributions, in a Shallow Coastal Environment (STUDENT PRESENTATION)**

Ipanema Mora-Carrera, Timothy S. Moore, Malcolm McFarland, Zack Wistort, and Stephanie Schreiber
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Satellite imagery is crucial for monitoring climate change-related phenomena across spatial and temporal scales. Phytoplankton absorption, a proxy for chlorophyll-a, can be derived through bio-optical inversion schemes to detect harmful algal blooms (HABs). Phytoplankton absorption models accounting for variations in species, cell size, and pigmentation can be integrated into inversion schemes to improve products and subsequent water quality assessments. Current inversion models, however, often mischaracterize shallow coastal waters by assuming them to be optically deep, overlooking benthic reflectance influences. The Indian River Lagoon (IRL) is a shallow system impacted by discharge from nearby canals, affecting water turbidity and optical depth year-round. To improve future retrievals, this study assesses the performance of a semi-analytical inversion model (HOPE) which explicitly defines benthic influences while retrieving optical properties in the IRL. Additionally, this study compares the performance of HOPE to that of global and regionally tuned optical models in the IRL.

**Seagrass, Macroalgae, and Phytoplankton…How Do We Regain the Balance Between Them?**

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Seagrass is a critical habitat in the Indian River Lagoon (IRL). However, declines in water quality have disrupted the critical balance between seagrasses, macroalgae, and phytoplankton which all compete for light and nutrients. This interplay resulted in recurring phytoplankton blooms which reduced light availability and triggered significant seagrass die-offs during the last decade, opening benthic habitat for macroalgae colonization. By 2021, aerial photo maps documented the lowest seagrass coverage since 1943, and in-water surveys noted a shift from diverse, persistent seagrass beds to colonizing species. Fortunately, 2024 data indicate that phytoplankton blooms have declined, and seagrasses are recovering where environmental conditions support growth. However, this recovery is not lagoon-wide; large areas in the central IRL show limited seagrass regrowth and are predominantly covered by macroalgae. With continued efforts to reduce nutrient loading, this balance may gradually return, helping to restore the once diverse and persistent seagrass communities throughout the IRL.

**Examining Relationships Between Sediment Nutrients and *Halodule wrightii* in the Southern Indian River Lagoon (STUDENT PRESENTATION)**

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Seagrass populations within the Indian River Lagoon (IRL) are declining due to the deleterious effects of eutrophication. Efforts to improve water quality have been undertaken in the IRL, but seagrass responses have varied because seagrasses uptake nutrients through their blades and rhizomes. Investigation into the impact that sediment nutrients have on seagrass occurrence is necessary. *Halodule wrightii* is a seagrass species within the IRL that can tolerate poorer water quality conditions. However, even during periods of improved water quality, *H. wrightii* density has not recovered to previous extents. Subsequently, there is a need for understanding the effects of sediment nutrients on *H. wrightii* populations in the IRL. In this study, seagrass tissue/sediment nutrient ratios, stable isotopes, and pore water samples will be evaluated to

examine the relationships between these factors. Seagrass coverage data will also be used to link sediment nutrients with *H. wrightii* density.

**Evaluating Survival of Entangled Free-Swimming Common Bottlenose Dolphins (*Tursiops truncatus truncatus*) in the Indian River Lagoon Estuary, Florida, USA (2008-2023)**

Wendy Noke Durden[1], Teresa Jablonski[1], Agatha Fabry[1], Lydia Moreland[1], Michael Walsh[2], Craig Pelton[2], Claire Erlacher-Reid[3], Stacy DiRocco[3], Jon Peterson[3], and Blair Mase[4]
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Interactions with fishing gear pose a growing threat and are a leading mortality cause for common bottlenose dolphins (*Tursiops truncatus truncatus*) inhabiting the Indian River Lagoon (IRL). Ecosystem changes have corresponded with a two-fold increase in anthropogenic mortality and reduced nutritional health. In this study, we compiled life-threatening entanglements in IRL dolphins (2008-2023), to assess survival following intervention. Efforts were presumed successful if the animal exhibited normal behavior and survived >12 weeks post-release. Twenty-nine dolphins were documented with life-threatening entanglements; 75% were calves. Interventions were conducted for 20 cases; 70% were successful and 30% of cases were recovered deceased or presumed dead (all dependent calves). Chronic entanglement can cause severe injuries, amputations, and infection risk, particularly in young animals. With declining ecosystem health, dolphin-fishery interactions and associated mortality may increase. Mitigating impacts is dependent on increased capacity to respond to this growing issue and targeted outreach to enhance community engagement.

**Effects of Bacteria on *Pyrodinium bahamense* Growth and Saxitoxin Production**

Jackie Palau and Malcolm McFarland
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*Pyrodinium bahamense* is a toxic dinoflagellate with a well-documented history of recurrent harmful algal blooms in the northern Indian River Lagoon (NIRL). Interactions between bacteria and harmful algae are now recognized to play important roles in bloom formation, duration, and toxicity. Here, the composition and diversity of bacteria associated with *P. bahamense* were investigated through 16S analysis of unialgal cultures and water samples collected from the NIRL. To understand the beneficial, mutualistic, or antagonistic effects these bacterial species have on *P. bahamense*, known bacteria were re-introduced to bacteria-free *Pyrodinium* cultures in an algal growth bioassay. The results of this study enhance our understanding of the effects of bacteria on *P. bahamense* blooms in the NIRL and could lead to improved bloom prediction and mitigation strategies. Furthermore, these results provide a basis for future work to understand how tropicalization may impact these bacterial communities and thus *P. bahamense* bloom dynamics.

**Review of Florida's Mosquito Control Impoundments for Natural Nursery of *Ruppia maritima* (STUDENT PRESENTATION)**

Providence Pangira, Hyun J. Cho, Anna Ponce, and Kelly M. San Antonio
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Mosquito control impoundments in Florida provide controlled habitats for *Ruppia maritima* (wigeongrass), which is an important seagrass species in the Indian River Lagoon (IRL). They allow seasonal growth and can be used as nurseries for *R. maritima* for seagrass restoration in the IRL. This study analyzed water quality and seed viability at impoundments to evaluate their role in *R. maritima* propagation at the North

Siphon impoundment and the Hall Road impoundment. Impoundment water temperature increased from March to August (20°C to 33°C), while turbidity and salinity fluctuated substantially from May through September, depending on storms and tides. Seed viability rates were 85 ± 5.2% for non-stratified seeds, 60.5 ± 11.9% for cold-stratified, and 53.5 ± 15.5% for dry-stratified seeds, with no significant difference between cold and dry methods ($p = 0.27$). Findings emphasize the value of mosquito control impoundments as natural nurseries for seagrass restoration.

**Submergence Modeling Indicates the Effects of Accelerating Sea Level Rise on Indian River Lagoon Ecosystem Services Will Be Substantial and Widespread**

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The NOAA tide gauge at Cape Canaveral indicates sea level rise has accelerated over the past 30 years to an average of $9.59 \pm 1.64$ mm $yr^{-1}$ during the 21st century (2003–2022). The current rate of rise tracks with NOAA's scenario-based High trajectory and it will continue to accelerate given no progress has been made to reduce CO2 emissions. Human-caused, fast rising water levels are expected to have a profound impact on the Indian River Lagoon's ecosystem services. An analysis was performed using FIU's Future Shorelines on-line geospatial tool to evaluate the effects of sea level rise on a broad and representative suite of service-proxies including boater access, rookeries, OSTDS, WWTP, and seagrass. Modeling was conducted using the NOAA High trajectory in target years 2050, 2070, and 2100. Results indicate the impacts will be substantial, widespread and evident within the next 25 years.

**Navigating Toxic Waters: A Preliminary Investigation of Harmful Algal Bloom-Associated Biotoxins in Bottlenose Dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida**

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The Indian River Lagoon (IRL) and St. Lucie River (SLR) are experiencing water quality changes that make them more susceptible to harmful algal blooms (HABs) and HAB-associated biotoxins. Bottlenose dolphins (*Tursiops truncatus*) inhabiting the IRL and SLR are considered sentinels of coastal environmental changes including HABs. To better understand how HAB-associated biotoxins may affect dolphin health, we evaluated kidney, liver, urine, and gastrointestinal contents samples from seven bottlenose dolphins that stranded in the IRL and SLR during 2018–2022. These samples were evaluated for 10 HAB-associated biotoxins using inductively-coupled plasma mass spectrometry. Saxitoxin, domoic acid, microcystins, nodularin, okadaic acid, and brevetoxins were detected. Dolphin stranding data were examined along with sighting histories collected via boat-based photo-identification surveys to evaluate for spatiotemporal trends associated with HAB-associated biotoxin detection. Pathology data for relevant organs were also reviewed to further understand how exposure to HAB-associated biotoxins may relate to dolphin health and mortality.

**Seagrass on the Brink: Implications of Marine Heatwaves in the Indian River Lagoon (STUDENT PRESENTATION)**

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Marine heatwaves (MHWs) have emerged as a significant threat to coastal ecosystems, including seagrass meadows. As the frequency and intensity of MHWs are projected to increase, understanding how seagrass species respond to thermal stress is critical to their conservation. Six sites across the Indian River Lagoon were selected based on the availability of long-term environmental data, ArcGIS data layers, and published studies on seagrass distribution and meadow structure. We hypothesized greater thermal stress impacts on southern, warmer latitudes. Spatiotemporal dynamics of *Halodule wrightii* meadows were quantified before, and after the warmest summer recorded. To investigate the relationship between environmental variables and seagrass metrics, a multiple linear regression analysis was performed. Results suggest significant increases in MHW frequency and intensity, with warming events influencing seagrass expansion and contraction. Natural resource managers may use these findings to develop adaptive management strategies to mitigate the effects of MHWs on essential seagrass habitats.

**Keep Calling Us: the U.S. Sawfish Recovery Hotline is a Key Tool that Promotes Recovery of the Endangered Smalltooth Sawfish in the Indian River Lagoon**

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Historically, the endangered smalltooth sawfish ranged in U.S. waters from Texas to the Carolinas. Over the last century, substantial reductions in range and population size have occurred and the core range is now in southwest Florida. In the late 1990s, scientists began collecting encounter reports from public sources such as anglers, boaters, and charter captains. These reports laid the groundwork for the current U.S. Sawfish Recovery Hotline (1-844-4SAWFISH; sawfish@MyFWC.com) and the associated U.S. Sawfish Recovery Database, which helps researchers and managers collect information on when and where sawfish are encountered throughout the southeastern U.S., including the Indian River Lagoon (IRL). Encounter data have played, and will continue to play, important roles in the success of research and management decisions that foster recovery. This talk is meant to highlight successful collaborations that have come from reporting that has occurred in the southern IRL in recent years.

**Climate-Driven Shifts in Fish Communities Along Florida's East Coast (STUDENT PRESENTATION)**

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Climate change is shifting environmental conditions and habitats along Florida's east coast, yet the effects of these changes on fish communities remain underexplored. To address this knowledge gap, here we examine abiotic factors and components of the forage and sportfish community over a 20-year period using Florida FWC's Fisheries Independent Monitoring program data from the Indian River Lagoon and Jacksonville. By analyzing landing trends and environmental drivers through non-metric multidimensional scaling, environmental fit tests, and generalized linear mixed models, initial findings reveal shifts in the fish community across three distinct regions. These findings shed light on how fish communities respond to environmental shifts, including latitudinal range expansions and novel predator-prey dynamics. These insights not only deepen our understanding of climate change impacts on fish communities, but also provide actionable science to inform resource managers in developing more effective conservation and management strategies.

**Evaluating & Comparing Seagrass Rhizosphere Microbial Communities associated with Indian River Lagoon Seagrass Restoration**

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In Spring 2023, the Brevard Zoo planted *Halodule wrightii* at multiple locations in the Indian River Lagoon (IRL). These pilot-scale planting projects intended to test planting methods and collect data to gauge the impact of environmental conditions on seagrass planting success. Sediment and seagrass samples were collected for 16S rRNA amplicon sequencing, with 105 samples sequenced from 6 restoration sites and two seagrass nurseries over a 1-year period. Seagrass planting units adapted to match the microbial community of adjacent natural seagrass within the first month, and certain genera (*Desulfomonile* and *Desulfonema*) had lower abundances at higher seagrass coverages. Comparing the microbial communities between the existing Florida Oceanographic Society seagrass nursery and newly established Brevard Zoo seagrass nursery also revealed a significant difference in composition. This data can be incorporated into future work to better understand microbial interactions with restoration and identify indicators of site success.

**Coping with Chaos: Insights into Inshore Movement of *Centropomus undecimalis* During Tropical Weather Events**

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Environmental disturbances such as tropical storms and hurricanes can cause significant geochemical and temperature changes to estuarine systems. These changes could disrupt normal movement and behavior of aquatic species. Response time and succession can vary greatly between species, and long-term datasets are important to properly analyze these trends. Common snook, *Centropomus undecimalis*, is a popular sportfish in south Florida that may exhibit behavioral changes to seek refuge from unfavorable conditions brought on by tropical weather systems. This study investigates movement patterns of common snook in response to environmental disturbances within the Indian River Lagoon (IRL) system. Snook were acoustically tagged within the IRL between 2008 and 2012. Detection data were cross-examined in relation to tropical systems to assess significant deviations in movement patterns from baseline behavior.

**Environmental DNA: A New Tool for Assessing Fish Diversity in Man Made Canals of the Indian River Lagoon (STUDENT PRESENTATION)**

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This study investigates fish diversity in man-made canals of the Banana River Lagoon using environmental DNA (eDNA), a method that identifies genetic material shed by organisms into their environment. Canals, often highly degraded habitats, can impact fish communities due to poor water quality and habitat fragmentation. These environments are difficult to sample with traditional methods, making it challenging to monitor fish diversity effectively. In November 2024, eDNA sampling (metabarcoding) was conducted near Sykes Creek using 24 kits divided into three groups: long canals, short canals, and the open Banana River. By comparing eDNA-derived diversity between canals and natural lagoon areas, this research aims to assess the ecological impacts of human-modified habitats. Although results are pending, this study has the potential to demonstrate eDNA as a valuable tool for monitoring biodiversity and guiding restoration efforts in the Indian River Lagoon.

**Assessing Trophic Pathways of the Southern Indian River Lagoon: Mapping Trophic Transfer Using Fatty Acid Markers (STUDENT PRESENTATION)**

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This study assessed rates of transfer between trophic levels in the Indian River Lagoon through the ratios of fatty acids (FAs) present in zooplankton and fish, including ratios unique to *Pseudo-nitzschia*, a harmful algae species common to the IRL. Zooplankton and several species of fish in the IRL were sampled over 12 months from different locations covering the southern end of the IRL, sampling 5 sites starting at the Sebastian Inlet and ending in the St. Lucie Estuary. Samples were analyzed for their FA content using a GCMS. Higher relative percentages of the FAs 14:0, 16:4ω1, and 20:5ω3 found suggest diatoms, particularly the potentially toxic *Pseudo-nitzchia* spp. Differences in FA ratios between seasons, locations, and species were also noted using yearly averages of each fatty acid and NMDS comparisons. This can provide valuable ecological information such as when blooms occurred and how toxins may travel into the food web.

**Exposure of Whitespotted Eagle Rays (*Aetobatus narinari*) to Phycotoxins in Florida's Coastal Waters: An Untold Story About HABs (STUDENT PRESENTATION)**

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Climate change and eutrophication are exacerbating toxic harmful algal blooms in Florida's coastal waters causing detrimental effects on tourism, fisheries, the marine environment and humans. However, very little is known about the mechanisms of toxin exposure, accumulation and effects on vulnerable species like sharks and rays. The whitespotted eagle ray for example, shares potential toxin exposure routes with humans (shellfish consumption), relies on HAB impacted areas throughout ontogeny and is susceptible to toxin bioaccumulation and biomagnification given their high lipid content, long life span and slow metabolism. However, this species has not been screened for chronic exposure to phycotoxins. This study evaluated toxin exposure, uptake and accumulation in several tissues from two populations of whitespotted eagle rays in Florida. Phycotoxin diversity overall was higher in Sarasota Bay in comparison to the Indian River Lagoon and toxin prevalence was higher in the gut content and liver tissues suggesting dietary exposure.

**Enumeration of *Microcystis aeruginosa* Colonies in the Indian River Lagoon Using Digital Holographic Imaging (STUDENT PRESENTATION)**

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Harmful algal blooms (HABs) within the Indian River Lagoon (IRL) driven by *Microcystis aeruginosa*, a colonial cyanobacterium, pose significant threats to the ecosystem, public health, and local economies. Accurately quantifying *Microcystis* cell counts within colonies is essential for understanding bloom dynamics, progression, and toxicological impacts. However, traditional cell enumeration methods are hindered by challenges such as colony fragmentation, structural obstructions, and inaccuracies in abundance estimates. This study addresses these limitations by employing digital holography, a three-dimensional imaging method, to characterize *Microcystis* colonies. Using lab-based digital holography, *Microcystis* colonies isolated and cultured from Lake Okeechobee, Florida were imaged. Colonies were then disaggregated into single cells through sonication which were re-imaged using digital holography and flow cytometry. By correlating laboratory measurements of colony size with cell abundance, this method enables the development of more accurate field estimation techniques, allowing for enhanced monitoring of bloom intensity and distribution within the IRL.

**A Review of the Parasite Communities in the Stingray Genus *Hypanus* (STUDENT PRESENTATION)**

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The stingray genus *Hypanus* includes 2 sympatric species widely distributed throughout the Indian River Lagoon (IRL) estuary. Based on parasite community studies from other localities in the North Atlantic, Northern Gulf of Mexico, Caribbean Sea, and Gulf of California, these species are known to host diverse parasite communities, including tapeworms (Cestoda, 12 families), flukes (Trematoda, 6 families), gill and skin worms (Monogenea, 4 families), thorny-headed worms (Acanthocephala, 2 families), and leeches (Hirudinea, 1 family). However, parasite data for *Hypanus* are lacking for the IRL, so we conducted parasite community surveys on two sympatric stingrays, *H. sabinus* and *H. say*. We report data from 31 individuals collected since July 2023, including preliminary information on several parasite taxa belonging to Cestoda, Monogenea, and Trematoda. We evaluate these results in the context of previously published parasite survey information for these two host species.

**Evaluating Protective Materials for the Growth of *Mercenaria mercenaria* for Indian River Lagoon Restoration**

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Brevard Zoo has implemented clam restoration projects in the IRL since 2021 through the planting of aquaculture raised clam seed; grown under protective measures to reduce predation. Clam survival on 2023 projects was very low and the Zoo aimed to investigate if protective materials or environmental conditions contributed to low survival. Approximately 250,000 clam seed were planted in spring of 2024 across five sites in the Indian River Lagoon. At those sites, clams were planted under various protective materials to test their efficacy including planting clams inside polyester mesh bags with two mesh sizes, under plastic mesh cover nets, and under plastic-free coconut fiber mesh. Clam size and estimated count of live clams was measured at each site every two months for six months. Although clam size was not affected by treatment, clam survivability was greatest in polyester mesh bags.

**Burrow-Associated Fauna: A "Black Box" of Diversity in the Indian River Lagoon**

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Burrowing animals are an ecologically important and taxonomically diverse component of soft sediment marine habitats. Some burrowing species support a wide array of associated inquiline (burrow cohabiting) fauna, including obligate and facultative symbionts. Burrow associates are often small bodied, inconspicuous and require specialized equipment and methods to collect, thus they are often overlooked in assessments of biodiversity. Here, we report on the results of one year of field sampling that specifically targeted burrow dwelling organisms throughout the Indian River Lagoon estuary. Utilizing integrative taxonomy methods, including DNA barcoding, we identified 113 species from these collections, several of which constitute new geographic records or are undescribed. Patterns in diversity are discussed in the context of biogeography within the estuary and sediment size, and a network of burrowers and their associates is constructed to examine patterns of specialization.

**Tropicalization Interacts with Other Human Stressors to Mediate the Diets of Expanding and Resident Herbivores (STUDENT PRESENTATION)**

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In response to warming temperatures, species worldwide are expanding their range poleward. Climate-driven expansions can lead to cascading changes in ecological communities. However, other anthropogenic stressors act in concurrence with the indirect, biotic effects of climate change. In this study, we investigated dietary similarity between sheepshead and an expanding congener, sea bream, in the IRL. We paired gut contents with long-term seagrass monitoring data to investigate the effects of a macrophyte cover gradient (a proxy for eutrophication driven die-offs) on the diets of these species. Sheepshead and sea bream had similar diets, dominated by macrophyte material. Tropical sea bream consumed more seagrass at locations with higher seagrass abundance compared to low seagrass abundance. These results suggest potential for competition between these species, which may impede future recoveries of currently declining sheepshead populations. Expansion of sea bream may hinder recovery of imperiled seagrasses by increasing grazing in this eutrophic, light-limited system.

**Impact of Environmental Changes in Bottlenose Dolphin Diets Over a Decade of Change in the Indian River Lagoon**

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The Indian River Lagoon (IRL) has experienced losses of critical habitats and declines in fish stocks with cascading negative impacts on top estuarine predators like dolphins. Over the past decade, the overall body condition of IRL bottlenose dolphins has declined and habitat degradation is likely a contributing factor. Bottlenose dolphins use myriad foraging strategies to feed on a variety of prey, so diet selection can be a response to prey abundance, which in turn is associated to overall ecosystem health. To investigate whether recent changes in the IRL have affected dolphin diets, we examined stomach contents from necropsies of stranded dolphins that occurred over the past 12 years. Using a combination of visual and genetic identifications we described the species of prey found in dolphin stomachs and discussed how changes in diets might reflect changes in IRL fish communities and the potential impacts on overall wellness of IRL dolphin populations.

**Caging Seagrass Restoration Projects: A Meta-Analysis and Practitioner Survey to Collate the State of the Science**

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Seagrass meadows support coastal resilience by providing essential ecosystem services, but they are increasingly threatened by global change, spurring restoration initiatives. A significant challenge to restoration is herbivory, which can damage newly planted seagrasses and project success. Herbivore exclusion devices may reduce grazing pressure until planting units establish, but there is limited evidence of their effectiveness in improving restoration outcomes. We performed a meta-analysis of 165 seagrass

growth metrics from 11 papers to analyze the relationship between herbivory exclusion device usage and seagrass growth and productivity. However, most studies focused on trophic cascades rather than direct restoration techniques, highlighting a significant research gap. To address this, we plan to survey local practitioners using herbivory exclusion devices to gather insights into observed trends, project progress, and outcomes. Greater understanding and standardization in evaluating herbivory exclusion devices could enhance seagrass restoration success, helping to restore degraded ecosystems and their valuable ecosystem services.

**Benthic Community Response to Shoreline Restoration (STUDENT PRESENTATION)**
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Florida's coastline is experiencing significant erosion due to sea level rise, coastal development, deforestation, and strong storms. Coastal erosion and shoreline armoring impacts native plant and animal species and reduces coastal ecosystem services. Living shoreline restoration has become increasingly popular with coastal homeowners, municipalities, communities, and organizations due to its increased effectiveness and lower maintenance costs than shoreline armoring. Kars Park, located in the Banana River Lagoon basin of the Indian River Lagoon (IRL), underwent shoreline restoration efforts in 2022. This study examines the benthic community of Kars Park and how it responded to restoration by using benthic infauna as a biological indicator of disturbance.

**Mole Crab (*Emerita talpoida*) Spatial and Temporal Abundance Along the Space Coast**
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Mole crabs, known by fishermen as sand fleas, are a foundational species of sandy beach ecosystems. Shorebirds and fish depend on these burrowing crustaceans for food and fishermen rely on them as bait to catch various species such as whiting and pompano. This pilot study surveys the abundance and distribution of Atlantic mole crabs along Canaveral National Seashore and Cocoa Beach using stainless steel sand flea rakes. Monitoring of populations over time indicate spatial and temporal patterns. We also investigate the impacts of sand grain size, specimen size, and tidal cycle, in relation to both location and mole crab abundance.

**Habitat Associations and Abundances of Bivalves in Mosquito Lagoon (STUDENT PRESENTATION)**
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This study investigates the understudied abundance and habitat associations of bivalves in Mosquito Lagoon. Seagrass habitats were found to support the highest diversity of mollusks in earlier surveys (Mikkelsen et al., 1995). Twelve sites, including seagrass-vegetated, unvegetated, and seagrass-restored areas, were sampled in March and May 2024. Habitat characteristics, such as sediment composition and seagrass cover, were analyzed alongside bivalve populations. Across all sites, 6 genera were identified among 44 individuals. Overall abundance and diversity of bivalves collected were low in all sites, and most individuals were juveniles. Sediment characteristics influenced differences in diversity across site types, with restored sites composing of a mean of 68% disarticulated shell. Contrary to expectations, seagrass habitats did not support higher diversity or abundance compared to unvegetated habitats. Determining a

revised profile of the bivalve community in Mosquito Lagoon and understanding habitat associations is important for improving water quality and restoration.

**Use of Shellfish Aquaculture Sites by Mobile Fauna in the Indian River Lagoon (STUDENT PRESENTATION)**

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Multiple shellfish aquaculture sites situated in the Indian River Lagoon are primarily used for the grow-out stage of hard clams (*Mercenaria mercenaria*). The presence of concentrated shellfish and gear with associated epifaunal growth may provide habitat to fishes and invertebrates. While our previous research has shown repeated visits to clam lease sites in the IRL by durophagous stingrays, the extent of these interactions (short transits vs. foraging) is unknown, and thus impedes mitigation research. Here, we describe our initial surveillance efforts via underwater cameras and net surveys at clam lease sites in Sebastian, and report on the presence of species hazardous to clammers (sharks and rays) and predators capable of feeding directly on farmed clams (loggerhead sea turtles, rays, etc.). Understanding the use of clam lease sites by marine fauna will help develop aquaculture practices that maximize ecological and economic benefits and guide deterrent implementation where and when necessary.

**Better with Age? Comparing Ecological Function of Aging Artificial vs Natural Oyster Reefs in the Southern IRL and St. Lucie Estuary (STUDENT PRESENTATION)**

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Restoration fills a critical need in areas with depleted and degraded ecosystems. The short-term development of artificial oyster reefs is well documented; however, patterns of reef persistence and ecological function in aging artificial oyster reefs are less well understood. This research seeks to analyze development and persistence of ecological function in artificial oyster reefs (6-14 years old) compared to natural reefs in the southern IRL and St. Lucie Estuary. Our team quantifies reef health and persistence, shoreline protection and sediment accumulation, and mobile invertebrate habitat quality. Preliminary data focusing on reef health and persistence including percent cover of substrate, density of live oyster, oyster size class frequency distribution, and spat recruitment show spatial variability across sites. Sampling will continue through summer 2025, with research ultimately resulting in a Quick Assessment Monitoring Guide focused on evaluation of aging artificial reefs for restoration practitioners in the southern IRL region.

**Effects of Off-Season Lake Okeechobee Discharges on Sediment Sulfide and Iron Biogeochemistry (STUDENT PRESENTATION)**

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The St. Lucie Estuary (SLE) in the lower province of the Indian River Lagoon (IRL), provides freshwater to the IRL through the estuary's north and south fork. In August 2024, changes to Lake Okeechobee's water level management protocol altered the criteria for scheduling freshwater releases through the C-44 canal into the SLE's south fork, leading to an off-season discharge in December, outside the typical rainy season. Discharge from Lake Okeechobee is known to transport excess nutrients to the estuary, enriching the already nutrient-laden SLE sediments. Using electrochemical characterization, elemental composition

analysis, and measured iron and sulfide, sediment core site comparisons pre- and post-discharge event showed the significant effects of changing water level management practices in the lake on the SLE. Increased nutrient loading during the off-season could have drastic effects on water quality in the lagoon during the rainy season.

**Sediment Transport in Eastern Oyster Reefs of the Indian River Lagoon: The Role of Flow, Turbulence, and Canopy Density (STUDENT PRESENTATION)**

Manisha Thenuwara, Kelly Kibler, Jyotismita Taye, and Peter Vien
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Oyster reefs act as natural breakwaters, reducing currents, waves, and stabilizing shorelines while adapting to sea level rise. This study investigates how canopy density in Eastern oyster reefs (*Crassostrea virginica*) affects sediment transport in the Indian River Lagoon, Florida. Field measurements of flow velocities and turbidity were taken within the oyster canopy and at the reef margin. Turbidity time series were converted to suspended sediment concentration (SSC) using calibration from paired turbidity (FTU) and SSC measurements. Inside the canopy, SSC levels were 9–26 mg/L, with slower flows (0.5–5.4 cm/s) compared to outside (6–15 mg/L SSC, 5.1–13.1 cm/s flows). In low-density canopies, SSC increased 56-100% while turbulence dropped 90-94% compared to outside. In high-density canopies, SSC rose by 37-57%, and turbulence fell by 72-84%. Flow velocity reductions varied, with sparse and clustered dense canopies reducing flow by 77-79%, and denser canopies by 89-91%.

**Optimizing Anatomical Sectioning Protocols for Aquatic Plants: Addressing Challenges of Aerenchyma and Tissue Preservation (STUDENT PRESENTATION)**

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Anatomical sectioning remains a cornerstone of anatomical studies, but most studies focused on terrestrial plants. Aquatic plants pose unique challenges, for instance, air within aerenchyma complicates paraffin infiltration. An effective embedding protocol is crucial for advancing research into aquatic plant physiology, evolutionary adaptations, and ecological contributions. This study's goal was to optimize the protocol and make recommendations for processing aquatic plant material. Floating and emergent plants with extensive aerenchyma may require the use of a vacuum to remove the air within tissues. Dehydration times should be extended to 0.5-24 hours, depending on species and sample size. Paraffin embedding requires three steps (below 60°C) to prevent material detachment. This protocol reduced tissue damage and improved paraffin infiltration. These findings not only improve anatomical studies of aquatic plants but also pave the way for more detailed investigations into plant adaptation mechanisms in aquatic environments and their role in ecosystem dynamics.

**Best Seagrass Planting Success: A Few Large Plots or Many Small Plots?**

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Seagrass planting success is generally not high. Is it better to plant a few large plots or many small scattered plots? I argue that we don’t know, but this question should be tested. Pros and cons of the two approaches will be presented.

**The 10 Year Check-Up: Assessing Syngnathid Populations in the Indian River Lagoon (STUDENT PRESENTATION)**

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Seahorses and pipefish (family Syngnathidae) are important components of coastal marine ecosystems but face numerous anthropogenic threats, including habitat loss, overharvesting, pollution, and climate change. The Indian River Lagoon (IRL) has been significantly impacted by repeated disturbances, such as harmful algal blooms since 2010, which have degraded benthic habitats like seagrass; potentially reducing syngnathid fish populations. This study examined syngnathid fish populations in the Mosquito Lagoon and Northern IRL using data collected in the summer of 2014 and in the summer of 2024. Results showed an increase in *Syngnathus scovelli* (Gulf Pipefish) populations over the decade, a shift in *Syngnathus louisianae* (Chain Pipefish) populations from the Northern IRL in 2014 to Mosquito Lagoon in 2024, and the absence of the two seahorse species, *Hippocampus erectus* (Lined Seahorse) and *Hippocampus zosterae* (Dwarf Seahorse) in 2024.

**Re-emergence of the Endangered Smalltooth Sawfish (*Pristis pectinata*) in a Historic Nursery (STUDENT PRESENTATION)**

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The smalltooth sawfish (*Pristis pectinata*) has been protected in Florida waters since 1992 and federally listed as endangered under the Endangered Species Act since 2003. Until recently, this species was rarely seen on the east coast of Florida. An increase in reports to the U.S. Sawfish Recovery Hotline and the successful tagging of 9 small juveniles has prompted attention to this area as a re-emerging nursery. Multiple lines of evidence such as public encounters and acoustic monitoring indicate that the south fork of the St. Lucie River is important for small juveniles in the southern Indian River Lagoon estuarine system. The south fork has emerged as a perennial high-use area, despite the degraded state of the estuary. The unique opportunity to study recovery of this iconic species in a former stronghold will improve our understanding of how resilient this species is and what recovery may look like in the future.

**Evaluating Diverse Shoreline Protection Strategies and Dune Ecosystem Management in Volusia and Flagler County (STUDENT PRESENTATION)**

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Coastal regions face increasing threats from rising sea levels, erosion, and extreme weather events, posing challenges for ecosystems, infrastructure, and communities. Natural barriers like dunes are essential for absorbing storm surge energy and reducing erosion. This study evaluates the effectiveness of shoreline protection methods, such as sand nourishment, dune restoration, sand fencing, and engineered structures, in maintaining shoreline stability. Several sites with diverse shoreline maintenance methods have been selected and documented in photographs. At the sites temporal and spatial shifts in shoreline will be assessed using ArcGIS Pro for geospatial analysis, NDVI for vegetation monitoring, and LiDAR for elevation. Field studies will evaluate plant coverage and species diversity in dune ecosystems, to assess their impact on dune erosion and restoration outcomes. Preliminary results suggest that dunes with strong plant cover enhance coastal resilience. This study evaluates diverse management strategies to protect coastal ecosystems while providing insights into sustainable shoreline protection.

**Movement Patterns of Cubera Snapper (*Lutjanus cyanopterus*) Along the Southeast Coast of Florida**
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Understanding fish movement patterns across different life stages is essential for effective species management. Cubera snapper, *Lutjanus cyanopterus* is a large, reef-associated species distributed throughout the western Atlantic. While it is known Cubera Snapper form large spawning aggregations, little is understood about their movement patterns and habitat use during the sub-adult to adult stage. Since 2020, 29 Cubera Snapper ranging in size from 455mm to 765 mm total length were acoustically tagged with help from the West Palm Beach Fishing Club near the Jupiter Inlet and Loxahatchee River. A total of 28 of 29 individuals were detected with 13 indicating movement offshore. These individuals indicated a coverage range at sites along the east coast of Florida from Canaveral to Riley's Hump in the Florida Keys. Preferred areas were identified for length of stay and repeated trips to these locations indicating critical habitats for feeding, shelter or spawning.

**Utilizing 20 Years of Citizen Science to Measure Water Quality in the St. Lucie Estuary and Indian River Lagoon**
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Anthropogenic changes have led to water quality degradation in the St. Lucie Estuary (SLE) and Southern Indian River Lagoon (sIRL), resulting in significant ecological alterations including loss of seagrass and oyster reefs, and fish, dolphin, and manatee kills, algal blooms, and hypoxia. Assessing long-term water quality data is critical to identifying the deviations from historical baseline conditions that are associated with these changes. In this study, we (1) validate the citizen science data from the SLE and IRL by estimating the variation from autonomous monitoring instruments (AMIs), (2) evaluate the ability for citizen science data to detect stressor events, and (3) examine changes in over two decades of water quality data. Preliminary results indicate citizen science data reflects similar patterns as the AMIs. Additional results will reveal the accuracy of citizen science and its ability to monitor shifts in estuary ecological health.

**Characterizing Contributions to Coastal Darkening in the Indian River Lagoon**
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Changes in coastal land use have led to increased surface runoff into the Indian River Lagoon worsening water quality. Increased surface water discharge carries with it greater fluxes of terrestrial sediments and dissolved organic matter that darkens the color of coastal waters. Coastal darkening is a growing environmental concern as decreased light availability has broad ecosystem impacts including loss of seagrass and reduced prey intake of fishes. We present a multi-year timeseries of *in situ* absorption, backscatter, attenuation, and particle size distribution measurements collected during monthly visits to five sites ranging from Sebastian Inlet to Middle Estuary. Laboratory measurements of light absorption components and particle composition were also co-generated. This analysis will lead to a better understanding of the dynamics of the optical components which contribute to darkening, and is necessary to guide management of coastal resources and improve water clarity.

**Assessing Unseen Environmental Impacts of Novel Non-Plastic Coastal Restoration Materials (STUDENT PRESENTATION)**

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Oyster reef restoration is a common practice around the globe that traditionally utilized plastic materials. As microplastics are a growing environmental concern, many restoration practitioners seek alternatives to plastic, however there is little information on the environmental impacts of these new materials. In this study, five non-plastic restoration materials are assessed for microparticle shedding. Four types of BESE biopolymer mesh and Natrx basalt shell bags are assessed by placing sections of each material in 150-ml flasks of seawater (30 ppt) on a shaker table. Naltex polyethylene plastic mesh is used as a control. Flask contents are vacuum-filtered each month for 1 year and microparticles counted and measured. All materials shed microparticles into the water, but the rigid biopolymer mesh and the basalt bags shed significantly more than other materials. This research is ongoing and will provide valuable insight into the environmental impacts of novel oyster reef restoration materials.

**Big Sawfish in the Southern Indian River Lagoon: What Are They Doing?! (STUDENT PRESENTATION)**

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Historical data show that the Indian River Lagoon (IRL) was once a nursery for the endangered smalltooth sawfish and supported large numbers of individuals from multiple life stages. In recent years, adults have been known to frequent nearshore ocean waters off the southern IRL, but until recently there have not been any tagging studies to answer questions about their movement patterns, residency, and association with the estuary. To date, 42 large juveniles and adults (2.3–4.6 m stretch total length) have been acoustically tagged in the lower St. Lucie River and St. Lucie Inlet. The goal of this talk is to present preliminary data on movements of these size classes in the region and relate patterns to previous work. In addition, this research is highly collaborative, and this aspect of the project will be a theme.

**Bridging the Genetic Gap: An Analysis of eDNA Markers to Assess the Potential for Metabarcoding to Infer Ecosystem Health in a Subtropical Estuary**

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Environmental DNA (eDNA) is increasingly used to assess the biodiversity and health of aquatic ecosystems and has been recently implemented to enhance infaunal monitoring in the Indian River Lagoon (IRL). For nearly two decades, IRL infauna (e.g., polychaetes, amphipods) have been surveyed to calculate M-AMBI, an index used worldwide to assess benthic condition. M-AMBI traditionally relies on time-consuming and expensive count data. eDNA offers a promising alternative, yet there is limited knowledge of eDNA markers and reference libraries for subtropical estuaries like the IRL. This study conducted a gap coverage analysis of five eDNA markers (COI, 18S, 16S, 12S, and 28S) for infauna. Utilizing the Indian River Lagoon Species Inventory and long-term monitoring data, we assess current marker availability and identify species detection gaps. Our findings underscore the need to enhance reference libraries and offer recommendations for research to advance eDNA-based monitoring that will contribute to effective ecosystem management.