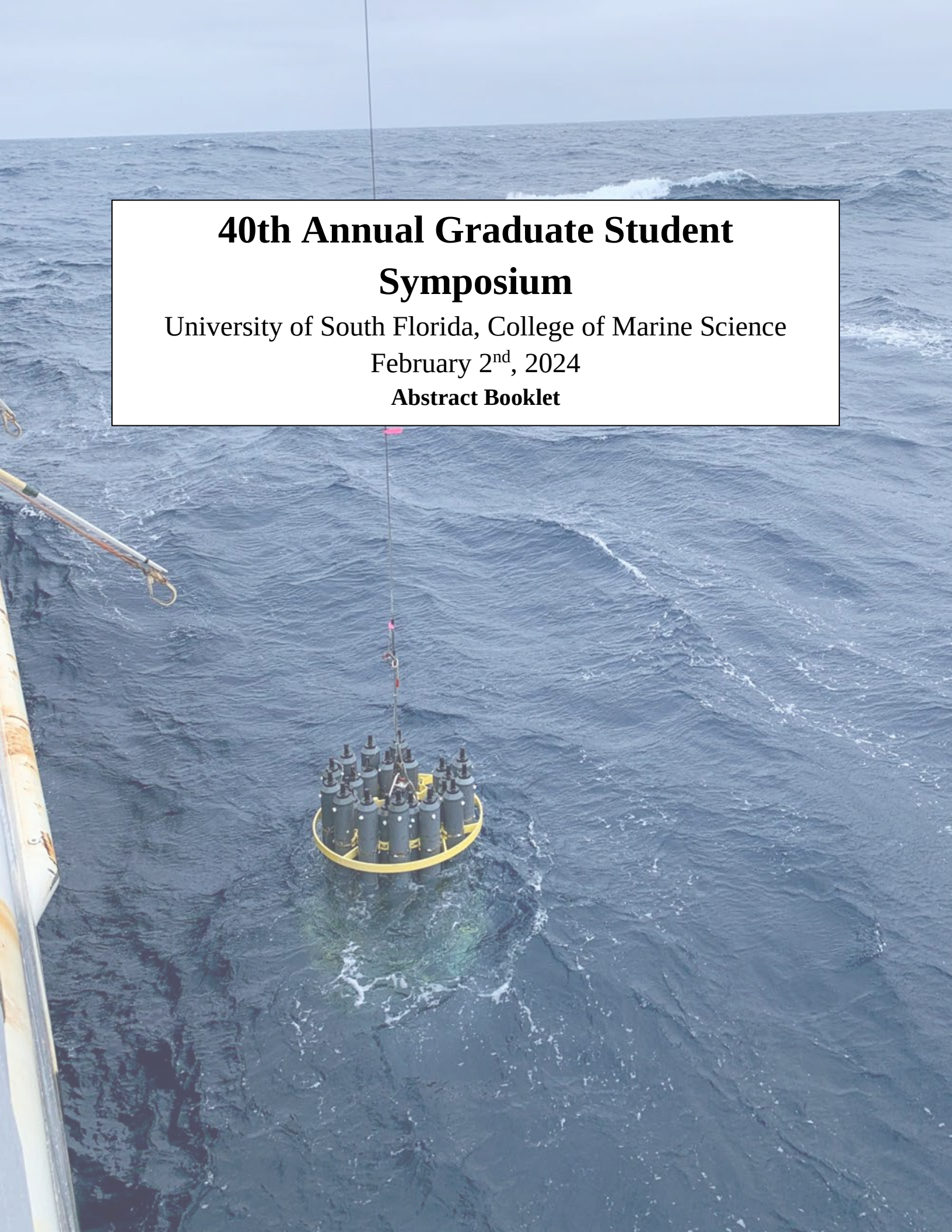

40th Annual Graduate Student Symposium

University of South Florida, College of Marine Science

February 2nd, 2024

Abstract Booklet

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10:00 am	Jill Thompson-Grim	PhD Student w/ Dr. Murawski
10:15 am	Bella Ritchie	PhD Student w/ Dr. Breitbart
10:30 am	Sara Jean Reinelt	PhD Student w/ Dr. Chambers

Break: 10:45 -11:00 am

11:00 am	Kylee Rullo	PhD Student w/ Dr. Murawski
11:15 am	Emily Kaiser	PhD Student w/ Dr. Shevenell
11:30 am	Shannon Riley	M.S. Student w/ Drs. Judkins & Murawski
11:45 am	Jessica Caggiano	PhD Candidate w/ Dr. Chambers

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Break: 2:00 – 2:15 pm

2:15 pm	Sophia Emmons	PhD Candidate w/ Dr. Seibel
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Emma Graves	PhD Student w/ Drs. Buck & Chappell
Samantha D'Angelo	Student Intern w/ Ocean Circulation Lab
Delfina Navarro-Estrada	PhD Student w/ Drs. Buck & Byrne
Keith Keel	M.S. Student w/ Dr. Breitbart

Alumni Speaker: Kara Doran

USGS Coastal Change Hazards Forecasts

Kara Doran, M.S. Physical Oceanography, USF

The USGS provides reliable coastal hazards information to communities and local/State/Federal partners in preparation for and response to extreme storms to enhance disaster preparedness and reduce risk to coastal communities. Information is presented through two systems: the Coastal Change Hazards (CCH) Portal and the Total Water Level and Coastal Change Forecast (TWL&CC) viewer. The CCH Portal provides National-scale assessments on multiple coastal change hazards: extreme storms, shoreline change, and sea level rise. Probabilities of erosion during extreme storm conditions are presented for real-time storm events and scenarios. Beach profiles are compared to water levels (tides, surge, and waves) to determine the probability of collision, overwash, and inundation. The TWL&CC viewer provides a continuously operating 6-day forecast of the combined effect of tide, surge, and wave runup along approximately 5000km of Atlantic and Gulf of Mexico coastline. Water levels and waves are extracted from National Oceanic and Atmospheric Administration (NOAA) models and are combined with empirically estimated wave runup. This time-varying total water level is compared to beach profiles along sandy coasts to evaluate the magnitude, timing, and duration of potential coastal change. These national-scale forecasts are validated using a variety of remote-sensing and in-situ observations at local scales. These observations allow continuous improvement and updating of the forecasts.

Oral Presentations

(In order of schedule)

Presentation I: Alexis Mitchum

Analyzing Spawning Patterns of Economically Important Fishes on the West Florida Shelf Through DNA Barcoding of Fish Eggs

Alexis B. Mitchem, Keith Keel, Maria Hopson-Fernandes, Arianna Rodriguez, Makenzie Kerr, Glenn Zapfe, Christopher D. Stallings, Mya Breitbart

Accurate species identification of fish early life stages is critical for conservation biology; however, eggs are challenging to identify due to a lack of distinguishing morphological features. For many fish species, reproductive aggregations and spawning sites have not been identified and of those that have, very few are protected or managed. Genetic techniques such as DNA barcoding have emerged as a powerful tool for identifying fish early life stages. We used DNA barcoding of the mitochondrial cytochrome c oxidase I (COI) gene to identify eggs collected along the West Florida Shelf (WFS) during September 2022 and September 2023. The fish eggs were collected on National Oceanic and Atmospheric Administration (NOAA) Southeast Area Monitoring and Assessment Program (SEAMAP) cruises using a continuous underway fish egg sampler (CUFES). We compared egg community composition between 2022 and 2023 and created maps of egg distributions for economically important fishes. Initial results showed an 81% DNA barcoding success rate with 80% being at the species level. We are currently applying other PCR primer sets for different genetic loci in an attempt to improve the barcoding success rate. Many of the species identified are known to be important to fisheries such as Sciaenops ocellatus (red drum), Rhomboplites aurorubens (vermillion snapper), and Lutjanus campechanus (red snapper). This study advances our knowledge of spawning sites of economically important species to inform fisheries management on the WFS.

Presentation II: Jill Thompson-Grim

Climate-Ready Fisheries: Spatially Defining Subsurface Climate-Vulnerable Regions of the Gulf of Mexico with High-Resolution Models

Jill Thompson-Grim, Don Chambers, Josh Kilborn, John Quinlan, & Steve Murawski

Semi-enclosed seas present complex and non-linear challenges to understanding climate impacts on fishes and fisheries because continental margins restrict poleward distribution shifts by taxa trying to maintain optimal temperature preferences. The Gulf of Mexico (GoM), a semi-enclosed sea surrounded by the North American continent, supports many economically and ecologically important fishes. Thus, a comprehensive assessment of demersal fish environments is vital to understanding and predicting distribution shifts and impacts of tropicalization in the GoM. Here we present a Gulf-wide and multi-decadal spatial evaluation of bottom temperature trends within the GoM continental shelf between 1996 and 2012. We validated and used bottom temperature products from a data assimilating reanalysis with 24-hour temporal and 1/25° spatial resolution (N = 33,159 grids and 6,209-day duration). We employed least-squares regression methods to estimate temporal trends, autoregressive models to calculate error, and optimized hotspot analyzes to identify spatial autocorrelation of trends. Results indicated heterogenous

temperature trends across the GoM with cooling in the West Florida Shelf and warming in the Bay of Campeche and Louisiana-Texas (LATEX) Shelf. We suggest increased duration of Loop Current impingement on the "pressure point" near the Dry Tortugas may modulate the observed cooling in the eastern GoM, whereas warming trends in the western GoM probably arise from mixing of shallow surface waters. This study highlights the value of using high-resolution model products to evaluate climate-driven spatial patterns in semi-enclosed seas. Managers will be able to use these results to identify regions of highest concern in respect to introduction of non-native tropical species and climate change.

Presentation III: Bella Ritchie

The ciliate (*Philaster apodigitiformis)* responsible for the 2022 *Diadema antillarum* mass mortality event also induces scuticociliatosis in *Diadema setosum*

Isabella T. Ritchie[1], Brayan Vilanova-Cuevas[2], Ashley Altera[2], Kaileigh Cornfield[3], Ceri Evans[3], James S. Evans[4], Maria Hopson-Fernandes[1], Christina A. Kellogg[4], Elayne Looker[3], Oliver Taylor[3], Ian Hewson[2], Mya Breitbart[1]

[1]College of Marine Science, University of South Florida, St. Petersburg, FL, USA [2]Department of Microbiology, Cornell University, Ithaca, NY, USA [3]Five Oceans Environmental Services, Muscat, Oman [4]St. Petersburg Coastal and Marine Science Center, U.S. Geological Survey, St. Petersburg, FL, USA

The long-spined sea urchin *Diadema antillarum* is an important herbivore on coral reefs and the mass mortality event Caribbean populations experienced in the early 1980s led to phase-shifts from coral- to algal-dominated reef communities. Population recovery after this mortality event has been minimal and was further hindered by the 2022 die-off of the same species. The scuticociliate, *Philaster podigitiformis*, was identified as the causative agent for the 2022 mass mortality of *D. antillarum* in the Caribbean. Signs of this infection, termed scuticociliatosis, include drooping spines, loss of tube foot control, stellate spine arrangement, and eventual spine loss and tissue necrosis. More recently, die-offs of the related urchin species, *Diadema setosum*, were reported in the Mediterranean and Red Sea, yet the cause of mortality was not determined. Here we present several lines of evidence suggesting that *P. apodigitiformis* is also responsible for *D. setosum* disease and mortality in geographically disparate locations. First, we demonstrate the presence of identical *P. apodigitiformis* 18S rRNA genes in grossly abnormal clade a *D. setosum* collected off the coast of Muscat, Oman in early 2023. Furthermore, we confirm the presence of *P. apodigitiformis* in clade b *D. setosum* obtained through the aquarium trade, indicating that this clade may also be susceptible to the scuticociliate. Finally, we show that clade b *D. setosum* can be infected experimentally with cultured *P. apodigitiformis* and exhibit gross signs of infection consistent with *D. antillarum* scuticociliatosis. These results demonstrate that scuticociliatosis caused by *P. apodigitiformis* has rapidly spread to geographically distant coral reefs, suggesting the need for global-scale awareness and monitoring for this devastating condition and efforts to understand long-range transmission mechanisms and explore mitigation strategies.

Presentation IV: Sara Jean Reinelt

Investigating Steric Sea Level Anomalies: Combining satellite altimetry, GRACE/GRACE-FO, and Argo

Sara Jean Reinelt, Don Chambers

Two major components of sea level rise are changes in steric sea level (eg. density changes) and changes in mass (eg. water additions due to ice melt etc.). Recent studies have derived steric sea level primarily from in situ observations from the Argo Program. One limitation to this method is the statistical mapping of sparse Argo float data, especially in eddy-rich regions. Here we conduct an initial study of combining satellite altimetry, GRACE/GRACE-FO, and Argo data to estimate monthly maps of steric sea level anomalies from January 2005 through December 2019. A consistent optimal interpolation method is used to recover the longest wavelength correlated patterns (while accounting for the eddy and other mesoscale signals in the covariance function). Individual Argo profiles of temperature/salinity are used to compute density and vertically integrated steric sea level anomalies (as well as thermosteric and halosteric components) for the exact time and location of the Argo float. These are then optimally interpolated into monthly maps of steric sea level anomalies, using the altimetry-GRACE/GRACE-FO estimate as a first guess. An examination of the Argo updates to the initial guess reveal several areas with anomalously large updates away from eddy-rich regions. A further examination of the thermosteric/halosteric anomalies reveal significant departures from other floats in several regions after 2014. These are tied to a handful of Argo floats. Although flagged as "good" in the standard Argo climatology, removing these floats leads to a significant reduction in misfit between Argo and the initial guess, and a significant rise in global steric sea level since 2014.

Presentation V: Kylee Rullo

Stable Isotope Analysis on Yellowfin and Blackfin Tuna Eye Lenses Reveals Life History Patterns in the Gulf of Mexico

Kylee M. Rullo, Ernst B. Peebles, Julie L. Vecchio, Steven A. Murawski

Spatial geography, ontogenetic movement, and trophic patterns of mobile species are key elements of species life history and knowledge of them is critical for effective marine resource management. In this study, we use stable-isotopic ratios of nitrogen ($\delta^{15}N$) and carbon ($\delta^{13}C$) in metabolically-inert, chronologically-layered eye lenses to characterize lifetime movements and trophic ecology of yellowfin tuna (*Thunnus albacares*) and blackfin tuna (*Thunnus atlanticus*) in the Gulf of Mexico. In both species, the $\delta^{13}C$ values was weakly related with eye-lens laminar midpoint (a proxy for length and age), reflecting changes in basal resource utilization. Smoothed curves of $\delta^{13}C$ by size exhibited decreasing $\delta^{13}C$ values before and around age 1 and subsequent increases, further supporting the idea of changing basal resources and revealing possible ontogenetic or seasonal movement by both species. The $\delta^{13}C$ values in the innermost lens-layer (eye-lens core) of yellowfin tuna were generally lower than values in blackfin tuna, indicating that yellowfin tuna likely spawn further offshore than blackfin tuna. Overall $\delta^{15}N$ values were strongly

correlated with eye-lens laminar midpoint in both species, consistent with increased trophic position with fish age. The relationship between $\delta^{15}N$ and $\delta^{13}C$ was weak for both species, but some individual profiles displayed moderate to strong correlations, indicating alternate periods of migration and residency. Despite the movement displayed in eye-lens profiles, the isotopic values were consistent with ranges previously measured in the Gulf of Mexico. These results demonstrate that stable-isotopic ratios in eye lenses can be mapped across isoscapes to determine broad life-history and movement patterns for large pelagic tunas without resorting to expensive and potentially biased tagging technologies.

Presentation VI: Emily Kaiser

Constraining the timing of and mechanisms forcing deglaciation along the Sabrina Coast, East Antarctica

[1]Kaiser, E.A.; [1]Shevenell, A.E.; [2]Leventer, A.R.; [1,3]Vadman, K; [4]Gulick, S.P.S., [5]Greenbaum, J., [1]Rosenheim, B.E.; [2,6]Meyne, R.; [7]Noble, T.

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Marine-terminating outlet glaciers along the Sabrina Coast, East Antarctica are losing mass due to ongoing atmospheric and oceanic warming. Observed regional glacier sensitivity to a warming climate is important because the Aurora Subglacial Basin catchment, which includes the Totten Glacier, contains 3-5 m of sea level-equivalent ice, similar to the ice volume contained in the entire West Antarctic Ice Sheet. To place regional ice mass loss into a longer-term context, we generated multi-proxy records from a transect of five marine sediment cores collected across the Sabrina Coast shelf, focusing on the last deglaciation. We developed radiocarbon chronologies using Ramped PyrOx 14C analyses of bulk sediments and established that the mid-shelf deglaciated between 18.8 and 14.0 ka (95% confidence; median:16.5±2.55 ka). This timing is similar, within analytical error, to deglaciation of the continental rise (16.8±0.18 ka), suggesting extremely rapid ice retreat during Henrich Stadial 1 (18-14.7 ka). During deglaciation, relatively high abundances of diatom F. kerguelensis (an indicator of offshore influence) and TEX86-derived sea surface temperatures suggest that warm waters from offshore the shelf influenced regional ice retreat. We hypothesize that deglacial oceanographic conditions on the Sabrina Coast shelf were driven by regional atmospheric circulation changes, which pushed warm Southern Ocean waters towards regional grounding lines. Support for our hypothesis comes from the Law Dome ice core, which indicates coincident regional atmospheric warming and increased windiness. Geomorphic features on the shelf and the deposition of laminated diatom muds/oozes indicate a productive, meltwater-influenced environment following deglaciation. Results suggest that ongoing atmospheric/oceanic warming in East Antarctica may contribute to global sea level rise in the next century. Additional ice-proximal paleoceanographic studies are required to assess outlet glacier sensitivity to oceanic/atmospheric warming on a catchment scale and improve projections of East Antarctica's contributions to sea level rise.

Presentation VII: Shannon Riley

Abundance and Vertical Distribution of Cephalopod Paralarvae in the Northern Gulf of Mexico

Shannon Leah Riley[1], Glenn Zapfe[2], Steve Murawski[1], Heather Judkins[3]

[1]College of Marine Science, University of South Florida; [2]Southeast Fisheries Science Center, National Oceanic and Atmospheric Administration; [3]Integrative Biology Department, University of South Florida St. Petersburg

Cephalopods are widely distributed throughout the Gulf of Mexico, but knowledge on the youngest life stages has been limited to few specific taxa in localized regions. As meroplankton capable of vertical movement but limited ability to swim against currents, the distribution of cephalopod paralarvae is dependent on adult spawning location and ocean circulation patterns. Paralarvae were collected over six cruises conducted in the northern Gulf of Mexico between 2009 and 2012 in various seasons in order to characterize their abundance and vertical distribution patterns. Samples were collected between 0-135 meters using a multiple opening-closing net and environmental sensing system (MOCNESS). A total of 2240 paralarvae were collected and examined, with an average concentration of 21.9 paralarvae per 1000 m^3. Twenty-one families were identified, with Octopodidae, Enoploteuthidae, Ommastrephidae, Pyroteuthidae, and Loliginidae having the highest numbers of individuals. Abundance of all paralarvae was highest in the 20-40 m depth bin at night and the 40-60 m depth bin during the day, and mean abundance was significantly different between depth bins during both day and night, although not all pairs of depth bins were significantly different. Some individual taxa also showed evidence of diel vertical migration, including Octopodidae and Pyroteuthidae. This study reveals the abundance and day and night vertical distribution patterns of paralarval cephalopods in the surface waters of the northern Gulf of Mexico, allowing for comparison studies with juveniles and adults in the region. Understanding the vertical distribution of cephalopod paralarvae enables future clarification of how paralarvae may be advected through the Gulf of Mexico via currents, which is especially important for coastal taxa that are benthic as adults, namely Octopodidae and Loliginidae.

Presentation VIII: Jessica Caggiano

Exploration of a coupled model's diurnal cycles at discrete Tropical Pacific buoy array locations

[1]Jessica Caggiano, [2]Meghan Cronin, [3]Jack Reeves Eyre, [4]Dongxiao Zheng

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The tropical Pacific Ocean is of significant interest to oceanographers due to its unique and complex dynamics, which play a crucial role in shaping global climate patterns and weather systems. Since the 1980's the Tropical Atmosphere Ocean (TAO) buoy array has been sampling atmospheric and oceanographic data at discrete locations along the equatorial Pacific. Based on similar buoy measurements from un-aspirated air temperature and relative humidity sensors, secondary mid-morning and mid-afternoon peaks in air temperature records have been attributed to biases caused by radiative warming of the sensor. A

bias in the atmospheric temperature data retrieved from these buoys is a current area of investigation. These errors could impact surface heat flux estimates and limit the usefulness of buoy measurements in studying the diurnal cycle of air temperature and air-sea interaction. Here we explore the diurnal cycle of atmospheric and oceanographic data from a natural run of the NCEP Climate Forecast System, to explore whether, or how much of, these diurnal anomalies may be related to the physics of the atmospheric boundary layer rather than a bias associated with radiative warming of the air temperature sensor.

Presentation IX: Bostony Braoudakis

Respirometry studies of oxygen supply capacity of an estuarine fish, spotfin mojarra (Eucinostomus argenteus), reveal physiological tolerance to elevated temperatures

Bostony Braoudakis, Brad Seibel

With climate change, elevated seawater temperatures can disrupt the balance of oxygen supply and demand by decreasing oxygen solubility and increasing rates of metabolic processes. Different fish species exhibit widely varied responses to environmental disturbance. The spotfin mojarra (Eucinostomus argenteus) is a highly abundant fish species that lives in coastal, shallow, and estuarine environments in the western Atlantic Ocean. The effects of environmental conditions, such as temperature and pH, on the physiology and distribution of mojarras are still largely unknown. This study uses respirometry methods to investigate the oxygen supply capacity and its temperature sensitivity in spotfin mojarras collected in Tampa Bay. Preliminary results show that oxygen supply capacity stays mostly constant across temperature, suggesting that mojarras have a wide range of thermal tolerance. Mojarras' exposure to highly variable salinities, oxygen concentrations, temperatures, and pH in estuaries could have helped them adapt their physiology, providing them with the ability to tolerate more extreme conditions.

Presentation X: Yao Yao

Remote detection of *Karenia brevis* blooms on the West Florida Shelf: accounting for spatial coherence

Yao Yao, Chuanmin Hu, Jennifer P. Cannizzaro, Brian B. Barnes, Yuyuan Xie

The West Florida Shelf (WFS) of the eastern Gulf of Mexico experiences Harmful Algal Blooms (HABs, often reported as red tides) almost annually caused by the toxic dinoflagellate, *Karenia brevis*. However, the spatial extent and temporal occurrence of *K. brevis* blooms are difficult and lacking to assess due to the limitations in the two primary bloom monitoring techniques used for bloom monitoring: microscopic evaluation of field-collected water samples and satellite remote sensing of ocean color. Although the previous study, applying a Red Band Difference (RBD) index-based approach on Moderate Resolution Imaging Spectrometer on Aqua (MODIS/A) to semi-objectively delineate *K. brevis* blooms, reveals the weekly, bi-weekly, monthly, and annual *K. brevis* bloom coverage and distribution patterns on WFS, there was still lack an auto-extract method to detect bloom patches as well as MODIS is aging. Here, a deep learning method on Suomi National Polar-orbiting Partnership (SNPP) Visible Infrared Imaging Radiometer Suite (VIIRS) is developed to achieve auto-extract *K. brevis* bloom patterns, which

uses spatial coherence of bloom patches to account for the patchiness of *K. brevis* concentrations. Notably, even without equipping a fluorescence band, the extracted *K. brevis* patches were consistent with those derived from the MODIS on the Aqua satellite which has a fluorescence band. VIIRS has a wider swath than MODIS (3040-km versus 2330-km) which led to more valid observations for improved near-real-time applications. Furthermore, the commercial small satellite constellation PlanetScope with SuperDove sensor combined high spatial resolution (~ 3 m) and high temporal resolution (near daily). It is expected to fill the gaps in monitoring HABs towards more effective management and mitigation.

Presentation XI: Natalia Sawaya

Quantification and diversity of a ubiquitous ssDNA phage group (*Gokushovirinae*) in the Red Sea

Natalie A. Sawaya[1], Shelby Mahank[1], Debbie Lindell[2], Mya Breitbart[1]

[1]University of South Florida, College of Marine Science- Saint Petersburg, FL USA [2]Technion – Israel Institute of Technology- Haifa, Israel

Viral metagenomics has revealed a vast diversity of marine viruses and uncovered previously overlooked groups, such as single stranded DNA (ssDNA) viruses. Understanding their ecological roles, however, has been hindered by methodological limitations and the absence of cultivated representatives. Specifically, ssDNA phage belonging to the *Gokushovirinae* subfamily are ubiquitous in marine environments, yet the abundance and host range of this group is completely unknown. This study focuses on the Gulf of Aqaba in the Red Sea, a location characterized by seasonal water column stratification and oligotrophic conditions. Therefore, despite its proximity to land, the Red Sea is analogous to an open ocean system, making it an ideal site to explore gokushovirus abundance and diversity across seasons and depths. Due to high levels of sequence divergence, quantitative PCR cannot be used to quantify this diverse group of ssDNA phage. To overcome this limitation, we have adapted the polony method, in which viral template DNA is immobilized in a gel, amplified by PCR, and subsequently detected by hybridization. Changes in gokushovirus abundance with water column stratification were assessed using the polony method on depth profiles from February (mixed) and September (stratified) of three years. Gokushovirus abundance exhibited up to a tenfold increase during the September months, with a distinct subsurface peak observed at depths ranging from 20 to 80 meters during this period. Virome analysis revealed multiple gokushovirus types across various depths and seasons, highlighting the absence of discernible spatial or temporal diversity patterns. Comparison of the polony molecular markers to the Red Sea gokushovirus diversity revealed that about 50% of the diversity is recovered with the polony method, with minimal spatiotemporal bias. This emphasizes that differences in gokushovirus abundance with depth and season are likely ecological in nature rather than stemming from methodological limitations. Understanding these spatiotemporal shifts in gokushovirus abundance and diversity, particularly pinpointing their peak abundance, is crucial for gaining insights into their host range and ecological roles within the Red Sea

Presentation XII: Alejandra Aguilar

Depth Matters: Insights into Peat Dynamics in Restored and Natural Mangroves of Florida's Gulf Coast

Aguilar, A.[1], Rosenheim, B.[1], Romero, I.[1]

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To calculate belowground carbon stock in mangrove, it is important to measure the depth of the sediment, the carbon content, and the density (dry bulk). These three numbers, when combined with the age of the sediment, can yield a burial rate of carbon. Uncertainty can be derived from measured variables in laboratory, however, when applied to larger areas these uncertainties don't account for spatial fluctuations in the dept of the sediment. We conducted a systematical approach and sampled probe data of 1m depth around the site to quantify uncertainty in depth. Using the core location as a central point, and the corners to take document the depths to various lithologic boundaries. The study was done in Florida Gulf Coast, comparing natural and restored sites. We collected a total of 99 gauges, and a total of 452 different depth horizons composed by peat, sand mud and different combinations of it. The natural sites show a tighter distribution in the peat depth compared to the restores sites. The younger restored site has a lower accumulation of peat and the restored sites with similar year of creation, have slightly differences in the peat formation.

Presentation XIII: Sophia Emmons

Influence of salinity on the oxygen limitations of estuarine species *Hypanus sabinus*

Sophia Emmons

Estuarine organisms have evolved the capacity to cope with a wide range of environmental conditions. Under projected climate change conditions, variations in temperature, salinity, and dissolved oxygen levels are expected to become more extreme, possibly pushing these organisms beyond their physiological limits. It is known that metabolic rate, which is oxygen dependent, is influenced by temperature; however, the influence of salinity changes on an organism's upper oxygen limits is not well understood. Estuarine species the Atlantic stingray (*Hypanus sabinus*) inhabits environments ranging from marine to freshwater conditions in Florida, the Gulf of Mexico, and the temperate northwest Atlantic Ocean. This study aimed to determine how changes in salinity impacted its oxygen supply capacity and critical oxygen limit at its maximum metabolic rate. Early analysis suggests that while oxygen supply capacity improves as salinity decreases, maximum metabolic rate decreases, resulting in a lower critical oxygen limit in near freshwater conditions. This finding may suggest that the organisms are physiologically compensating in low salinities and thus cannot sustain a high metabolic rate or they have ecologically evolved to not need to reach as high of a metabolic rate in low salinities.

Presentation XIV: Sarah Sullivan

Sargassum in the Florida Keys: Application of High-resolution Satellite Imagery and a Deep Learning Model

Sarah Sullivan, Lin Qi, Yuyuan Xie, Brian Barnes, Jennifer Cannizzaro, Chuanmin Hu

Pelagic Sargassum abundance has been increasing in intensity and extent since 2010. At sea the floating macroalgae provides a home to many oceanic species, but as Sargassum encroaches on shorelines it brings environmental, health, and economic issues to coastal communities. The introduction of large quantities of Sargassum to the Florida Keys, a tourism hub renowned for coral reef and marine diversity, poses a potentially devastating threat. Currently, Sargassum mats are widely monitored using medium resolution satellite imagery such as the Moderate Resolution Imaging Spectroradiometer (MODIS, 1km) and spectral band difference algorithms such as the Alternative Floating Algae Index (AFAI); but these methods lack the detail and nearshore certainty necessary for Sargassum detections in the optically complex study region. To overcome these limitations, high resolution Sentinel-2 satellite imagery (10-20 m resolution) was processed with a Res-UNet deep learning (DL) model to extract Sargassum features. Such detected features were linearly unmixed to estimate subpixel Sargassum coverage, then gridded to 4km monthly Sargassum density maps to facilitate feature visualization and generate a time series. This study aims to aid Sargassum management by providing high-resolution nearshore detections.

Poster Presentations

Poster I: Emma Graves

Entrained Mississippi River Plume Shifts Phytoplankton Community Composition on the West Florida Shelf

E.E. Graves, K.A. Confesor, K.E. Powell, S. Caprara, K.N. Buck, P.D. Chappell

The West Florida Shelf (WFS) is a unique coastal area that is generally oligotrophic with robust seasonal variation in circulation. Periodic interactions associated with the Loop Current, including intrusions of Mississippi River plume water, combined with local estuarine input and submarine groundwater discharge create an ideal ecosystem for supporting variable phytoplankton communities. Previous studies on phytoplankton community composition in this highly dynamic ecosystem have used microscopy and pigment concentrations, which are limited in the ability to identify smaller phytoplankton taxa to lower taxonomic classifications. This study aimed to better characterize the phytoplankton community composition across the WFS using metabarcoding. In June 2022, seawater samples were collected from both the surface and chlorophyll maximum at 16 stations across the WFS, including sampled collected from the Loop Current and an adjacent region of lower salinity water believed to be an entrained plume of Mississippi River influenced water, which had traveled ~400 km from the mouth of the river before being sampled. 18S metabarcoding was carried out on the filtered water samples and matched to taxonomy to determine phytoplankton community composition at each station and then further analyzed across gradients of temperature, salinity, and nutrient and trace metal concentrations present at the stations. Distinct phytoplankton communities were observed in the entrained Mississippi River water surface plume indicating that the geochemical influence of the river on microbial populations can extend well into the WFS.

Poster II: Samantha D'Angelo

Implementation of the Tampa Bay Observing Network (TBON), a comprehensive approach to monitoring real-time water quality in Tampa Bay.

Samantha D'Angelo, Jason Law, Yonggang Liu

The University of South Florida's Coastal Ocean Monitoring and Prediction System (USF-COMPS) is a coordinated ocean observing system comprised of in-situ observations informing predictive models on the west Florida shelf (WFS). In the spring of 2021, the COMPS Tampa Bay Coastal Ocean Model (TBCOM) was utilized to inform emergency management and the public as to the fate of wastewater released into Tampa Bay from the Piney Point phosphor-gypsum waste stack. This demonstration of modeling and observing capabilities of the COMPS system led directly to the establishment of an instrumented water quality and circulation array for Tampa Bay, the Tampa Bay Observing Network (TBON). TBON is comprised of four real-time water quality and meteorological stations mounted on U.S. Coast Guard range towers and six bottom mounted current meters in Middle and Lower Tampa Bay that

collect current and bottom pressure data in delayed time. The current meters were initially deployed in May 2022 and the four real-time water quality and meteorological stations were added in 2023. The TBON stations collect a full set of water quality variables including water temperature, salinity, dissolved oxygen, turbidity, pH, and chlorophyll-a. The continuous water quality, meteorology and current velocity time series collected at the fixed locations will provide opportunities for multi-disciplinary collaborations in the future.

Poster III: Delfina Navarro-Estrada

Biological cycling of trace metals during the EXPORTS 2021 study of the North Atlantic Spring Bloom

Delfina Navarro-Estrada, Kristen Buck, Salvatore Caprara, Bethany Jenkins, Mark Brzezinski, Sarah Lerch, Kathy Roche

The North Atlantic Spring Bloom (NASB) is an annual occurrence between April and June upon the onset of stratification that shoals the mixed layer. The reduced mixing, and increased availability of light and macronutrients, promotes rapid growth of the biological community. Over time, a succession from diatoms to flagellates is observed as macronutrients are depleted. Although macronutrient availability is considered the primary driver of the NASB, the micronutrient iron (Fe) may also play an important role. Resolving primary, secondary and/or colimiting nutrients is crucial to elucidate the processes that lead up to the termination of the bloom, and the role of these nutrients in primary production.

In May of 2021, three nutrient-addition incubation experiments were conducted shipboard during the Spring Bloom at the Porcupine Abyssal Plane Sustained Observatory (PAPSO). The three amendments included: (a) Control (+0); (b) added Fe (+Fe); and (c) added Fe and Si (+Fe +Si), in low and high light conditions (12% and 47% PAR, respectively). The incubations were sampled for dissolved (<0.4 μm) and labile particulate fractions (>0.4 μm and 0.4-5 μm) of the bioactive trace metals, including Mn, Fe, Co, Ni, Cu, Zn, and Cd. Collections occurred at the initial time of the incubation set-up, and at harvesting times, after 45 to 70 hours of phytoplankton growth. Measurements of the dissolved and labile particulate trace metal phases will allow novel assessments of the fraction of dissolved metals that are taken up during phytoplankton growth and the extent that these nutrient additions enhance growth relative to a control in this region of the Northeast Atlantic.

Poster IV: Keith Keel

Exploring the Dynamics of September Fish Spawning on the West Florida Shelf Through the DNA Barcoding of Fish Eggs

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Identifying spawning areas for economically and ecologically important fishes is critical for fisheries conservation and ecosystem-based management. Additionally, further understanding how environmental and geographical parameters relate to spawning dynamics of fishes is increasingly more relevant as temperatures and oceanic conditions change. In this study, genetic barcoding was used to

identify fish eggs collected across the West Florida Shelf (WFS) during September 2013, 2014, and 2019. Fish eggs were collected on National Oceanic and Atmospheric Administration Southeast Area Monitoring and Assessment Program cruises using a continuous underway fish egg sampler. Analysis of 4,400 fish eggs from the three years resulted in the identification of 85 unique species within 36 families. An 81% DNA barcoding success rate was achieved, with 44% of all identifications being at the species level. There were significant differences in fish egg beta-diversity across the three years sampled and four preassigned depth classes. Several economically important species were collected and observed at relatively high frequencies, including: Red Snapper Lutjanus campechanus, Lane Snapper Lutjanus synagris, Vermillion Snapper Rhomboplites aurorubens, Yellowedge Grouper Hyporthodus flavolimbatus, and King Mackerel Scomberomorus cavalla. The West Florida Coastal Ocean Model was used to hindcast the trajectories of the fish eggs and predict possible spawning locations. Backward tracking over a span of 48 hours was conducted, as it is assumed that most fish eggs undergo hatching within this time window. The model yielded estimates for egg transport distances ranging from 10-111 km (average maximum distance of ~25 km), with greater transport distances observed on the outer shelf in comparison to the middle and inner shelf. These results further our understanding of spatial and interannual variation of fish spawning dynamics on the WFS and mark the beginning of a long-term monitoring effort.