39th Annual Graduate Student Symposium

University of South Florida, College of Marine Science

January 27th, 2023

Abstract booklet

UNIVERSITY OF SOUTH FLORIDA
College of MARINE SCIENCE

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Schedule:

Opening remarks and plenary speaker:

9:00 am	**Opening remarks**	GSS committee
9:05 am	**Dr. Kara Radabaugh**	CMS alumni

BREAK 9:35-9:45 am

Oral presentations:

9:45 am	Olivia Blondheim	PhD Student with Dr. Stallings
10:00 am	Caitlyn Parente	MS Student with Drs. Breitbart and Buck
10:15 am	Keith Keel	MS Student with Dr. Breitbart
10:30 am	Luis Sorinas Morales	PhD Student with Drs. Liu and Weisberg

BREAK 10:45-11:00 am

11:00 am	Isabella Ritchie	PhD Student with Dr. Breitbart
11:15 am	Nicola Guisewhite	MS Student with Dr. Chambers
11:30 am	Angelique Rosa Marín	PhD Student with Dr. Hallock Muller
11:45 am	Calyn Crawford	MS Student with Dr. Buck
12:00 pm	Catalina Rubiano	MS Student with Dr. Graham

BREAK - lunch 12:15-1:15 pm
(Poster presenters please put your posters up at this time)

Poster presentations (1:30pm-3:30pm):

Tiff Raetzel	MS Student with Dr. Ainsworth
Rebecca Scott	PhD Candidate with Dr. Ainsworth
Jessica Caggiano	PhD Candidate with Dr. Chambers
April Ellis	PhD Student with Drs. Dishaw and Naar
Naja Murphy	PhD Student with Drs. Buck and Byrne
Shannon Riley	MS Student with Drs. Murawski and Judkins
Macarena Martin Mayor	PhD Student with Dr. Byrne

ALUMNI SPEAKER:

Kara Radabaugh, PhD

Kara is the current coordinator for FWC's Coastal Habitats Integrated Mapping and Monitoring Program (CHIMMP) and the Oyster Integrated Mapping and Monitoring Program (OIMMP). She graduated from USF-CMS in 2013 from Dr. Ernst Peebles' lab, where her research focused on (1) phytoplankton and zooplankton dynamics in Florida estuaries, (2) the use of stable isotope analysis to study fish diets and food webs in the Gulf of Mexico, (3) the creation of dynamic isoscapes in the Gulf of Mexico based on isotopic signatures of fish, and (4) the impact of light availability on aquatic primary productivity.

ORAL PRESENTATION 1:

Filtering friends: Evaluating bivalve water filtration services

Olivia N. Blondheim, Christopher D. Stallings

Oysters are a foundation species that provide important ecosystem services such as water filtration, shoreline stabilization, and habitat structure. Marine ecosystems previously dominated by oyster reefs and other foundation species such as salt marsh are transitioning to those containing and even being dominated by mangroves as they expand their distributions poleward in response to climate change. As oyster reefs are transitioning to mangrove-dominated habitats in Tampa Bay, it is essential to understand how this may affect the ecosystem services that oysters provide. I propose three studies that will evaluate the water filtration services of bivalves. I will estimate the density, size, and biomass of the eastern oyster (*Crassostrea virginica*) on different substrates (i.e., oyster reefs, mangroves, pilings, seawalls) in Tampa Bay, resulting in an estimate of water filtration services for the region. Additionally, I will experimentally evaluate whether oyster water filtration rates and capacity differ between oysters growing horizontally (as on reefs) or vertically (as on mangrove roots, pilings, and seawalls). Lastly, I will experimentally examine the restoration potential of oysters and other bivalves (i.e., mussels and clams) for the removal of harmful algal blooms (HABs). This comprehensive study will provide better predictions for how bivalve water filtration services may be affected as oyster reefs are replaced by mangroves in Tampa Bay and other regions globally.

ORAL PRESENTATION 2:

Investigating Marine Phage as a Potential Form of Dissolved Iron in the Ocean

Caitlyn Parente, Salvatore Caprara, Kristen Buck, Mya Breitbart

Iron, an essential trace metal, limits phytoplankton growth in much of the modern surface ocean. Iron is required for many biological processes, yet it is found in exceedingly low concentrations due to its limited solubility in seawater; its bioavailability is further complicated by widespread organic complexation. Phytoplankton obtain iron from the dissolved size fraction (<0.2 μm), and viruses, the most abundant biological entities in the ocean, fall into this size fraction. Most marine viruses are phage (viruses that infect bacteria), and evidence from non-marine systems shows that some phage incorporate iron in their structures. I hypothesize that some marine phage also contain iron in their structures and specifically, that iron from bacterial cell reserves is utilized in the production of progeny phage. To investigate this hypothesis, I will cultivate *Vibrio natriegens* on media containing isotopically labelled iron and infect this bacterium with phage. The labelled iron will be followed through phage infection and cell lysis, and phage particles will be purified for quantification and trace metal analysis. This study could be the first to show the presence of iron in any marine phage, demonstrating that phage may act as a form of dissolved iron in the oceans. Based on their abundance in the dissolved size fraction, marine phage could constitute a significant portion of the apparently dissolved iron in seawater, with implications for iron bioavailability. Furthermore, determining the origin of iron incorporated into progeny phage could provide critical information about the biogeochemical cycling of iron in the oceans.

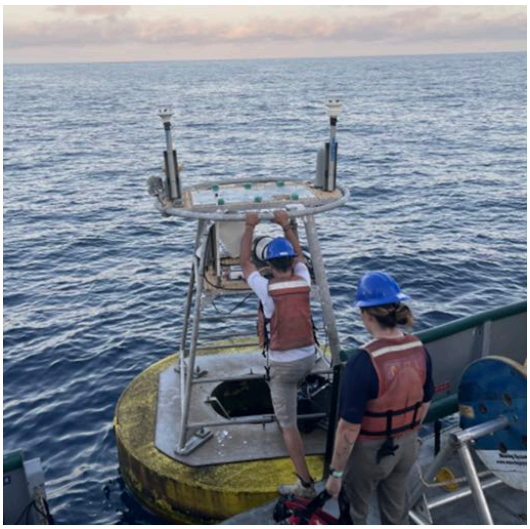
ORAL PRESENTATION 3:

Assessing Fall Spawning Dynamics of Fishes on the West Florida Shelf Using DNA Barcoding

Keith Keel, Makenzie Kerr, Glenn Zapfe, Christopher Stallings, Ernst Peebles, Mya Breitbart

Identifying spawning areas for commercially and ecologically important species is of great importance for fisheries conservation and ecosystem-based management. Additionally, further understanding how environmental and geographical parameters affect spawning dynamics of fishes is increasingly more relevant as temperatures and oceanic conditions continue to change due to climate change. In this study, genetic barcoding was used to identify thousands of fish eggs collected from the West Florida Shelf during September 2013, 2014, and 2019. 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) attached to the ship's hull that collects fish eggs at a 3m depth. So far, 2013, 2014, and 2019 fish eggs have all been processed and identified, and when combining all three years, a total of 84 unique species and 94 unique taxa were identified from 4,464 fish eggs. Species of interest that were collected and identified with relatively high frequency included: *Lutjanus campechanus* (northern red snapper), *Rhomboplites aurorubens* (vermillion snapper), *Hyporthodus flavolimbatus* (yellowedge grouper), *Sciaenops ocellatus* (red drum), *Scomberomorus cavalla* (king mackerel), and *Scomberomorus maculatus* (Atlantic Spanish mackerel). Future plans for this study include the use of location data, environmental data, and oceanographic models to further analyze spawning trends of the fishes identified.

ORAL PRESENTATION 4:



On the Seasonal Cycle of Ocean-Atmosphere Heat Exchange on the West Florida Continental Shelf Identified through Analyses of Surface Meteorological and Oceanographic Data from Long-term Moorings

Luis Sorinas, Robert H. Weisberg, Yonggang Liu, Jason Law

Twenty-three years of surface met-ocean data sampled from moored buoys are used to study the seasonal and interannual variations of ocean-atmosphere heat exchange and its influence on West Florida Continental Shelf (WFS) water temperature and stratification. The data are from the University of South Florida's Coastal Ocean Monitoring and Prediction System (COMPS). Observed are incoming short and long wave radiation, air and sea surface temperatures (SST), barometric pressure, relative humidity, wind velocity, water column velocity profiles, and water column temperature at discrete depths. These data are used to estimate net short and long-wave radiation and sensible and latent heat fluxes via the COARE 3.6 algorithm. When combined, these radiative and turbulent heat flux influences are compared with the heating and cooling of the WFS water column and SST. Heating starts in February and lasts through August, with a maximum rate of change in May, while cooling starts in September and lasts through January, with a maximum rate of change in October. SST varies from 18.4°C in February to 30.4°C in August at mooring C10 and from 20.1°C in February to 30.2°C in August at mooring C12. The water column begins to stratify in March, peaking in June – July and lagging the surface heating by one or two months, then decreasing through September at C10 and October at C12. Stratification is also modified by persistent upwelling when the Gulf of Mexico Loop Current interacts with the WFS slope at its southwest corner near the Dry Tortugas.

ORAL PRESENTATION 5:

Investigation into the causative agent of the 2022 Diadema antillarum mass mortality event
Isabella T. Ritchie, Ian Hewson, James S. Evans, Yasunari Kiryu, Christina A. Kellogg, Mya Breitbart

Diadema antillarum, the long-spined sea urchin, is an ecologically important herbivore in Caribbean reef ecosystems, particularly as herbivorous reef fishes are in decline. The species experienced a mysterious die-off in the early 1980s for which the cause was never determined. When a similar die-off occurred in the same regions in 2022, we employed transcriptomic and veterinary pathologic methods to compare the microbial communities of affected versus healthy urchins. A scuticociliate most similar to *Philaster apodigitformis* was consistently associated with dying urchins and not found in their healthy counterparts. This ciliate was cultured from dying urchins in the field and used to challenge naïve urchins in aquarium experiments. Through these experiments, we fulfilled Koch's postulates by successfully inducing symptoms (up to and including mortality) similar to those seen in the field, in a controlled lab environment. Future work will explore the host range of this ciliate, as well as treatments that can prevent its growth and spread.

ORAL PRESENTATION 6:

Exploring the impact of southern ocean eddies on biogeochemical structure using BGC-ARGO float observations

Nicola Guisewhite, Don Chambers, Veronica Tamsitt, Sarah Bartoloni

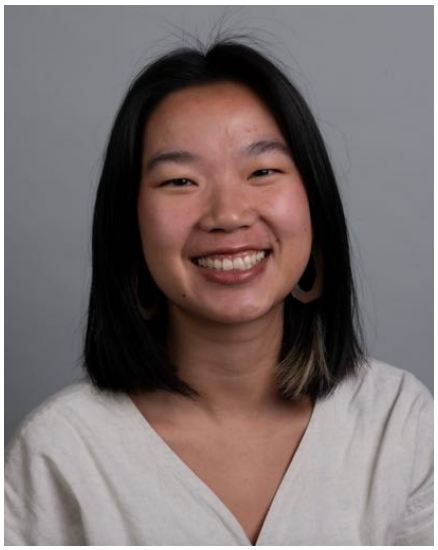
Recent studies have found that eddies in the Southern Ocean can contribute to both uptake and outgassing of CO_2, emphasizing a need to understand the impact of eddies on biogeochemical structure in the Southern Ocean. Despite having a significant role in climate regulation and global ocean transport, the Southern Ocean and its eddies are largely under-sampled, leaving many unknowns when trying to understand how the Southern Ocean can be impacted by a changing climate. Whereas CO_2 and other biogeochemical properties including oxygen and nitrate (which can be studied as indicators of a changing climate) are historically under-sampled and understudied in the Southern Ocean, the use of autonomous vehicles has allowed for the collection of high-quality data that can be used to analyze the impact of eddies on Southern Ocean biogeochemical structure. We pull biogeochemical data from all known eddy encounters by SOCCOM BGC-Argo floats and determine the significance of eddies on biogeochemical structure in the Southern Ocean by comparing anomalies in biogeochemical properties.

ORAL PRESENTATION 7:

Benthic foraminifera as bioindicators of reef health in Jobos Bay, Puerto Rico
Angelique Rosa Marín, Michael Martínez-Colón

Monitoring tools are needed to support effective management actions to protect the coral reefs in Jobos Bay National Estuaries Research Reserve at Salinas, Puerto Rico. My project evaluated the feasibility of assessing benthic-foraminiferal assemblages to better understand the role of environmental parameters on these reefs. Water-quality, nutrients, sediment parameters, and foraminiferal assemblages were assessed in samples from the fore-reef and back-reef of Cayo Morillo, Cayo Pájaros, and Cayo Caribe. Water-quality data such temperature and salinity reflected seasonal variations; nitrates and ammonium concentrations indicated terrestrial runoff; and sediment parameters such as predominant grain-size and proportions of organic carbon and carbonate calcium indicated wave energy and wind influence. Foraminiferal assemblages in the fore reef were dominated by *Amphistegina* (algal-symbiont-bearing) indicating suitable water-quality, while the back-reef stations were dominated by heterotrophic species such *Discorbis* and *Quinqueloculina*, reflecting their dominance in finer sediments with higher organic content. Low densities, water depth and wave energy limited further interpretation of foraminiferal assemblages. Additional research is needed to better understand the spatial distributions of foraminiferal taxa among the coral reefs of Jobos Bay.

ORAL PRESENTATION 8:

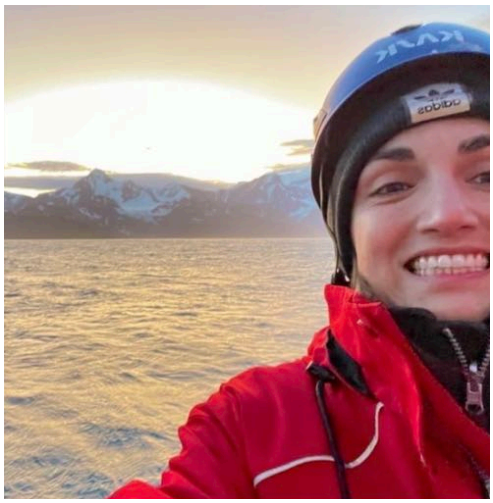


Labile nickel (Ni) concentrations across biogeochemical gradients in the North Pacific Ocean: insights into Ni bioavailability

Calyn Crawford, Kristen Buck

Trace metals are important micronutrients as key components of metalloenzymes. These elements are thus tightly coupled with biological processes such as photosynthesis and respiration. One of the less studied trace metals is nickel (Ni) which is used in two distinct enzymes for dissolved organic nitrogen (DON) acquisition and cell protection. Despite nickel's known biological uses and suspected obligate requirement, a persistent 2 nM in the global surface ocean remains. The reason behind this persistence and apparent inertness is an active area of research, but one ultimately stunted by lack of field data. Thus, my project aims to take the first set of labile Ni depth profiles in the North Pacific Ocean across three distinct biogeochemical regimes to examine how much of the dissolved pool of Ni is bioavailable. These data are extremely important to advance our knowledge of Ni cycling and its ties to related macronutrients.

ORAL PRESENTATION 9:



From the Field in 2022: Postcards from the Poles
Catalina Rubiano

This presentation will focus on the experiences from two research cruises undertaken last year on opposite ends of the Atlantic Ocean. EX2204 was the first of three cruises on board the NOAA Ship Okeanos Explorer that made up the Voyage to the Ridge expedition in 2022, and its purpose was to map the poorly studied Charlie-Gibbs Fracture Zone in the North Atlantic Ocean. Participation on the 4-week cruise was granted as part of a NOAA Explorer-In-Training Internship. This presentation will showcase the seafloor mapping work completed on the ship as well as some of the outcomes of the cruise, and images from the two ensuing ROV cruises that followed EX2204. Then, switching gears to the opposite side of the Atlantic: research cruise PS133/2 was completed onboard the German research vessel Polarstern in cooperation with the Alfred Wegener Institute for Polar and Marine Research as a continuation of work that was begun by Dr. Ali Graham and colleagues. PS133/2 sailed out of Punta Arenas, Chile to its study area near the sub-Antarctic island of South Georgia. Discussion will include the various scientific goals of PS133/2 along with some of the unique experiences that came along with sailing with an international scientific consortium.

POSTER 1:

Artificial reefs as management tools

T. M. Raetzel, C. D. Stallings, M. J. Shram, C. H. Ainsworth

Artificial reefs are attractive tools for fisheries management and reef conservation, and the West Florida Shelf is home to many. Artificial reefs may host larger fish biomass than natural reefs, attract fisheries-important species, and augment fisheries production. However, biodiversity may be lower on artificial reefs because they are less complex in structure, and so host a narrow range of ecological niches. Artificial reefs may be less vulnerable to environmental disturbances, such as harmful algal blooms. The potential benefits of using artificial reefs as management tools have motivated Gulf states to invest in deploying and monitoring artificial reefs. Here we use trophic ecosystem modeling (Ecopath with Ecosim) to investigate community structure and the diversity of functional roles in natural and artificial reefs. Diver-survey data collected seasonally over seven years near Tampa Bay were used to develop Ecopath models of artificial and natural reefs. These models were used to test responses to ecological disturbance using a realistic harmful algal-bloom time series as an example environmental stressor, and the influence of fishing. From model results, we postulate that a) the greater biodiversity on natural reefs affects the response to pulse disturbance including resiliency, and b) fishing leads to a long-term decrease in reef resiliency to environmental disturbance. This research will better inform the utility of artificial reefs as management tools and the degree to which artificial reefs replicate natural reef communities and processes.

POSTER 2:

Modeling the impact of circulation-driven dispersal patterns on juvenile Kemp's ridley feeding on the West Florida Shelf

Rebecca L Scott, Nathan Putman, Hallie C Repeta, Cameron H Ainsworth

Juvenile survival and subsequent recruitment acts as a bottleneck on the population size of many marine taxa. Understanding the mechanisms behind the survival in early life stages is critical to managing populations, particularly of endangered species. We combined an ICHTHYOP particle-tracing model simulating the dispersal of juvenile Kemp's ridley (Lepidochelys kempii) sea turtles across the Gulf of Mexico with an Atlantis ecosystem model to examine the spatial overlap of young turtles with their prey resources. We were particularly interested in whether oceanographic circulation patterns were driving successful dispersal of juveniles to settlement sites with adequate food availability. We identified both annual and seasonal patterns suggesting that mesoscale circulation features on the West Florida Shelf may impact whether juvenile turtles are able to reach inshore areas of high feeding opportunities during crucial periods. These circulation features are expected to change with warming ocean temperatures. Findings from this study hold implications for the management of endangered sea turtle populations in the Gulf, as well as other marine species with planktonic-stage larvae.

POSTER 3:

Quantifying wave error on SWOT sea surface height in the Southern Ocean
Jessica Caggiano, Don Chambers

The SWOT error budget for sea surface height measurements are predicated on a significant wave height (SWH) of 2 meters. Within this range, the surface wave error on the swath falls below the noise floor, and is assumed it can be ignored. However, there are many locations within the oceans where this SWH is an under-estimation. Specifically, within the Southern Ocean the SWH regularly varies between 4-8 meters, and often reaches 12 meters. The resulting regional under-estimation of modeled SWH may contaminate the signal returned by KaRIN especially after onboard processing. Ocean general circulation models (OGCM) often do not represent sea surface heights for wavelengths < 20 km, which is potentially observable by SWOT. To remedy this, we create our own sea surfaces which include sub-mesoscale energy and wave motions. We create our own sea surfaces using spectral techniques, creating two different surfaces that will then be added together. For generation of the sub-mesoscale surface we utilize a spectral extension method to continue the sea surface height spectra through the noise floor. To generate the wave surface, we utilize the various wave spectra that are representative of different ocean wave states, e.g. realistic to the Southern Ocean and in line with the current SWOT technical documentation. The sub-mesoscale and wave layers are then added together at high resolution (~5 km for sub-mesoscale, ~5 m for waves) and then sampled using a simplified point target response function and averaged into a 5 km x 5km swath that is identical to the OGCM sampled swath from the SWOT simulator. We then compare the spectra, kinetic energy, and statistics of the resulting swaths. We present here a quantification of wave error on SWOT sea surface height measurements.

POSTER 4:

A filter-feeder invertebrate chordate model to study the impact of plastics ingestion in the gut of animals

April Ellis, Larry Dishaw, Dr. Ojas Natarajan., Susanne Gibbony

Plastic pollution reflects major anthropomorphic influences spanning at most the past fifty years of the modern era. Microplastics (MPs) are defined as having a particle size of less than 5mm in diameter according to The National Oceanic and Atmospheric Administration (NOAA). MPs produced are primarily of three polymer types: polypropylene (PP), polyethylene (PE), and polyvinylchloride (PVC) (Andrady). Their influences can now be detected at every trophic level from primary producers to apex predators. Recent research efforts reveal overwhelmingly clear evidence that MP's can impact animal health either directly, e.g., chemistries that impact animal physiology, or indirectly, e.g., by influencing dietary choices. *Ciona robusta* is an ideal model organism to study the impact of plastics because they are filter-feeders that move a large volume of water across their tissues and concentrate dietary material, and they are genetically tractable and a very well-defined developmental system. In preliminary studies, I investigated ingestion and impact on lifespan by comparing polystyrene MPs of different sizes. Statistical analysis was performed using R studio to produce Kaplan Meier survival curves and chi-squared testing for independence revealed no significant difference in survival rates for the first conditions tested. However, these ongoing studies will include additional sized plastics of disparate chemistries and will also incorporate a focus on the impact of microplastics on development and immune maturation.

POSTER 5:

Seasonality of Aluminum on the West Florida Shelf
Naja Murphy, Lise Artigue, Kristen Buck

Aluminum and iron are considered elements of lithogenic origin as they are abundant in the earth's crust (third and fourth most abundant metals). Although these two metals have similar sources and abundances, their internal cycle in the ocean is very different. Iron is an essential micronutrient for marine organisms and is involved in redox reactions. Meanwhile, aluminum has no known biological function and does not participate in redox reactions making it a good tracer of lithogenic sources. At the surface, aluminum concentrations are mainly used to trace atmospheric dust inputs. My research aims to provide new insights into lithogenic sources of metals, such as iron, in the surface waters of the West Florida Shelf. To do this, I am measuring aluminum with a custom-built flow injection method that detects the fluorescence of the lumogallion-aluminum complex. My samples were collected in inshore-offshore transects on the West Florida Shelf during GoMeTS and NOAA-AOML survey cruises spanning from 2020 to 2022. My data will be the first measurements of dissolved aluminum on the shelf. I will interpret my results with air mass back trajectory modeling to elucidate the seasonal contributions of dust deposition versus anthropogenic and coastal sources to the shelf. Furthermore, using aluminum as a tracer for lithogenic iron on the shelf will also allow me to test the hypothesis that Saharan dust deposition in Florida's surface waters releases a significant amount of iron that nitrogen-fixing bacteria can use to make the bioavailable nitrogen needed by the red tide dinoflagellate Karenia brevis.

POSTER 6:

Influences on the Variability of Paralarval Cephalopod Beta-diversity in the Gulf of Mexico
Shannon Leah Riley, Glenn Zapfe, Steve Murawski, Heather Judkins

Cephalopods are an ecologically important and diverse group of organisms which utilize a range of habitats. The early life stages of cephalopods have been infrequently studied in the Gulf of Mexico; accordingly, while the paralarval cephalopod community is known to be variable, the drivers of this variability are not well understood. This study sought to explore whether season, location relative to the continental shelf, and depth of collection influence the beta-diversity (i.e., the taxa composition and abundance) of the paralarval cephalopod community in the Gulf of Mexico. Specimens were collected during three seasons in 2012 using a Multiple Opening and Closing Net and Environmental Sensing System. Cephalopods were identified to family level where possible. Family richness, Shannon diversity, and standardized family abundances were calculated for each sample and differences among variable levels were identified. Univariate measures of diversity showed that family richness only varied significantly between seasons while Shannon diversity did not vary significantly within any of the variables. Multivariate analysis of standardized family abundances showed a significant difference in beta-diversity at sites on the continental shelf vs. off the continental shelf and between samples collected at the shallowest depths and those collected at the deepest depths, but not between samples collected at more similar depths. Lastly, there was some evidence for differences in beta-diversity between seasons. These findings improve the understanding of paralarval cephalopod ecology in the Gulf of Mexico. Additionally, clarification of community variability allows for targeted sampling, particularly for species that may be commercially important.

POSTER 7:

Ocean Acidification in the Gulf of Mexico: a multi-decadal evaluation of pH and carbonate ion concentration

Macarena Martin-Mayor, Loraine Martell-Bonet, Juan Millán-Otoya, Robert Byrne

As anthropogenic CO_2 emissions continue to increase, the change in carbon parameters is clearly observable across the global oceans. Repeat ocean acidification (OA) surveys supported by NOAA, such as the Gulf of Mexico Ecosystems and Carbon Cycle (GOMECC) cruises, provide critical climate-grade carbonate chemistry datasets to monitor OA. Now, four GOMECC surveys conducted between 2007-2021 offer unparalleled insights into the natural and anthropogenic OA dynamics in both the coastal and open-Gulf water column. The third (2017) and fourth (2021) GOMECC surveys are presently the only Gulf-wide research missions that have collected CO_2 parameters, making the GOMECC datasets are uniquely suited to evaluate ongoing acidification in the Gulf of Mexico. Trends for measured pH are presented here for the full GOMECC time-series. A compilation of GOMECC-4 (2021) with the other cruise datasets show a continued progression of surface ocean acidification and an associated decline in $[CO_3^{2-}]$. The GOMECC datasets facilitate a multi-decadal examination of Gulf phenomena, such as extensive freshwater input from rivers in the northern region of the Gulf of Mexico, on carbonate chemistry dynamics. We present, for the first time, a comparison of previously collected GOMECC pH data to the most recent GOMECC-4 dataset (collected Fall 2021). These measurements help us to better understand the historical record OA in the Gulf of Mexico, which provides valuable information for predicting future acidification and implications for ocean ecosystems.