January 13th, 2017

34th Annual Graduate Student Symposium

UNIVERSITY OF SOUTH FLORIDA
COLLEGE OF MARINE SCIENCE

Book of Abstracts

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Poster Presentations

Graduate Student Symposium Schedule for Friday, January 13, 2017

9:15 am - 9:30 am	**Oral Session Welcome, Breakfast and Coffee Available** *MSL Conference Room; Breakfast and Coffee from Publix and Kahwa Coffee*		
9:30 am - 10:45 am	**Oral Session I (Breakfast and Coffee Available Throughout)** *MSL Conference Room*		
	Presentation Time	**Presenter**	**Abstract Title**
	9:30 am - 9:45 am	Ed Hughes	*Characterizing West Florida Shelf Reef Fish Communities Using Acoustics*
	9:45 am - 10:00 am	Susan Snyder	*Forming a Gulf-wide Dataset of PAH Exposure and Accumulation in Benthic-dependent Teleosts*
	10:00 am - 10:15 am	Kema Malki	*Exploring the Composition of Viral Communities within Florida's Freshwater Springs*
	10:15 am - 10:30 am	Julie Vecchio	*The "Carbon Bump" Phenomenon in Reef-fish eye Lens δ13C Signatures: An Indicator of Trophic Shifting?*
	10:30 am - 10:45 am	Kelly Vasbinder	*Ecosystem Modeling and Larval Dispersal*
10:45 am - 11:00 am	**Break**		
11:00 am - 12:15 pm	**Oral Session II** *MSL Conference Room*		
	Presentation Time	**Presenter**	**Abstract Title**
	11:00 am - 11:15 am	Katelyn Schockman	*Determination of Carbonate Dissociation Constants in Seawater Using Spectrophotometric pH*
	11:15 am - 11:30 am	Katie Bruder	*Uncovering Gokushoviruses in Florida's Freshwater Springs*
	11:30 am - 11:45 am	Justin Saarinen	*Western Lake Erie Restoration Assessment (WLERA): a Geodesign Framework to Measure Potential Restoration of Coastal Wetlands.*
	11:45 am - 12:00 am	Shannon Burns	*Characterizing Bioactive Trace Metal Uptake by Southern Ocean Phytoplankton*
	12:00 pm - 12:15 pm	Shuangling Chen	*Estimating Surface Salinity in the Northern Gulf of Mexico from Satellite Ocean Color Measurements*
12:15 pm - 12:30 pm	**Poster Session Welcome, Lunch Available** *FIO Conference Room; Lunch from The Campus Grind*		

12:30 pm - 1:40 pm	**Poster Session (Lunch Available Throughout)** *FIO Conference Room*		
	Judging Time	**Presenter**	**Abstract Title**
	12:30 pm - 12:40 pm	Adrienne Hollister	*Riding the Ferrous Wheel: Mapping Marine Iron Remineralization After a Phytoplankton Bloom*
	12:40 pm - 12:50 pm	Jonathan Peake	*A Meta-Analysis of Invasive Lionfish (Pterois volitans and Pterois miles) Feeding Ecology in the Temperate and Tropical Western Atlantic*
	12:50 pm - 1:00 pm	Jong Jin Lee	*Geochemical Change of Core KI-13-C1 in the Central Basin of the Ross Sea (Antarctica)*
	1:00 pm - 1:10 pm	Alyssa Andres	*Feeling the Burn: An Investigation of the Effects of Rising Temperature on Metabolic Scope in the Spiny dogfish, Squalus acanthias*
	1:10 pm - 1:20 pm	Gabriel A. Browning	*Characterization and Distribution of Humic-Like Iron-Binding Ligands in the Marine Environment*
	1:20 pm - 1:30 pm	Kara Vadman	*Holocene Variations in Modified Circumpolar Deep Water Presence near the Totten Glacier System, East Antarctica*
	1:30 pm - 1:40 pm	Benjamin Ross	*Observations of the Symbiont-bearing Foraminifer Amphistegina ibbosa Utilizing CellTracker Green and Epifluorescent Microscopy*
1:40 pm - 2:00 pm	**Break**		
2:00 pm - 3:30 pm	**Oral Session III** *MSL Conference Room*		
	Presentation Time	**Presenter**	**Abstract Title**
	2:00 pm - 2:15 pm	Meaghan E. Faletti	*Life Through the Eyes of a Hogfish: Investigating Movement of Hogfish (Lachnolaimus maximus) Using Eye-lens Stable Isotopes*
	2:15 pm - 2:30 pm	Jonathan D. Sharp	*The Effect of Observed Instrumental Dissimilarities on the Accuracy of Seawater Carbonate Ion Concentration Measurements*
	2:30 pm - 2:45 pm	Natalie Sawaya	*Assessing Diversity in the Florida Keys through Environmental DNA*
	2:45 pm - 3:00 pm	Christian Gfatter	*Utilizing Image Recognition Technology for Foraminiferal Assemblage Analyses*
	3:00 pm - 3:15 pm	Imogen Browne	*Little Ice Age conditions (~600-100 yr BP) and ocean warming over the past century, recorded on the western Antarctic Peninsula shelf*
	3:15 pm - 3:30 pm	Jordan Meyer	*Examination of the Depth of the Boundary Between the Atlantic Poleward Transport and North Atlantic Deep Water Equatorward Transport at 26.5°N*
3:30 pm - 4:00 pm	**Closing** *MSL Conference Room*		
4:30 pm & Beyond	**TGIF and Awards Announced** *MSL Student Lounge*		

Characterizing West Florida Shelf Reef Fish Communities Using Acoustics

Ed Hughes, Dr. David Naar, and Dr. Steve Murawski

A potential approach for performing rapid, broadscale assessments of fish in a reef ecosystem are the applications of active sonars that can survey the entire water column. Although such applications are still in their nascency, the approach is showing promising results. I propose to evaluate the efficacy and limitations of opportunistic acoustic surveys to characterize reef fish populations in various hard-bottom habitats on the West Florida Shelf.

The purpose of this research is to utilize scientific sonar technology (EK60 split beam echosounder) to characterize select West Florida Shelf reef fish communities in a rapid, fisheries-independent, fashion coupled with ground truth data obtained using underwater video in several different scenarios. This research will also be used to show where strengths and weaknesses are with these acoustic approaches.

For this presentation, I will give a brief overview of the EK-60 echosounder system and some of the data collected as part of the ongoing C-SCAMP research program led by Dr. Steve Murawski. I will discuss some of the advantages and challenges to employing acoustics in reef environments. I will also discuss some preliminary processing and results, including fish densities determined through echocounting and echointegration, along one of the transects surveyed in the Madison-Swanson MPA in April 2016.

Program Start Date: Spring 2013
Expected Graduation Date: Spring 2020
Degree: PhD
Field: Biological Oceanography
Advisor: Dr. David Naar

Forming a Gulf-wide dataset of PAH exposure and accumulation in benthic-dependent teleosts

Susan Snyder, Erin Pulster, Steve Murawski

Since 2011, longline surveys have sampled teleosts in the northeastern Gulf of Mexico in response to the Deepwater Horizon blowout. In 2015 and 2016, surveys were extended to the southern Gulf of Mexico to create a Gulf-wide dataset of polycyclic aromatic hydrocarbon (PAH) exposure and accumulation. Target species include benthic-dependent fishes, such as golden tilefish, king snake eel and red snapper. To date, a time series of 700 bile samples collected from 2011 to 2016, has been analyzed using high performance liquid chromatography with fluorescence detection to measure PAH metabolites as a short term biomarker of exposure to PAHs. Results indicate species-specific differences in exposure and decreases in metabolite concentration in the years following the Deepwater Horizon. Biliary PAH metabolite concentrations are higher in fishes sampled in the northeastern Gulf, compared to those sampled in Mexican waters. Analysis of parent PAHs and alkylated homologs is ongoing in liver samples. Preliminary results show a dominance of the low molecular weight PAHs, with low concentrations of high molecular weight and carcinogenic PAHs. These PAH measurements will be correlated with ongoing studies of additional biomarkers of exposure. Creating this gulf-wide dataset of PAH exposure and accumulation will provide baseline data on contamination and associated health effects as oil and gas activity continues to expand in the Gulf of Mexico.

Program Start Date: Fall 2012 (MS), Spring 2015 (PhD)
Expected Graduation Date: Spring 2019
Degree: PhD
Field: Marine Resource Assessment
Advisor: Dr. Steve Murawski

Exploring the Composition of Viral Communities within Florida's Freshwater Springs

Kema Malki, Katie Bruder, and Mya Breitbart

Viruses play a critical role in mediating biogeochemical processes by influencing bacterial community composition. In comparison to their marine counterparts, freshwater systems are understudied. Florida's freshwater springs support entire ecosystems containing multitudes of diverse as well as endemic species. They also represent the only visible portion of the Floridian Aquifer, which supplies most of the state's water. The proposed project focuses on exploring the viral communities in two of Florida's springs: Manatee and Blue Springs.

In order to ascertain the composition of the microbial and viral communities within the springs we propose to sequence their bacterial and viral metagenomes. Sequencing will be performed for three sites from the springs' outflow seasonally. The metagenomic studies will allow us to survey both microbial and viral diversity and seasonal variation within the springs, which we hypothesis to increase in sites downstream of the outflow. Epifluorescence microscopy will be used to determine bacterial and viral abundances, while quantitative transmission electron microscopy will also be utilized to morphologically characterize the viral communities. The proposed project will offer insight into the spatial and temporal variation of the springs' microbial and viral communities as well as an opportunity to compare marine and freshwater viral communities.

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2021
Degree: PhD
Field: Biological Oceanography
Advisor: Dr. Mya Breitbart

The "Carbon Bump" Phenomenon in Reef-fish eye Lens δ13C Signatures: An Indicator of Trophic Shifting?

Julie Vecchio, Ernst Peebles

Eye lenses of all vertebrates and some invertebrates are composed primarily of proteins called "crystallins." Since all proteins are high in both carbon and nitrogen and crystallins are conservative over time, the eye lens is an ideal candidate for recording stable isotopic histories throughout the lifespans of individuals. While investigating the eye lens $\delta^{13}C$ histories of several important reef-fish species on the West Florida Shelf, an unexpected phenomenon was observed, which was dubbed the "carbon bump." The carbon bump is a conspicuous increase and decrease in $\delta^{13}C$ that occurs during early life. We hypothesize that the carbon bump is an obligate part of the growth and development of some reef fish species, and that it represents a shift from pelagic prey to largely benthic prey, followed by a final shift to a combination of both benthic and pelagic prey. Here, we examine the ubiquity of the carbon bump phenomenon among reef-fish species and consider possible explanations for the feature.

Program Start Date: Fall 2015
Expected Graduation Date: Summer 2019
Degree: PhD
Field: Marine Resource Assessment
Advisor: Dr. Ernst Peebles

Ecosystem Modeling and Larval Dispersal

Kelly Vasbinder

The Gulf of Mexico (GoM) is an ecologically and economically important ecosystem supporting a large combined commercial and recreational industry in the U.S. Among the most important species supporting this fishing industry are those within the grouper-snapper complex; some of which are estimated to be overfished or have unknown status. This project will investigate better Marine Protected Area placement strategy for members of this essential fishery complex, via a study of source-sink dynamics throughout the GoM using a combination of statistical and ecosystem modeling techniques. This study seeks to improve upon current knowledge of larval transport trajectories by identifying vertical migration behaviors. A generalized additive model (GAM) is currently being built to predict depth distributions of larvae. The results will be used in conjunction with circulation data from the WFCOM hydrodynamic model to determine larval trajectories and source and sink areas. Simulations using the Atlantis ecosystem model will test the value of protecting source and sink populations using Marine Protected Areas.

Program Start Date: Fall 2015
Expected Graduation Date: Spring 2020
Degree: PhD
Field: Marine Resource Assessment
Advisor: Dr. Cameron Ainsworth

Determination of Carbonate Dissociation Constants in Seawater Using Spectrophotometric pH

Katelyn Schockman, Robert Byrne

The carbonate system in the ocean is characterized using four parameters: pH, total alkalinity, total dissolved inorganic carbon, and the fugacity of carbon dioxide. Following in situ measurement of two parameters, the other two can be calculated through thermodynamic relationships. Carbonate dissociation constants, necessary for the thermodynamic calculations, have large inherent errors that lead to significant errors in the calculated parameter values. The dissociation constants of carbonate, K_1 and K_2, quantitatively describe the relative concentrations of CO_2, HCO_3^-, and CO_3^{2-} in seawater. Values of K_1 and K_2 have been measured in previous studies and give errors of 2% and 5% respectively. The goal of this study is to improve measurements of these dissociation constants. To determine K_1 and K_2, spectrophotometric pH measurements are performed using the indicator meta-cresol purple. The ratio of the two absorbance maxima of the indicator are used to calculate pH. In the experimental procedure, the pH of a sample is brought asymptotically close to the equilibrium pH through additions of $NaHCO_3$. This is the pH at which another addition of $NaHCO_3$ leads to no changes in pH and is equal to $\frac{1}{2}(pK_1+pK_2)$. Values of K_1 from the literature will then be used to calculate new K_2 values. The improved values will be assessed by over-determination of the carbonate parameters with the goal of less error between in situ measurements and calculated values with the new dissociation constants.

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2019
Degree: MS
Field: Chemical Oceanography
Advisor: Dr. Robert Byrne

Uncovering Gokushoviruses in Florida's Freshwater Springs

Katie Bruder, Kema Malki, Mya Breitbart

Phages (viruses that infect bacteria) are the most numerous biological entities on Earth and are found anywhere that bacteria exist. Phages drive bacterial diversity and play major roles in structuring bacterial communities. They also have significant influence at a global scale through their role in the biogeochemical recycling of carbon and nutrients. Phages with double-stranded DNA (dsDNA) genomes represent the most abundant phage type in aquatic ecosystems; due to their numbers and biases that exist in current methods, most knowledge regarding phages relates to dsDNA phages. The resulting bias in our knowledge prevents us from fully understanding the contribution of all phages to microbial and ecological processes. The focus of my research is on single-stranded DNA (ssDNA) phages of the Gokushovirinae subfamily which have been identified in a wide variety of ecosystems, yet remain largely understudied. I will explore several aspects of the gokushovirus community in the freshwater springs Florida, including abundance, diversity, host range, and roles in ecosystem function. Using a combination of molecular techniques, culture methods, and microcosm experiments, I hope to gain a fuller picture of the gokushovirus community and its function in the springs. Ultimately, I hope to obtain a phage/host model system that can be assessed to explore specific aspects of the virology of gokushoviruses (e.g. morphology, burst size, growth rate, host range, decay rates, etc.).

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2021
Degree: PhD
Field: Biological Oceanography
Advisor: Dr. Mya Breitbart

Western Lake Erie Restoration Assessment (WLERA): a Geodesign Framework to Measure Potential Restoration of Coastal Wetlands.

Justin Saarinen, Kurt Kowalski

We used well-established conservation planning principles and techniques framed by geodesign to assess the restorability of areas that historically supported coastal wetlands along the U.S. shore of western Lake Erie. The resulting analysis supported planning efforts to identify, prioritize, and track wetland restoration opportunity and investment in the region. To accomplish this, we used available public data, criteria derived from regional managers and local stakeholders, and geospatial analysis to form an ecological model for spatial prioritization (Western Lake Erie Restoration Assessment (WLERA)). Within our 192,618 ha study area that was bounded by the mouths of the Detroit River, MI to the north and Black River, OH to the south, our model identified and prioritized 10,387 hectares of land most suitable for coastal wetland habitat restoration. Model results are available through an online geospatial mapping system (http://glcwra.wim.usgs.gov/wlera/) and will support additional user-driven analysis including spatial aggregations based on irregular boundaries, combining with other data for conservation planning, and modeling of ecosystem services associated with different restoration scenarios.

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2021
Degree: PhD
Field: Biological Oceanography
Advisor: Dr. Frank Muller-Karger

Characterizing Bioactive Trace Metal Uptake by Southern Ocean Phytoplankton

Shannon Burns, Dr. Kristen Buck

Iron concentrations limit Southern Ocean phytoplankton growth, and other bioactive trace metals also affect productivity. Global trace metal concentration demands for phytoplankton growth are ranked Fe ≈ Zn > Mn ≈ Ni ≈ Cu >> Co ≈ Cd, though trace metal cycling beyond iron (Fe) has been relatively understudied. I propose a baseline study of how the size-fractionated concentrations of these micronutrients evolve during shipboard phytoplankton incubations in the Southern Ocean from austral winter 2006 and spring 2016. To supplement the 2006 incubations, which had (a) unamended water and (b) +1 nM 57Fe additions in light and dark bottles, the 2016 incubations included (c) +4 nM 57Fe and (d) +10 nM 57Fe additions. Filters size-fractionated the samples into particulates (>3 µm), intermediate particles (0.4-3 µm), and the dissolved fraction (<0.4 µm). Trace metals will be extracted from the filters by leaching, and I will pre-concentrate the dissolved samples using the Nobias-chelate PA1 resin on a SeaFAST system. To measure metal concentrations, I will use a magnetic sector inductively coupled plasma mass spectrophotometer. I expect to see a general decrease in dissolved concentrations of selected trace metals. Additionally, I hypothesize that changes in concentrations will be significantly different between Fe-limited and Fe-enriched treatments. Understanding biogeochemical feedbacks is critical in order to predict the effects of future ecosystem pressures.

Program Start Date: Fall 2016
Expected Graduation Date: Fall 2018
Degree: MS
Field: Chemical Oceanography
Advisor: Dr. Kristen Buck

Estimating Surface Salinity in the Northern Gulf of Mexico from Satellite Ocean Color Measurements

Shuangling Chen, Chuanmin Hu

Sea surface salinity (SSS) is important to characterize physical and biogeochemical processes, yet its remote estimation in coastal waters has been difficult because satellite sensors designed to "measure" SSS lack sufficient resolution and high-resolution ocean color measurements suffer from optical complexity when used to estimate SSS. Here, this challenge in the northern Gulf of Mexico is addressed through modeling. Specifically, using extensive SSS datasets and MODIS and SeaWiFS estimated remote sensing reflectance (Rrs) at 412~670 nm and sea surface temperature (SST), a neural network-based SSS model has been developed and validated with a spatial resolution of ~1km. The model showed an overall performance of root mean square error (RMSE) = 1.225, coefficient of determination (R2) = 0.86, mean bias (MB) = 0.022, and mean ratio (MR) = 1.005 for SSS ranging between ~1 and ~37 (N=3640). Comparison with concurrent Aquarius-derived SSS maps (110-km resolution) showed good agreement in offshore waters but the new 1-km resolution SSS maps revealed more finer-scale features as well as salinity gradients in coastal waters. The sensitivity of the model to errors in SST and Rrs was also thoroughly examined, with uncertainties in the modeled SSS being always < 1 for SSS > 30. The extensive validation, evaluation, and sensitivity test all indicated the robustness of the model in estimating SSS in most, if not all, coastal waters and offshore plumes in the northern GOM.

Program Start Date: Fall 2013
Expected Graduation Date: Spring 2018
Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Chuanmin Hu

Life Through the Eyes of a Hogfish: Investigating Movement of Hogfish (Lachnolaimus maximus) Using Eye-lens Stable Isotopes

Meaghan E. Faletti, Christopher D. Stallings

Ontogenetic migrations of fishes can lead to depth-specific size distributions across habitats occupied during different life stages. Hogfish in the eastern Gulf of Mexico (eGOM) use seagrass beds as juveniles and reefs as adults. Offshore movement with age may explain why smaller Hogfish are found in shallow versus mid-shelf reefs. However, Hogfish are also highly sought by spearfishers, so most harvest activity occurs within SCUBA diving depth limits (30m). Thus, it is unknown whether the different size distributions are the result of ontogenetic migrations, intense spearfishing, or both. Our study uses recent advances in chemical ecology to address this issue.

We examine Hogfish movement using stable isotope analysis on eye lenses sampled across size and depth gradients. Stable isotope analysis on muscle and liver tissues has informed prior studies on fish movement. However, these tissues are limited to short, recent temporal periods. Recently, $\delta^{13}C$ and $\delta^{15}N$ values have been sampled from the laminae of fish eye lenses, which can serve as chronological recorders of isotopic values. Since background $\delta^{13}C$ and $\delta^{15}N$ change predictably in the eGOM, we can estimate the fish's previous locations using measured values from laminae, and recreate their movements. Improved knowledge about the timing of Hogfish migrations will help disentangle the relative influences of life history and fishing intensity on population dynamics and demographics in the eGOM.

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2018
Degree: MS
Field: Marine Resource Assessment
Advisor: Dr. Chris Stallings

The Effect of Observed Instrumental Dissimilarities on the Accuracy of Seawater Carbonate Ion Concentration Measurements

Jonathan D. Sharp, Robert H. Byrne, Xuewu Liu

The marine CO_2 system has historically been examined through direct determination of at least two of four measurable parameters—pH, total alkalinity, dissolved inorganic carbon, and CO_2 partial pressure—and subsequent calculation of additional parameters. Recently, direct spectrophotometric determination of carbonate ion concentration has added a fifth measurable parameter. Carbonate ion concentration is particularly important in marine systems as it plays a role in biological calcification and dissolution processes.

At typical seawater pH, the major lead species present in marine systems are $PbCO_3$ and Pb(II) chloride complexes. These species show distinct absorbance spectra in the ultraviolet. Consequently, with knowledge of chloride concentration (from salinity) and an appropriate model, carbonate ion concentrations can be determined from absorbance ratios in the ultraviolet spectrum.

However, a significant bias has recently been recognized between absorbance measurements performed using different spectrophotometers. This bias results in measured carbonate ion concentrations that, while retaining the expected precision, can be inaccurate by as much as ~10% depending on the wavelength accuracy of a particular instrument. Correcting for this bias will be a critical step for all future spectrophotometric measurements of carbonate ion concentration. Applying a correction is also feasible for re-analysis of past datasets for which the appropriate information has been archived.

Program Start Date: Fall 2015
Expected Graduation Date: Spring 2020
Degree: PhD
Field: Chemical Oceanography
Advisor: Dr. Robert Byrne

Assessing Diversity in the Florida Keys through Environmental DNA

Natalie Sawaya, Dr. Anni Djurhuus, Dr. Mya Breitbart

Environmental DNA (eDNA) is the DNA left behind by organisms in the water through shedding of cells, scales, mucus, and fecal matter. Sequencing eDNA present in a single water sample can reveal the species composition of an entire ecosystem at a higher resolution than visual surveys alone, which is useful for determining the health and understanding the dynamics of that ecosystem. The Marine Biodiversity Observation Network (MBON) aims to analyze eDNA at various marine sanctuaries, including the Florida Keys National Marine Sanctuary (FKNMS), with the goal of providing a more complete picture of the diversity across trophic levels. Samples have been collected at various stations within the FKNMS on a seasonal basis and two different molecular markers (COI and 18S rDNA) have been tested to analyze the diversity of eukaryotes in the Keys. Our preliminary results show that both marker genes are useful for capturing diversity in the Keys and that metabarcoding of eDNA can provide sanctuary managers with critical information about biodiversity.

Program Start Date: Fall 2015
Expected Graduation Date: Spring 2020
Degree: PhD
Field: Biological Oceanography
Advisor: Dr. Mya Breitbart

Utilizing Image Recognition Technology for Foraminiferal Assemblage Analyses

Christian Gfatter

Analyses of foraminiferal assemblages involve long hours of repetitive microscopic assessment of sediment samples. Image recognition software is widely used in contexts where it systematically matches features within sample images against an image library. Most oceanographic applications utilize flow through systems in which samples are suspended in water or similar liquid and pass through a beam of light where the images are captured. One issue for sediment analyses is finding an appropriate liquid matrix. Also, flow-through systems are mainly designed to use transmitted versus reflected light. Identification of foraminifera generally utilizes reflected light, as most shells are relatively opaque. My strategy is to directly image samples using reflected light, and then apply recognition software to the images. A library of high quality digital images to be utilized by the identification software can be developed by photographing foraminifera identified conventionally from samples of interest. Sediment samples from the west Florida shelf are being used to develop a reference set of images for assemblage analyses. Recognition software will then be trained to automate assemblage counts and results will be compared to those from traditional picks and counts. Other advantages include the ability to collect quantitative data such as diameter, allowing size frequency assessments of foraminiferal populations while automating grain size analyses without requiring separate processing.

Program Start Date: Fall 2014
Expected Graduation Date: Summer 2017
Degree: MS
Field: Geological Oceanography
Advisor: Dr. Pamela Hallock Muller

Little Ice Age conditions (~600-100 yr BP) and ocean warming over the past century, recorded on the western Antarctic Peninsula shelf

Imogen Browne, Amelia Shevenell, Patrick Schwing, Amy Leventer, Meghan Duffy, Brad Rosenheim

The western Antarctic Peninsula (WAP) is undergoing rapid atmospheric and oceanic warming, linked to accelerated loss of ice sheets via the surface and basal melting of ice shelves. Ocean warming along the WAP is associated with increased wind-driven upwelling of warm (~2°C) nutrient-rich Circumpolar Deep Water (CDW), related to a southward migration and/or strengthening of the Southern Hemisphere Westerlies with increasing atmospheric pCO2. A previous upper ocean temperature reconstruction from Ocean Drilling Program Site 1098 using the Tetra Ether indeX of 86 carbon atoms (TEX86; based on an empirical relationship between the ratio of archaeal lipids and upper ocean temperature) does not include the past 200 years of ocean temperature change. Here we present TEX86 and diatom assemblage data from a new sedimentary record with an intact sediment-water interface, recovered from Site 1098 (LMG1311 JKC1; 64°S, 64°W), and use new 210Pb and existing 14C data to establish a chronology. Our decadal to centennial resolution TEX86 record demonstrates cool upper ocean temperatures (-1.8-2°C) and/or decreased nutrient supply during the Little Ice Age (LIA; ~600-100 yr BP), indicating decreased influence of CDW. LIA conditions at Site 1098 are in phase with cooling in East Antarctica and the Northern Hemisphere, and out of phase with the eastern Antarctic Peninsula. Our record also shows a 5°C warming over the past century, consistent with instrumental temperature and ice core records.

Program Start Date: Fall 2015
Expected Graduation Date: Fall 2020
Degree: PhD
Field: Geological Oceanography
Advisor: Dr. Amelia Shevenell

Examination of the Depth of the Boundary Between the Atlantic Poleward Transport and North Atlantic Deep Water Equatorward Transport at 26.5°N

Jordan Meyer

We are investigating the depth of zero velocity where Atlantic currents transition from the poleward transport characteristic of the Gulf Stream to the equatorward transport of the North Atlantic Deep Water. We are using meridional velocity data from the high resolution Estimating the Circulation and Climate of the Ocean 2 (ECCO2) state estimate run at Jet Propulsion Laboratory to look at the velocity-depth profiles at five locations selected along the 26.5°N latitudinal transect. Profiles from 1992 to 2015 were considered and were averaged monthly. Velocities were linearly interpolated to determine the depth of zero meridional velocity at which the currents transition between significant poleward transport to significant equatorward transport.

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2022
Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Don Chambers

Riding the Ferrous Wheel: Mapping Marine Iron Remineralization After a Phytoplankton Bloom

Adrienne Hollister

Phytoplankton are a vital part of the ocean food web and global environment, and are responsible for roughly half of our planet's photosynthetic carbon fixation. Iron is a critical growth-limiting element for phytoplankton in roughly 40% of the surface ocean. Correspondingly, the processes that govern iron concentration distribution are exceedingly important for understanding and modeling marine ecosystems. However, compared to the relatively well-studied process of nitrogen remineralization, the timing and speciation of iron remineralization remains largely unknown. Iron chemistry complex- free iron can be present as Fe(II), which quickly oxidizes, or Fe(III), which is poorly soluble. Iron binding ligands can further impact its solubility. My proposed study will track the release of iron and other trace metals (Zn, Cu, Mn, Co, Ni, and Cd), during the death of a phytoplankton bloom. I will simulate the natural process of remineralization by obtaining oligotrophic water from the Gulf of Mexico, spiking with iron and nutrients to induce a phytoplankton bloom, and terminating the bloom by removing light. I will study both natural mixed populations and inoculations of known monocultures, in order to compare species-specific differences. As the phytoplankton die, I will use flow injection analysis to measure dissolved iron as Fe(II) and Fe(III) over ~6 months. I will also monitor iron speciation, chlorophyll, macronutrients (N, P, Si), and the other trace metals. By studying iron remineralization in a controlled environment, my experiments will provide insight into the timing and chemistry of this crucial process.

Program Start Date: Fall 2016
Expected Graduation Date: Fall 2018
Degree: MS
Field: Chemical Oceanography
Advisor: Dr. Kristen Buck

A Meta-Analysis of Invasive Lionfish (Pterois volitans and Pterois miles) Feeding Ecology in the Temperate and Tropical Western Atlantic

Jonathan Peake, Alex Bogdanoff, Craig Layman, Bernard Castillo, Jennifer Chapman, Kristen Dahl, Corey Eddy, Meaghan Faletti , Nicholas Higgs, Michelle Johnston, Roldan C. Munoz, Vera Sandel, Juan Carlos Villasenor-Derbez, and James A. Morris, Jr.

Invasive lionfish (Pterois volitans/miles) have become one of the most abundant top level reef predators in the temperate and tropical western Atlantic. The impact of their invasion is not yet fully understood, but current research efforts are documenting their ecological and economic impacts through lionfish diet studies. The goal of this study was to use a meta-analysis approach to characterize and compare lionfish feeding ecology throughout the invaded range. Lionfish diet data was obtained from eight published and six unpublished datasets. A total of 5,874 stomachs containing prey were found to contain 17,365 total prey items representing 158 unique species belonging to 61 families. Fish and shrimp made up the clear majority of lionfish diet across the region. Lionfish diet shifted from primarily shrimp to primarily fish with increasing lionfish size. Several prey items of high importance in lionfish diet represent species of high commercial and ecological importance. Distinct locational differences were found in prey composition, prey size, and lionfish size.

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2021
Degree: PhD
Field: Marine Research Assessment
Advisor: Dr. Chris Stallings

Geochemical Change of Core KI-13-C1 in the Central Basin of the Ross Sea (Antarctica)

Jong Jin Lee, Boo-Keun Khim, Ester Colizza, Sunghan Kim, Jong Kuk Hong, Kyu Cheul Yoo, Heung Soo Moon, Sung Ho Kang

Biogenic opal and Calcium Carbonate ($CaCO_3$) contents were measured for a 3.26-m long gravity core KI-13-C1 (71°52.0'S, 179°30.3'E, 2246 m water depth) collected during ANA03B Cruise in 2013 to reconstruct paleoenvironmental change in association with the stability of the East Antarctic Ice Sheet (EAIS) during the late Quaternary. Biogenic silica concentration was measured by the wet-alkaline extraction method modified from DeMaster (1981) and the biogenic opal content was calculated by multiplying the biogenic silica concentration by 2.4 (Mortlock and Froelich, 1989). Total inorganic carbon (TIC) was measured by UIC CO_2 Coulometer (Model CM5014), and $CaCO_3$ content was calculated by multiplying TIC content by 8.333. Biogenic opal content varies from 2.3% to 36.3% with an average of 13.6% and $CaCO_3$ content changes from 0.3% to 2.5% with an average of 0.8%. Biogenic opal and $CaCO_3$ contents are consistently low in the upper 2 m of the core, whereas both contents are high in the lower part. This transition depth (at about 2.5 m) coincides with the change of magnetic polarity. An interval of increased biogenic opal and $CaCO_3$ contents is likely to indicate the paleoceanographic and paleoclimatic change toward the cool and less productive conditions in the Central Basin of the Ross Sea.

Program Start Date: Fall 2016
Expected Graduation Date: Spring 2018
Degree: MS
Field: Geological Oceanography
Advisor: Dr. Eugene Domack

Feeling the Burn: An Investigation of the Effects of Rising Temperature on Metabolic Scope in the Spiny dogfish, *Squalus acanthias*

Alyssa Andres, Brad Seibel

On the US Northeast Shelf, sea surface temperature rises significantly faster than that of the global moving average. Fisheries surveys indicate a shift in species assemblages and productivity of many marine organisms, including *Squalus acanthias* (the spiny dogfish). The spiny dogfish is one of the most commercially important species on the Northeast coast and serves an important role as intermediate prey and predator within the ecosystem. Effective management of dogfish populations requires an ability to predict their spatial and temporal responses to climate change. Yet, existing models do not take into account time lags between changes in habitat and organisms responses, struggle with accuracy where habitat gradients are steep, and are limited in predicting changes in the face of future environmental states. Recent studies suggest that the balance between metabolic oxygen demand and supply plays an important role in limiting species distributions. Thus, metabolic measurements may provide necessary fine-tuning of distribution model predictions. As ectotherms, the metabolism of these sharks is highly dependent on ambient temperature. Here we measured metabolic scope, defined as the difference between basal and maximum sustained metabolism. This scope provides an indication of the metabolic energy available for all activities of an animal, such as growth, reproduction and foraging. In ectotherms, this scope becomes limited at high temperatures. Using temperature controlled respirometry, we can determine the temperatures at which metabolic scope becomes limited. The results from this study will serve to inform future models to provide more flexible and accurate predictions of species distribution in the face of climate change.

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Field: Biological Oceanography
Advisor: Dr. Brad Seibel

Characterization and Distribution of Humic-Like Iron-Binding Ligands in the Marine Environment

Gabriel A. Browning, Kristen Buck

Iron is an essential micronutrient for phytoplankton, though roughly 30% of the open oceans' surface is growth limited by a lack of iron. Due to iron's poor solubility organic ligands that complex iron are largely responsible for iron remaining dissolved in the water column. This work will focus on the prevalence of humic-like substances (HS) as iron-binding ligands in the oceans. A comprehensive approach will be taken to compare HS and exopolysaccharides (EPS), both of which form electroactive complexes with iron and can be directly detected through voltammetric methods. Building upon prior work by Laglera and van den Berg on HS and by Hassler et al on EPS, model ligands for these substances will be tested using competitive ligand exchange-adsorptive cathodic stripping voltammetry (CLE-AdCSV) with salicylaldoxime as the added ligand. In addition, multiple analytical windows will be used by varying the amount of added ligand to achieve a more thorough comparison. Standardization of these techniques will provide a robust method to distinguish between HS and EPS in natural samples and give insight into the shoulder peaks that have been attributed to these two ligand types during routine CLE-AdCSV trials. These methods will be applied to archived field samples from four ocean basins (Eastern Pacific, North Atlantic, Drake Passage, and Gulf of Mexico) in order to cross-reference and resolve the distribution and contribution of HS to the pool of iron-binding ligands in the oceans.

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Holocene Variations in Modified Circumpolar Deep Water Presence near the Totten Glacier System, East Antarctica

Kara Vadman, Amelia Shevenell, Amy Leventer, Brad Rosenheim, Bruce Huber, Alejandro Orsi, Sean Gulick

The Totten Glacier (TG) system is the gateway to the marine-based Aurora Subglacial Basin, drains 1/8 of the East Antarctic Ice Sheet, and is losing mass. In 2014, warm modified Circumpolar Deep Water (mCDW) was observed over a region of the continental shelf with access to the TG grounding line, so ocean-cryosphere interactions may be important in the stability of this outlet system. Here we integrate oceanographic data with foraminifer and diatom assemblages and foram stable isotopes from sediments collected proximal to TG to calibrate paleoceanographic proxies. We then reconstruct Holocene oceanographic changes in a laminated diatom ooze and mud sequence with well-preserved forams, most abundant in modern and mid-Holocene sediments. We constrain chronology with $CaCO_3$/Ramped PyrOx-based AMS ^{14}C dates. Modern benthic foram assemblages suggest nutrient-rich bottom conditions influenced by mCDW. Similar benthic and planktic $\delta^{18}O$ values and increased ACC-associated diatoms in recent sediments suggest a well-mixed water column influenced by offshore water masses. Down core, fossil benthic foram assemblages suggest lower nutrient availability and/or increased bottom current activity in the past. Benthic and planktic stable isotope offsets and high % of mat-forming diatoms indicate mid-Holocene water column stratification. Preliminary data suggest oceanographic changes during the Holocene and a recent increase in mCDW influence on the outlet of the Aurora Subglacial Basin.

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Observations of the Symbiont-bearing Foraminifer Amphistegina ibbosa Utilizing CellTracker Green and Epifluorescent Microscopy

Benjamin Ross

The use of fluorescent microscopy and fluorescent probes, such as the metabolically activated probe CellTracker Green CMFDA (CTG) or the calcite marker Calcein, has become more common in work involving living foraminifera. CTG is especially useful in determining the vitality of foraminifers collected in situ compared to the more traditional Rose Bengal due to the requirement of metabolic activity in producing fluorescence. This metabolic requirement, as well as the relatively quick production of the fluorescent reaction products, makes CTG a prime candidate for determining mortality in laboratory experiments. Work with the symbiont bearing foraminifer Amphistegina gibbosa has shown that the species is capable of surviving both acute chemical exposure and extended periods of total darkness by entering a low-activity dormant state. The use of CTG and fluorescent microscopy may help speed the determination of mortality in such experiments, but is complicated by the autofluorescence of the diatom symbionts. Here we present methods adapting fluorescence microscopy for use with symbiont-bearing foraminifera, as well as observations on CTG fluorescence and autofluorescence in A. gibbosa following both chemical exposure and periods of total darkness.

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Advisor: Dr. Pamela Hallock Muller

Refugia for Carbonate Producing Organisms in High Carbon Dioxide Environmental Conditions

Christian Gfatter

An interesting paleontological phenomenon following mass extinction events is the reappearance at a later time of a fossilizable taxon thought to have suffered extinction, but in fact survived for an extended period of time without leaving a fossil record. Several studies of larger benthic foraminifera (LBFs) that host algal symbionts have provided evidence for how some fossil taxa, sometimes referred to as "Lazarus" taxa, may have survived ocean acidification (OA) events. One study demonstrated that several species were able to live in low pH conditions in which their shells had no preservation potential. Another showed that some LBF species can tolerate much lower salinities than previously reported. Key to both observations appears to be very high carbonate alkalinity and high rates of photosynthesis. The LBFs can live and calcify under such conditions, although their shells have little or no preservation potential. Sediment samples from the Florida Springs Coast, a region with limestone substrata and freshwater input from carbonate aquifers, were used to assess the range of Archaias angulatus, an LBF species more commonly associated with normal marine to slightly hypersaline environmental conditions. Extinctions of LBFs by the end of the century have been predicted due to OA, but other aspects of water chemistry, such as alkalinity influenced by the underlying substrata, may provide habitable conditions that serve as refugia until more favorable conditions return.

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