



**UNIVERSITY OF  
SOUTH FLORIDA**  
College of MARINE SCIENCE



# **ANNUAL REPORT**

January 1 – December 31, 2019

Submitted by: Dean Jacqueline E. Dixon

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## The View from the Bridge



This is the last edition of the *View from the Bridge* that I will write as Dean. I will step down on June 30, 2020 and start a sabbatical to reinvigorate my research. The year 2019 has been a dynamic one, filled with both uncertainties and opportunities emerging from the University consolidation and a new president at the USF helm. As of this writing (mid-March 2020) we also find ourselves in uncharted waters with the emergence of the Covid-19 pandemic. USF has responded quickly and effectively, recalling students studying abroad, restricting travel, transitioning to online delivery of classes, and ultimately calling for those able to work from home to do so. We are fortunate in that most of what we do can be done remotely. As long as the internet is working, we can deliver classes, interact with our graduate students and colleagues, write and review papers and proposals, and continue to move this great university forward.

I am proud of how our CMS community has risen to the challenge. For example, Dr. Mya Breitbart, our resident virus expert, is leading the way to round up spare medical supplies such as gloves, masks, and gowns, to donate to local hospitals. There will be unforeseen challenges ahead but I'm confident that the College of Marine Science (CMS), USF, and our community will come through this crisis stronger than ever.

Despite the current challenges, we have a great deal to celebrate as we reflect on 2019. Our greatest strength lies in our ability to bring together marine biologists, chemists, geologists, and physicists to solve the challenges of the deep. Our faculty have cross-disciplinary expertise in how to monitor and manage healthy ecosystems; ocean observation and modeling; climate change in the past, present, and future; development of new sensing technologies; and ocean-human interactions. I'm excited to see how the next CMS Dean will leverage these assets for growth. While our Dean search has been delayed due to the pandemic, here are a few successes from our 2019 dossier that I know will serve the next Dean well.

- In 2019, CMS faculty, staff, and students continued their outstanding levels of scholarly productivity. Faculty, staff, and students published 130 peer-reviewed articles along with three books, 47 book chapters, and 12 other scholarly products. Our total research expenditures are ~\$14.1 M, with ~\$11.5 M in direct research expenditures and ~\$2.6 M in indirect cost recovery.

# THE VIEW FROM THE BRIDGE

- We've made great strides in improving the visibility of our science in a more strategic manner than ever before (under the leadership of Kristen Kusek), and of course these efforts only succeed if our research stories are compelling. One of the greatest highlights of our year was the discovery by Dr. Chuanmin Hu and his student Dr. Mengqui Wang of the "Great Atlantic Sargassum Belt." Since 2011, this belt has stretched from the west coast of Africa to Florida's coast. Its discovery was included in the "Top 50" discoveries of 2019 by *Discover* magazine and was covered by more than 500 news outlets worldwide, including a spot on the morning NBC "Today Show" that has more than 13 million viewers. Dr. Wang also received the 2019 USF Outstanding Dissertation Award for this work.
- Another highly visible program is the Center for Integrated Modeling and Analysis of Gulf Ecosystems (C-IMAGE). For the last decade, CMS has been the lead institution of this global research consortium involving 17 institutions in 5 countries to evaluate the long-term impact of the 2010 Deepwater Horizon oil spill on the Gulf of Mexico ecosystem. With Dr. Steve Murawski as Principal Investigator and Dr. David Hollander as Chief Scientist, a total of 12 faculty, 35 graduate students, and 20 post-docs and research staff at CMS have contributed to the effort. As the Gulf of Mexico Research Initiative funding for this program comes to an end, the C-IMAGE team is hard at work synthesizing results. The program has brought in over \$36 million, published 139 papers and two major books in 2019, unearthed technological and academic discoveries, and identified priorities that will be critical to future oil spill response efforts.
- We welcomed two new faculty members in 2019: Drs. Alistair Graham and Nancy Williams. Dr. Graham, an internationally recognized sedimentologist and geophysicist, studies the link between ice sheets and the geological record and spent several months in 2020 in Antarctica studying the Thwaites glacier (also called the "Doomsday glacier" because its demise will impact global sea level rise). Dr. Williams studies the ocean's role in the global carbon cycle using a variety of cutting-edge tools such as autonomous platforms equipped with biogeochemical sensors that allow us to remotely keep our finger on the pulse of even the most remote stretches of the ocean.
- The Graduate Program, led by David Naar, with invaluable assistance by Sami Francis and Ana Arellano, has continued to improve the curriculum and mentoring, to deliver professional development workshops, and to involve more undergraduates in teaching and research. A new NSF-funded REU (Research Experiences for Undergraduates) was launched and run by Ana Arellano within the labs of Drs. Conway, Dishaw, Liang, Rosenheim, and Shevenell. 2019 was a banner year for external and internal funding obtained by students, totaling over \$662,000, which is in addition to the graduate student support provided by external faculty research grants.
- We have submitted a preliminary plan to establish a cross-departmental Center for Coastal Resiliency (CORE) at USF, one that joins >50 experts from departments and colleges across three different campuses representing the disciplines of hazard assessment (e.g., coastal flooding, water quality), mitigation and adaptation (e.g., port sustainability, resilient infrastructure), and

# THE VIEW FROM THE BRIDGE

public policies and programs (e.g., modeling socio-technical change from sea level rise). I hope the Center might play a role in a new Center of Excellence in oceanography and environmental science that is being developed in St. Petersburg as part of the University consolidation plans.

As I look forward, I anticipate that the next decade will bring an increased focus on climate change. Florida is ground zero for climate change and a kaleidoscope of natural hazards such as sea-level rise and hurricanes that threaten its future. Recent studies rank Florida as the number 1 state for costs of climate change. The latest special report from the Intergovernmental Panel on Climate Change (IPCC) sounds the alarm for how the oceans and frozen regions of the planet are changing in response to the rising carbon dioxide levels in the atmosphere. While the oceans become more acidic and warm, less oxygen dissolves in seawater. The upper layers of the world's seas have lost 1-3% of their oxygen in recent years. Fish populations are migrating in response to these changes and fish catches could decline by as much as a quarter relative to average levels between 1986 and 2005. Melting glaciers and ice sheets are causing sea levels to rise, increasing the risk to hundreds of millions of people living in coastal areas.

There is good news amidst these alarming headlines - CMS is well prepared to meet these challenges. The research of every faculty member at CMS bears on understanding climate change in some way. We have a lot to be proud of at CMS, and we are prepared to face an uncertain future with academic prowess backed by a strong community of administration and staff members.

On the staff front we were deeply saddened last year in losing two longstanding members of CMS: Anita Thompson and Chris Schwint. Anita, our unit sponsored programs administrator, lost a long battle with cancer, and Chris, our budget director, died unexpectedly of a heart condition. Monica Dufault has stepped up as budget director, and we also welcomed Traci Aquara from Ohio State University to serve as our sponsored programs administrator. In addition, we welcomed Laurie Scott as our new Director of Development (Dr. Howard Rutherford is now Senior Director of Development in USF's Office of Planned Giving) and Renate Jurden joined us as Executive Administrative Specialist shortly after Linda Kelbaugh retired in 2019.

At the end of 2019 we also suffered the loss of Anne Von Rosenstiel, who with her late husband Werner, was a pillar of support for USF and the College of Marine Science. For more than three decades, Anne provided enthusiastic support for our graduate students. The Von Rosenstiel Fellowship in Marine Science has significantly advanced our graduate program, allowing us to attract the best and the brightest students internationally. Anne's support for our Bridge to the Doctorate Endowed Graduate Fellowship helps us recruit and mentor under-represented minority students. She also empowered us to offer the Oceanography Camp for Girls (OCG) at no cost for participants, helped transform Bayboro Harbor from what was once St. Petersburg's eyesore to what has become its crown jewel, and so much more. We are so humbled to have had Anne as part of the USF family and will miss her deeply. Her legacy, along with Werner's, will continue in perpetuity at USF and CMS.

It has been my great privilege to serve as the Dean of the College of Marine Science for the past nine years. I wish you all continued success and smooth sailing in the years ahead.

## College of Marine Science Leadership Team

### **JACQUELINE DIXON**

**Dean, College of Marine Science**

**PhD, California Institute of Technology, 1992**

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Dr. Jacqueline Dixon is Dean of the College of Marine Science and Professor in Geological Oceanography. She received her bachelor's and master's degrees in geology from Stanford University in 1981 and 1983, respectively, and her PhD in geochemistry from the California Institute of Technology in 1992. From 1992 through 2010, Dr. Dixon was at the University of Miami, where she served as Director of the Abess Center for Ecosystem Science and Policy's Undergraduate Program, Senior Associate Dean for the Life and Physical Sciences, and Interim Dean of the College of Arts and Sciences. She received an Early Career Development award from the National Science Foundation for excellence in research and education, and is internationally recognized for her research on submarine volcanoes and the role of volatiles in magmatic processes. In 2015, Dr. Dixon was elected Fellow of the American Association for the Advancement of Science. Dr. Dixon served as Chair of the Executive Board of the Consortium for Ocean Leadership from 2015 through 2019 and is a member of the NOAA Ocean Exploration Federal Advisory Board.

### **GARY MITCHUM**

**Associate Dean, College of Marine Science**

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Dr. Mitchum is the Associate Dean and Professor of Physical Oceanography. After receiving his PhD from the Department of Oceanography at the Florida State University in 1985, he spent 11 years in the Department of Oceanography at the University of Hawaii, first as a postdoctoral researcher and then as a member of the research faculty and as the Director of the University of Hawaii Sea Level Center. He came to the University of South Florida in 1996. His research interests emphasize short-term climate changes, ranging from interannual variations such as ENSO, to decadal processes, to the problem of long-term sea-level rise. He has also done work on continental shelf dynamics, mesoscale eddy interactions with mean flows, internal tide generation and propagation, physical controls on fisheries variables, and storminess changes in the southeastern United States. He is especially interested in analyses of tide gauge and satellite altimetric data, and notably proposed and developed the presently accepted method of estimating temporal drift in altimeters via comparisons with the global tide-gauge network. Mitchum serves on numerous local, national, and international committees, most notably he serves as Chair of the Global Sea Level Observing System (GLOSS) Group of Experts and is President of the IUGG/IAPSO Commission on Mean Sea Level and Tides.

# COLLEGE OF MARINE SCIENCE LEADERSHIP TEAM

## **DAVID NAAR**

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**PhD, Scripps Institution of Oceanography, UCSD, 1990**

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Dr. Naar is the Associate Dean of Academic Affairs and Associate Professor in Geological Oceanography. He has overseen the graduate academic program and graduate student matters since 2012. He received his bachelor's degree in Geology with an emphasis in Geophysics from University of California, Santa Barbara in 1982, and his PhD in Earth Sciences from Scripps Institution of Oceanography, at the University of California, San Diego in 1990. Dr. Naar started as an assistant professor at the University of South Florida's Department/College of Marine Science in 1990. In 1996, he became an associate professor at USF and subsequently the co-director of the Center of Coastal Ocean Mapping at USF. His research interests are on microplate tectonics, propagating rifts, plate motions, seamount chains, and seafloor mapping from deep ocean trenches to the shoreline, including mapping several marine protected areas from American Samoa to Florida. Dr. Naar has served on several panels and working groups for the National Science Foundation, Ocean Observatory Initiative, and Ocean Drilling programs, and on the United States Scientific Advisory Committee.

## **MONICA DUFAULT**

**Budget Director, College of Marine Science**

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Ms. Monica Dufault Leake is the Budget Director for the College of Marine Science. She received her Master's degrees in Research Administration and Nonprofit Management from the University of Central Florida. She began her career in higher education and research administration at the University of Central Florida from 2000-2007 before relocating to Baltimore to work at Johns Hopkins University from 2007-2011. Dufault returned to Florida in 2011 to join the College of Marine Science as the Manager of Business and Fiscal Administration.

## **TIM TROWBRIDGE**

**Unit HR Administrator, College of Marine Science**

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Mr. Tim Trowbridge is the Unit HR Administrator for the College of Marine Science. He received his bachelor's degree in business management and minor in leadership studies from the University of South Florida in 2008. Since that time, he has been employed by the University of South Florida serving as the Unit HR Coordinator for the Student Affairs Shared Services Center from 2009-2011 and in the College of Marine Science from 2011-2012. In May 2012, Trowbridge was promoted to Unit HR Administrator and continues to serve in this role. He earned his Professional in Human

# COLLEGE OF MARINE SCIENCE LEADERSHIP TEAM

Resources (PHR) certification in December 2013 and earned Certified Research Administrator (CRA-USF/basic) designation in August 2015.

## **JOSEPH DONNELLY**

**Facilities Project Manager, College of Marine Science**  
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Mr. Donnelly is the Facilities Project Manager for the College of Marine Science. He received his bachelor's degree in marine biology from the University of West Florida in 1980 and master's degree in marine science from USF in 1986. From 1985 through 2006, he was an assistant/associate in research at CMS working with Dr. José Torres studying the biology and ecology of midwater fish and invertebrates. From 1988 to 1997 he also worked as an adjunct instructor in Earth Science and Oceanography at St. Petersburg Junior College (now St. Petersburg College). After recovering from a serious work-related accident in 2006, he took on the newly-created position of CMS Facilities Manager in 2008. Donnelly currently serves on several CMS committees (Space, Safety, and Computer) and is also a member of the USFSP campus EMT, which deals with all matters relating to the USFSP Campus Emergency Management Plan (CEMP).

## **KRISTEN KUSEK**

**Director of Strategic Communications**  
**MS, MA, University of South Florida, 1998**  
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Ms. Kusek was promoted from Strategic Communication Strategist to Director of Science Communications in 2019. Her primary job is to lead the communications strategy for the College. She is also spearheading the newest education outreach STEAM program in the CMS portfolio, a partnership with Boys & Girls Clubs of the Suncoast that is focused on coastal resiliency. The first to earn dual master's degrees in marine science and journalism/mass communications from USF, Kusek brings to her cross-functional role more than 20 years of experience working on all sides of the ever-evolving science communications landscape. Her passion is developing cross-functional programs that leverage the power of storytelling to inspire, educate, and empower. Before boomeranging back to USF, she served as Chief Communications and Development Officer for the Boston-based global nonprofit Earthwatch Institute, where her team raised more than \$4 million annually while implementing creative campaigns that increased expedition sales year over year. Career highlights include reporting "live" from expeditions in the South Pacific and the Arctic, spearheading Earthwatch's first virtual reality experience, leading Harvard's Wyss Institute for Biologically Inspired Engineering in its communication strategy, serving as creative education director in an NSF-funded IMAX film "Volcanoes of the Deep Sea," and founding a Science Journalism Center at USF – an effort worth a re-vision and re-launch in the CMS future.

# COLLEGE OF MARINE SCIENCE LEADERSHIP TEAM

## **LAURIE SCOTT**

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Ms. Laurie Scott joined the College of Marine Science as director of development in July 2019. Prior to this, she worked for the Baker Institute for Public Policy, a think tank at Rice University in Houston, TX. She holds an MA degree in Political Science from the University of Nebraska-Lincoln. Laurie has spent her entire career working in development both in the education sector, as well as for large non-profits in New Zealand and the U.S. focused on human services and the environment. In collaboration with the Dean and the Associate VP of Development, she is responsible for promoting and enhancing public awareness about the college and fostering an exchange of information, talents and private support (fund-raising) for advancing its mission from various constituency groups including alumni, parents, friends, students, current and former faculty, corporations and foundations.

## **RENATE JURDEN**

**Executive Administrative Specialist, College of Marine Science**

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Ms. Renate Jurden is the Executive Administrative Specialist to the Dean of the College of Marine Science. She received her M.Ed. from Plymouth State University. She worked at the University of New Hampshire prior to moving to Florida and joining the College of Marine Science in April 2019. Jurden is the first point of contact for the Dean's office. She manages the Dean's calendar, organizes meetings and events for the college, oversees the college's foundation accounts, and acts as a liaison with other colleges, and collaborators in federal and state agencies. She is the central resource person for information, referral, and assistance.

## Graduate Program

### ACADEMIC PROGRAMS

An online course entitled, *Resilient, Sustainable, and Secure Port Operations and Infrastructure*, also known as *Port Sustainability* has been approved by the State of Florida as a new formal course taught by Dr. Mark Luther. Several new formal course proposals will be submitted. These courses are being taught as part of the undergraduate **Marine Biology Major** curriculum in Integrative Biology. Progress on a **new non-thesis Master of Arts in Marine Business is being made** in coordination with the administration, faculty, and staff of the Business College across all three campuses. The entire program is designed to be completely online and will result in a Master of Arts degree from the College of Marine Science and a certificate from the College of Business, providing flexibility for conventional and non-traditional students (e.g., full-time employees). This degree will be based on course work without a thesis and would serve the needs of various oceanographic agencies or individuals who want to: update their knowledge base, improve their skill sets, and obtain a higher degree. Although this program is focused on merging oceanography and business, future hybrids are envisioned for ocean journalism, ocean policy, etc. Due to the USF consolidation activities, the new degree proposal submission has been postponed for Fall 2020.

### DIVERSITY

The College of Marine Science has a new Graduate Exemplary Mentoring (GEM) program! Starting in late 2019, David Naar, Ana Arellano, and Frank Muller-Karger, began the process of institutionalizing the USF Alfred P. Sloan Foundation University Center for Exemplary Mentoring (UCEM) three years ahead of the 2023 target date. Part of this early departure, was to allow additional STEM (Science, Technology, Engineering, and Math) graduate programs at the USF Tampa Campus, such as those in the USF College of Arts and Sciences, to increase their participation in the Sloan UCEM program with the College of Engineering. This program **prepares underrepresented minority PhD students to become and succeed as professors in the workforce. USF is only one of only eight such centers in the USA** and the only one that is not a member of the American Association of Universities (AAU). The new Marine Science GEM program has expanded the best practices from the Sloan UCEM program to be more inclusive. Any student who feels marginalized, who is seeking a sense of community, or desires additional mentoring is welcome. Several students have noted that this type of program is and will be helpful for new incoming students, including first-generation graduate students.

In the spring of 2019, CMS Professors Brad Rosenheim and Don Chambers gave science seminars and served on a climate change panel at Xavier University, and Morehouse College, Spelman College; and Georgia State University, respectively. These activities continued to improve collaborations with these and other minority serving institutions. These collaborations led to the recruitment of outstanding undergraduates to a **successful summer Research Experience for Undergraduates**, that Drs. Ana Arellano and David Naar ran for ten weeks over the summer funded by **NSF supplements** provided to Drs. Timothy Conway, Larry Dishaw, Xinfeng Liang, Brad Rosenheim, and Amelia Shevenell. Dr. Arellano took the students on several field trips around Florida including the Kennedy Space Center. These five

# GRADUATE PROGRAM

professors and their graduate students mentored the five undergraduate students, which culminated into oral and poster presentations of their work at the college and at USF Tampa. These students also presented their summer research results at the December 2019 AGU or at other national meetings in early 2020.



*Group Photo of the Summer 2019 REU participants visiting NOAA. From left to right, Richard Rivera, Jenelle DeVry, Angel Cedeno, Alexis Petersen, Tione Grant, and Dr. Ana Arellano.*

## STUDENT AFFAIRS

In 2019, there were six PhD and 12 MS degrees conferred. We had a **50% increase in new enrollment**, with nine PhD and 11 MS incoming students. Nearly all new students participated in a series of presentations, workshops, and Presentation Boot Camp during the Orientation Week in late August. Student participation continued in educational outreach activities listed below. These training activities and the students' strong research and presentation efforts have paid off as documented by the numerous honors, awards, presentations, and publications listed later this section of the annual report.

### GRADUATE PROGRAM HIGHLIGHTS FROM 2019:

#### New Students:

- 9 entering the PhD program
- 11 entering the Master's program

# GRADUATE PROGRAM

## Degrees Conferred:

- 6 PhD
- 12 Master's

## Orientation:

- 19 students participated in 2.5 days of workshops and presentations,
- 21 students participated in the two-day Presentation Boot Camp

## Student Workshops provided to students, staff, and faculty:

- *Intro to Emotional Intelligence*, in partnership with USFSP Wellness Center
- Mental Health Workshop in partnership with USFSP and FWRI
- Diversity Workshop, in partnership with USFSP Office of Multicultural Affairs, attended by approx. 20 students, faculty and staff.
- *Conducting a Comprehensive Literature Review*, writing workshop with Dr. Vernetta Williams, which served 25 students, 2 faculty, and 2 staff members
- National Geospatial-Intelligence Agency recruiter visit
- Six student networking lunches with external Seminar Speakers
- Launched Marine Science Job Board at <https://www.marine.usf.edu/job-postings/>

## Outreach Opportunities and Programs provided by CMS Personnel:

- Spoonbill Bowl / National Ocean Science Bowl
- Oceanography Camp for Girls
- St. Petersburg Science Festival
- Graduate Student Symposium (results below)
- MSAC at Saturday Morning Market in St. Petersburg

**Research or Outreach activities for K-12 students, their teachers, or undergraduates - Over 1730 K-12 students, teachers, and undergraduates** were engaged in research activities or educational outreach activities by CMS personnel in 2019, including:

- Girls Inc.: ~ 15 middle and elementary school students (Breitbart and Kerr)
- Science Festival: ~100 elementary school visitors (Breitbart and Kerr)
- Taste of Science: ~15 middle school students
- Great American Teach in: ~150 K-12 students (Keer, Lopez-Figueroa, and Rosario)
- Robotics Camp: ~30 middle school students (Breitbart)
- Arts & Science Night: 1 high school student and 5 undergraduates (Breitbart)
- Skype a Scientist: ~ 100 elementary and middle school students (Breitbart)
- Lab tours: 12 undergraduates (Breitbart)
- Guest Lectures: ~50 undergraduates (Lopez-Figueroa, Kema, and Kerr)
- Skype a Scientist: ~150 K-12 students (Shevenell)
- Science Festival: ~125 K-12 students (Shevenell)
- Local School Visits: ~100 K-12 students (Shevenell)
- Sargassum Lectures: 3 high school students and 3 undergraduates (Hu)
- Clam Bayou Comps Tour: ~ 40 undergraduates (Luther and Scudder)

# GRADUATE PROGRAM

- Summer Interns: 5 (Luther)
- Geochemistry Lab interns: 3 high school students (Sherwood and Byrne)
- Remote Sensing interns: 12 undergraduates (Muller-Karger and lab)
- Wax Model Demos of Plate Tectonics: ~20 undergraduates & ~40 K-12 students (Naar)
- Princeton Day via Skype a Scientist: ~60 K-12 students (Ainsworth)
- Ecopath 35 Short course: ~20 undergraduates (Ainsworth)
- Clam Bayou Visitors: ~44 undergraduates, ~80 K-12 teachers, & 530 K-12 students (Greely)
- Other CMS Internships: ~20 (CMS Faculty)

**Undergraduate Teaching - Over 410 undergraduates from the USF system** took formal courses from Marine Science Faculty and Adjuncts. 15 sections of 9 courses were taught including:

- *Introduction to Oceanography* - Online (Arellano)
- *Introduction to Oceanography* - Tampa campus (Greely)
- *Geological History of Florida* - Online (Arellano)
- *Marine Aquaculture* - Online (Main)
- *Port Sustainability* - Online (Luther)
- *Coral Biology & Reef Ecology* –St. Pete campus (Arellano)
- *Scanning Electron Microscopy w/ Lab* –St. Pete campus (Greco)
- *Fish Biology* –St. Pete campus (Stallings)
- *Experiential Learning in Marine Science* –St. Pete campus (Greely)
- *Honors Course about Estuaries* – Tampa Campus (Naar, Luther, Conway, Peebles, and Hu)

## **Student Publications:**

- 23 articles were published by 14 students
- 7 of these articles were first-authored by students

## **Student Presentations:**

- 33 Presentations made at national and international conferences
- 30 of these presentations, the student was the first Author
- 7 of these presentations were made at international locations

**The annual GRADUATE STUDENT SYMPOSIUM held on January 11, 2019, in the MSL Conference Room with eight oral presentations and five poster presentations.**

- 1st place oral presentation: Natalie Sawaya
- 2nd place oral presentation: Natalia Lopez-Figueroa
- 3rd place oral presentation: Kara Vadman
- 1st place proposed research oral presentation: Garrett Miller
- 1st place poster presentation: Alyssa Andres
- 2nd place poster presentation: Catherine Prunella

## **DEGREES OFFERED**

The following certificate and degrees are offered at the College of Marine Science:

**Graduate Certificate in Teaching & Communication Ocean Sciences Broader Impacts**

# GRADUATE PROGRAM

**Master of Science (M.S.) and Doctoral (Ph.D.) degrees in Biological, Chemical, Geological, Marine Resource Assessment (MRA), and Physical Oceanography Concentrations**

## **STUDENTS GRADUATED IN 2019**

### Doctoral (6)

**Abercrombie, Mary**, advised by Dr. Kendra Daly and Dr. Paula Coble, fall, *Use of Spectrofluorometry to Detect Petroleum Hydrocarbons in the Marine Environment*

**Chacin, Dinorah**, advised by Dr. Christopher Stallings, fall, *Investigation of Seascape Heterogeneity and Ecological Responses in Tropical and Subtropical Systems*

**Johnson, Selena**, advised by Dr. Pamela Hallock Muller, fall, *Untapped Potential of Gorgonian Octocorals for Detecting Environmental Change in Biscayne National Park, Florida, USA*

**Larson, Rebekka**, advised by Dr. David Hollander, spring, *High-Resolution Investigation of Event Drive Sedimentation: Response and Evolution of the Deepwater Horizon Blowout in the Sedimentary System*

**Wallace, Amy**, advised by Dr. Ernst Peebles, fall, *Re-creating Geographic and Trophic Histories of Fish Using Bulk and Compound-specific Isotopes from Eye Lenses*

**Zhu, Yingli**, advised by Dr. Gary Mitchum, spring, *Studies of the Long-term Change of Global Mean and Regional Sea Surface Height*

### Masters (12)

**Amergian, Kyle**, advised by Dr. Pamela Hallock Muller, fall, *Can Florida's Springs Coast Provide a Refuge for Calcifying Organisms? Evidence from Benthic Foraminifera*

**Bonnain, Chelsea**, advised by Dr. Mya Breitbart and Dr. Kristen Buck, summer, *Iron-Virus Interactions: Development and Testing of the Ferrojan Horse Hypothesis*

**Burrows, Makenzie**, advised by Dr. Mya Breitbart, spring, *DNA Barcoding of Fish Eggs in the Gulf of Mexico*

**Clark, Kristine**, advised by Dr. Brad Seibel (CMS) and Dr. Heather Judkins (USFSP-Biology), spring, *Species Abundance, Spatial and Vertical Distributions of Large Heteropods (Pterotracheidae and Carinariidae) in the Northern Gulf of Mexico*

**Dubickas, Kate**, advised by Dr. Kendra Daly, spring, *Zooplankton Community Structure in the NE Gulf of Mexico: Impacts of Environmental Variability and the Deepwater Horizon Oil Spill*

**Faletti, Meaghan**, advised by Dr. Christopher Stallings, fall, *Life History through the Eyes of a Hogfish: Evidence of Trophic Growth and Differential Juvenile Habitat Use*

**Helmueller, Greta**, advised by Dr. Steve Murawski, summer, *Population Demographics of Golden Tilefish *Lopholatilus chamaeleonticeps* in the Gulf of Mexico*

**Hollister, Adrienne**, advised by Dr. Kristen Buck, spring, *Remineralization of trace metals during phytoplankton decay: an experimental study*

**Huang, Chih-Wei**, advised by Dr. Chuanmin Hu, spring, *Estimating Coastal Water Turbidity Using VIIRS Nighttime Measurements*

**Lee, Jong Jin**, advised by Dr. David Hollander, spring, *Variations of Sedimentary Biogenic Silica Deposition in the Gulf of Mexico during the Deepwater Horizon and IXTOC-1 Oil Spill*

**Liu, Chao**, advised by Dr. Xinfeng Liang, summer, *Variations of Global Ocean Salinity from Multiple Gridded Argo Products*

**Viau, Elizabeth**, advised by Dr. Cameron Ainsworth, spring, *Fish Communities on Natural and Artificial Reefs in the Eastern Gulf of Mexico*

# GRADUATE PROGRAM

## STUDENT HONORS, AWARDS, AND ACHIEVEMENTS

In 2019, there were 21 new external awards (including an honorable mentions) totaling \$204,075. There were also four multi-year awards from previous years whose 2019 funding totaled \$93,000.

**Combined, the students brought in \$297,075 of external funding to the College of Marine Science.**

Many of the federal awards and the McKnight Fellowships also come with extra funds to cover tuition and health insurance covered, but those amounts are not shown in the award amounts totaled above or listed below. **Another \$365,500** was distributed from internal CMS endowed sources. The students at CMS **received over \$662,000** in funding from combined sources (in addition to grant funding sources that the faculty provided).

## 2019 STUDENT AWARDS FROM OUTSIDE OF CMS

**Alyssa Andres:** Sigma Xi Grant-in-Aid of Research, \$300

**Imogen Browne:** International Conference on Paleoceanography Student Travel Award, The Oceanography Society, \$1,400

**Dinorah Chacin:** McKnight Doctoral Fellowship \$13,000 (*last year of 5*)

**Cara Estes:** GCOOS Fellowship, \$25,000

**Savannah Hartman:** Florida Education Fund McKnight Doctoral Fellowship, \$13,000 (*Year 2 of 5-year award totaling \$36,000*)

**Luis Lizcano Sandoval:** Fulbright-Colciencias, \$29,000

**Luis Lizcano Sandoval:** NASA Earth and Space Science Fellowship, \$10,000

**Natalia Lopez-Figueroa:** Strategies for Ecology Education, Diversity and Sustainability (SEEDS) Program Alumni Mentor Travel Award, Ecological Society of America, \$1,000

**Mark Mussett:** USF University Graduate Fellowship, \$18,000

**Delfina Navarro-Estrada:** USF Graduate Student Success Fellowship \$18,000 (*Year 1 of 3-year award totaling \$36,000*)

**Anna Omjola:** Alfred P. Sloan Foundation Minority Ph.D. Program (MPHD) Research Fellowship, 2019, \$40,000

**Anna Omjola:** NSF/USF Florida-Georgia Louis Stokes Alliances for Minority Participation Bridge to the Doctorate (FGLSAMP BD) 2019, \$32,000

**Jonathan Peake:** USF International Travel Grant, \$1,500

**Rebecca Scott:** Fish Florida! Scholarship, \$10,000

**Rebecca Scott:** Kaye Pearson Memorial Scholarship, \$10,000

**Jing Shi:** USF Presidential Fellowship, \$32,000 (*Year 1 of 5-year award totaling \$160,000*)

**Susan Snyder:** Guy Harvey Scholarship for 2019, \$5,000

**Kelly Vusbinder:** USF Presidential Fellowship, \$25,000 (*Year 4 of 5-year award totaling \$125,000*)

**Ryan Venturelli:** NSF travel award for West Antarctic Ice Sheet Workshop, \$825

**Ryan Venturelli:** NSF travel funding to ISAES meeting in Korea, \$1,800

**Ryan Venturelli:** SCAR Early Career travel award for ISAES meeting in Korea, \$250

**Yingjun Zhang:** 2019 Future Investigator (formerly NASA student fellow) for project 19-EARTH19-0277: *Sub-Mesoscale Eddies Derived from Novel Ocean Color Imagery and ICESat Missions in Support of the SWOT Mission*, \$42,000 (*Year 1 of 3-year award totaling \$126,000*)

# GRADUATE PROGRAM



*Group Photo of the 2019-2020 CMS Endowed Fellowship Recipients.*

## **2019 CMS STUDENT FELLOWSHIPS AND AWARDS WITHIN CMS (\$365,500 distributed)**

**Alyssa Marie Andres:** Gulf Oceanographic Charitable Trust Fellowships Endowment, \$12,000

**Alexandra Burns:** Southern Kingfish Association's Fellowship, \$10,000

**Shannon Burns:** Carl Riggs Fellowship in Marine Science, \$10,000

**Makenzie Burrows:** USF Inaugural Vembu Subramanian MSAC Award, \$1,500

**Brigid Carr:** Wells Fargo Fellowship in Marine Science, \$10,000

**Laura Carvalho Britto C Azevedo:** Von Rosenstiel Fellowship, \$26,000

**Dinorah Chacin:** Endowed B2D Fellowship, \$10,000

**Jing Chen:** Von Rosenstiel Innovation Award, Second Place for project *Material Convergence for Tampa Bay and the Adjacent Gulf of Mexico*, \$7,000

**Kalla Fleger:** Von Rosenstiel Fellowship, \$26,000

**Michelle Guitard:** George Lorton Fellowship in Marine Science, \$10,000

**Jay Law:** David K. Costello Award for Interdisciplinary Engineering, \$1,000

**Loraine Martell-Bonet,** Endowed Bridge-to-the-Doctorate Fellowship, \$26,000

**Brianna Michaud:** William T. Hogarth Fellowship in Marine Mammals, \$10,000

**Juan C. Millan-Otoya:** Young Fellowship Program Fund, \$13,000

**Garrett L. Miller:** Tampa Bay Parrot Head Fellowship in Marine Science, \$10,000

**Bryan J. O'Malley:** Paul Getting Endowed Memorial Fellowship in Marine Science, \$13,000

**Bich Vi Viviane Nguyen:** Sanibel-Captiva Shell Club / Mary & Al Bridell Memorial Fellowship, \$10,000

**Jonathan Peake:** Linton Tibbetts Endowed Graduate Student Fellowship, \$10,000

# GRADUATE PROGRAM

**Martina Plafcan:** Von Rosenstiel Fellowship, \$26,000

**Catherine Prunella:** Jack and Katharine Ann Lake Fellowship in Marine Science, \$13,000

**Natalie A. Sawaya:** Garrels Memorial Fellowship in Marine Science, \$15,000

**Natalie A. Sawaya:** Renate E. Bernstein Outstanding Authorship Award, \$1,000

**Natalie A. Sawaya:** WLP Dorothy L. Morgan Endowed Scholarship in Marine Science, \$2,000

**Carey Schafer:** St. Petersburg Downtown Partnership Fellowship in Coastal Science, \$24,000

**Katelyn Schockman:** William and Elsie Knight Endowed Fellowship Fund for Marine Science, \$28,000

**Rebecca Scott:** Paul Getting Endowed Memorial Fellowship in Marine Science, *Honorable Mention*

**Jonathan Sharp & Ryan Venturelli:** Von Rosenstiel Innovation Award, First Place for project *Measuring Isotopic and Carbonate Chemistry Characteristics of an Antarctic Subglacial Lake*, \$5,000

**Alexander Timpe:** Von Rosenstiel Fellowship, \$26,000

**Kara Vadman:** Thomas E. Pyle Memorial Fellowship in Marine Science, \$10,000

**Julie Vecchio:** Gulf Oceanographic Charitable Trust Fellowships Endowment, \$12,000

## OUTSTANDING RESEARCH/PRESENTATION AWARDS

**Brigid Carr:** GOMRI Scholar, Gulf of Mexico Research Initiative

**Imogen Browne:** Panelist for Fall 2019 Welcome Event, Mid-Florida Fulbright Chapter

**Jing Chen:** The Richard and Megumi Strathmann Endowed Fellowship at University of Washington, Friday Harbor Labs

**Julie Vecchio:** Runner-up Best Student Poster (2019) Florida AFS meeting

**Madison Schwaab:** Gulf of Mexico Research Initiative (GOMRI) Scholar

**Mengqiu Wang:** USF Outstanding Dissertation Award

**Natalia Lopez-Figueroa & Natalie Sawaya:** Genomics of Global and Planetary Health Annual Symposium Outstanding Poster, USF

**Natalia Lopez-Figueroa:** 2019 Outstanding Poster at Genomics of Global and Planetary Health Annual Symposium

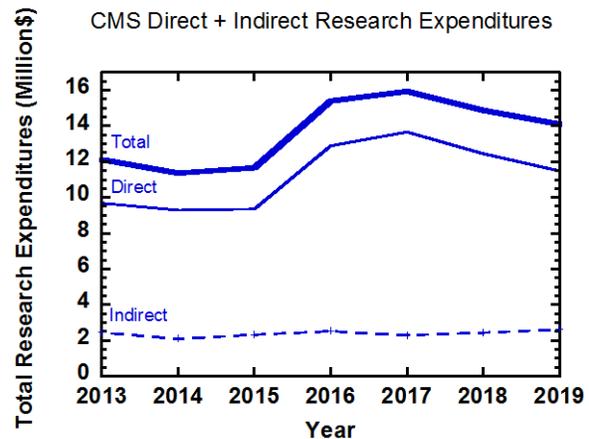
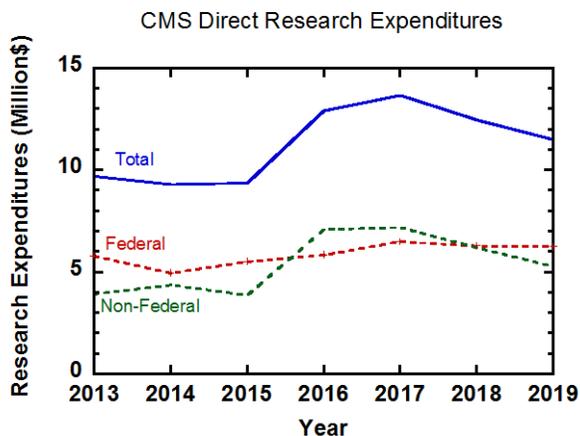
**Natalie Sawaya:** 2019 Outstanding Poster at Genomics of Global and Planetary Health Annual Symposium

**Ryan Venturelli:** NOSAMS Graduate Student Internship at WHOI

## CMS Research

### EXCELLENCE IN RESEARCH

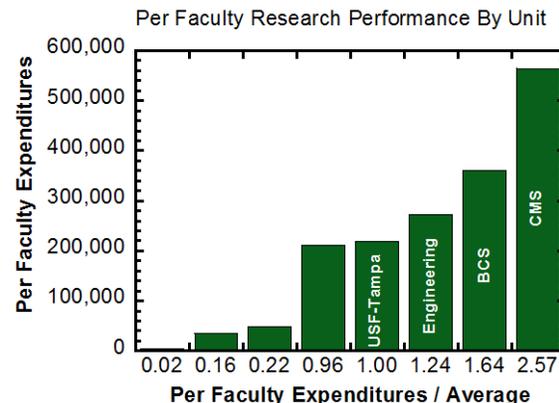
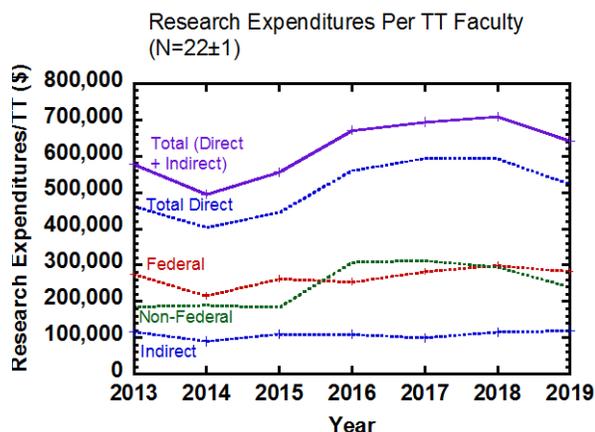
Our total research expenditures are ~\$14.1 M, with ~\$11.5 M in direct research expenditures and ~\$2.6 M in indirect cost recovery. The dip in the total research expenditures is related to the winding down of the non-federal Gulf of Mexico Research Initiative funded C-IMAGE consortium.



### ANNUAL RESEARCH EXPENDITURES PER FACULTY

As expected for a research-intensive unit, **our faculty have some of the highest per faculty research performance metrics in the university.** Over the past year the total research expenditures per full-time equivalent tenure-earning faculty member remains stable between \$600,000 and \$700,000.

Our faculty average almost 3X the average research expenditures relative to the USF Tampa average.



## Highlighted Research

### **A KILOMETER OF ANTARCTIC ICE HIDES LAKE AND CLUES TO THE FUTURE OF OUR WARMING PLANET**

On December 31, 2018, the dawn of 2019, scientists led by Dr. Brad Rosenheim, Associate Professor of Geological Oceanography at the USF CMS, hauled up their first sediment cores from the bottom of Lake Mercer, a subglacial lake buried more than a kilometer below ice in the middle of Antarctica. At 15 meters deep, Mercer is the deepest subglacial lake to have been directly sampled.

Another success of the Subglacial Lake Mercer expedition, known as Subglacial Antarctic Lakes Scientific Access (SALSA), was the recovery of deeper sediment cores that extended down beyond the upper most sediments of the lake bed. The longer cores are the result of a collaboration between scientists from USFCMS and Woods Hole Oceanographic Institution that created a gravity corer capable of capturing as much as 5 meters of sediment.

The cores the team retrieved were also the furthest south of any that have ever been extracted, just 600 km from the South Pole, where conditions are, to say the least, unforgiving.



For Rosenheim, CMS Ph.D. student Ryan Venturelli, and other team members, the first “result” of the expedition came well ahead of any data analysis. It was simply the success of their coring techniques. Immediately upon retrieval of the first sediment core, the team knew that they had developed a worthwhile method and created infrastructure that could be replicated for future missions to these remote environments.

“It was a treasure we just brought up to the surface,” said Rosenheim, “not only for us but for the whole [scientific] community.”

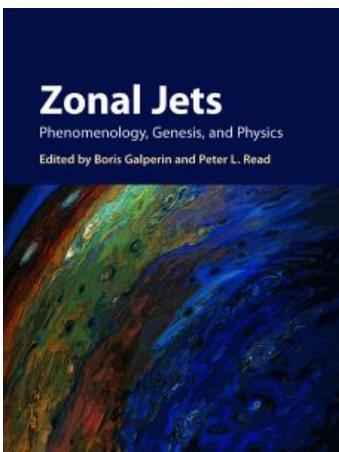
*Ryan Venturelli, CMS Ph.D. student, holds the first ever gravity core from a subglacial lake. Photo Credit: Billy Collins, SALSA*

**Read the full story – plus a Q&A with Ryan Venturelli about what it’s like to work in Antarctica – here: <https://www.marine.usf.edu/news-and-events/a-kilometer-of-antarctic-ice-hides-lake-and-possible-clues-to-the-future-of-our-warming-planet/>**

## ZONAL JETS: THE BOUNDLESS CAPILLARIES OF THE SEA

*USF professor Dr. Boris Galperin leads global effort to publish the first comprehensive book on zonal jets, complex features of atmospheric and ocean circulation that evaded discovery in the ocean for decades*

Anyone who has experienced headwinds or tailwinds on a plane traveling through the jet stream, or admired Jupiter’s majestic cloud bands, is familiar with zonal jets—even if you didn’t know it. The large-scale, concentrated currents powering these bands move in an east-west direction and are an important part of the atmospheric circulation. Scientists have studied them since the dawn of the telescope centuries ago.



Starting in the mid-1970s scientists suspected that these jets probably existed in the ocean as well, albeit as weaker currents than the powerful Gulf Stream in the North Atlantic or the Kuroshio Current in the North Pacific.

But they couldn’t find them.

It was only 15 years ago, nearly 30 years after those initial hunches, that a team led by Dr. Boris Galperin, Associate Professor at the USF College of Marine Science, not only proved their existence using computer simulations but suggested that zonal jets are in fact ubiquitous ocean features governed by the same laws of physics as the Jovian jets.

“Even though the oceanic jets are weak, they are among the most fundamental building blocks of ocean circulation,” said Galperin.

Zonal jets play a key role in transferring energy, water mass, salt, heat, solids, gases, and even fish and other sea life across huge swaths of the ocean basin. Understanding and quantifying them is critical to improving weather and climate models, as well as our ability to forecast hurricanes, said Galperin.

Just as you’d be hard-pressed to understand human blood circulation without comprehending the role of the capillaries in addition to the larger arteries and veins, you cannot understand global ocean circulation without appreciating zonal jets in conjunction with the major boundary current systems.

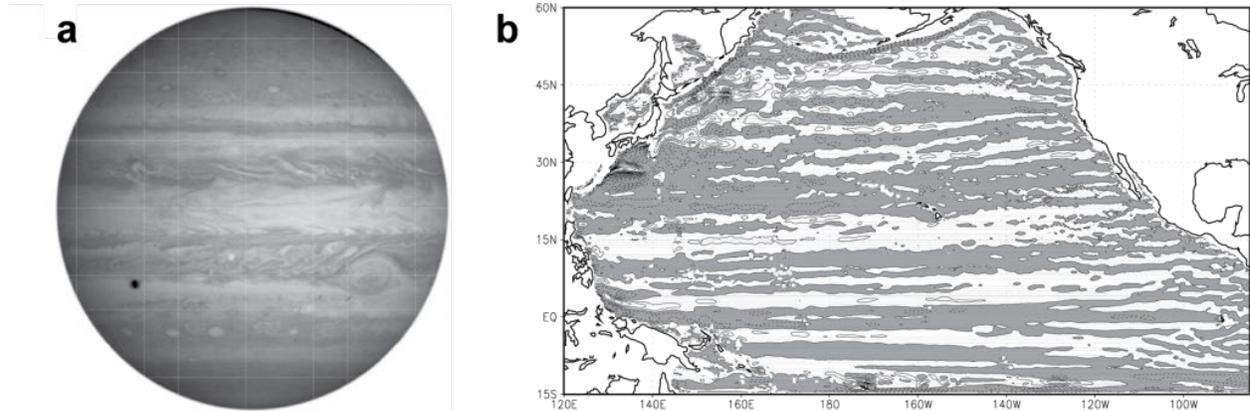
“Paradoxically, we know more about the jets in outer space than we do in our own ocean,” Galperin said. And there’s another problem, too—one Galperin has been working on for the last six years.

In 2011, with initial support from the International Space Sciences Institute (ISSI) in Bern, Switzerland, Galperin initiated an effort equivalent to assembling an Olympic team: corralling 70 of the world’s experts in meteorology, oceanography, planetary physics, and other disciplines to write a comprehensive book about zonal jets.

The product of this effort, *Zonal Jets: Phenomenology, Genesis, and Physics*, was published by Cambridge University Press on February 28, 2019. Galperin and Peter L. Read, Professor at the

# HIGHLIGHTED RESEARCH

Department of Atmospheric, Oceanic and Planetary Physics at Oxford University, serve as editors of the book.



*Twins: Jupiter's atmosphere and Earth's ocean? See how the composite view of the banded structure of the disk of Jupiter (a) looks similar to the zonal jets at 1000 m depth in the North Pacific Ocean (b). The North Pacific zonal jets were averaged over five years of a 58-year-long computer simulation performed by Galperin and his team. The Jupiter image was taken by NASA's Cassini spacecraft on December 7, 2000 (Credit: NASA/JPL/University of Arizona)*

**Read the full story here:** <https://www.marine.usf.edu/news-and-events/zonal-jets-the-boundless-capillaries-of-the-sea/>

## SCIENTISTS DISCOVER THE BIGGEST SEAWEED BLOOM IN THE WORLD

*The record-breaking belt of brown algae stretches from West Africa to the Gulf of Mexico—and it's likely here to stay, says a team led by Drs. Chuanmin Hu and Mengqiu Wang at USF CMS*

Scientists led by the USF CMS used NASA satellite observations to discover the largest bloom of macroalgae in the world called the Great Atlantic Sargassum Belt (GASB), as reported in *Science*. The discovery was highlighted as one of the top 50 scientific discoveries of 2019, as reported by *Discover* magazine.

They confirmed that the belt of brown macroalgae called *Sargassum* forms its shape in response to ocean currents, based on numerical simulations. It can grow so large that it blankets the surface of the tropical Atlantic Ocean from the west coast of Africa to the Gulf of Mexico. This happened in 2018 when more than 20 million tons of it – heavier than 200 fully loaded aircraft carriers – floated in surface waters and some of which wreaked havoc on shorelines lining the tropical Atlantic, Caribbean Sea, Gulf of Mexico, and east coast of Florida.

The team also used environmental and field data to suggest that the belt forms seasonally in response to two key nutrient inputs: one human-derived, and one natural.

## HIGHLIGHTED RESEARCH

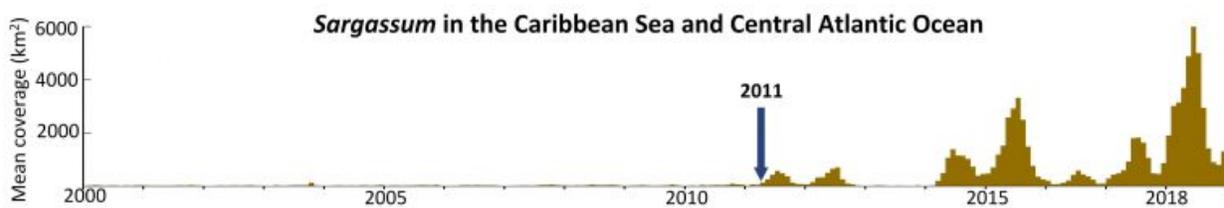
In the spring and summer, Amazon River discharge adds nutrients to the ocean, and such discharged nutrients may have increased in recent years due to increased deforestation and fertilizer use. In the winter, upwelling off the West African coast delivers nutrients from deep waters to the ocean surface where the *Sargassum* grows.

“The evidence for nutrient enrichment is preliminary and based on limited field data and other environmental data; we need more research to confirm this hypothesis,” said Dr. Chuanmin Hu of the CMS, who led the study and has studied *Sargassum* using satellites since 2006. “On the other hand, based on the last 20 years of data, I can say that the belt is very likely to be a new normal,” said Hu.

Hu spearheaded the work with first author Dr. Mengqiu Wang, a postdoctoral scholar in his Optical Oceanography Lab at USF. The team included others from USF, Florida Atlantic University, and Georgia Institute of Technology. The data they analyzed from NASA’s Moderate Resolution Imaging Spectroradiometer (MODIS) between 2000-2018 indicate a possible regime shift in *Sargassum* blooms since 2011.

### 2011: A Tipping Point

Before 2011, most of the pelagic *Sargassum* in the ocean was primarily found floating in patches around the Gulf of Mexico and Sargasso Sea. In 2011, *Sargassum* populations started to explode in places it hadn’t been before, like the central Atlantic Ocean, and it arrived in gargantuan gobs that suffocated shorelines and introduced a new nuisance for local environments and economies. Some countries, such as Barbados, declared a national emergency last year because of the toll this once-healthy seaweed took on tourism.



This plot shows the dramatic change in *Sargassum* biomass since 2000. Note the start of a “new normal” in 2011, and a particularly bad year in 2018. Credit: USF College of Marine Science

“The ocean’s chemistry must have changed in order for the blooms to get so out of hand,” Hu said. *Sargassum* reproduces vegetatively, and it probably has several initiation zones around the Atlantic Ocean. It grows faster when nutrient conditions are favorable and when its internal clock ticks in favor of reproduction.

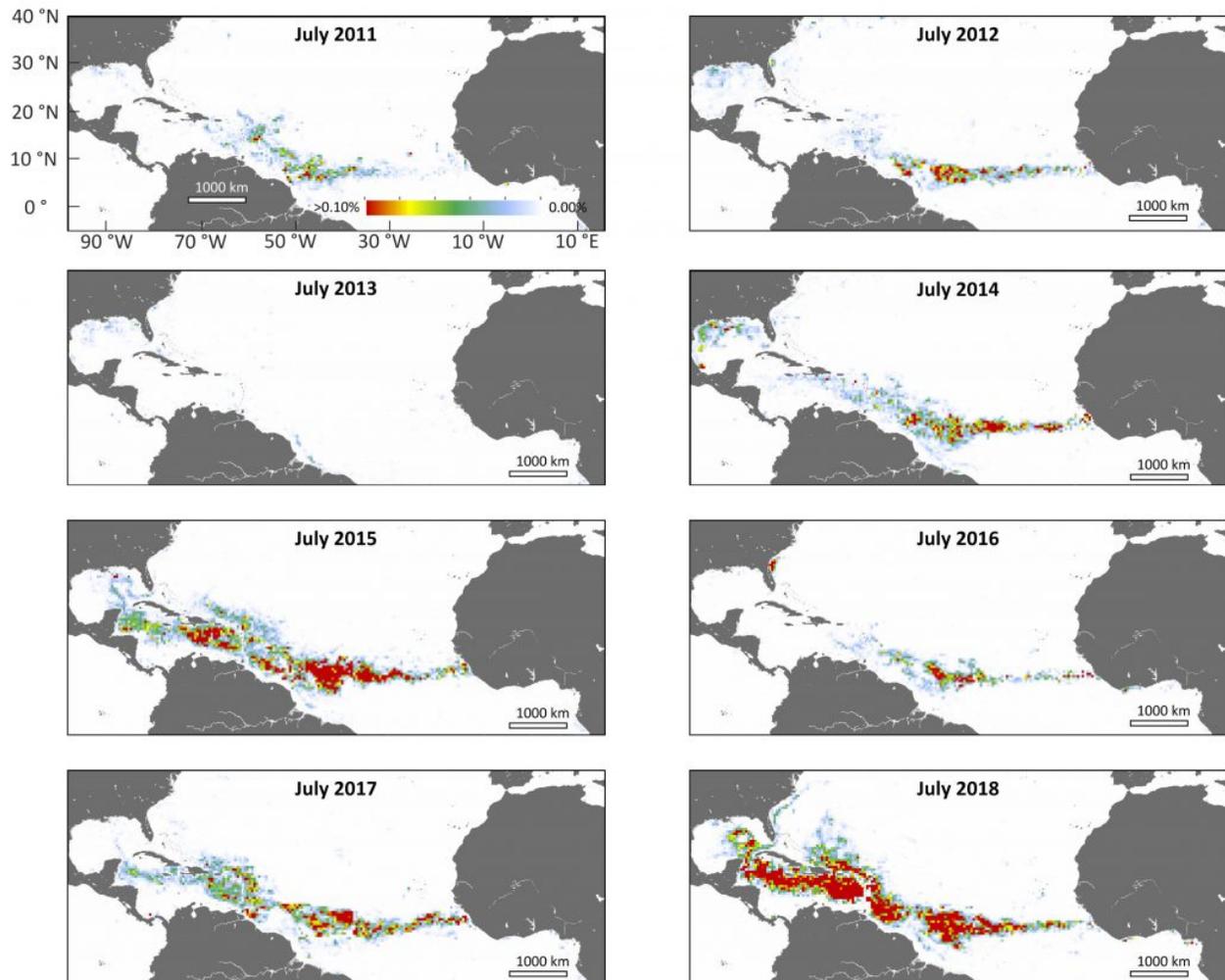
To unravel the mystery, the team analyzed fertilizer consumption patterns in Brazil, Amazon deforestation rates, Amazon River discharge, two years of nitrogen and phosphorus measurements taken from the central western parts of the Atlantic Ocean, among other ocean properties.

While the data are preliminary, the pattern seems clear: the explosion in *Sargassum* correlates to increases in deforestation and fertilizer use, both of which have increased since 2010.

“We hope this provides a framework for improved understanding and response to this emerging phenomenon,” Hu said. “We need a lot more follow-on work.”

# HIGHLIGHTED RESEARCH

This work was funded by several programs in NASA's Earth Science Division, NOAA RESTORE Science Program, the JPSS/NOAA Cal/Val project, the National Science Foundation, and by a USF College of Marine Science William and Elsie Knight Endowed Fellowship.



*NASA's satellite data (MODIS) confirms that the record-breaking seaweed belt forms in the summer months (northern hemisphere). 2015 and 2018 had the biggest of the massive blooms that started in 2011. Credit: USF College of Marine Science*

**Read the full story here:** <https://www.marine.usf.edu/news-and-events/scientists-discover-the-biggest-seaweed-bloom-in-the-world/>

## **21-YEAR CARIACO OCEAN TIME SERIES ENDS: THAT'S A WRAP! ¡FIN DEL DÍA!**

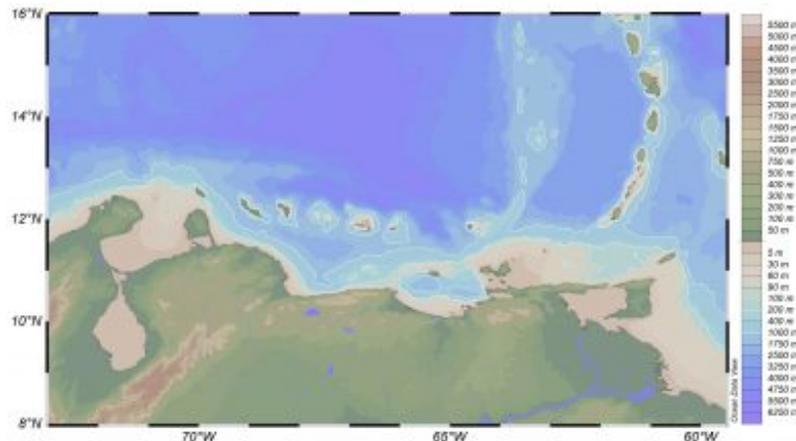
*Award-Winning program, led by scientists in Venezuela & the U.S., leaves a rich 21-yr legacy - and perhaps a few tears*

Scientists in Venezuela and the United States established the CARIACO Ocean Time Series program, one of the longest running oceanographic studies in the world, in the Cariaco Basin, Venezuela, in

## HIGHLIGHTED RESEARCH

1995 – a year when the “Macarena” was a dance party favorite, U.S. postage stamps cost \$0.32, and the web browser Netscape debuted. It was a long time ago.

The team reported on the scientific dossier of the 21-year program, a tour de force for ocean science, in the *Annual Review of Marine Science*.



*The CARIACO basin off the eastern Venezuelan coast is the world’s largest marine anoxic basin and home base for one of the longest running oceanographic studies on record.*

In the Cariaco Basin, the world’s largest marine anoxic basin, neatly stacked sediments provide one of the best climate records on the planet. Nestled off the eastern coast of Venezuela, the basin has served as a living laboratory that allows scientists to step back in time and see how the ocean responds to natural and human-induced climate processes, including warming and cooling, and wet and dry periods in the Atlantic Ocean and much of the Americas.

Recognized twice during its lifetime by UNESCO’s Intergovernmental Oceanographic Commission, the CARIACO Ocean Time Series program was one of only three comprehensive and sustained time series stations around the world focused on the ecology and biogeochemistry of ocean waters – and the only one in a tropical ocean setting.

The program carried out 310 oceanographic expeditions, one or more almost every month, and involved more than 100 researchers from around the globe. The team developed standard methods now widely used and everyone made their data freely available – leading to more than 185 publications. They collected a spate of repeated chemical, physical, biological, ecological, and geological observations, and characterized seasonal to interannual changes in dissolved nutrients and oxygen, primary and secondary productivity, species diversity, sinking and suspended particle fluxes, and more — over a timeframe more than double the length of the Apollo space program. These repeated, long-term observations made it possible for scientists to measure changes in the ocean that could not be measured any other way. They also found several new species, including a new Order of bacteria, the Cariacotrichida.

But the legacy of CARIACO is greater than all of that.

“I am most proud of the strong partnership and friendships we developed between U.S. and Venezuelan scientists,” said Dr. Frank Muller-Karger, CMS professor and architect of the CARIACO

# HIGHLIGHTED RESEARCH

program. “The actual science and the discoveries we made are a product of that collaboration between people of different countries, different languages and cultures.”



*The sun sets on the 21-year CARIACO Ocean Time Series program, which was led by scientists from the U.S. and Venezuela and involved more than 100 researchers from around the globe. Shown in the photo: Ramón Varela (Co-PI, EDIMAR/FLASA), Yrene Astor (Co-PI, EDIMAR/FLASA), José (Chuchú) Narváez (EDIMAR/FLASA), Aitzol Arellano (EDIMAR/FLASA), Michael McIntyre (USF/U.S.), Glenda Arias (EDIMAR/FLASA), Aparicio Narváez (First Officer), Maxi (crew), German Marin (Chef), and Julio (crew).*

## **CARIACO and Climate Change**

A significant legacy of the time series is new understanding about how climate change is affecting the ocean.

CARIACO, the name of the project, stands for Carbon Retention in a Colored Ocean. “Our job was to measure and characterize the major processes that cause changes in the type, amount and composition of particles that settle to the bottom of the basin,” said Dr. Enrique Montes, a researcher at the USF CMS who is from Venezuela and worked on the CARIACO time-series starting in 2006. These particles carry a signature of the present climate that is preserved at the bottom of the Cariaco Basin.

The Cariaco Basin is well known for its anoxic waters and sediments. Scientists from around the world began studying it in the 1940s. The part of the water column without any oxygen stretches from about 140 meters to the bottom (1,380 meters). The sediments are undisturbed because there are no animals reworking the sediment, as they do in waters with oxygen. The particles that settle to the bottom from the surface of the ocean nearly a mile above are layered season after season, year after year, and decade after decade. These layers offer as close to a bird’s eye view as you can get of how the climate has changed over the past several hundred thousand years.

The shells and other remains of marine organisms, sediment from rivers, pollen, dust, and other particles settle to the bottom of the basin and pile up through time. Scientists collect long cores of these sediments to reconstruct past ocean and climate conditions by ‘dating’ the age of each layer. They have analyzed the composition of several elements in the sediments to track, for example, how much of the carbon released into the atmosphere by the burning of fossil fuels has been absorbed by the ocean.

“We measured clear and unambiguous signals of the carbon burned by humans in the sediments falling through the water. They have accumulated at the bottom of the ocean through the life of the time-series,” said Montes. They also observed warming and a decrease in the pH of sea water near

# HIGHLIGHTED RESEARCH

the ocean surface, which is the result of carbon dioxide in the atmosphere dissolving into the sea water.

“There are very few places in the world where you can see these processes unfolding at this high temporal resolution,” said Montes. “This was a world-class effort in one of the best places on the planet to do oceanography.”

**Read the full story here:** <https://www.marine.usf.edu/spotlight-on-research/21-year-cariaco-ocean-time-series-ends-thats-a-wrap-fin-del-dia/>

## NEARLY 10 YEARS LATER: THE DEEPWATER HORIZON OIL SPILL

Under the leadership of Dr. Steve Murawski, the CMS has led C-IMAGE, the research consortium of 19 U.S. and international partners that is tasked with understanding the impacts of the Deepwater Horizon oil-well blowout. The team was busy this year as we approach April 20th, 2020, which will be the 10th anniversary of the Deepwater Horizon oil-well blowout, the lives it took, and the damage inflicted upon the environment.

As the funding provided through the Gulf of Mexico Research Initiative (GoMRI), established in the wake of the disaster, is coming to completion, large, multi-institution teams of scientists are working to make sense of the body of knowledge produced post-spill. What follows are excerpts describing two key milestones, just a snapshot of the team’s progress in 2019:

- Hosting a synthesis workshop in St. Petersburg, FL in July (Full story here: <https://www.marine.usf.edu/news-and-events/multi-institution-science-team-meets-in-st-petersburg-fl-to-synthesize-ecosystem-impacts-of-the-historic-deepwater-horizon-oil-spill/>)
- Publishing a powerful two-volume series (<https://www.marine.usf.edu/news-and-events/2-new-books-summarize-findings-from-historic-deepwater-horizon-oil-spill/>), which the team also presented at the annual Tampa Bay Times Festival of Reading held in November 2019

### Synthesis Workshop in July 2019

A core team met in St. Petersburg, FL from July 23-25 to participate in a workshop entitled “Ecosystem Impacts of the Deepwater Horizon Event: Assembling the Record of Species and Community Change.”

“We have several working theories at this stage, and are excited to keep our momentum going in the final stretch,” said Murawski. “It continues to be an honor and privilege to unearth new understanding in the wake of such a historic disaster that devastated too many lives and families.”

Here are a few of the working hypotheses that the team is refining:

- The Deepwater Horizon incident resulted in one of the most complex and diverse sets of ecosystem impacts in the history of oil spills, ranging from trivial to catastrophic—and concerns abound that the system is less resilient to ongoing environmental stressors, such as overfishing, nutrient pollution, hurricanes, and climate change.
- Many resources have still not fully recovered, and for some it could take several more decades to a century or more.

# HIGHLIGHTED RESEARCH

- Two major chronic “reservoirs” of oil residue remain in the deep benthic and coastal wetland environment.
- With industry pushing to move to deeper Gulf waters, we must prioritize research to better understand the ecology of this poorly understood environment.
- The daily vertical migration of small animals in the Gulf’s mid-depths acts as an “elevator” that brings oil to the surface, where it can contaminate surface animals.
- Some inshore countermeasures to the spill were not only ineffective but counterproductive.
- The impacts of the spill on Gulf fisheries are complex. Most species along the continental shelf will experience a modest to severe decrease in population but compounding factors exist that are tough to tease out, such as the rapid increase in invasive lionfish.

## Two major books

The CMS also led on the production of a powerful two-volume series published by Springer in 2019 about the historic Deepwater Horizon oil spill: [Deep Oil Spills: Facts, Fate, and Effects](#) and [Scenarios and Responses to Future Deep Oil Spills: Fighting the Next War](#).

Editors involved from the College of Marine Science include: Dr. [Steve Murawski](#), Dr. [Cameron Ainsworth](#), [Sherryl Gilbert](#), and Dr. [David Hollander](#).

## IS A GREAT IRON FERTILIZATION EXPERIMENT ALREADY UNDERWAY?

*Using a new, highly sensitive tracer for human-derived iron falling on the ocean, researchers led by the USF College of Marine Science say we have underestimated the iron we add to the ocean compared to natural sources*

It’s no secret that massive dust storms in the Saharan Desert occasionally shroud the North Atlantic Ocean with iron, but it turns out these natural blankets aren’t the only things to sneeze at. Iron released by human activities contributes as much as 80 percent of the iron falling on the ocean surface, even in the dusty North Atlantic Ocean, and is likely underestimated worldwide, according to a new study in *Nature Communications*.

“People don’t even realize it,” said lead author Dr. Tim Conway, Assistant Professor at the USF College of Marine Science, “but we’ve already been doing an iron fertilization experiment of sorts for many decades.”

Burning fossil fuels, biofuels, and forests all release iron, which can be transported as an aerosol over large distances from land into the guts of the North Atlantic and beyond. But human-derived iron aerosols have been nearly impossible to see in the data – until now. The team used the isotope ratios of iron in the atmosphere to ‘fingerprint’ whether the iron came from Saharan desert dust or human sources such as cars, combustion, or fires.

### A new tracer for human-derived iron

“Despite much research, iron chemistry is still something of a black box in the ocean,” Conway said. Iron, a trace element, is found in exceedingly low amounts in the ocean; one liter of seawater contains

## HIGHLIGHTED RESEARCH

35 grams of salt but only around one billionth of a gram of iron. This makes it very hard to measure. The iron is also hard to sample without risking contamination, especially if working on a rusty ship.

Trying to establish how much atmospheric iron lands on and dissolves in the ocean presents even more challenges, with storms, seasons, and land use all changing how much dust gets blown from the continents. Digesting dust particles in the lab to see how much iron dissolves is also problematic, and has led to estimates of iron that dissolves when it hits the ocean ranging from 0 to 100 percent.

The current study addresses some of these mysteries that remain in iron chemistry, taking our understanding of atmospheric iron supply to the oceans to the next level.

Conway and his colleagues analyzed aerosol samples collected on research cruises to the North Atlantic in 2010 and 2011 on board the R/V Knorr. The cruises were part of GEOTRACES, a global coordinated research program of 35 countries to study trace metals and their isotopes in the ocean.

Samples were taken from an area off West Africa known to collect dust from the Saharan dust storms, and the others were taken off the coasts of New England and Europe where human-derived pollution is expected to be more important. The team then measured iron isotope ratios in the samples in order to determine whether the iron came from a natural or human source.

Iron isotope ratios ( $^{56}\text{Fe}/^{54}\text{Fe}$ ) can change in response to chemical reactions, so human-induced processes like burning fossil fuels release iron with a different isotope 'signature' than iron derived from natural materials. Saharan dust particles were previously assumed to have a ratio that looked like the average continental crust, and Conway has suggested that when Saharan dust particles hit the ocean, the iron that dissolves interacts with organic molecules that bind the heavier  $^{56}\text{Fe}$ .

"We carried out this research to investigate that idea and fully expected to see continental signals or perhaps more heavy isotopes in the samples from all three regions," said Conway. "What we found was pretty crazy and very light. We weren't expecting this at all," Conway said.

The iron in Saharan air was indeed a match for the continental crust but was much heavier than the samples from North America and Europe, which were loaded with lighter (more  $^{54}\text{Fe}$ ), human-derived iron – not iron from the Sahara. "The fact that we found human-derived iron in the dusty North Atlantic shows how effective this tracer is for anthropogenic iron," Conway said.

Next, they used the iron-isotope tracer work to improve the models used to predict the amount of dust that falls over the global ocean, and were able to show that the iron from human input is much greater than previously thought.

### **Implications for Climate Change**

Since the 1990s scientists have proposed the idea of fertilizing the water with iron released from ships to accelerate the growth of phytoplankton. The thinking goes like this:

Iron is a vital micronutrient that phytoplankton need to grow but it's generally scarce in the ocean. When available via dust storm or other source, the phytoplankton slurp up the carbon dioxide during photosynthesis at the ocean's surface. When they die and sink to the ocean bottom, they take the

# HIGHLIGHTED RESEARCH

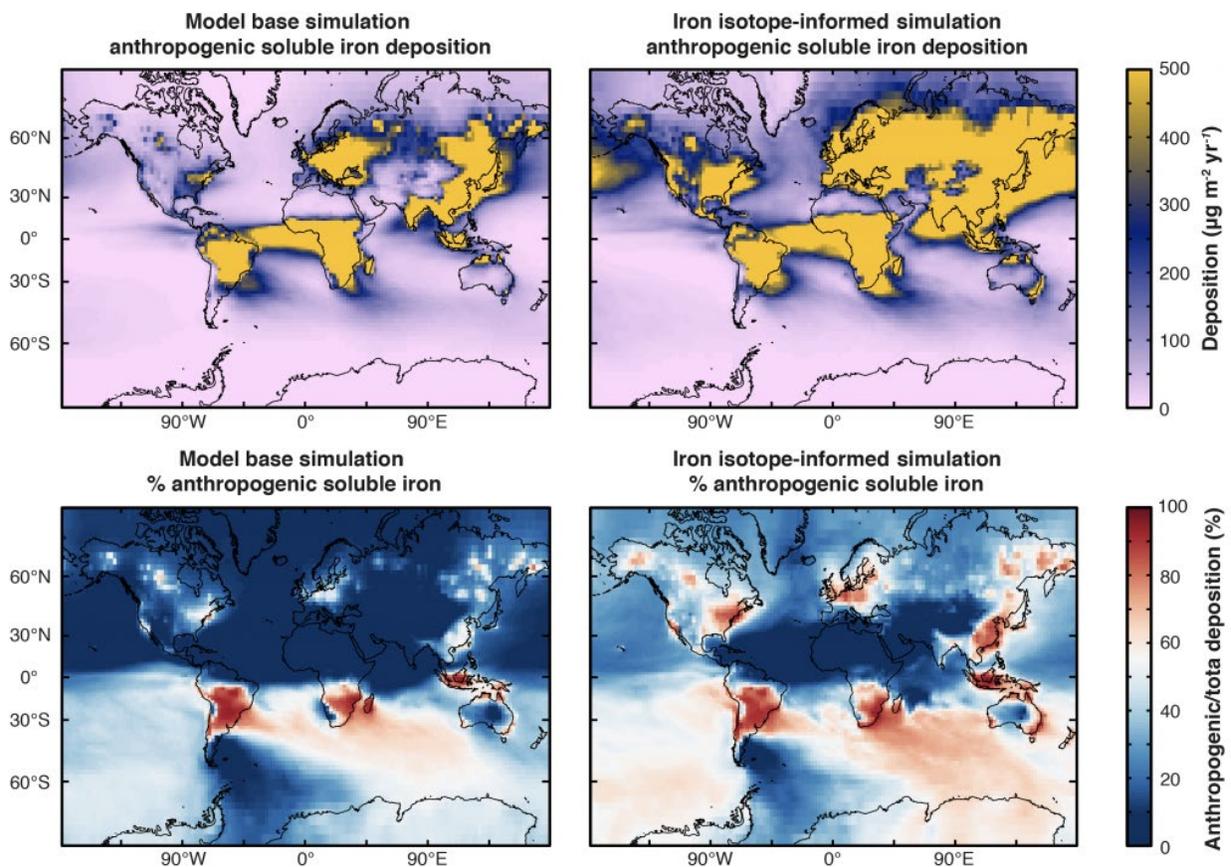
carbon with it – effectively acting as a “carbon sink.” So let’s add more iron to decrease the carbon dioxide from climate change, say geoengineering enthusiasts.

This geoengineering exercise is still hotly debated today, and the study by Conway and team add fuel to the fire with an unexpected twist.

“It seems we’ve already been fertilizing the ocean. We just couldn’t quantify it,” Conway said, although scientists have had a hunch about the human iron input since the mid-2000s.

“We’ve completely changed the system,” he said, and routinely add iron to the ocean when cutting down forests or driving cars. Ironically, because of the way iron works it’s therefore possible that these human sources of iron to the ocean may in fact have been acting to mitigate climate change.

“We don’t know the magnitude of it yet but it’s a fair statement,” Conway said.



*The work by Conway and others showed that scientists have significantly underestimated the amount of human-derived iron aerosols to the North Atlantic Ocean compared to natural-derived iron aerosols from Saharan dust storms. Right hand panels show the updated model scenarios (left panel shows the originals). As seen in the new panels, many more areas are deep orange, indicating up to 80% iron deposition from human sources such as fossil fuels, biofuels, and fires, especially in the iron-limited Southern Ocean region.*

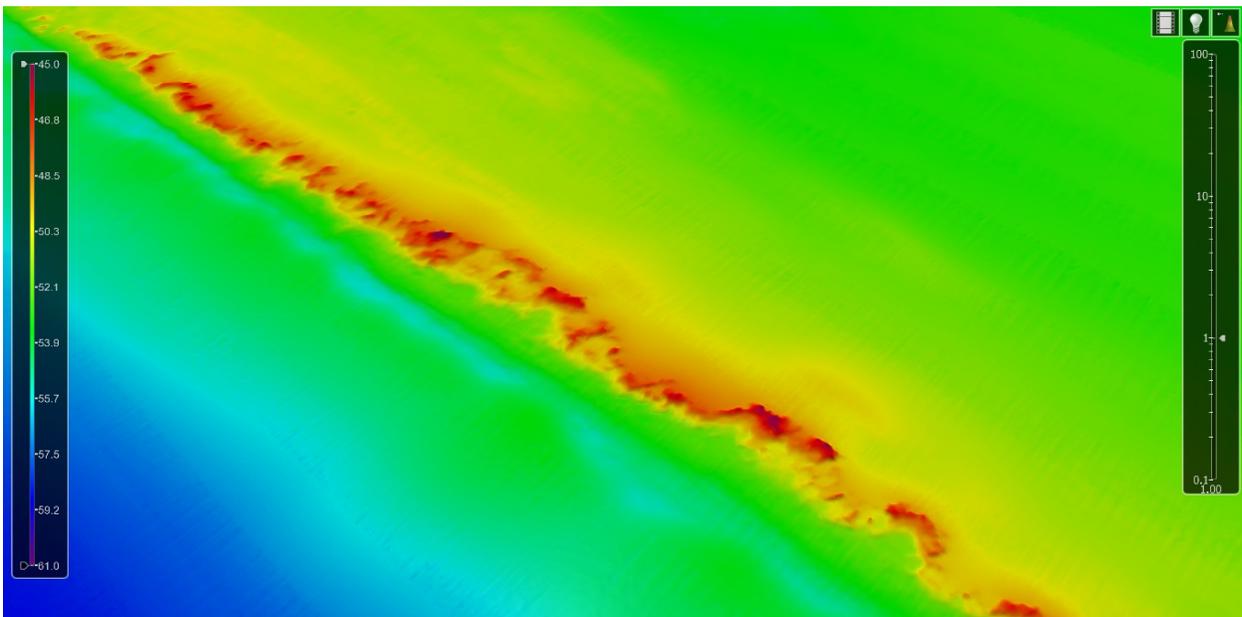
# HIGHLIGHTED RESEARCH

The work was funded by the National Science Foundation and included researchers from Cornell University, Florida State University, the University of Alaska Fairbanks, and the University of Southern California. Additional support was provided by the USF College of Marine Science.

Read the full story here: <https://www.marine.usf.edu//?s=iron+fertilization>

## FLORIDA'S MOST VALUABLE TREASURE MAP?

In an unprecedented four-year, \$4.5 million effort, a team led by the USF College of Marine Science to map the seafloor off the west Florida coast will double the area surveyed to date—but even then it's less than 10 percent of the goal.



*This is a bathymetry map of The Elbow, a popular fish hangout, that was collected by the USF College of Marine Science (USFCMS) team. The Elbow area has a prominent north-south ridge feature that sits more than 115 miles west of Tampa Bay in nearly 180 feet of water. The red color indicates the top of the ridge in the Elbow. It reaches nearly 25 feet above the surrounding seafloor – about the height of a telephone pole.*

There is a map for everything these days, and, it seems, fewer and fewer secrets. You can easily zoom in on a bush in your backyard, see the planes flying above at any given second, or find the best place to get New York-style bagels in your neighborhood.

But here in Florida there's a gargantuan map – one that is 15 percent larger than the state of Florida itself – that is nearly empty despite its critical role in the state's economy, culture, and future. This map remains chock full of secrets despite a valiant effort in recent years to fill in the data.

"It's crazy that we haven't done this yet," said Dr. Steve Murawski, Professor at the USF College of Marine Science.

## HIGHLIGHTED RESEARCH

Murawski is helping to lead the most ambitious and comprehensive effort to date to develop a map of the seafloor that stretches from the west Florida coastline into the belly of the Gulf of Mexico. The goal is to identify the fish “neighborhoods” along the West Florida Shelf, which starts about 20 miles off the coast of St. Petersburg in waters that deepen from 60 to 600 feet deep.

Some maps still in use today date back to the 18th century.

The Continental Shelf Characterization, Assessment, and Mapping Project – C-SCAMP for short – started in 2015 and is wrapping up this year. By the end, Murawski’s team will have mapped a total area larger than Jacksonville, the largest city in Florida, doubling the areas mapped to date from three to 6 percent. This builds off of USGS’s previous efforts as well as those led by USFCMS professor Dr. David Naar and his team who mapped several areas on the West Florida Shelf between 1999 – 2009.

But the west Florida shelf is a whopping 77,000 square miles.

Aside from the vastness of the space, mapping the seafloor beneath several hundred feet of saltwater is tough business – but a priceless treasure to local fisherman, resource managers, and scientists. It empowers them not only to determine where the prized grouper, red snapper, and golden tilefish live but where endangered loggerhead turtles hang out, where the most sensitive marine habitats or safest shipping routes are, where we should source sand for beach renourishment projects, and more.

In addition to the USF team, collaborators include scientists from the Florida Institute of Oceanography, Florida Fish and Wildlife Conservation Commission, and the National Oceanic and Atmospheric Administration (NOAA).

**Read the full story – including a new model for mapping the team is pioneering, and a new way to count fish – here: <https://www.marine.usf.edu/spotlight-on-research/floridas-most-valuable-treasure-map/>**

## Faculty Highlights

### **FACULTY AWARDS:**

- **Dr. Pamela Hallock Muller:** Received Raymond C. Moore Medal for Excellence in Paleontological Research from the Society for Sedimentary Geology (SEPM)
- **Dr. Mya Breitbart** was elected as a Fellow of the American Academy of Microbiology
- **Dr. Chuanmin Hu's** paper Wang et al. in *Science* listed in **Top 50 discoveries of the year by Discover Magazine**
- **Dr. Don Chambers** was selected to be a member of the 2020-2024 NASA GRACE Follow-on Science Team

### **TENURED AND TENURE-TRACK FACULTY ANNUAL UPDATES:**

Below are select 2019 highlights reported by faculty, along with their students and staff. Publications for CMS faculty are listed in a separate section.

#### **DR. CAMERON AINSWORTH (Fisheries Biology; Ecosystem and Resource Management)**

Dr. Cameron Ainsworth's laboratory completed significant synthesis work on a Deepwater Horizon oil spill investigation that began in 2011. They published five chapters in Springer books, submitted two papers in the primary literature, and participated in synthesis and legacy events including a GOMRI in-person national meeting and eight webinars on integrated modeling. MS student Elizabeth Viau graduated. Her study offered a comparison between natural and artificial reefs and showed the potential for artificial reefs to offer important ecosystem services. Ainsworth contributed to the environmental impact review process for Mississippi River sediment diversions conducted by Louisiana's Coastal Protection and Restoration Authority. Ainsworth hosted a series of events to advance ecosystem-based management and establish USF as a national leader in this field. The Ecopath35 conference held at CMS/FWRI Dec 4-6 drew attendance from 110 scientists/students from 25 countries and six continents. An additional 5 days of training workshops were attended by about 40 students. Ainsworth also hosted NOAA's Fifth National Workshop on Ecosystem Modeling (NEMoW 5) Dec 9-11 and NOAA's Southeast Regional Ecosystem Modeling Strategic Planning workshop on Dec 11 and 12. These were terrific networking opportunities for CMS students, codified the MRA program as an important part of NOAA's training efforts.

#### **DR. MYA BREITBART (Genomics; Marine Microbiology; Wastewater Microbiology; and Virology)**

Dr. Mya Breitbart's genomics and microbial ecology and genomics laboratory had an extremely successful year, publishing eleven peer-reviewed scientific manuscripts and accomplishing major goals on several federally-funded projects. Research areas included: 1) Using viral metagenomics to identify and describe the viral communities in a variety of environments and organisms, 2) Inclusion

## FACULTY HIGHLIGHTS

of DNA barcoding into marine biodiversity surveys, 3) Microbial water quality and risk assessment, 4) Bacteriophage diversity and dynamics in aquatic environments. Locally relevant research papers published in 2019 included the first description of a virus in seagrass from Tampa Bay, genetic identification of fish eggs in the Gulf of Mexico, biodiversity observations in the Florida Keys National Marine Sanctuary through analysis of environmental DNA, and demonstration of a vertically transmitted virus in spiders. International activities include a major NSF-funded study on microbial water quality and the risks associated with recreation in coastal waters in Costa Rica. In 2019, Dr. Breitbart was elected as a Fellow of the American Academy of Microbiology, two graduate students earned their MS degrees, and five interns (including two high school students) were trained during the summer. Lab members presented at several national and international conferences, and the entire lab attended the Annual Meeting of the Florida Branch of the American Society for Microbiology. Finally, the Breitbart lab was very active in outreach and education, leading a ten-week marine science summer program for Girls Incorporated of Pinellas, developing a “DNA detectives” activity for the St. Petersburg Science Festival, and producing several blog posts and social media postings to ensure public outreach and dissemination of results.



*Breitbart lab at the Annual Meeting of the Florida Branch of the American Society for Microbiology*

### **DR. KRISTEN BUCK (Trace Metal Biogeochemistry; Metal-Binding Organic Ligands)**

Dr. Kristen Buck had five active NSF awards and four newly funded non-NSF awards in 2019. Buck’s lab group sailed on eight research expeditions in 2019 related to these projects. Buck’s research was published in Annual Reviews of Marine Science and Marine Pollution Bulletin. Buck continues to serve on the Editorial Board for Limnology and Oceanography: Letters as an Associate Editor. Buck served The Oceanography Society (TOS) on the 2020 Ocean Sciences Meeting Program Committee, and will be Chair of the 2020 Ocean Sciences Meeting. Buck currently supervises three PhD students and two MSc students; two of these students are underrepresented minorities in science. Buck graduated two MSc students in 2019.

# FACULTY HIGHLIGHTS

## **DR. ROBERT BYRNE (Marine CO<sub>2</sub> System Chemistry and Ocean Acidification; Seawater Trace Element Chemistry; and Development of In Situ Methods and Instrumentation for Analysis of Seawater)**

Dr. Robert Byrne published six papers in 2019 that were first-authored by students. Three student authors were from USF, and the others were from the California Institute of Technology, the University of Southern California and Xiamen University. The first-authored 2019 publication of CMS student Jon Sharp describes a method for direct spectrophotometric measurements of carbonate saturation states at ambient temperatures without the expected requirement for measurement of two CO<sub>2</sub> system variables. This development greatly simplifies procedures for in situ measurements of calcite and aragonite saturation states.

## **DR. DON CHAMBERS (Using satellite observations to understand climate change and ocean dynamics)**

Last year, Dr. Don Chambers contributed to several community papers on understanding the current mechanisms of global sea level change and describing necessary improvements in the measuring system to advance our knowledge. He also contributed (with a former post-doc) to a new data set that can be used to quantify changes in extreme sea level events around the United States coastline, published in Nature Science Data. This new data set moves away from giving information at single tide gauges (e.g., the St. Petersburg tide gauge), to providing information for an entire region (e.g., the west coast of Florida), providing information to policymakers where there are no observations. Chambers was also selected to be a member of the 2020-2024 NASA GRACE Follow-on Science Team.

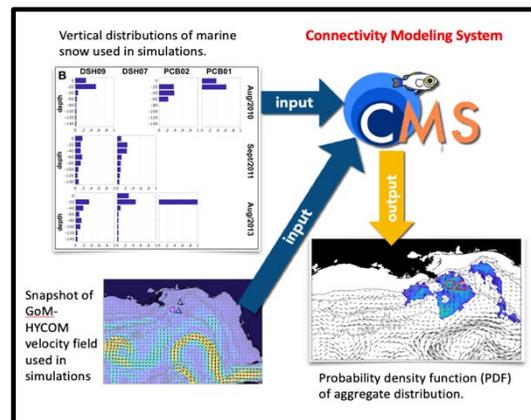
## **DR. TIM CONWAY (Marine trace elements, trace metal isotopes, biogeochemistry, marine geochemistry, GEOTRACES)**

In 2019 Dr. Tim Conway has continued to establish himself at USF as a field leader in micronutrient metal cycling in the ocean, especially in marine iron cycling. Conway is federally funded to participate in the USGEOTRACES program, but is also involved in German, Dutch, UK and Japanese oceanographic research programs. Although iron is essential for all life, low concentrations and contamination potential combine to make iron in credibly challenging to measure in seawater. Despite these challenges, Conway has developed world-leading facilities at USF for the analysis of iron and iron isotopes in open ocean seawater, a procedure that can only be carried out by a handful of institutions worldwide. Accordingly, Conway has welcomed a number of national and international collaborators to USF during 2019. Conway also graduated his first PhD student during the year. Conway published four research articles in 2019, with two of these first authored by a graduate student, and two in the prestigious journal Nature Communications. One of these articles focused on how ice shelves in a changing climate can affect iron release to the Antarctic Ocean, and one article showed how human-derived iron from combustion on land can be an important atmospheric source of iron to the ocean, drastically influencing surface ocean productivity. The second of these studies was featured in Scientific American.

## DR. KENDRA DALY (Zooplankton Ecology; Gulf of Mexico and Antarctic Ecosystems; Low Oxygen Regions in the Ocean; Ocean Observatories; Sensor Technology)

Dr. Kendra Daly's paper (Daly, Vaz, and Paris, 2020) used marine snow particle distributions observed during the Deepwater Horizon oil spill coupled with a 3-D circulation model to demonstrate (1) where particles came from during the oil spill and (2) how far oil in marine snow particles could be transported during and after the oil spill. Mississippi River influence, mesoscale circulation, and cross shelf transport are important processes affecting particle transport in the NE Gulf of Mexico. Most particles that we observed at sampling stations came from the region that was covered by oil. Denser, rapidly sinking particles sank near their site of origin, but slower sinking particles could be transported 10s to 100's of kilometers away.

*Schematic showing inputs (i.e., marine snow vertical distributions and velocity fields from HYCOM model) into the Connectivity Modeling System and model output showing where the surface particles that we observed during the oil spill came from within the region covered by surface oil.*



Daly's former PhD student, Claire Crowley, came out with a series of papers in the last two years substantially increasing our knowledge on the biology of the stone crab, which is the third most valuable fishery in Florida. This fishery has been over-exploited since 1997. Dr. Crowley's research provided critical information needed by models to assess whether different management regulations and fisheries practices would substantially improve the resiliency of stone crab populations

## DR. JACQUELINE DIXON (Igneous Petrology; Mantle Geochemistry; Role of Volatiles in Magmatic Processes; Deep Earth Geochemical Cycling of Volatiles/Dean)

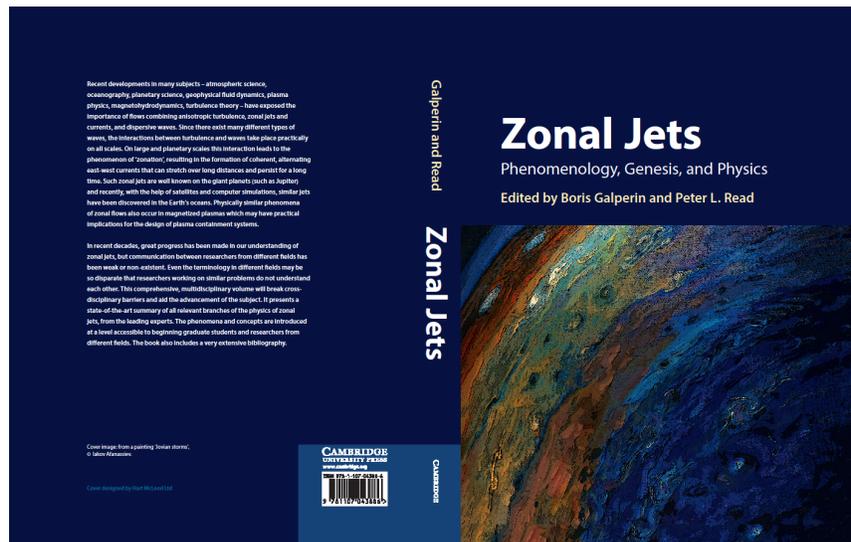
Dr. Jacqueline Dixon was invited to give the keynote address at the Goldschmidt Conference in Barcelona in the session "Subduction Zones and Associated Fluid and Mass-Transfer Processes". Her talk "Extended subduction factory model for generation of mantle heterogeneity" builds on her 2017 paper on the same topic.

## DR. BORIS GALPERIN (Atmospheric; Oceanic and Planetary Turbulence; Theory, Modeling, Experiments)

A book "Zonal Jets: Phenomenology, Genesis, and Physics", co-edited by Professors Galperin and Read of the University of Oxford, was released on 28 February, 2019. This is a unique, highly interdisciplinary book that serves a broad scientific community, from graduate students to experienced researchers. The phenomenon of zonal jets is to the Atmospheric and Planetary sciences, Oceanography, Astronomy, Plasma Physics, Experimental and Computational Physics, and more. The book surveys both the history and the state-of-the-art, and outlines new directions of research. The

# FACULTY HIGHLIGHTS

book has received a very good review from Professor Carl Wunsch who is known as a very scrupulous and demanding reader. His message follows: “Boris, I took your book to Woods Hole for a month. I can't say I read it through---that's a bit like trying to read an entire encyclopedia. It's very well done, and I think will be the standard reference for many years to come. A great job. Regards, Carl”



## **DR. DAVID HOLLANDER (Chemical Sedimentology; Isotopic Biogeochemistry and Organic Geochemistry; Oil Spill Ecosystem Impact Assessment)**

Dr. David Hollander published 21 peer-reviewed articles and book chapters; five of which have lead authors that are students and staff under his direct supervision and two with students outside USF which Hollander was a committee member. Moreover, Hollander presented over 23 talks at national and international meetings-many with his students as lead presenters. Hollander was active at the professional level including as a member and workshop leader of the Gulf of Mexico Research Initiative-Synthesis and Legacy Group focusing on Oil Fate and Degradation, as a convener of a scientific session at the GOMOSES national meeting, and as a keynote lecturer at a workshop on “Leveraging science and academic engagement during an incident”. Of significant accomplishment is the publication (on-line version in 2019; print version in 2020) of a two-volume series of books by Springer Nature entitled: I) Deep Oil Spills –Facts, Fate and Effects, and II) Scenarios and Responses to Future Deep Oil Spills –Fighting the Next War.

## **DR. CHUANMIN HU (Ocean Optics and Optical Remote Sensing)**

Dr. Chuanmin Hu’s research group published a total of 27 peer-reviewed publications and had an annual expenditure of \$921K from externally supported projects, Of the numerous publications, the most noteworthy paper was led by his student (now postdoc, M. Wang). The paper “The Great Atlantic Sargassum Belt” appeared in the July 4<sup>th</sup> edition of the Science magazine. Both Hu and Wang received many interviews from television channels, newspapers, and other online media for the

# FACULTY HIGHLIGHTS

discovery of this largest seaweed belt. The discovery was selected by the Discovery magazine as one of its 50 top discoveries of the year for 2019, and recorded in the World Geniuses Records. The discovery also formed the basis to a NASA proposal to continue Sargassum research, which was selected by NASA to support its PACE space mission and C. Hu selected to be on the PACE science team. Two students (S. Sun and S. Chen) who graduated from his group in 2018 were offered associate professorship positions, and another student (M. Wang) received the Sacket Prize and USF Outstanding Dissertation Award. Another student (Y. Zhang) received a 3-year NASA fellowship award. Hu also received the USF Outstanding Graduate Mentor award in 2019.

**DR. MARK LUTHER (Maritime Safety and Security; Real-Time Ocean Observation Systems; Numerical Models of Ocean Circulation; Coastal Water Quality)**

Dr. Mark Luther is working with the Tampa Bay Estuary Program, the US Fish and Wildlife Service, and the Tampa Port Authority to analyze Automatic Identification System vessel tracking data (AIS) to estimate the impacts of ship wakes on critical marine habitat in Tampa Bay. Two papers were presented on this work at the 2019 Coastal and Estuarine Research Federation Conference in Mobile, AL on Nov. 4, 2019. AIS data is being mined for other Maritime Domain Awareness applications, such as identification of optimal vessel transit windows and automated anomaly detection, in collaboration with the port authority, the Tampa Bay Pilots and others in the regional maritime community. Dr. Luther and collaborators performed an analysis of the potential impacts of future sea-level rise on commercial vessel movements in Tampa Bay, showing that changes in future tidal currents may provide expanded windows for optimal vessel transits. An invited manuscript on this effort was published in the journal *Maritime Policy & Management*. With funding from the Tampa Bay Environmental Restoration Fund, Dr. Luther is working with the City of St. Petersburg and Pinellas County water management staff to develop predictive tools based on short-term climate forecasts to help mitigate future wastewater releases into Tampa Bay and surrounding waters. Data from the water quality station his lab maintains on Clam Bayou have been very useful for assessing the impacts of the recent wastewater releases on dissolved oxygen (DO), chlorophyll, and turbidity.

**DR. GARY MITCHUM (Climate Change; Ocean Eddies; Satellite Remote Sensing; and Sea Level Rise/Associate Dean for Research)**

Dr. Gary Mitchum has spent a lot of time over the past several years helping to explain sea level rise and climate science in general to local and state level decision makers. This past year was very busy in this regard. Mitchum, in partnership with state-wide members of the Florida Climate Institute, worked with our own Saint Petersburg Florida Representative Ben Diamond to draft a bill to enable a comprehensive Florida Climate Assessment. As part of this effort, Mitchum also traveled to Tallahassee as part of an FCI team to discuss this idea with state officials. This bill did not ultimately pass, but Mitchum also gave testimony before Senator Tom Lee's committee in Tallahassee and we now expect to have a sea level rise task force that will be charged with assessing the risks that we all face from climate change, which is a first for Florida.

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**DR. PAMELA HALLOCK MULLER (Biological, Environmental and Evolutionary Controls on the Production and Accumulation of Carbonate Sediments: Geologic History of Reefs; Modern Coral Reefs; Shelf Ecology; Environmental Management; Micropaleontology; Paleoceanography; Paleoecology)**

Dr. Pamela Hallock Muller co-authored eight peer-reviewed papers in 2019, six in collaboration with her recently graduated students and two with international colleagues. She completed a 4-year term as Editor of the Journal of Foraminiferal Research, a quarterly society journal that deals with the most abundant shelled organisms in the world's oceans. In May 2019, she was awarded Raymond C. Moore Medal for Excellence in Paleontological Research by the Society for Sedimentary Geology (SEPM). In fall semester, she graduated two students: Kyle Amergian MS and Selena Kupfner Johnson PhD.

**DR. FRANK MULLER-KARGER (Changes in Marine Ecosystems Using Field-based and Satellite Remote Sensing Time Series)**

Dr. Frank Muller-Karger published 24 peer-reviewed manuscripts in 2019, with four others already accepted for publication for 2020. Among the publications was a synthesis of 22 years of time series observation in the Cariaco Basin off Venezuela in the prestigious journal Annual Review of Marine Science. This synthesis which documented major changes in the food web during the decade of 2010 that were caused by major changes in the oceanography of the entire Atlantic Ocean. These changes led to the collapse of the sardine fishery in the eastern Caribbean Sea, and to changes in the sediments that settle to the bottom of the Cariaco Basin. The Cariaco program helped understand the connection between climate at the surface of the ocean and the sediments at the bottom of the ocean. Other manuscripts published in 2019 focused on strategies for ocean observing and the importance of addressing societal needs in oceanography. Muller-Karger was on the Program Committee for the OceanObs'19 conference, which is held only once every 10 years. In addition, he served in the Integrated Marine Biosphere Research (IMBeR) Science Steering Committee, the steering committee for the Ocean Best Practices System at the Intergovernmental Oceanographic Commission (IOC), the IOC's Bio-Eco Panel of the Global Ocean Observing System, led the Ocean Obs Research Coordination Network sponsored by the National Science Foundation, and co-chaired the Marine Biodiversity Observation Network (MBON) that operates under the Group on Earth Observations (GEO).

**DR. STEVE MURAWSKI (Population dynamics of exploited marine species; impacts of fishing and other anthropogenic stresses on marine ecosystems; ecosystem modeling and analysis /St. Petersburg Downtown Partnership Peter R. Betzer Endowed Chair)**

The Murawski Laboratories' (elements of the C-IMAGE consortium and the C-Scamp project) major research deliverable was a two volume book series (published in 2019) consisting of 63 chapters with over 115 authors for each volume. These books deal with deep oil spills from documented impacts of previous spills and consider factors in responding to future deep spills. Dr. Steve Murawski co-edited the volumes and authored or co-authored 13 chapters, among the two volumes. In addition to the book project, Murawski's lab also organized, participated in and developed products for the synthesis

## FACULTY HIGHLIGHTS

of Deepwater Horizon impacts to ecosystems (GoMRI's Core area 3 activities). Workshops Murawski chaired in July (St. Petersburg) and October (Washington, DC) gathered all relevant information describing population and community-level impacts of DWH on biota in four ecotypes: nearshore/coastal, continental shelf, open ocean pelagic and benthic. These summaries will be published in 2020. Field activities consisted of four research expeditions for the "Great Red Snapper Count" in the Gulf. Under Murawski's leadership, a workshop synthesizing "lessons learned" from DWH applied to future deep ocean oil spills was conducted at the GoMOSES Conference. Additionally, his group sponsored sessions at AGU (October), the Mexican AGU (October) and at the Deep Ocean Symposium in Hamburg. Outreach activities sponsored by the lab included a presentation of the book *Scenarios and Responses to Future Deep Oil Spill* at the Tampa Bay Reading Festival, and participation in the "Expert is in" program at the Smithsonian Institution.

**DR. DAVID NAAR (Marine Magnetism; Mid-Ocean Ridge and Hotspot Interactions; Plate Tectonics; Seafloor Mapping with High-Resolution Multibeam Sonars of Artificial and Real Coral Reefs, Mines, Paleoshorelines, Hydrothermal Vents, and Fish Habitats; and Wax Analog Modeling of Seafloor Spreading Processes/Associate Dean for Graduate Studies)**

Dr. David Naar remained active in assisting and advising in seafloor mapping proposals and projects that led to successful surveys in the Bahamas and in the Tampa Bay, one of which he led as Chief Scientist as part of an NSF-funded Research Experience for Undergraduates (REU). This cruise led to a successful Florida Institute of Oceanography (FIO) ship-time proposal submitted by him. Naar assisted Dr. Ana Arellano run the NSF-Funded REU program in the summer, and has been assisting Dr. Arellano in preparing a College-wide NSF REU program proposal to be submitted in 2020. In addition to these research and teaching activities, he has assisted a university-wide task force to address Graduate and Professional Student Success. As Associate Dean, he was also busy implementing recommendations from an external site review of the program and preparing for the July 1, 2020 USF consolidation.

**DR. ERNST PEEBLES (Biological Oceanography/Marine Resource Assessment)**

Dr. Ernst Peebles continued serving as Principal Investigator on a research grant that has established USF as a Florida RESTORE Act Center of Excellence (FLRACE). During summer 2019, personnel from the Peebles, Breitbart, Stallings, and Murawski labs executed the first comprehensive survey of drifting fish eggs on the west coast of Florida. This egg survey is scheduled to be repeated on an annual basis until at least 2033, generating fundamentally important information on linkages among fish stocks in different parts of the Gulf of Mexico. The annual egg surveys will make intensive use of DNA barcoding, an approach that is being enhanced and perfected by Dr. Breitbart's lab. Earlier pilot studies for this effort are presently being published, with the most recent paper, "DNA barcoding of fish eggs collected off northwestern Cuba and across the Florida Straits identifies the significance of egg transport by mesoscale eddies" being recently accepted for publication in the journal *Fisheries Oceanography*. Dr. Chuanmin Hu's lab at USF was instrumental in the completion of this latest paper, with his contributions to the paper's physical-oceanography component making the paper truly

## FACULTY HIGHLIGHTS

interdisciplinary. Also as part of this larger effort, Peebles' lab continued developing forensic methods that allow re-creation of the lifetime habitat and feeding histories of individual fish using natural, chemical tags that are sequentially stored within fish eye lenses. Additional information about the Florida RESTORE Act Centers of Excellence Program, which is administered by the Florida Institute of Oceanography, can be found at <https://www.facebook.com/floridainstituteofoceanography/posts/880959472015865:0>.

### **DR. BRAD ROSENHEIM (Paleoceanography/Paleoclimate, stable isotopes, carbon cycling)**

Soon after 2019 commenced, which was hard to discern where the sun shines for 24 hours each day and time zones are only about 80 km apart, members of the SALSA project had been up nearly continuously for a few days. The first sediments had successfully been sampled from Mercer Subglacial Lake, 1,067m below the Mercer Ice stream, by multicore, but the team was reeling from the loss of their first gravity core. Now it was time for USF's major contribution to the field work, but the first attempt at using it brought an inverted core catcher and no sediment. With the hot water drill limping in this remote camp, they were not sure how many other attempts they would have. Using the innovation of the gravity corer, a free-fall brailer-release designed at Woods Hole Oceanographic Institution, the next two attempts brought the longest subglacial sediment cores ever sampled to the surface. The group improved their deployment methods and marveled at how well the simple device had worked. Most importantly, this rendered the transdisciplinary project a success! Dr. Brad Rosenheim led the first post-field season core sampling party in the new national Marine Geology Research Facility in Corvallis, Oregon. The cores showed obvious lake sediment on top of glacial till, a major finding itself. Through the rest of the year, Rosenheim has worked with his students on this project, on IODP Expedition 379 to the Amundsen Sea, Antarctica, on mangrove carbon cycling, and planning a 2020 expedition to the Amazon River.

### **DR. BRAD SEIBEL (Physiological response of marine animals to extreme environments, ocean acidification, deoxygenation and warming, polar and deep-sea biology, biology of mollusks)**

Dr. Brad Seibel's research in 2019 focused on the response of marine animals to ocean warming and deoxygenation. He discovered a novel quantitative relationship between the oxygen and temperature sensitivities of marine animals that, despite nearly a century of study, had gone unrecognized. The relationship provides the ability to map habitat that is metabolically available and how that habitat will shift with changing climate. It provides a precise measure of the decrement in metabolism and the scope available for growth and reproduction with declining oxygen and increasing temperature. He presented this work at four international conferences and at UNESCO's Global Ocean Oxygen Network (GO2Ne) and the GO2Ne summer school in Xiamen, China. This work will be published in 2020 in at least three papers in *Nature*, *Science Advances* and the *Journal Experimental Biology*. Seibel also contributed a chapter to the IUCN's report on Ocean Deoxygenation on the effects on Mesopelagic Communities.

# FACULTY HIGHLIGHTS

**DR. AMELIA SHEVENELL (Paleoceanography/Paleoclimatology; Trace and minor elements in biogenic calcite and marine sediments; Stable isotopes in carbonate and siliceous marine microfossils; Lipid biomarkers; Sedimentology)**

Dr. Amelia Shevenell received the 2019 USF Faculty Outstanding Research Achievement award and was elected as a full member of Sigma Xi, the Scientific Research Honor Society. Shevenell's impact in the field of Paleoceanography and Antarctic Science was also recognized by Wikipedia, where she earned an official Biography of Living Person entry. Shevenell, her students, and collaborators published 11 papers, with an additional 3 accepted or in review in high profile journals, including *Oceanography*, *Paleoceanography and Paleoclimatology*, and *GSA Bulletin*. Her USF CMS PhD student, Michelle Guitard, sailed on International Ocean Discovery Program (IODP) Expedition 382 to the Weddell Sea, Antarctica (February-April, 2019) as a member of the multi-national shipboard scientific party. The two-month expedition aboard the JOIDES Resolution, recovered marine sediments from close to Antarctica that will help scientists better understand the evolution of Antarctica's ice sheets over the last 20 million years. In addition to her research and teaching commitments at USF, Shevenell is the Geological Oceanographer Councilor to The Oceanography Society's governance council, and a member of their Ethics Committee. In 201, Dr. Shevenell was appointed an Associate Editor for the American Geophysical Union journal, *Paleoceanography and Paleoclimatology*, the premier specialist journal in her subfield.

**DR. CHRIS STALLINGS (Ecology; Marine conservation and management efforts)**

Dr. Chris Stallings served as senior author on four peer-reviewed publications from his lab and a fifth as a co-author. One of his recent papers was recognized by Web of Science as a "highly cited" contribution, which placed it in the top 1% of publications based on a highly cited threshold for the field of Environment/Ecology. Stallings also received three new grant contracts, enabling him to continue his research programs in coastal ecology. In teaching, Stallings led a three-university collaboration among USF, UF, and FAU for the inaugural offering of an immersive course for graduate students in fisheries science. The course was a success and the three schools plan to offer it again in the future. Such collaborations can become a model for the future of college education and training. Three students from the Stallings successfully defended their masters theses (2) and doctoral dissertation (1). These students have secured highly competitive positions in their fields, further signifying the successes and accomplishments of the training provided by Dr. Stallings and the CMS.

**DR. ROBERT WEISBERG (Ocean Circulation; Ocean-Atmosphere Interaction Studies in the Tropics; and West Florida Continental Shelf Circulation)**

Dr. Robert Weisberg's best work for 2019 was his collaborative paper: Weisberg, R.H., Y. Liu, C. Lembke, C. Hu, K. Hubbard, M. Garrett (2019), The Coastal Ocean Circulation Influence on the 2018 West Florida Shelf K. brevis Red Tide Bloom, *J. Geophys. Res.: Oceans*, 124, doi:10.1029/2018JC014887, which explained why the 2018 red tide was so severe and why it resulted in the rare instance of simultaneous blooms on Florida's west, Panhandle and east coasts. This work resulted in numerous speaking engagements, plus articles written in various public interest journals, all garnering

# FACULTY HIGHLIGHTS

attention in service to the College of Marine Science. While it has taken a few decades to make the point, there now seems to be some recognition that processes of ecological importance to the State of Florida should be viewed in an interdisciplinary manner. Ecosystems services, largely attributed to the west Florida continental shelf, have their origins in the circulation because the circulation is what largely determines the water properties in which organisms reside. Now approaching the end of a career, Weisberg continues to be astounded at how difficult it is to overcome disciplinary biases in getting this point across.

## **DR. NANCY WILLIAMS (Ocean Carbon Cycle, Carbonate Chemistry, Ocean Biogeochemistry, Ocean Acidification, Earth System Modeling, Autonomous Platforms)**

Dr. Nancy Williams joined USF CMS as an Assistant Professor in October of 2019 and has been working to build up her research lab, secure external funding, plan future courses, and recruit students. Dr. Williams uses autonomous platforms equipped with newly-engineered chemical sensors as well as output from computer climate models to study the ocean's role in the global carbon cycle and in regulating climate. She is a coauthor on recent study by Bronselaer et al. (in press as of December 2019) now published in *Nature Geoscience* titled "Importance of wind and meltwater for observed chemical and physical changes in the Southern Ocean" (also see commentary on this manuscript). Williams plans to work with the USF CMS' Center for Ocean Technology to integrate additional biogeochemical sensors onto newly-commissioned ocean robots to study the biogeochemistry of the Gulf of Mexico and the West Florida Shelf.

## **CMS OCEAN TECHNOLOGY GROUP:**

The CMS Ocean Technology (COT) group was involved in a large number of high-profile projects this past year including, but not limited to:

- Supporting observing systems in the Gulf of Mexico, including designing and building two new data acquisition systems for the Pressure Point mooring, integrating a new multi-parameter Meteorological instrument into the C12 buoy. On the GPS buoy, we enabled Iridium communication with the system, and are now downloading the data over the satellite network. This will allow us to deploy the system anywhere in the world while retaining daily data return.
- Supporting four ocean glider deployments, including the glider deployment described in the Highlighted Research section. Deployments were in conjunction with three entities in the past year; the State of Florida, the Gulf of Mexico Coastal Ocean Observing System, and the Southeast Coastal Ocean Observing Regional Association. This included deployments in the Atlantic Ocean and the Gulf of Mexico in support of red tide research, hurricane strength forecasting and exploratory efforts aimed at using these glider platforms for understanding fish movements and patterns.
- Supporting a variety of fisheries related projects, including obtaining acoustic tag telemetry data, taking acoustic recordings of somniferous fish and a new effort to map fish biomass using calibrated fisheries echo sounders integrated into gliders. This has the potential to map

# FACULTY HIGHLIGHTS

fish biomass across the eastern Gulf of Mexico if persistent glider observations are funded and technological issues are worked out.

- Supporting five multibeam and four video mapping cruises. Several multibeam and video mapping cruises were completed across the Gulf of Mexico and in the Bahamas in support of several projects including the final cruises on a National Fish and Wildlife Foundation grant were completed. During the duration of this effort we conducted over 30 cruises of at least 5 days, involving over 20 science party members and at least a dozen crew members. This has resulted in significant new insight into the habitat of the eastern Gulf of Mexico and how the vast resources should best be managed. No effort to this scale has ever been accomplished in the time we have been working on this.
- Supporting a central and western Gulf of Mexico survey of Red Snapper distribution and habitat using video and sonars that was conducted to help determine population levels and distributions.

## RESEARCH FACULTY ANNUAL UPDATES:

### DR. JOSHUA KILBORN

Dr. Joshua Kilborn was newly appointed to the research faculty in April 2019, and has had a productive nine months at the College of Marine Science (CMS) since then. Building off of previous work exploring the Gulf of Mexico (GoM) in an ecosystem-based fisheries management (EBFM) context, Dr. Kilborn has helped to develop a framework and vision for implementing a next-generation, fishery ecosystem plan (FEP) for the region. A Gulf-wide FEP is critical for developing sustainable EBFM initiatives. In conjunction with colleagues from the Florida Wildlife Federation and the Cooperative Institute for Marine and Atmospheric Studies, he co-authored an article on the issue for the Bulletin of Marine Science (“Advancing ecosystem management strategies for the GoM’s fisheries resources: implications for the development of a fishery ecosystem plan; Dell’Apa et al. 2020), which is being advocated for among fishery management professionals by Pew Charitable Trusts. Lastly, Kilborn was invited to participate in the Gulf of Mexico Research Initiative/C-IMAGE III (No. SA 18-16): Core Area III Synthesis efforts. Here, he participated in two workshops in 2019 (St. Petersburg, FL & Washington D.C.) and the 2020 Gulf of Mexico Oil Spill Ecosystem Science annual conference. Kilborn continues to work closely with CMS’s Drs. Steven Murawski and Patrick Schwing (among others) to continue his exploration of the GoM ecosystem by developing community-level multivariate analyses for both faunal and system-wide responses to the Deepwater Horizon event.

### MR. CHAD LEMBKE (Ocean technology and glider operations)

Mr. Chad Lembke specializes in enabling technology to be used for a diverse set of projects by managing and enabling personnel, coordinating and facilitating operations, and performing lab, field, maintenance, and facilities work as needed. In 2019 this resulted multiple successful research operations including:

- The conclusion of the large-scale habitat mapping project in collaboration with a team of up to 14 other staff and students. This project has nearly doubled the amount of seafloor

# FACULTY HIGHLIGHTS

mapped with high resolution multi-beam sonar with the added benefit of near bottom video to assist in classification schema resulting in large scale habitat identification to assist stock managers in understanding “fish neighborhoods”

(<https://www.marine.usf.edu/scamp/index.php>).

- Expansion of the College’s glider fleet and capabilities has been accomplished by adding two new gliders, sending four team members for training, and adding new fisheries echo sounders to two of the gliders in our fleet. Research efforts include but are not limited to: Evolution and prediction of red tide blooms in the eastern Gulf of Mexico Monitoring the western boundary of the Gulf Stream along the southeast Atlantic coast. Assessing overall heat content in the water column to assist in knowing the potential “fuel” available to storms, therefore assisting in the prediction of storm strength. Assessing fish populations through tag telemetry, somniferous fish, and water column biomass estimations.
- Continued support of the USF Geodesy buoy at the mouth of Tampa Bay
- Maintenance and oversight of a large portion of COT infrastructure, including a new 2.5m x 5m x 1.5m tank housed in the COT flume lab.

## **NONTENURE-TRACK FACULTY RESEARCH UPDATES**

### **DR. BRIAN BARNES (Ocean Optics and Optical Remote Sensing)**

In 2019, Dr. Brian Barnes worked on calibration of numerous satellite ocean color sensors, challenging some key assumptions in satellite data processing which impact the accuracy of all derived satellite ocean color products. Through continued work, this will likely lead to improved cross-sensor agreement and ability to quantify long-term trends in the satellite ocean color record. Relatedly, Barnes’s most impactful publication in 2019 was as third author of an assessment of floating algae blooms in the Northern Atlantic Ocean, published in the journal *Science*. Through analysis of long-term satellite time series, we have identified a major expansion in the size and density of these blooms, subsequently determining potential environmental factors leading to this growth and improving mechanisms for prediction of future bloom occurrence and location.

### **DR. TERESA GREELY (Education and Outreach Director)**

Dr. Teresa Greely taught 15 course credits, directed three education programs, and led two externally-funded projects during 2019. Dr. Greely was a coeditor for a Special Issue of *Current*, the Journal for Marine Education, Featuring the Gulf of Mexico Research Initiative – Research Resulting from the 2010 Deepwater Horizon Oil Spill. *Current*, 33, 1, 1-46. She co-published an article, An Underwater Blizzard of Marine Oil Snow as part of the 2019 special issue. In 2019 she co-led a new initiative with NOAA and the Pinellas County School Board to provide elementary students and teachers coastal watershed field trips and classroom lessons specifically for Title I schools serving the south St. Petersburg schools adjacent to USF and Clam Bayou. Over 450 young scholars and teachers participated in coastal watershed field trips in 2019. As a NOAA Ocean Exploration facilitator, Greely provided over 60 Florida teachers with “NOAA’s Exploring the Deep Ocean” Professional Development training. Dr. Teresa Greely and the E&O team completed the 15<sup>th</sup> year of the Spoonbill Ocean Sciences Bowl competition

## FACULTY HIGHLIGHTS

that has supported over 1000 high school students and teachers along Florida's west coast. She continues to extend her professional service as a regular reviewer for NSF and NOAA, as well as, review manuscripts for both ocean science and science education journals.

### **DR. YONGGANG LIU (Ocean Circulation; West Florida Continental Shelf Circulation)**

Dr. Yonggang Liu was responsible for maintaining the automated West Florida Coastal Ocean Model (WFCOM) & Tampa Bay Coastal Ocean Model (TBCOM) daily runs, as well as the associated red tide short-term forecast products. These nowcast/forecast model products provided valuable information of coastal ocean currents and red tide trajectories to the local community and government agencies. He also utilized the WFCOM and *in situ* observations in studying the impacts of Hurricane Irma on the circulation and transport along the west Florida coast, and published a paper in *Estuaries and Coasts*. He investigated the major red tide event in 2018 and published a paper in *Journal of Geophysical Research Oceans*, demonstrating the importance of ocean circulation in marine ecosystem.

### **DR. CLIFF MERZ (Ocean monitoring and prediction)**

Dr. Cliff Merz is a research engineer, elected government official, author, and inventor of sustainable marine water/food/energy nexus technologies. Merz is USF's Coastal Ocean Monitoring and Prediction System (COMPS) Program and Oceanographic Surface Current Measurement High Frequency Radar (HFR) Operations Director and is a 3-time elected commissioner (currently Vice-Mayor) of Pinellas County's City of Safety Harbor where he makes policy and budget decisions for 17,000+ residents with a \$68 million budget. Merz is PI on a National Academy of Sciences, Engineering and Medicine's (NASEM) grant designed to better understand the Gulf of Mexico's Loop Current. This 2-year, \$1,371,027, multi-institutional (UM and Rutgers) effort, entails instrumenting specific locations within the lower Florida Keys with HFR systems and then observing the measured real-time surface current as it moves through the Florida Straits. In addition, He is Co-PI on several grants (HFR and Coastal Station) from the Southeast Coastal Ocean Observing Regional Association (SECOORA), part of the federal NOAA U.S. IOOS. Merz submitted a provisional patent application and authored a paper entitled "Physicochemical and Colligative Investigation of Alpha (Shrimp Shell) and Beta (Squid Pen) Chitosan Membranes: Concentration Gradient Driven Water Flux and Ion Transport for Salinity Gradient Power and Separation Process Operations" that was selected for publication in the American Chemical Society's Omega journal. He was a co-author on a book chapter entitled "Bubble farming: Scalable microcosms for diatom biofuel and the next Green Revolution" and presented the material at the North American Diatom Symposium (NADS) in Georgia.

### **DR. ISABEL ROMERO (Organic chemistry and oil spill impacts)**

Dr. Isabel Romero was recognized by the National Academies of Sciences, Engineering, & Medicine with the early-career fellowship award, for her research using organic molecules (including contaminants) as tracers of processes at depth in the Gulf of Mexico. Also, her publication "Decadal assessment of polycyclic aromatic hydrocarbons in mesopelagic fishes from the Gulf of Mexico reveals exposure to oil-derived sources (in *Environmental Science & Technology*)" was highlighted by the Gulf of Mexico Research Initiative (GOMRI) as the first time-series study indicating long-term persistence of contaminants at depth potentially impacting new generation of deep-pelagic fishes. In addition,

# FACULTY HIGHLIGHTS

Romero was awarded a grant to continue her studies in deep-pelagic fauna through the NOAA Restore Program for the next 5-10 years ([https://restoreactscienceprogram.noaa.gov/projects/deep-pelagic-fauna?utm\\_medium=email&utm\\_source=GovDelivery](https://restoreactscienceprogram.noaa.gov/projects/deep-pelagic-fauna?utm_medium=email&utm_source=GovDelivery)).

## **DR. KARYNA ROSARIO (Genomics; Marine Microbiology; Wastewater Microbiology; and Virology)**

Dr. Karyna Rosario's research focused on using metagenomic approaches to identify viruses from a diversity of organisms (parasites, arthropods, aquatic plants) and wastewater resulting in seven peer-reviewed publications. Rosario helped organize and participated in the first Parasite Microbiome Project (PMP) workshop, which gathered international scientists to discuss the need and research priorities for investigating parasite-associated microbes and how these microbes affect parasite fitness and infection outcomes. Discussions throughout the PMP workshop led to a publication in the PLOS Pathogens journal describing critical research areas in the parasitology field that need to be addressed. The article has been viewed over 5,500 times since its publication in October 2019 and was highlighted as an editor's pick in one of the journal's microbiome homepage. Since Rosario published the first comprehensive survey of viruses in indoor air, she was invited to give a talk at a second workshop entitled 'Viruses of the Built Environment (ViBE)', where she shared her findings and methodological insights regarding virus detection in air. Rosario also published locally relevant research papers in 2019 including the first description of a virus in seagrass from Tampa Bay and demonstration of a vertically transmitted virus in spiders commonly found throughout Florida. Finally, Rosario was involved in outreach and education. She gave a TEDxYouth talk at Palm Harbor University High School and enjoyed interacting with adults and kids as part of Taste of Science, the Great American Teach-In, St. Petersburg Science Festival and Science & Art night at CMS.

## **DR. PATRICK SCHWING (Oil spill impacts on deep benthic ecosystems)**

Dr. Patrick Schwing is currently a visiting assistant professor at Eckerd College. He has maintained his position as principal scientist in the CMS short-lived radiochemistry laboratory and as a courtesy professor, where he provides ongoing analytical support for CMS research programs and continues to sustain the laboratory operations. He is currently writing a synthesis paper for the Gulf of Mexico Research Initiative entitled Deep Benthic Ecosystem Impacts of the Deepwater Horizon Event: Assembling the Record of Species and Community Change along with two other manuscripts directly related with the CIMAGE Gulf-wide survey of benthic habitat health and sedimentary biogeochemical processes. In support of these efforts he recently gave two presentations and served as a session organizer at the 2020 Gulf of Mexico Oil Spill and Ecosystem Science Conference in February, 2020. He is serving as a member on Bryan O'Malley's (CMS) thesis committee for which he is developing a benthic foraminifera-based marine biotic index of ecological health. This index should serve as an effective management decision support tool.

## Other Events and Highlights

### STAFF AWARD:

**Joe Donnelly and Samyntha Francis** were both selected as recipients for a 2019 Outstanding Staff Award. They will be recognized at an awards ceremony hosted by President Steven Currall on the Tampa campus later this year.

### 2019 EMINENT SCHOLAR LECTURE SERIES:

The USF CMS held its annual Eminent Scholar Lecture Series on April 10-12, 2019 to celebrate “Frontiers in Marine Science.” Our four featured guest lecturers were:

- **Maria Dornelas** PhD, St. Andrews University Scotland, “Gains and losses of biodiversity”
- **Sean Gulick**, PhD, University of Texas, Austin, “Life and death by impact: Drilling for clues”
- **Tina van De Flierdt** PhD, Imperial College London England, “Drilling back to the future: Secrets hidden in the chemistry of ancient dirt”
- **Andrew Thompson** PhD, CalTech, “Enemy at the gates: Ocean circulation and the fate of Antarctic ice sheets”

The SciCafé was held on April 10, 2019 at the Dali Museum, St. Petersburg featuring guest speaker **Sean Gulick**, PhD from the University of Texas, Austin.

### ALUMNI HIGHLIGHTS:

In 2019 the Communications team started an effort to better track the successes of CMS alums and to share those in a Q&A story format. In partnership with the Director of Development, the team plans to continue our outreach to, and dialogue with, the hundreds of alums CMS has around the world.

One particularly noteworthy success story is that of Dr. Chris Simoniello, the U.S. Environmental Protection Agency’s (EPA) first place winner of the Gulf Guardian Award in the Individual category for her work with the Gulf of Mexico Coastal Ocean Observing System (GCOOS). She graduated with her Ph.D. from the USF College of Marine Science (CMS) in 2003. As stated in the EPA’s press release, “**Dr. Simoniello** has comprehensive knowledge of the Gulf, is passionate about education and outreach, and **is the person everyone wants to work with in the Gulf of Mexico.**” What a tremendous legacy you are building, Chris! Read the full Q&A here: <https://www.marine.usf.edu/news-and-events/a-qa-with-cms-alum-dr-chris-simoniello/>

Additional notable alum stories tracked in 2019 include:

- Dr. Glenn Parsons, “the Shark Man” (Class of 1987): <https://www.marine.usf.edu/podcasts-and-interviews/a-qa-with-cms-alum-dr-glenn-parsons-shark-man/>
- Globetrotter (and geophysical consultant) Dr. Shane Dunn (Class of 2016): <https://www.marine.usf.edu/podcasts-and-interviews/a-qa-with-cms-alum-dr-shane-dunn/>

## Facilities

Major projects that were completed in 2019 included the replacement and upgrade of the HVAC Controls in KRC; Phase 1 of the replacement and upgrade of the KRC fire alarm system; a new coil and pan in KRC AHU-6; and an engineering study for replacing air handlers 1 & 2 in MSL. These two AHUs serve the entire south wings of the building and are notably deteriorated; their replacement will involve a complete system reconfiguration and significant space modifications.

Numerous minor projects were also completed throughout the year including the refreshing (new ceiling, LED lights, and painting) of KRC 2122, 2132 and MSL 233A; new flooring and painting of the MSL lobby; roof repairs for KRC and MSL; electrical upgrades in several KRC and MSL office and lab spaces; and painting of various offices and restrooms. The complete remodel of MSL 222C was started but not completed by end of year.

## Education and Outreach

### CMS EDUCATION AND OUTREACH PROGRAMS

Teresa Greely led the college's education and outreach (E&O) programs in support of the USF mission for community engagement. The accomplishments in E&O reflect a diversity of programs and events that have advanced ocean literacy and research amongst K-12 teachers and their students, undergraduate and graduate students, as well as collaborations with scientist and community agencies.

**The Spoonbill Ocean Sciences Bowl.** E&O team hosted the 15th annual academic brain bowl with over 160 participants, including 110 high school students and teachers from across West Florida. Volunteers, both returning and new, represented the Eckerd College, FMSEA, FWC, New College, NOAA, Ocean Optics, USGS, USFSP, and USF Marine Science. Congratulations to Academy of Environmental Sciences (AES) team from Crystal River, Florida who advanced to the NOSB Finals. The AES team placed in the top 12 at the National Finals.



*Academy of Environmental Sciences – Crystal River, FL*



*Volunteers: FWC, USGS, NOAA, Eckerd, USF*

**The Oceanography Camp for Girls.** 2019 was the **28th year for the OCG**. Our pre-college STEM program continues to encourage teens to consider careers in the sciences while developing a positive sense of self, science, and the environment. More than **1200 teenaged girls have completed the 3-week program, with 30 girls participating this past summer**. Graduate and undergraduate students served as science mentors with professional staff, and participating scientists from FWCC, USGS, NOAA and USF Marine Science.



# EDUCATION AND OUTREACH



*OCG on Research Cruise Measuring Fishes Substructure*



*OCG @ Caladesi Is. Coastal Geology*

**As NOAA Ocean Explorer facilitators, the E&O team led a series of Teacher Professional Development opportunities.** Florida teachers learned ‘How We Explore, and Why We Explore the Oceans’ through support by the NOAA Office of Ocean Exploration and Research and National Marine Sanctuaries Foundation. NOAA OER strives to engage broad audiences to enhance America’s environmental literacy through the excitement of ocean discovery following the NOAA Ship *Okeanos Explorer*. Participants learned about the importance of ocean exploration and the advanced technological capabilities used to explore the deep ocean. Educators received standards-based, hands-on activities and online resources to guide classroom teaching and learning. A total of 48 educators completed the *Exploring the Deep Ocean with NOAA* 7-hour professional development.



“It helped provide resources relating material to daily life for students.”

“Excellent, very informative... Thank YOU!”

“Live stream with Okeanos was wonderful!”



*Teachers at NOAA Professional Development Development*



*Teachers at Elementary GLOBE Professional*

# EDUCATION AND OUTREACH

As Florida GLOBE US Partners & Facilitators, **the E&O team continued to lead GLOBE Environmental Monitoring (Citizen Scientist) Teacher Professional Development Program.**

Two new partnerships were launched with Florida League of Environmental Educators and the NASA KSC MEI summer programs. Through the **NASA MEI** collaboration 96 pre-service and alternative route STEM educators from Minority Serving Institutions were prepared to lead their future students to be citizen environmental scientists. Teachers learned how to collect and analyze hydrologic, atmospheric, and soil measurements following scientific protocols and sharing internationally. C-MAGE funding helped to support these teacher professional development opportunities. Fifteen Florida teachers and 5 graduate students completed GLOBE protocols in 2019.



Other Education programs included:

- Taught ocean sciences courses for the USFSP Honors College and USF Tampa
- Hosted 5 school groups for summer Precollege STEM programs, lab tours and career explorations
- Over 350 elementary students engaged in coastal field trips at Clam Bayou Marine Education Center through support from a NOAA Gulf of Mexico Bay and Watershed Educational Experiences award in partnership with the Pinellas County Schools and Title 1 elementary school teachers
- Served on National Science Foundation panel reviews for UG and Graduate Education
- 35 community education events at the Clam Bayou Marine Education Center

Publications included:

Greely, T., J. Kastler, S. Beresford, and K. Fillingham. 2019. An Underwater Blizzard of Marine Oil Snow. *Current*, 33, 1, 17-20

2019. Special Issue Featuring the Gulf of Mexico Research Initiative – Research Resulting from the 2010 Deepwater Horizon Oil Spill. Co-Editors: J. Kastler, K. Fillingham, S. Beresford, and T. Greely *Current*, 33, 1, 1-46

## Communications

### STRATEGIC COMMUNICATIONS UPDATE

**Communications Team.** CMS alum Kristen Kusek ('98) serves as Director of Strategic Communications and has managed the communications team since the fall of 2018. The team includes webmaster Jay Novitzke and through most of 2019, included full time web content developer Sean Beckwith. Sean left this role in November 2019 and although we planned to re-hire, we learned in December that CMS no longer had the funds to support the role.

**2019 Highlights.** We continued to increase story and media coverage of the tremendous research going on at the CMS and showed steady engagement growth over time across all social media and website metrics. Capacity remains a top challenge. Despite our small size what follows is a snapshot of key highlights from a productive 2019, broken down into the following categories: GENERAL, MEDIA OUTREACH, WEBSITE, SOCIAL MEDIA, AUDIENCE ENGAGEMENT, STEM ENGAGEMENT AND OUTREACH, and CMS IN THE NEWS.

#### GENERAL

- Continued to operationalize our communications function and implement data-driven procedures and QC protocols.
- Continued to strategize cost-effective ways to increase our capacity. For example, we harness the talent of graduate students interested in improving their communications skills who contribute blogs or perspective pieces while receiving communications training in return (See, for example, a perspectives piece by graduate student Carey Schafer, <https://www.marine.usf.edu/opinion/28-years-of-oceanography-camp-for-girls-how-are-we-doing/>; a blog covering outreach work by CMS alum and staff member Makenzie Burrows, <https://www.marine.usf.edu/blogs/girls-go-gaga-over-science/>).
- Joined an informal group of STEM communications professionals at USF who are interested in formalizing this work at USF.
- Improved alignment between Communications and Development functions.

#### MEDIA OUTREACH

- Continued to improve media outreach, including the bolstering of relationships with media teams across USF such that we now have a much more streamlined process than in the past.
- Generated press release about Drs. Chuanmin Hu's and Mengqiu Wang's discovery of the largest seaweed belt in the world that attracted more than 500 articles of coverage in major media outlets including a spot on the morning *Today Show* (13 million viewers). The ad value for this spot alone exceeds \$250,000, and the USF media team estimates that the coverage in exceeded \$1 million in total ad value.
- We were quoted in more than 100 news articles in 2019 aside from the Seaweed-related stories, for a total of more than 600 articles featuring CMS research.

# COMMUNICATIONS

- Another significant press release in 2019 was on red tide, focusing on research by Dr. Bob Weisberg (<https://www.marine.usf.edu/news-and-events/red-tide-forensics-so-thats-what-happened/>). This led to robust coverage in Florida news outlets especially.
- Launched an expert search tool for reporters (<https://www.marine.usf.edu/experts-guide-search/>).
- Launched a Job Postings page to serve as a resource for graduate students (<https://www.marine.usf.edu/job-postings/>).

## WEBSITE (marine.usf.edu)

- Achieved 36% growth in the number of unique monthly visitors to the CMS website (a function of improved content, user experience (UX) / website design, navigational structure and SEO).
- Performed a complete redesign and update of the Education and Community Engagement sections.
- Launched a blog (“From the Porthole”) (<https://www.marine.usf.edu/category/blogs/from-the-porthole/>).

## SOCIAL MEDIA (Facebook.com/USFMarineScience, Twitter.com/USFCMS, Youtube.com/USFMarineScience, Instagram.com/usfmarinescience)

- Achieved 23% growth in Facebook community over prior year.
- Launched Instagram (Primary goal: increase engagement with prospective students).



*Graph showing increase d engagement on Facebook throughout 2019.*

## AUDIENCE ENGAGEMENT

- Re-designed and re-launched the “Rising Tides” newsletter in October 2019 (bimonthly)
- Improved relationships across USF communications teams who now regularly help cross-promote our content on additional USF feeds outside of the CMS (e.g. Research and Innovation team, USF.edu)
- Started to track the many successes of CMS alums around the globe using Q&A story format

## Audience Engagement

	Website	Facebook	Twitter	YouTube	Insta
2018	43,422	1400	No Data	No Data	N/A
2019	59,199	1726	1880 total	280	256

\*Facebook and Twitter were launched in December 2012.

## STEM ENGAGEMENT AND OUTREACH

An additional and significant achievement this year was the development of a new STEAM program focused on coastal resiliency called **Guardians of the Gulf**. The program is a partnership with the Boys & Girls Club of the Suncoast. Dean Dixon asked Kusek to lead this effort in early 2019 when the St. Petersburg Innovation District secured St. Pete as the first in Florida to join U.S. Ignite’s Smart Gigabit Communities (a consortium of 28 U.S. and two international cities). The Innovation District chose Guardians of the Gulf as one of its pilot efforts. Additional program partners include the St. Petersburg Innovation District, the city of St. Petersburg, St. Petersburg College, USF St. Petersburg, Spectrum (Charter Communications), and U.S. Ignite. From the CMS side, Kusek recruited help to fully develop the program model from fellow CMS staffers (and CMS alums) Sarah Grasty (whom Kusek hopes will become program manager) and Teresa Greely.

Here is the executive summary of the program, as written for a recently submitted NOAA proposal:

Florida is ground zero for climate change and natural hazards that threaten its future -- demanding action and meaningful engagement with all sectors of society. It is paramount that underserved communities have a voice, especially children who will inherit these new realities. The USF College of Marine Science, a leader in coastal resiliency, is launching "Guardians of the Gulf: A Multisensory STEAM Program that Empowers Underserved Florida Youth to Champion our Coasts" in St. Petersburg in partnership with the Boys & Girls Clubs of the Suncoast. This eight-week summer initiative leverages the power of real-time, multisensory tools, fosters an appreciation of the natural environment, empowers children to realize what’s at stake, and inspires them toward action. Their future, and Florida’s, depend upon it. We seek investment from NOAA to help us launch a program primed to grow in audience, content, and impact.

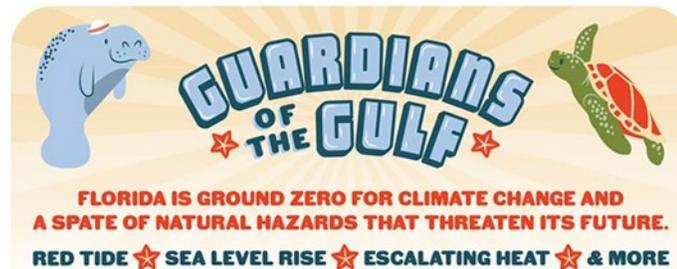
We have designed this program to scale in audience, geography, and content. Milestones achieved in the development of this program in 2019 include:

- The program concept won the IDC Smart Cities North America national award in the sustainable infrastructure category, covered in this news story: <https://stpetecatalyst.com/marine-education-project-from-innovation-district-usf-boys-girls-clubs-wins-smart-cities-award/> Our program will be recognized at the Smart Cities Connect conference in Denver, CO, on April 7, 2020. Our program was also featured in the summer 2019 issue of ‘BurgLife (Please see

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[http://www.magazinevolume.com/32650SP/page\\_17.html](http://www.magazinevolume.com/32650SP/page_17.html)), the publication of the St. Petersburg Chamber of Commerce.

- We secured a \$10,000 pilot grant from Duke Energy Foundation to facilitate a 3-day trial of select program elements for 50 participants from four area Boys & Girls Club facilities. We will run this program in June 2020.
- We leveraged an initial start-up investment from the smart city consortium of about \$10,000 that allowed us to install some “bricks and mortar,” including wireless connections and video equipment required by our program design.
- We secured the donation of two Sofar Trident ROVs for the program worth \$1695 each (<https://bit.ly/2xb7n1G>).
- We launched a fundraising effort to find critically needed funding for Sarah Grasty’s role, which we’d like to be full-time on this program. She is currently funded through summer 2020 and we seek additional funding to ensure she remains as program manager for the Guardians program.
- We submitted a ~\$500,000 proposal to the NOAA Environmental Literacy program. The preproposal, submitted in November 2019, was one of 46 out of 189 proposals to get through to the full proposal round. (We submitted the full proposal in March 2020)
- We established a partnership with a USF St. Petersburg senior design class who created the branding for the program. The class worked in groups during the Fall 2019 semester to design three brand concepts. We chose the one shown below.



## CMS IN THE NEWS

The following list shows select media highlights from 2019. As stated earlier our coverage of the seaweed belt discovery was significant for USF. Here are just a handful of more than 500 news pieces tracked in July 2019. See Appendix C for more complete list.

- NBC's The Today Show, <https://www.today.com/video/onslaught-of-seaweed-affecting-us-beaches-could-posehealth-risks-63338053507>
- Newsweek, <https://www.newsweek.com/world-largest-seaweed-bloom-west-africa-gulf-mexico-1447391>
- BBC News, <https://www.bbc.com/news/science-environment-48869100>
- US News & World Report, <https://www.usnews.com/news/world-report/articles/2019-07-05/largest-seaweed-bloom-in-the-world-discovered>
- AP, <https://www.apnews.com/2a17cd70104e4ba7b3695b958dbd0e18>
- Boston Globe, <https://www.bostonglobe.com/news/world/2019/07/16/cancun-has-nasty-seaweed-problem-and-tourists-are-staying-away/u8J3Bk8Bwk70zJFUC60fSP/story.html>
- Tampa Bay Times, <https://www.tampabay.com/environment/sargassum-seaweed-now-piling-up-on-florida-beaches-becoming-a-regular-belt-across-atlantic-to-africa-20190704/>
- NBC Miami, <https://www.nbcmiami.com/news/local/Floridas-Seaweed-Influx-to-Continue-Study-512251851.html>

## Obituaries

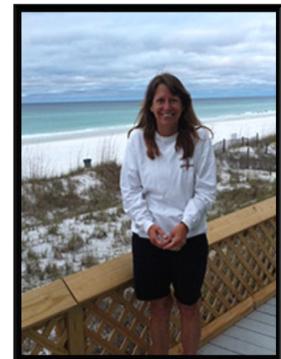
### **Christopher Schwint (1958-2019)**

Christopher Thomas Schwint, 60, of St. Petersburg died unexpectedly July 21, 2019 from a heart attack. Born in New York, NY to Kenneth and Virginia Schwint, he moved to St. Petersburg in 1964. He was a graduate of USF and worked as the budget director for the College of Marine Science at USF. He is survived by his daughter, Nicole; father, Kenneth; a sister, Kathy Altum; and former spouses, Kathryn Peterson and Desiree Woroner and his beloved Jack Russell, Dexter. He loved boating, fishing, traveling, music, and philosophy.



### **Anita M. Thompson**

Anita Thompson (nee Hanson), of St. Petersburg, FL and formerly of Evanston, IL, passed away July 27, after an 11-year fight against cancer. Her thoughtful and kind ways are what defined her - not cancer. She is survived by her husband of 33 years, Keith and her devoted dog, Bailey and by her siblings, Diane Dawson, Eric (Leslie), Alan and April (Tom) Maher. Siblings Peggy Blakely, Duffy Christiansen and Michael Hanson and parents, Barney & Peggy predeceased her. Anita was a thoughtful and devoted aunt to Brett (d), Brad, Kialynn, Erin, Jennifer, Demian, Amy, Elizabeth, Dallas and Brian. She was loved by her grand-nieces and grand-nephews, her dear friends and thoughtful colleagues. Anita worked for the University of South Florida, College of Marine Science, where she made a huge positive impact.



## Appendices

### Appendix A

Publications

### Appendix B

Active Research Awards

### APPENDIX C

CMS students in the news

## Appendix A. Publications

**Bold** indicates Faculty and Research Staff/Faculty; Underline indicates CMS graduate student or post-doc. Total of 130 peer-reviewed journal articles, 3 books, 37 book chapters, and 21 additional products.

### CMS PATENTS (1)

U.S. Patent - Chitosan Based Membrane and Associated Method of Use. Investor **Cliff Merz**. Application submitted in May of 2019, a follow-on utility patent application is scheduled to be submitted in May of 2020.

### CMS JOURNAL PUBLICATIONS (130 peer-reviewed journal articles)

Androulidakis, Y., V. Kourafalou, M. Le Hénaff, H. Kang, T. Sutton, S. Chen, **C. Hu**, and N. Ntaganou (2019) Offshore spreading of Mississippi waters: pathways and vertical structure under eddy influence. *Journal of Geophysical Research: Oceans*, doi:10.1029/2018JC014661.

**Barnes, B. B., J. P. Cannizzaro, D. English, and C. Hu** (2019) Validation of VIIRS and MODIS reflectance data in coastal and oceanic waters: An assessment of methods. *Remote Sensing of Environment*, 220, 110-123, doi:10.1016/j.rse.2018.10.034.

Bassi, D., J. C. Braga, G. Di Domenico, J. Pignatti, S. Abramovich, **P. Hallock**, J. Koenen, Z. Kovács, M. R. Langer, G. Pavia, and Y. Iryu (2019) Palaeobiogeography and evolutionary dynamics of the larger foraminifer *Borelis* Montfort (Borelidae). *Palaeontology*, doi:10.1002/spp2.1273.

Bax, N. J., P. Miloslavich, **F. E. Muller-Karger**, V. Allain, W. Appeltans, S. D. Batten, L. B.-C. Luigi Buttigieg, S. Chiba, D. P. Costa, J. E. Duffy, D. C. Dunn, C. R. Johnson, R. M. Kudela, D. Obura, L.-M. Rebelo, Y.-J. Shin, S. E. Simmons, and P. L. Tyack (2019) A response to scientific and societal needs for marine biological observations. *Frontiers in Marine Science*, <https://doi.org/10.3389/fmars.2019.00395>.

Beckwith, S. T., R. H. Byrne, and P. Hallock (2019) Riverine calcium end-members improve coastal saturation state calculations and reveal regionally variable calcification potential. *Frontiers in Marine Science*, 6: 169, <https://doi.org/10.3389/fmars.2019.00169>.

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Berenshtein, I, S. O'Farrell, N. Perlin, J. N. Sanchirico, **S. A. Murawski**, L. Perruso, and C. B. Paris (2019) Predicting the impact of future oil-spill closures on fishery dependent communities -a spatially explicit approach. *ICES Journal of Marine Science*, doi:10.1093/icesjms/fsz138.

Birk, M. A., A. Mislán, and B. A. Seibel (2019) Pelagic octopod response to hypoxia in oxygen minimum zones. *Deep-Sea Research*, <https://doi.org/10.1016/j.dsr.2019.04.017>.

Bosquilia, R. W. D., C. M. U. Neale, S. N. Duarte, S. J. Longhi, S. F. de B. Ferraz, and **F. E. Muller-Karger** (2019) Evaluation of evapotranspiration variations according to soil type using multivariate statistical analysis. *Geoderma*, 355, 113906, <https://doi.org/10.1016/j.geoderma.2019.113906>.

**Broadbent, H., S. Grasty, R. Hardy, M. Lamont, K. Hart, C. Lembke, J. Brizzolara, and S. Murawski**, (2019) West Florida Shelf pipeline serves as sea turtle benthic habitat based on *in-situ* towed camera observations. *Aquatic Biology*, doi:10.3354/ab00722.

# APPENDIX A. PUBLICATIONS

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# APPENDIX A. PUBLICATIONS

## CMS BOOKS (3 with 39 CMS-authored book chapters)

*Zonal Jets: Phenomenology, Genesis, and Physics* (2019) **Galperin, B.** and P. L. Read (Eds), Cambridge University Press, 29 chapters, ~550pp.

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*Deep Oil Spills – Facts, Fate and Effects*, **Murawski, S. A., C. Ainsowrth, S. Gilbert, D. J. Hollander**, C. B. Paris, M. Schluter, and D. Wetzel (Eds), 34 chapters: Springer, on-line versions published July 2019, print versions published January 2020, p. 542, ISBN 978-3-020-12692-0, <http://doi.org/10.1007/978-3-030-12964-7>, <https://www.springer.com/us/book/9783030116040>.

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# APPENDIX B. ACTIVE RESEARCH AWARDS

## Appendix B. Active Research Awards

Awd PI Name	Name - Co PI If Applicable	Sponsor Name	Total Expenses	Awd Begin Date	Awd End Date
Barnes		Kent State University	21563.67	5/1/2016	4/30/2020
Barnes		National Aeronautics & Space Admin	70321.15	1/1/2017	12/31/2020
Barnes		Fish and Wildlife Research Institute	40922.03	9/22/2018	12/31/2020
Bonin		National Aeronautics & Space Admin	77745.95	3/1/2017	2/28/2021
Breitbart		National Science Foundation	26203.87	12/1/2012	11/30/2018
Breitbart		US Israel Binational Science Foundation	45519.10	9/1/2015	8/31/2020
Breitbart		National Science Foundation	133515.93	7/1/2016	6/30/2020
Breitbart		National Science Foundation	139566.98	9/15/2016	8/31/2020
Buck		National Science Foundation	53203.76	7/15/2015	6/30/2019
Buck		National Science Foundation	89575.32	2/1/2017	1/31/2020
Buck		National Science Foundation	50281.85	3/1/2018	2/28/2022
Buck		University of Fairbanks	1848.87	6/14/2018	8/31/2020
Buck		National Science Foundation	23970.32	9/1/2018	8/31/2021
Buck		Woods Hole Oceanographic Institute	89556.16	10/9/2018	9/15/2019
Buck		National Science Foundation	1205.24	1/1/2019	12/31/2021
Byrne		National Science Foundation	54176.58	8/1/2014	7/31/2018
Byrne		Texas A&M University	10692.56	9/1/2015	8/31/2019
Byrne		National Science Foundation	16831.02	2/1/2017	1/31/2021
Byrne		National Science Foundation	174676.05	2/1/2017	1/31/2021

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Awd PI Name	Name - Co PI If Applicable	Sponsor Name	Total Expenses	Awd Begin Date	Awd End Date
Chambers	Galperin	University of Miami	39759.75	7/1/2017	6/30/2020
Chambers		NASA Jet Propulsion Laboratory	3348.07	6/1/2013	9/30/2018
Chambers		National Aeronautics & Space Admin	150365.48	2/16/2016	8/31/2020
Chambers		University of Miami	39334.20	7/1/2017	6/30/2020
Chambers		Arizona State University	63819.22	8/22/2017	8/21/2020
Chambers		University of Central Florida	60442.67	9/1/2017	8/31/2020
Conway		National Science Foundation	45924.37	8/15/2017	7/31/2020
Conway		National Science Foundation	6395.00	8/15/2017	7/31/2020
Conway		National Science Foundation	17804.73	9/1/2018	8/31/2021
Daly		University of Georgia	42862.55	1/1/2016	12/31/2019
Dixon, T.	Lembke	National Science Foundation	14246.32	12/1/2015	11/30/2020
Dixon, J	Naar	US Geological Survey	32239.29	5/1/2018	2/20/2020
Dixon		US Geological Survey	1254185.00	8/1/2017	7/31/2022
Greely		National Marine Sanctuary Foundation	12099.27	8/1/2018	6/30/2020
Hu	Romero	Nova Southeastern University	38575.64	1/1/2015	6/30/2020
Hu		National Aeronautics & Space Admin	32227.72	7/8/2014	12/31/2018
Hu		National Aeronautics & Space Admin	13123.31	1/15/2015	1/14/2019
Hu		National Aeronautics & Space Admin	40957.64	10/9/2014	2/28/2020
Hu		Nova Southeastern University	25482.13	1/1/2015	6/30/2020
Hu		National Aeronautics & Space Admin	89399.41	3/1/2015	2/29/2020

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Awd PI Name	Name - Co PI If Applicable	Sponsor Name	Total Expenses	Awd Begin Date	Awd End Date
Hu		University of Miami	102886.36	10/1/2015	9/30/2019
Hu		University of Miami	76914.95	1/1/2016	12/31/2019
Hu		National Aeronautics & Space Admin	28343.07	9/1/2016	8/31/2019
Hu		National Aeronautics & Space Admin	77330.12	1/1/2017	12/31/2020
Hu		National Aeronautics & Space Admin	73703.66	2/21/2017	2/20/2021
Hu		Pennsylvania State University	74798.25	2/24/2017	2/23/2020
Hu		Observatoire du Milieu Marin Martiniquai	848.61	5/11/2017	9/30/2018
Hu		University of Southern Mississippi	104837.89	6/1/2017	5/31/2020
Hu		National Aeronautics & Space Admin	17701.46	2/12/2018	6/30/2020
Hu		University of Miami	39421.43	1/1/2018	12/31/2019
Hu		Global Science & Technology, Inc.	43294.11	4/22/2019	5/31/2019
Kilborn		Natl Oceanic & Atmospheric Admin	162033.18	9/1/2017	8/31/2020
Lembke		Southeast Coastal Ocean Observing Region (SECOORA)	30818.24	6/1/2016	5/31/2021
Lembke		Florida International University	6919.62	9/1/2018	8/30/2020
Lembke		University of Miami	28132.23	8/1/2018	7/31/2019
Lembke		Florida Fish and Wildlife Conservation	6085.77	3/19/2019	6/30/2019
Liang	Chambers	National Science Foundation	5646.50	9/1/2017	8/31/2020
Liang	Liu	Gulf of Mexico Research Initiative	128217.28	1/1/2018	6/30/2020
Liang	Weisberg	Gulf of Mexico Research Initiative	50482.67	1/1/2018	6/30/2020
Luther		Greater Tampa Marine Advisory Council	16.45	4/9/2004	3/6/2024

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Awd PI Name	Name - Co PI If Applicable	Sponsor Name	Total Expenses	Awd Begin Date	Awd End Date
Luther	Merz	Southeast Coastal Ocean Observing Region	52879.35	6/1/2016	5/31/2020
Luther		Texas A&M University	115182.73	6/1/2016	5/31/2020
Luther		Texas A&M University	20420.55	6/1/2016	5/31/2020
Luther		Tampa Bay Estuary Program	13615.56	10/1/2017	2/28/2019
Merz		National Academy of Sciences	33603.86	11/1/2018	10/31/2020
Mitchum		NASA Jet Propulsion Laboratory	26290.09	10/1/2013	6/30/2019
Mitchum		US Geological Survey	2737.84	9/13/2013	9/14/2018
Mitchum		University of Hawaii	61261.31	9/1/2017	8/31/2020
Muller-Karger	Breitbart	National Aeronautics & Space Admin	160557.82	8/18/2014	8/17/2020
Muller-Karger		National Science Foundation	5342.28	9/1/2013	8/31/2018
Muller-Karger		National Science Foundation	138863.38	2/1/2014	7/31/2019
Muller-Karger		National Aeronautics & Space Admin	752295.17	8/18/2014	8/17/2020
Muller-Karger		National Aeronautics & Space Admin	842.55	8/18/2014	8/17/2020
Muller-Karger		National Aeronautics & Space Admin	16944.13	9/1/2015	7/31/2019
Muller-Karger		University of Miami	9484.33	9/1/2015	8/31/2019
Muller-Karger		National Aeronautics & Space Admin	135346.70	5/1/2016	4/30/2020
Muller-Karger		National Aeronautics & Space Admin	27742.08	5/1/2016	4/30/2020
Muller-Karger		National Science Foundation	81836.45	8/15/2017	7/31/2022
Muller-Karger		National Science Foundation	3849.12	8/15/2017	7/31/2022
Muller-Karger		Oregon State University	35751.86	1/18/2018	1/17/2020

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Awd PI Name	Name - Co PI If Applicable	Sponsor Name	Total Expenses	Awd Begin Date	Awd End Date
Muller-Karger		National Science Foundation	116899.44	8/15/2018	7/31/2021
Muller-Karger		University of Michigan	129619.84	9/1/2018	11/30/2019
Muller-Karger		University of Michigan	449.89	9/1/2018	11/30/2019
Murawski	Daly	Consortium for Ocean Leadership	25694.60	1/1/2018	6/30/2020
Murawski	Greely	Consortium for Ocean Leadership	92104.53	1/1/2015	12/31/2018
Murawski	Hu	Consortium for Ocean Leadership	79465.62	1/1/2015	12/31/2018
Murawski	Daly	Consortium for Ocean Leadership	849.79	1/1/2015	12/31/2018
Murawski	Paul	Consortium for Ocean Leadership	0.12	1/1/2015	12/31/2018
Murawski	Peebles	Consortium for Ocean Leadership	1969.15	1/1/2015	12/31/2018
Murawski	Peebles	Consortium for Ocean Leadership	39468.83	1/1/2018	6/30/2020
Murawski		Consortium for Ocean Leadership	1043409.05	1/1/2015	12/31/2018
Murawski	Gilbert	Consortium for Ocean Leadership	192936.81	1/1/2015	12/31/2018
Murawski	Hollander	Consortium for Ocean Leadership	-85.48	1/1/2015	12/31/2018
Murawski	Hotaling	Consortium for Ocean Leadership	16229.43	1/1/2015	12/31/2018
Murawski		Consortium for Ocean Leadership	197966.58	1/1/2015	12/31/2018
Murawski	Walsh	Consortium for Ocean Leadership	0.16	1/1/2015	12/31/2018
Murawski		National Fish and Wildlife Foundation	969228.52	1/1/2015	5/1/2020
Murawski		Gulf of Mexico Alliance	23204.39	10/1/2016	6/30/2020
Murawski		National Academy of Sciences	367113.57	12/1/2016	9/30/2019
Murawski		Consortium for Ocean Leadership	1308957.28	1/1/2018	6/30/2020

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Awd PI Name	Name - Co PI If Applicable	Sponsor Name	Total Expenses	Awd Begin Date	Awd End Date
Murawski	Gilbert	Consortium for Ocean Leadership	256082.56	1/1/2018	6/30/2020
Murawski	Greely	Consortium for Ocean Leadership	20265.88	1/1/2018	6/30/2020
Murawski	Gilbert	Consortium for Ocean Leadership	274072.56	1/1/2018	6/30/2020
Murawski	Hotaling	Consortium for Ocean Leadership	47965.08	1/1/2018	6/30/2020
Murawski	Hu	Consortium for Ocean Leadership	90554.04	1/1/2018	6/30/2020
Murawski		Consortium for Ocean Leadership	243241.60	1/1/2018	6/30/2020
Murawski		Texas A&M Research Foundation	39468.83	10/1/2017	3/31/2020
Paul		Natl Oceanic & Atmospheric Admin	47202.16	9/1/2015	8/31/2019
Peebles	Lembke	US Department of Treasury	-0.23	9/1/2015	8/31/2019
Peebles		University of Miami	243924.55	10/1/2015	9/30/2020
Romero		University of Southern Mississippi	23074.53	1/1/2018	6/30/2020
Rosenheim		National Science Foundation	-438.41	7/1/2015	6/30/2018
Rosenheim		National Science Foundation	960.38	6/15/2016	5/31/2020
Rosenheim		National Science Foundation	168847.77	9/15/2016	8/31/2021
Rosenheim		National Science Foundation	123239.81	3/15/2017	2/29/2020
Seibel		Natl Oceanic & Atmospheric Admin	85541.73	1/1/2017	12/31/2019
Seibel		University of Rhode Island	199387.32	12/1/2016	9/30/2020
Shevenell		National Science Foundation	25417.41	4/1/2013	1/31/2019
Shevenell		National Science Foundation	21395.96	8/1/2018	7/31/2021
Shevenell		National Science Foundation	6000.00	8/1/2018	7/31/2021

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Awd PI Name	Name - Co PI If Applicable	Sponsor Name	Total Expenses	Awd Begin Date	Awd End Date
Stallings		National Science Foundation	25492.51	2/15/2019	7/31/2020
Stallings		Florida Fish and Wildlife Conservation	40802.80	1/27/2016	7/31/2019
Weisberg	Merz	SECOORA	92480.58	6/1/2016	5/31/2021
Weisberg	Liu	SECOORA	136538.57	6/1/2016	5/31/2021
Weisberg	Russell	Pinellas County Florida (Restore Act)	1859.87	11/6/2016	12/31/2019
Weisberg		Natl Oceanic & Atmospheric Admin	38370.47	9/15/2015	8/31/2018
Weisberg		Pinellas County Florida (Restore Act)	26414.81	11/6/2016	12/31/2019
Weisberg		Pinellas County Florida (Restore Act)	132580.33	11/29/2016	12/31/2020
Weisberg		National Academy of Sciences	17281.46	4/1/2018	3/31/2019
Weisberg		National Academy of Sciences	99533.73	11/1/2018	10/31/2020
Weisberg		National Academy of Sciences	37546.51	11/1/2018	10/31/2020

# APPENDIX C. EVENTS IN THE NEWS

## APPENDIX C. EVENTS IN THE NEWS

- 1/6/2019, It's back: Red tide returns to Sarasota, Manatee Beaches, <https://www.heraldtribune.com/news/20190106/its-back-red-tide-returns-to-sarasota-manatee-beaches>
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- 1/11/2019, Analysis crew to check results of ocean acidification on iron availability to phytoplankton in North Pacific, [http://infosurhoy.com/cocoon/saii/xhtml/en\\_GB/science/science-analysis-crew-to-check-results-of-ocean-acidification-on-iron-availability-to-phytoplankton-in-north-pacific-report/](http://infosurhoy.com/cocoon/saii/xhtml/en_GB/science/science-analysis-crew-to-check-results-of-ocean-acidification-on-iron-availability-to-phytoplankton-in-north-pacific-report/)
- 2/24/2019, Climate Change is here. Will Tampa Bay finally get ready?, <https://www.tampabay.com/news/publicsafety/climate-change-is-here-will-tampa-bay-finally-get-ready-20190222/>
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- 4/18/2019, Ocean currents carried red tide close to shore, scientists say, <https://www.tampabay.com/environment/ocean-currents-carried-red-tide-close-to-shore-scientists-say-20190418/>
- 4/18/2019, Red tide newscast, <https://www.wtsp.com/article/news/red-tide/usf-researchers-say-ocean-currents-to-blame-for-red-tide-outbreak-in-2018/67-0f763841-5c0f-4ea1-b4d4-6c67e7db1493>
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- 6/4/2019, Miami dredging caused “extensive coral mortality and critical habitat loss” for the US’ only continental reef, <https://www.zmescience.com/science/us-florida-reef-dredge-8932525253/>
- 6/12/2019, Glowing 'Blue Tears' in China's Seas Are Incredibly Toxic — And They're Growing, <https://www.livescience.com/65704-glowing-deadly-algae-grows.html>

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- 6/12/2019, Sparkling blue seas are glowing brighter - but they're not as safe as they look, <https://www.mirror.co.uk/science/sparkling-blue-seas-glowing-brighter-16511692>
- 6/24/2019, The U.S. government has studied the longest oil spill in history — 14 years after the leak began, [https://www.washingtonpost.com/climate-environment/2019/06/24/fourteen-years-after-it-started-federal-government-has-studied-longest-oil-spill-history/?utm\\_term=.588673226539](https://www.washingtonpost.com/climate-environment/2019/06/24/fourteen-years-after-it-started-federal-government-has-studied-longest-oil-spill-history/?utm_term=.588673226539)
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- 6/27/2019, Is a great iron fertilization experiment already underway?, <https://phys.org/news/2019-06-great-iron-fertilization-underway.html>
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- 10/14/2019, Florida GOP leaders finally utter sea level rise, lament 'lost decade', <https://www.tampabay.com/florida-politics/buzz/2019/10/15/ten-years-late-floridas-gop-lawmakers-address-climate-change-what-now/>
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<https://www.palmbeachpost.com/news/20191122/red-tide-blamed-for-64-sea-turtle-deaths-on-southwest-coast-will-toxic-tide-reach-us>

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