Fate and Effects of Chemical Contaminants Program Review

Volume 1: Introduction and F&ECCP Overview

September 15 -17, 2020

NCCOS/Stressor Detection and Impacts Division

Volumes of the Fate and Effects of Chemical Contaminants Program (F&ECCP) Review

Volume 1: Introduction and F&ECCP Overview

Volume 2: Ecotoxicology

Volume 3 Monitoring and Assessment

Volume 4: Key Species and Bioinformatics

Fate and Effects of Chemical Contaminants (F&ECC) Program Review

Volume 1: Introduction & F&ECCP Overview

Table of Contents

CHAPTER 1
F&ECC Program Review Panel and Charge

INTRODUCTION

The independent and expert review and evaluation of a research program serves to ensure its scientific integrity, caliber, performance and relevance by providing written assessments and recommendations for ensuring the achievement of high research and performance standards. These principles are codified and outlined in NOAA Administrative Order 216-115: Strengthening NOAA's Research and Development Enterprise which establishes the requirements and guidelines for conducting the review of NCCOS' Stressor Detection and Impacts Division's *Fate and Effects of Chemical Contaminants Program* (F&ECCP).

NOAA's National Ocean Service (NOS), also known as America's Ocean & Coastal Agency provides data, tools, and services that support coastal economies and their contribution to the nation. NOS advances three priorities: Safe and Efficient Transportation and Commerce; Preparedness and Risk Reduction, and Stewardship, Recreation, and Tourism. The National Centers for Coastal Ocean Science (NCCOS) is the research, monitoring and assessment organization within NOS. NCCOS delivers science solutions: **a)** for the stewardship of ocean and coastal resources; and **b)** that support thriving coastal communities and economies. NCCOS research priorities are Marine Spatial Ecology, Coastal Change, Social Sciences and Stressor Impacts & Mitigation. It is under the priority Stressor Impacts & Mitigation that F&ECCP operates within the Stressor Detection and Impacts Division (SDI).

F&ECCP assumed its current organizational and programmatic configuration in FY 2017, and therefore this Program Review covers FY 2017 to the present, using the following evaluation criteria: **Quality** (*the scientific merit of the work/value to scientific community*); **Relevance** (*the value of science to users beyond the scientific community*); and **Performance** (*effectiveness/efficiency in delivering products & services*). NOAA published its *NOAA Omics Strategy* in February 2020, and the Program Review includes a discussion on omics by invited experts on the potential role of omics in advancing the capabilities of F&ECCP to detect, characterize and predict the effects of chemical contaminants on coastal ecosystems.

Hollings Marine Laboratory, Charleston, SC

Charge to the Panel

As per NOAA Administrative Order 216-115: Strengthening NOAA's Research and Development Enterprise, the Program Review Panel is chaired by a Federal Employee. The Chair will provide a summary report that will include an evaluation of the Program Review process itself, including the quality of instructions, materials provided, the presentations, discussions of the omics panel, and whether the review reports provided by Panel members are responsive to the Program Review charge and evaluation criteria. Panel members *(Appendix A)* will be focused on the F&ECCP itself, and will deliver independent reports to the Chair. The evaluation criteria, specific charge and requirements for the Review Panel are attached (*Appendix B*).

Information Provided to the Panel

The Panel is provided with a four volume Briefing Book on F&ECCP.

- **Volume 1** -- Introduction and F&ECCP Overview
- **Volume 2** – Ecotoxicology Branch
- **Volume 3** – Monitoring and Assessment Branch
- **Volume 4** – Key Species and Bioinformatics

The individual volumes contain detailed information on F&ECCP. The Panel will also be provided with slide presentations on the main topics in each volume.

Program Review Format

The Panel and participants including stakeholders are unable to attend the Program Review in person due to the COVID-19 pandemic. Apart from curtailing the direct interactions all participants would have enjoyed, the 3-day agenda had to be shortened and restructured to accommodate the realities of webinar-based program reviews. The Panel however is being provided with much of the required information (the four Briefing Book Volumes and PowerPoint Presentations) to execute their duties well in advance of the Program Review. Therefore, the quality of their reviews and recommendations should not be impaired by the change in the Program Review format due to COVID-19.

Appendix A

FATE AND EFFECTS OF CHEMICAL CONTAMINANTS PROGRAM REVIEW PANEL

Panel Chair

Pantoja, Alberto PhD

Acting Director, Midwest Area, Agricultural Research Service
US Department of Agriculture
Peoria, Illinois

Panel Members

Boufadel, Michel PhD, PE, BCEE

Director, Center for Natural Resources
New Jersey Institute of Technology,
Newark New Jersey

Garcia-Reyero Vinas, Natalia PhD

Research Biologist, Engineer Research and Development Center, Environmental Laboratory
US Army Corps of Engineers
Vicksburg, Mississippi.

Matuszko, Jan

Acting Director, Environmental Fate and Effects Division, Office of Pesticides
US Environmental Protection Agency.
Washington DC

McConnell, Laura, PhD

Principal Scientist,
Regulatory Scientific Affairs Group
Bayer CropScience
St. Louis, Missouri.

Schuster, Robert

Bureau Chief, Bureau of Marine Water Monitoring
New Jersey Department of Environmental Protection
Trenton, New Jersey

Appendix A *Continued*

PROGRAM REVIEW PANEL MEMBERS

Panel Chair
Pantoja, Alberto PhD
Acting Director, Midwest Area, Agricultural Research Service
US Department of Agriculture
Peoria, Illinois.

Dr. Pantoja is internationally recognized for developing practical approaches for biological control of insect pests. He received a B.S in Agronomy and Soils from the University of Puerto Rico and earned his M.S. and Ph.D. degrees in Agronomy Entomology from Louisiana State University. He initiated his career as Pesticides Inspector and Pesticides Liaison Officer for the U.S. Environmental Protection Agency and Puerto Rico Department of Agriculture. He subsequently worked as an entomologist for the Puerto Rico Agricultural Experiment Station. In 1989, he joined the International Center for Tropical Agriculture (CIAT), Cali, Columbia, where he occupied the position of Research Fellow and Chief Rice Entomologist, where he led a multidisciplinary, international team of scientists to publish the first book on integrated pest management devoted to rice management in Latin America and the Caribbean. In 1993, he returned to the University of Puerto Rico-Mayaguez, where he progressed through the ranks to Full Professor, Department Head, Deputy Director for Research, and Associate Dean for Research. Dr. Pantoja joined the USDA's Agricultural Research Service in 2003 as Research Leader and Location Coordinator for the Subarctic Agricultural Research Unit in Fairbanks, Alaska. In 2011, he joined the United Nations Food and Agriculture Organization Regional Office in Santiago, Chile as Crop Production and Protection Officer (CPPO) for South America. In 2012, he was appointed CPPO for Latin America and the Caribbean. He completed a six-month detail in Asuncion, Paraguay as Technical Officer, FAO Paraguay office. Dr. Pantoja has published over 100-peer-reviewed articles in scientific literature and 75 lay articles for growers and crop protection specialists.

Panel Member
Boufadel, Michel PhD, PE, BCEE
Director, Center for Natural Resources
New Jersey Institute of Technology,
Newark, New Jersey.

Dr. Boufadel is Professor of Environmental Engineering and Director of the Center for Natural Resources. He is a Professional Engineer in New Jersey, and a Board Certified Environmental Engineer in the USA. Dr. Boufadel served recently on four National Research Council (National Academies) committees in relation to oil spills. He also served on a committee by the Royal Society of Canada on "The impact and behavior of oil in aquatic environments", and served on the Environmental Protection Agency (EPA) Science Advisory Board on natural gas extraction from shale formations (2011-2012). Dr. Boufadel's expertise is environmental fluid mechanics and large-scale mathematical simulations. He applied his expertise mostly on coastal systems and on oil spills. His work includes the remediation of the Exxon Valdez oil spill and assessment of oil fate in the environment following the Deepwater Horizon oil spill. He also investigated the impact of Hurricane Sandy on the mobilization of hazardous compounds, and the blowout of oil and gas wells underwater. Dr. Boufadel has more than 170 refereed articles in environmental publications, such as NATURE geosciences, NATURE's Scientific Report, Proceedings of the Natural Academy of Science and Environmental Science and Technology.

Appendix A *Continued*

Panel Member
Garcia-Reyero Vinas, Natalia PhD
Research Biologist, Engineer Research and Development Center, Environmental Laboratory
US Army Corps of Engineers
Vicksburg, Mississippi.

Dr Garcia-Reyero Vinas received her BS in Biology from Universitat de Girona (Spain), and her MS and PhD from Universitat de Barcelona, in Barcelona, Spain. She currently serves as a senior researcher at the US Army Engineer Research & Development Center (ERDC) Environmental Laboratory, where she leads the Zebrafish Testing Facility. After receiving her PhD, Dr Vinas became a postdoctoral associate at the University of Florida (Gainesville, FL). She then joined Jackson State University (Jackson, MS) as an Assistant Research Professor, and after that she became an Associate Research Professor at Mississippi State University (Starkville, MS), until she joined ERDC in 2014. The principal focus of her research is on understanding the impacts and sub-lethal effects of contaminants and other stressors on water quality, aquatic and terrestrial organisms, and ecosystem and human health. She is an internationally recognized leader in the fields of ecotoxicology, toxicogenomics and predictive toxicology. The quality and relevance of her scientific research is evidenced by over 100 publications in high impact peer-reviewed journals such as Science, Nature Biotechnology, or Environmental Health Perspectives among others. She holds adjunct Professor positions from Mississippi State University and University of Florida. Her work also includes national and international work both in research and in establishing new approaches for regulatory toxicology, in collaboration with national and international agencies such as the US Environmental Protection Agency, the Office of the Secretary of Defense, the European Commission, the Organisation for Economic Co-operation and Development (OECD), Environment Canada, and other foreign governments and universities.

Panel Member
Matuszko, Jan
Acting Director, Environmental Fate and Effects Division, Office of Pesticides
US Environmental Protection Agency.
Washington DC.

Ms. Matuszko is the Acting Director of the Environmental Fate and Effects Division (EFED) within the Office of Pesticides at the Environmental Protection Agency. EFED is an interdisciplinary division responsible for conducting ecological, drinking water, and endangered species assessments to evaluate potential risks posed by conventional pesticides to support registration and reregistration decisions under the Federal Insecticide, Fungicide and Rodenticide Act; the Federal Food, Drug and Cosmetic Act; the Food Quality Protection Act; and the Pesticide Registration Improvement Act. Jan also has extensive experience in the Engineering and Analysis Division (EAD) within the Office of Water. EAD is also an interdisciplinary branch responsible for carrying out primary core Clean Water Act functions of producing new and revised national best available technology-based standards (effluent guidelines) for the abatement and control of effluent discharges to waters of the United States from industrial sources. The Division is also responsible for codifying laboratory analytical methods, or test procedures that are used by industries and municipalities to analyze the chemical, physical and biological components of wastewater and other environmental samples required by the CWA. Jan has a M.S. in Civil Engineering (Environmental) and a B.S. in Chemical Engineering from Virginia Tech.

Appendix A *Continued*

Panel Member
McConnell, Laura, PhD
Principal Scientist, Regulatory Scientific Affairs Group
Bayer CropScience
St. Louis, Missouri.

Dr. McConnell works on engagement with universities and scientific societies on topics relevant to modern agricultural technologies. Her expertise is in environmental and analytical chemistry. She also has a Senior Research Scientist appointment in the Department of Civil and Environmental Engineering at University of Maryland College Park. Previously she was a Research Chemist in the United States Department of Agriculture – Agricultural Research Service where she specialized in the investigation of the chemical and physical processes controlling the environmental fate of agriculturally-relevant chemicals. A primary focus of her research was the development of improved conservation practices to mitigate pollutant transport and to provide ecosystem services; innovative approaches to assess and reduce the bioavailability of pollutants in soil and water; and development of sustainable farming systems to address challenges at the agriculture-urban interface. She has authored more than 90 peer-reviewed journal articles, and she has mentored many graduate students and postdoctoral/visiting scientists. She has served on science-related advisory panels for the US Environmental Protection Agency and the European Food Safety Authority, and she is a Fellow of the American Chemical Society.

Panel Member
Schuster, Robert
Bureau Chief, Bureau of Marine Water Monitoring
New Jersey Department of Environmental Protection)
Trenton, New Jersey.

Mr. Schuster is the Bureau Chief at the New Jersey Department of Environmental Protection's (NJDEP) Bureau of Marine Water Monitoring (BMWM) which has the responsibility for oversight of all NJDEP Marine Water Quality Monitoring, including sample collection, laboratory analysis, and data assessment. BMWM manages several public health and safety-related programs within NJ's coastal waters including the ocean, estuaries, tidal rivers, and creeks. BMWM also administers programs that support its core responsibility of safe shellfish harvesting. These programs include pollution source track-downs to identify potential pollution sources impacting the State's coastal waters. The Bureau incorporates the use of real-time continuous data sensors on buoys and deployed an ocean glider equipped with real-time continuous sensors to collect vast amounts of data that are used to more accurately characterize NJ coastal waters. Mr. Schuster has over 25 years in the collection, chemical, biological, and microbial analysis, and data assessment of Marine and Fresh waters. This includes Shellfish Classification for the National Shellfish Sanitation Program, as well as for ambient nutrient monitoring, real-time continuous monitoring, beach testing, and NJDEP special projects (storm water monitoring and microbial source tracking) and the EPA National Coastal Condition Assessment.

Appendix B

PANEL MEMBER DUTIES

- **Tasks/Duties of the Panel Chair**
  - ✔ Per the Procedural Handbook for NOAA Administrative Order (NAO) 216-115A: Research and Development in NOAA, that governs External program Reviews: "*The panel should be chaired by a Federal employee to comply with the FACA, and the individual should also be from outside NOAA to avoid conflicts of interest. Per these guidelines, the panel's final report should summarize panelists' individual findings, rather than seek consensus of the panel*"
  - ✔ The Chair:
    - Will evaluate the Program Review Process using the attached evaluation criteria and provide recommendations for improving future Program reviews.
    - Will prepare a Summary Report that collates the recommendations of Panel members by securing individual reports from Panel members.

- **Tasks/Duties of Panel Members**
  - ✔ Each Panel Member will use the attached Evaluation Criteria and conduct and independent evaluation of the Fate & Effects of Chemical Contaminants Program.
  - ✔ These individual reports (prepared without consultations with other Panel Members or the Chair) will be based on an evaluation of :
    - The Program Review Briefing Book
    - Presentations provided during the Program Review
  - ✔ Panel members will have the option of participating in the Omics Panel discussions

- **Deliverables & Due Dates (Chair and Panel)**
  - ✔ Panel Member Reports will be written and provided in electronic format (in Microsoft Word) to the Chair and NCCOS Point of Contacts two weeks after the conclusion of the Program review (i.e. by September 30, 2020).
  - ✔ The Chair will provide a Summary Report by October 14, 2020.

- **NOAA Requirements**
  - ✔ All Panel Members and the Chair will be required to sign the attached COI Form
  - ✔ After the conclusion of the Program Review, information on the Review will be posted to the NCCOS Website and will be available to the public.
    - All Panel members and the Chair will be identified. A brief biographical sketch for each Panel member and the Chair will be drafted by NCCOS and approved for posting by each Panel member
    - The full Report of each Panel Member will be posted online with public access, however, Panel member attribution by name or affiliation *etc.* will not be included.
    - The full Report of the Chair will be posted online with public access. Given the unique and singular role of the Chair, the Chair will be identified by name & affiliation.

Appendix B *Continued*

Evaluation Factors and Charge to Panel

EVALUATION CRITERIA		CHARGE TO PANEL CHAIR
Instructions to the Panel		a) Are the instructions, charge provided to the review panel clear?
Briefing Book		b) Is the information provided sufficiently detailed and complete given the charge of the Review Panel? c) Are there areas of the Program that should have been reviewed, and are not covered by the Panel's charge?
Presentations		d) The quality/utility of information/presentations? e) The quality of exchanges between Panel members and presenters (*e.g.* questions answered; issues clarified, informative exchanges?)
Special Topic Panel Discussions		f) The utility and value of the Omics Panel discussion?
Review Panel Reports		g) Did Review Panel reports meet the requirements of the Panel's charge?
CRITERIA (equal weights)	**SUB-CRITERIA (equal weights under each criteria)**	**CHARGE TO PANEL MEMBERS**
QUALITY (The Scientific Merit of the Work/Value to Scientific Community)	***Scientifically Sound, Reproducible Products & Services***	a) How would you characterize the scientific quality of the products and services delivered by the Program and what steps would enhance the program's scientific standing?
	Scientific Leadership and the Delivery of Scientific Products & Services	b) Describe the level and caliber of leadership provided to the scientific community (both nationally and internationally) by the Program, and how can the Program enhance its scientific stature? c) Are scientific products & services delivered to the scientific community in a manner that maximizes their utility (e.g.- timely, understandable, sufficiently detailed, and readily accessible format) and what actions would enhance their delivery?
RELEVANCE (The Value of Science to Users Beyond the Scientific Community)	***Alignment with NCCOS, SDI Priorities, Mandates***	d) How and to what extent are products and services aligned with NOAA, NCCOS legislative mandates and priorities, and what actions would improve this alignment?
	Impact of Work	e) To what extent do those beyond the scientific community, including resource managers, use Program products and services to mitigate contaminant impacts and how can the relevance and usefulness of products and services be improved? f) Are there research areas that should/should not be pursued and if so, why?
PERFORMANCE (Effectiveness & Efficiency in Delivering Products & Services)	***Leadership & Workforce Management***	g) Describe how Program leadership functions as a team, including the degree of guidance and what aspects of management practices foster collaboration, support employee engagement, and promote innovation to ensure the effective & efficient delivery of scientific products and services? What actions would strengthen leadership? h) Characterize the level and mix of the Program's technical and scientific expertise, and what steps if any should be taken to ensure the achievement of Program goals and objectives. i) What training, if any, should be provided to staff to ensure their skills and capabilities remain up-to-date & relevant?
	Science Investments and Infrastructure	j) Characterize the relative allocation of investments in research/science areas. Would you suggest changes? If yes, why? k) How would you describe the quality and caliber of support provided to the Program's scientific activities in the areas of facility services, equipment, information technology and administrative services, and what recommendations would secure needed support?
	Stakeholder Involvement	l) What types and caliber of strategies does the Program have for identifying, establishing & maintaining relationships with stakeholders, the-external community (including internationally) and what steps would expand and strengthen relationships and ensure they are effectively leveraged?

Appendix B *Continued*

CONFLICT OF INTEREST CERTIFICATION

NAME:
TELEPHONE:
EMAIL ADDRESS:
EMPLOYER & ADDRESS:

INSTRUCTIONS

Please complete this form, sign and date and return the form to the NOAA Office coordinating the peer review process. Retain a copy for your records.

The information provided to you as a Reviewer of the Fate and Effects of Chemical Contaminants Program Provided:

a) Is NOT confidential
b) Is NOT proprietary
c) Is publically available
d) Is NOT considered influential scientific information or highly influential scientific information by NOAA
e) Is NOT being reviewed to support a specific government regulatory process.

♦

General Principles

Involves an Interest: The term "conflict of interest" means something more than individual bias. There must be an *interest,* ordinarily financial, that could be directly affected by the work of the peer reviewers. Conflict of interest requirements are objective and preventive. They are not an assessment of one's actual behavior or character, one's ability to act objectively despite the conflicting interest, or one's relative insensitivity to particular dollar amounts of specific assets because of one's personal wealth. Conflict of interest requirements are objective standards designed to eliminate certain specific, potentially compromising situations from arising, and thereby protect the individual, other peer reviewers, NOAA, and the public interest. The individual, the other peer reviewers, and NOAA should not be placed in a situation where the findings and conclusions of a review could be reasonably questioned, and perhaps discounted or dismissed, simply because of the existence of conflicting interests.

♦

Applies Only to Current Interests: The term "conflict of interest" applies only to *current interests*. It does not apply to past interests that have expired, no longer exist, and cannot reasonably affect current behavior. Nor does it apply to possible interests that may arise in the future but do not currently exist, because such future interests are inherently speculative and uncertain. For example, a pending formal or informal application for a particular job is a current interest, but the mere possibility that one might apply for such a job in the future is not a current interest.

♦

If there are relevant aspects of your background or present circumstances that might reasonably be construed by others as affecting your judgment in matters within the assigned task as a Panelist you have been invited to undertake, and therefore might constitute an actual or potential source of bias, please describe them briefly.

During your period of service in connection with the activity for which this form is being completed, any changes in the information reported, or any new information, which needs to be reported, should be reported promptly by written or electronic communication to NOAA.

_____ _____

Panel Member Signature (Certification of no COI) Date

Reviewed by: _____ _____

Name Date

CHAPTER 2
F&ECC PROGRAM–*Research Overview*

Table of Contents

INTRODUCTION

This document provides an overview of NOAA's **National Ocean Service**, the role of its scientific unit, the **National Centers for Coastal Ocean Science** (NCCOS) and the responsibilities of the **Stressor Detection and Impacts** (SDI) Division that sits within NCCOS. SDI's **Fate & Effects of Chemical Contaminants Program** (F&ECCP), its priorities, legislative mandates, guiding principles, research themes, future directions and challenges are the focus of this document.

THE IMPORTANCE OF US COASTS

Coastal ecosystems provide four services: 1) ***provisioning*** (*e.g.* the production of food and water), 2) ***regulating*** (*e.g.* the control of climate and diseases); 3) ***supporting*** (*e.g.* nutrient cycles and oxygen production), and 4) ***cultural*** (*e.g*. spiritual and recreational benefits). The ecological importance of US Coasts cannot be overstated: coastlines especially with estuaries, wetlands, marshes, mangrove forests, seagrass beds and coral reefs and adjacent continental shelves are the most biologically diverse and productive areas of marine ecosystems. They also provide feeding and nursery grounds for offshore species, protection from predators, maintain water quality and stabilize shorelines. Coastal economies are a major component of the US economy. Approximately 40% of the US population (*i.e*. 125 million) is coastal (including the Great Lakes) with coastal communities contributing $7.9 trillion to the Gross Domestic Product and employing 55 million individuals with wages in excess of $3 trillion.

LEGISLATIVE MANDATES AND PLANNING

The protection of coastal ecosystems is a national priority and F&ECCP scientific activities support a number of Federal legislative mandates (*Appendix*) that protect and conserve coastal ecosystems, including the Endangered Species Act, National Marine Sanctuaries Act, Coral Reef Conservation Act, and the Coastal Zone Management Act.

The NCCOS Advancing Coastal Science Plan (2017-2021) which guides F&ECCP efforts lays out a Vision of *Science serving coastal communities* and a Mission to *Deliver ecosystem science solutions for stewardship of the Nation's ocean and coastal resources in direct support of NOS priorities, offices, and customers to sustain thriving coastal communities and economies*. As outlined in the Advancing Coastal Science Plan (2017-2021) NCCOS has four strategic priorities:

1) **Stressor Impacts and Mitigation** which includes Harmful Algal Bloom Detection and Forecasting, and Biological Effects of Contaminants and Nutrients. F&ECCP supports the Biological Effects of Contaminants and Nutrients strategic priority.
   - Contaminants and nutrients pollute the marine and coastal environment, causing acute or long-term impacts to ecosystems, humans and animals – from shellfish to pets. Federal agencies with regulatory, management, or response missions have science needs that frequently overlap with those of community, fisheries, and public works managers.
   - NCCOS provides the science to help managers understand the biological effects of contaminants and nutrients and evolve actions over time, or respond quickly to avert a crisis.
   - NCCOS conducts national or long-term research to understand the effects of contaminants,

nutrients, and hypoxia.

- Measuring contaminants in mussels and oysters, or the breadth of the Gulf of Mexico's dead zone, where agricultural runoff from the middle of the country leads to summertime conditions that cannot support bottom-dwelling marine life. These measurements and predictions allow better decisions affecting health and seafood safety by local, regional, and upstream managers.
- NCCOS is also concerned with more specialized or localized research questions where there is a unique need by Federal, tribal, state, and local officials, often in partnership with an industry or non-profit organization. For example, scientific understanding of the impacts of oil dispersants in a laboratory setting can help coastal and fisheries managers, and the oil and chemical industries make long-term and rapid response decisions.
- NCCOS provides the science to help managers understand the biological effects of contaminants and nutrients and evolve their actions over time, or respond quickly to avert a crisis.

2) **Marine Spatial Ecology** which includes, Ecological and Biogeographic Assessments, Habitat Mapping, Regional Ecosystem Science, Coastal Aquaculture Siting and Sustainability

3) **Coastal Change: Vulnerability, Mitigation, and Restoration** which includes Vulnerability and Risk Assessment; Natural and Nature-based Features; Climate Impacts on Ecosystems; and Restoration

4) **Social Science** which includes Ecosystem Services Valuation; Assessing Human Use; and Assessing Vulnerability and Resilience

SOURCES AND IMPACTS OF CHEMICAL CONTAMINANTS ON COASTAL ECOSYSTEMS

Chemical contaminants are substances that are present in the environment at levels or at concentrations that give rise to concerns about their potential adverse biological effects and impacts on the delivery of ecosystem services. Chemical contaminants enter coastal ecosystems *via* land, sea and atmospheric routes.

Land-based contaminants

As much as 80% of the contaminants affecting US coasts are land-based, with coasts serving as a major "route" for the exposure of marine ecosystems to a host of contaminants that can impact shallow, off-shore and deep water ecosystems. Coasts are subject to both point and nonpoint sources of contaminants delivered via effluent, rivers and runoff. Significant sources of contaminants include cities, factories, agricultural activities, forestry and mining that can also be inland/upstream, and ports and marinas.

Sea-based contaminants

Sea-based sources of contaminants include dredging, shipping and maritime traffic that are subject to chemical spills (including oil and dispersant/surfactants used to remediate oil spills and other hazardous or noxious substances transported by sea). Vessels are also responsible for "operational pollution" that includes bilge water from machinery spaces, ballast water of fuel oil tanks, detergents, cleaners, lubricants, and chemicals from refrigerating equipment and fire-extinguishers. The hull of vessels are often painted with antifouling chemicals that prevent the growth and accumulation of fouling organisms that reduce vessel performance and increase fuel consumption. These antifouling chemicals are typically antimicrobial compounds that may enter the marine environment with deleterious effects.

The highest risks of sea-based chemical contamination are from off-shore activities, and are generally related to oil and gas exploration and extraction activities, where the contamination of coastal ecosystems derive from drilling wastes, fluids and cuttings, lubricants, additives including viscosifiers, biocides, corrosion inhibitors, shale inhibitors, emulsifiers, wetting agents, surfactants, detergents, salts and organic polymers. In addition, several metals are present in most water-based drilling muds that may have arsenic, barium, chromium, cadmium, copper, iron, lead, mercury, nickel and zinc. Seabed mining for precious minerals with increasing demand such as manganese, cobalt, nickel and thallium further increases the risk posed by contaminants. Offshore aquaculture operations that use medicines, biocides and nutrients may also introduce contaminants to coastal ecosystems.

Atmospheric Contaminants

Airborne contaminants (including hydrocarbons, metals, pesticides *etc*.) can enter the atmosphere via factory emissions or wind-driven contaminated dust particles, and are able to travel long distances before being deposited in coastal areas via precipitation.

With continued increases in coastal populations, construction and development, and efforts to further exploit marine resources (by both extractive and non-extractive means), the pressure being brought to bear on coastal ecosystems will continue to increase.

Contaminants of Concern for Coastal Ecosystems

There are a number of contaminants of concern for coastal ecosystems including legacy compounds (*e.g.* Dichlorodiphenyltrichloroethane (DDT)), current-use, and new designer chemicals. Chemicals that are toxic, hazardous, persistent and bio-accumulate garner the greatest attention and include crude oil and its toxic components, polycyclic aromatic hydrocarbons, heavy metals, pesticides, polychlorinated biphenyls, per and polyfluoroalkyl substances, flame retardants, microplastics, nano materials, pharmaceuticals and personal care products including sunscreen/sunblock.

Contaminants of the greatest concern include those that cause acute, sub-chronic, chronic, developmental and genetic toxicity (including chromosome aberrations) and carcinogens. In addition to lethal effects, there is a range of possible sub-lethal effects (*e.g*. neurotoxicity, endocrine disruption, reproductive impairment). F&ECCP also focuses on environmental factors that may further increase the toxicity of contaminants such as photo-oxidation, the transformation and degradation of contaminants and the formation of toxic by-products.

Within coastal systems, there are many stressors that can exacerbate the adverse effects of contaminants and further degrade coastal ecosystems including sedimentation, sewage, overfishing, invasive species (ballast tank water), harmful algal blooms, hypoxic and dead zones, ocean acidification, climate change, rising sea levels, floods and hurricanes.

F&ECCP collaborates with members of the scientific community and private sector and works with resource managers at the local, state, tribal, federal and international levels to deliver scientific products and services to monitor and assess the ecosystem-wide effects of chemical contaminants and their toxicity to support both the development of mitigation/remedial actions and the evaluation of their effectiveness.

IDENTIFYING PRIORITY CONTAMINANTS

Within the context of NCCOS' mission, F&ECCP considers a number of factors when deciding on chemical contaminants that should be the focus of research and scientific efforts (*i.e.* priority contaminants). In addition to F&ECCP's research capabilities, expertise and capacities (*i.e*. resources) considerations include:

1) What are the potential toxic/deleterious effects of the contaminants and the likely level of exposure of coastal resources to the contaminants?
2) Are there science needs not filled by another NOAA, Federal, State or local entity that need to be met, or is there a specific request from any of these entities?
3) Who are potential collaborators/partners within the scientific or user communities?
4) How useful are the scientific products and services that F&ECCP would deliver (*i.e.* is F&ECCP adding real value, being impactful)?

GUIDING PRINCIPLES

Ensuring Science Quality and Transparency

- Research adheres to rigorous quality assurance standards; will be reproducible, transparent and publicly accessible.
  - ✔ The commitment to quality science includes rigorous internal and external peer review (including adherence to NOAA's Framework for Internal Review and Approval of Fundamental Research Communications (2016), and NOS' Communications Research Policy) publishing results in peer-reviewed journals and review by external scientific committees.
  - ✔ The commitment to transparency includes public access to publications and supporting scientific data.

Advancing Environmental Science and Technology

- Investing in, encouraging and promoting innovative ideas, technologies and processes.
- Investing in the development and use of cost-effective technologies, methods and models that improve environmental decision-making.

Scientific Collaborations

- Strengthening F&ECCP's leadership through strong collaborations with the scientific community.
- Establishing and developing strong partnerships within NOAA and external organizations to achieve goals.
- Establishing domestic and international scientific partnerships that achieve synergies in expertise, data-sharing, joint projects, the pooling of resources in the public and private sector and academic institutions.

Informing Decisions and Actions

- Working closely with resource managers/users (including the private sector) to define the most pressing issues, data gaps and research needs, and delivering science for informing decisions that affect communities across the nation as well as the international community.
- Providing research that informs decisions on contaminant impacts (*e.g.* injury assessments), response activities (e.g., oil and dispersant impacts) and restoration/remediation actions.

- Collaborating with customers/users, including states and territories, Tribal Nations, and NOAA (*e.g.*, Office of Response and Restoration, Office for Coastal Management, National Marine Sanctuaries, Coral Reef Conservation Program, National Marine Fisheries Service, Oceanic and Atmospheric Research) National Institute of Standards and Technology and Federal partners (*e.g.*, U.S. Environmental Protection Agency/Great Lakes Restoration Initiative, U.S. Geological Survey, Bureau of Ocean Energy Management, Food and Drug Administration, National Park Service, and international partners (*e.g*. Canada)

RESEARCH

Themes

F&ECCP focuses on five science themes and supporting objectives. Themes one, two and three will be integrated to support an overarching theme of comprehensive contaminant-based ecosystem monitoring and assessments.

Theme 1. Identify and Monitor Priority Contaminants in Coastal Ecosystems.

- ✔ *Conduct chemical analyses of contaminants in water, sediment, plants and animals in coastal ecosystems.*

Theme 2. Determine the Effect of Contaminants on Coastal Ecosystems

- ✔ *Determine the potential impacts (including toxicity/mode of action)*
- ✔ *Determine the actual or likely level of exposure of coastal ecosystems to contaminants*
- ✔ *Determine genetic, molecular, individual, population and ecosystem level effects*
- ✔ *Determine environmental factors that compound/increases the severity of effects (via increased toxicity and or exposure).*

Theme 3. Determine the Socio-economic Impact of Coastal Contaminants

- ✔ *Conduct socio-economic impact studies on contaminant effects*
- ✔ *NCCOS possesses socioeconomic impacts assessment capabilities, however currently, while there are individual efforts in F&ECCP to link socioeconomic data with land-based sources of chemical contaminants etc., socioeconomic assessments are not conducted within F&ECCP.*

Theme 4. Support the Mitigation of Contaminant Impacts

- ✔ *Provide scientific advice/consultations on mitigation actions (including restoration/remediation)*
- ✔ *Develop and provide mitigation technologies*
- ✔ *Evaluate the performance/efficacy of mitigation/remedial actions*

Theme 5. Strengthening the Scientific Enterprise

- ✔ *Expand and improve data collection and analytical methods & technologies.*
- ✔ *Improve database management and employ cutting-edge computer technologies and tools in analyzing and sharing data (i.e. maximize the utility of data)*
- ✔ *Strengthen or increase access to machine-learning and artificial intelligence capabilities*
- ✔ *Develop predictive models and ecosystem assessment tools*
- ✔ *Invest in areas such as omics that will provide greater efficiency and effectiveness in detecting, monitoring and supporting the mitigation of contaminant impacts.*
- ✔ *Ensure appropriate/adequate expertise in-house that is aligned with science priorities*
- ✔ *Achieve effective workload management including employee training to meet future needs and support career development and advancement*
- ✔ *Modernize facilities & labs and employ up-to-date technologies*

Research Overview

F&ECCP conducts field research, mesocosm studies and laboratory investigations to detect, monitor, and assess the effects of contaminants and support the mitigation of their impacts on coastal ecosystems. These efforts cut across **Themes 1 thru 5** and include data collection and analysis, the development of analytical tools, methodologies, protocols and standards, the development and application of predictive models, and support for restoration/remediation methods.

F&ECCP conducts studies on the presence and fate of chemical contaminants (and their degradation products) in coastal ecosystems by utilizing a wide range of survey methodologies and sampling devices (active and Passive) and applying a range of techniques including analytical chemistry, chromatography, trace elemental analyses (spectrometry/spectroscopy), and nuclear magnetic resonance to water and sediments samples. Analyses of contaminants in key marine species including plants, fish, invertebrates and protected species (*e.g*. corals, marine mammals) are also conducted. The results of these studies indicate the level of toxicity and chemical contaminant exposure and characterize the condition of coastal ecosystems. The monitoring of the contaminant loads of species such as bivalves provide insights into the extent to which contaminants are bioavailable and are likely to enter the marine food web. The collection of long-term chemical contaminant data allows for the monitoring of contaminant concentration trends and can identify concerns that must be addressed and evaluate the efficacy of management/remedial measures.

In understanding the effect of chemical contaminants on coastal ecosystems, F&ECCP relies on existing data on the toxic chemical properties and investigates the toxicity of contaminants, including their mechanism of action, effects at the genetic/molecular levels, and lethal/sub-lethal effects. The development and use of methodologies such as adverse outcome pathways will allow for predictions on the effect of contaminants at the molecular, cellular, individual, population and ecosystem levels. Research is also conducted on environmental factors that can increase the toxicity (*e.g*. photo-oxidation of crude oil) of contaminants. These data establish toxicity end-points/thresholds used in assessing risk and establishing regulatory criteria.

Research supports restoration/remediation actions, such as the replanting of marsh plants in areas impacted by oil-spills. Genetic analyses that characterize (*e.g*. species identification & composition) pre-impact communities (*e.g.* corals) and establish restoration targets are also employed.

F&ECCP also conducts research to develop sampling technologies & methods, protocols, standards and models that advance capabilities (including those of partners) to detect and monitor contaminants and assess and mitigate their effects.

FUTURE DIRECTION & CHALLENGES

A Focus on the Utility of Research/Science Products & Services

- The main objective of F&ECCP is providing resource managers at the Federal, state, local levels with scientific data, information, advice and technologies for protecting, conserving and managing coastal ecosystems.
- The scientific support F&ECCP provides should allow resource managers to: identify chemicals that threaten coastal ecosystems; take actions to prevent, limit or modify the exposure of coastal ecosystems to these chemicals; inform and guide remediation efforts; and monitor the effectiveness of management actions implemented to address the threat posed by chemical contaminants.

Successfully Characterizing the Effects of Chemical Contaminants

- F&ECCP focuses on chemicals that are present in coastal ecosystems, and an ideal suite of capabilities now and in the future would include the ability to:
  1) Detect and identify chemical contaminants
  2) Determine/predict the toxicity/adverse effects of chemical contaminants
  3) Determine/predict the level of exposure in coastal ecosystems to chemical contaminants
  4) Determine/predict effects of chemical contaminants at the molecular, individual, population and ecosystem levels

Future Demands

- The future demands that F&ECCP:
  1) Must always be positioned to effectively address current and emerging contaminants, especially those with the most deleterious effects on coastal ecosystems.
  2) Should be able to provide early scientific input into the potential effects of chemicals on coastal ecosystems that are being evaluated by agencies such as EPA and FDA for registered use.
  3) Must be ready to provide input in support of NOAA regulatory and management responsibilities through partnerships with other line offices.

Challenges

- Coastal Resources Include a Number Complex, Distinct but Interrelated Ecosystems with Each Requiring Specialized Research Expertise, Analytical Capabilities *etc*.
  - ✔ Coastal ecosystems are known for their high biological diversity and productivity and include wetlands, salt marshes, mangrove forests, tide flats, beach-dune systems, beaches, seagrass beds, kelp beds, coral reefs and lagoons/estuaries.

- Chemical Contaminants are Numerous, Varied and Complex with New Chemicals Always Becoming Available
  - ✔ Chemical contaminants include natural or manufactured compounds and derivatives resulting from environmental (*e.g*. photic, temperature) and biological (*e.g*. assimilates, metabolites) transformations. Transformation products may have additional and more adverse effects on coastal ecosystems compared to their parent compounds. In addition to transformation products, the assessment of chemical impacts on coastal ecosystems must consider the impact of chemical mixtures and novel chemicals such as nanomaterials and designer chemicals. Future chemical analyses must include opportunities for non-targeted approaches - cases where chemicals (or categories of chemicals) in marine samples are originally unknown.

- Ensuring that Research/Science Products & Services are Impactful/Making a Difference
  - ✔ Ensuring that research efforts target the most severe threats to coastal ecosystems and research products and services are aligned with resource management needs and are used to protect, conserve and manage coastal ecosystems.

    Strategies:
    - Enhanced engagement with resource managers will ensure that our investments are most relevant and impactful in addressing contaminant effects.
    - It may be necessary to include well-developed "utility & impact requirements" for research efforts, including details on how research results can or will be realistically used, including the identification of specific resource managers.

- F&ECCP Fragmentation: Organizationally, Programmatically and with Funding.
  - ✔ A complete and comprehensive assessment of the fate and effects of any chemical contaminant (*i.e*. going from detection to toxicity, exposure and effects) should be a seamless activity, supported with funding to ensure progress from detection to effects determinations. The three SDI Branches (i.e. Ecotoxicology; Key Species and Bioinformatics; and Monitoring and Assessment) take advantage of opportunities to collaborate; however, their efforts are not fully integrated due to: 1) our organizational structure (*i.e*. they are separate Branches); and 2) funding (within and external to NCCOS) is often for discrete and specific projects and efforts with specific objectives.

    Strategies:
    - Successful and sustained collaboration requires participants with functional roles (*i.e*. they are providing something of value). A critical first step is ensuring that potential participants are aware of opportunities to collaborate.
      - Better use must be made of information-sharing, communications technologies to ensure staff are informed.
    - Efforts to foster collaboration includes a broad and well-attended, moderated and monthly Bioeffects Workshop where presentations are given with the express purpose of: informing colleagues about developing work products and investigations; utilizing collective expertise to work through problems; encouraging collaboration, group discussion and opportunities for advancing scientific analysis; identifying opportunities to provide communities and decision makers with relevant science.
    - Branch Chiefs with F&ECC Program responsibilities have been meeting monthly to discuss common challenges and share information on research activities and opportunities.
    - The NCCOS Programmatic Approach to Funding for research projects, also promotes collaboration, by encouraging the funding of longer-term projects that cut across NCCOS Branches and Divisions.

- Identifying Gaps in Expertise, Equipment/Tools and Funding and Establishing Partnerships to Address these Gaps.
  - ✔ Insufficient resources will naturally limit the extent of any research/science activity. The focus here is on identifying gaps/needs in expertise (including interdisciplinary expertise), equipment, tools/software, data *etc*. and identifying and establishing partnerships to address these challenges by adopting strategies such as the pooling and sharing of resources to ensure cost-effective investments.

Strategies:

- Within SDI there is a funded *Equipment Refresh Plan*, however, consistent, sustained efforts must be undertaken for ensuring that staff are kept apprised of scientific developments, capabilities, equipment, activities, resources external to F&EC and NOAA, from which F&EC can benefit.
  - For example, EPA's *Sequence Alignment to Predict Across Species Susceptibility (SeqAPASS) - "a fast, online screening tool which predicts chemical susceptibility for hundreds of species without data, by using available protein sequence and structural information. SeqAPASS uses existing data from model organisms to predict likely or unlikely chemical interactions for untested species, minimizing the need for additional resource-intensive toxicity testing and making the process more rapid for scientists."*

- The Need to Spur Innovation
  - ✔ Innovations that advance research/science and enhance and expand the usefulness of F&EC scientific products and services are essential. The range, types and combinations of chemical contaminants are ever changing, for example now we have nanomaterials and designer chemicals. There are also chemicals where impacts, though severe or systematic (*e.g.* endocrine disruptors), may be difficult to discern because we don't have access to the required analytical methods and tools. Innovations will ensure that we are not stuck in the past and are able to meet current and future resource management needs.

    Strategies:

    - Within NCCOS, the Innovation Incentive Awards Program encourages innovative ideas and rewards awardees with funds that support winning projects.
    - The NCCOS Programmatic Approach to Funding while focusing on strategic priorities, also encourages and funds innovative projects

APPENDIX

LEGISLATIVE MANDATES SUPPORTED BY F&ECCP

- NOAA and other Federal agencies with regulatory, management or response missions have needs that require: the detection, monitoring of chemical contaminants and the mitigation of effects on coastal and marine resources; the design and implementation of remediation and restoration efforts; and the evaluation of resource management measures.
- The primary legislative authorities under which F&ECCP operates are in Table 1.

Table 1. Primary Legislations Under Which SDI's F&ECC Program Operates

Legislation:	Purpose
Magnuson-Stevens Fishery Conservation and Management Reauthorization Act	● The primary law governing marine fisheries management in U.S. federal waters. MSA fosters long-term biological and economic sustainability of our nation's marine fisheries. Key objectives of the MSA include: Rebuilding overfished stocks; Ensuring a safe and sustainable supply of seafood and Increasing long-term economic and social benefits
Endangered Species Act	● Protects species that are at risk of extinction, and provides for the conservation of the ecosystems on which they depend. Under the ESA, NOAA works to conserve and recover marine resources by: ● Listing species under the ESA and designating critical habitat. ● Developing and implementing recovery plans for listed species. ● Consulting on federal actions that may affect listed species, to minimize the effects of the action. ● Cooperating with non-federal partners to develop conservation plans for the long-term conservation of species. ● Authorizing research to learn more about protected species.
Marine Mammal Protection Act	● A response to concerns that significant declines in some species of marine mammals were caused by human activities. ● Established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part.
Oil Pollution Act	● The principal statute governing oil spills into the nation's waterways. ● The Oil Pollution Act (OPA) passed in the wake of the Exxon Valdez oil spill in 1989 establishes liability and limitations on liability for damages resulting from oil pollution. ● In conjunction with CERCLA, it mandates a "National Oil and Hazardous Substances Pollution Contingency Plan (NCP)" to provide the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants. It requires preparation of spill prevention and response plans by coastal facilities, vessels, and certain geographic regions. ● OPA amended the Clean Water Act and includes the Oil Terminal and Oil Tanker Environmental Oversight and Monitoring Act of 1990.
Coastal Wetlands Planning, Protection, and Restoration Act	● Restoring lost wetlands of the Gulf Coast protects wetlands from future deterioration.
Coral Reef Conservation Act	● Preserves coral reef ecosystems, promotes wise management and gains better information on the current condition of coral reefs.
National Marine Sanctuaries Act	● Protects marine resources, such as coral reefs, sunken historical vessels, or unique habitats. The act authorizes the U.S. Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational or esthetic qualities as national marine sanctuaries.
Coastal Zone Management Act	● Provides for the management of the nation's coastal resources, including the Great Lakes. The goal is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." ● The CZMA outlines three national programs, the National Coastal Zone Management Program, the National Estuarine Research Reserve System, and the Coastal and Estuarine Land Conservation Program (CELCP). The National Coastal Zone Management Program aims to balance competing land and water issues through state and territorial coastal management programs, the reserves serve as field laboratories that provide a greater understanding of estuaries and how humans impact them, and CELCP provides matching funds to state and local governments to purchase threatened coastal and estuarine lands or obtain conservation easements.

CHAPTER 3
F&ECC PROGRAM - *Organization & Resources Overview*

Table of Contents

Introduction

This report describes the organizational structure, funding, and other resources supporting the Fate & Effects of Chemical Contaminants (F&ECC) Program within the Stressor Detection and Impacts (SDI) Division. The information provided here reflects the three years for this program review (Fiscal Years 2017, 2018, 2019), unless otherwise indicated.

Organizational Structure

The National Centers for Ocean Coastal Science (NCCOS) implemented a reorganization in 2017. Where NCCOS was previously Center-focused with personnel aligned with the location where they worked, the reorganization aligned personnel with similar functions or priority areas. Designed to carry out the organization's strategic plan, the NCCOS structure consists of two science divisions (Stressor Detection and Impacts and Marine Spatial Ecology), a business management division, an external funding program (Competitive Research), and a communications and outreach program (Figure 1. NCCOS Organization Chart). Staffing for NCCOS is nationwide in various NCCOS run laboratories, Silver Spring headquarters building, and numerous remote locations (Figure 2. NCCOS locations map).

The F&ECC staff are duty stationed in Charleston, SC, and Silver Spring, MD and are organizationally in three branches: (1) Ecotoxicology Branch, (2) Monitoring & Assessment Branch, (3) Key Species & Bioinformatics Branch (Figure 3. SDI Org Chart). The SDI Division Chief is duty stationed in the Silver Spring NCCOS Headquarters along with the rest of the NCCOS Senior Leadership. The SDI Deputy Division Chief is duty stationed in Charleston, SC and has a dual role as Laboratory Director of the NCCOS Charleston Laboratories.

Resources: Staffing for F&ECC Program

Core staffing for the F&ECC Program is made up of federal FTE and contractor science support. During the period of this review, the total number of onboard federal staffing did not vary much from 24 FTEs. This was two positions short of the approved organizational chart for this program. During the 2017-2019 timeframe, the branch chief position for each of the three branches with F&ECC Program responsibilities was vacant for at least two of those three years. All three positions were filled permanently in FY 2019. Even though the branch leadership positions were filled, the branches saw a loss of four federal scientist positions by the end of FY 2019. It should be noted, that in FY20, federal FTE is at 21 for this program. Federal positions are base funded.

Contractor support is a critical component of the F&ECC program. Contract staff bring expertise, capabilities and skillsets that complement federal staff and enhance and advance the research and its outcomes and outputs. During this time period, the number of contractors working on this program was relatively stable at 13 positions (Figure 4. F&ECC Staffing Levels FY2017-2019). Contractor positions are considered soft funded through project based funding sources.

Resources: Funding

Personnel and NCCOS-led research are funded via various means:

- **Base funded** refers to congressionally appropriated funds provided to NCCOS via the National Ocean Service PPA. NCCOS base funds for the F&ECC Program are directed towards federal personnel costs (salary & benefits), travel, supplies, materials, equipment, service agreements, training, and some science contract support (Figure 5 Base Total Funding by Year). The non-salary base funds ensure the ability of the staff to maintain supplies and materials to conduct non-project specific activities and field work as well as travel to partner or stakeholder meetings and professional conferences. (Figure 6. Total Base Expenditures By Branch)

- **Discretionary Projects** refers to funds allocated based on an internal NCCOS competitive process whereby NCCOS researchers can submit proposals for funding. Funds provided via this means in 2017-2019 were for one to three year projects and could be used on travel, supplies, materials, internal/external agreements, laboratory services, and science contract staffing support (Figure 7. Table of discretionary project titles 2017-2019)(Figure 8. Distribution of Discretionary Project funds by branch).

- **Reimbursable Funds** and **Transfers** refers to funds provided to NCCOS from sources outside of NCCOS. Reimbursable funds are from external NOAA sources such as other Federal agencies that are made available to NCCOS via interagency agreements. These sources are typically for specific projects or deliverables. Transfers refers to funds originating within NOAA that are transferred from another line office to NCCOS. In both cases, funds are typically used for science-support contracts, travel, supplies and materials to support the project or research requested. Beginning in FY19, these sources became subject to a NCCOS 10% indirect rate to cover facility and administrative costs of the NCCOS labs and facilities (Figure 9. Reimbursable/Transfer totals by year).

NOTE: Given the limited scope of this review to only the chemical contaminant research conducted in SDI, resource related data for the Key Species & Bioinformatics Branch is adjusted to reflect an estimated 30% of branch staffing, funding and efforts on the FECC Program.

Resources: Facilities and Equipment

The SDI Fate and Effects of Chemical Contaminants Program includes field work, mesocosm experimentation, computer-based data analytics and laboratory based work. The NCCOS Charleston Labs provide the only site for F&ECC research for NCCOS. There are two laboratories that support this work. The Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) building and associated structures house the ecotoxicity testing laboratories, live shallow coral aquaria and research building, marsh replication mesocosm, marine mammal necropsy lab and aquatic species rearing building. The Hollings Marine Laboratory (HML) serves as the lab and scientific instrumentation base for the analytical chemistry functions, microbiology, genetics instrumentation and challenge laboratories. The Ecotoxicology Branch and the Key Species & Bioinformatics Branches use various capabilities of the

labs and instrumentation therein to conduct research. The formal HML partnership that includes the National Institute of Science and Technology, the South Carolina Department of Natural Resources, the College of Charleston, and the Medical University of South Carolina, provides additional opportunity to leverage expertise and instrumentation in the conduct of NCCOS research.

In FY 2019, NCCOS/SDI began targeting aged equipment for replacement. For FY 2017-2019, total investment by SDI toward equipment updates or replacement totaled approximately $342,700. Note that this figure includes equipment that may fully or partially support the Harmful Algal Bloom programs of SDI.

Challenges and Opportunities for the Future

The staffing model for the F&ECC Program brings together Federal and contract staffing in a way that is complementary and leads to the accomplishment of goals and objectives. Beginning in FY19, NCCOS began a shift towards a programmatic approach to funding projects to expand beyond one year projects and allow for a longer view to research planning. This is expected to provide increased certainty for funding to maintain critical expertise and capabilities for research within this portfolio. Federal staffing replacement has lagged behind the rate of attrition. Continual eroding of positions for these programs will negatively impact the capacity to address emerging issues. This issue is further exacerbated by the increasing time researchers spend on the administrative aspects of securing, tracking and spending funds to support their research efforts.

Maintenance of scientific equipment and replacement of aged equipment and instruments is a critical aspect of conducting research. In 2019, a NOAA Research Small Infrastructure Workgroup (considering lab and field equipment valued >$25k) estimated that NOS had over 16.5k assets with an average acquisition date of 2011[1]. The last major investment in equipment for HML and CCEHBR dates back approximately 15 years. The current investment needed to fully update or replace aging equipment supporting this program has not been quantified. A lifecycle plan and approach to equipment replacement is needed so that there is an ability to replace equipment in the same way that such approaches are used for the replacement of staff computers or facility infrastructure.

The Charleston Laboratories are being consolidated into one facility (the Hollings Marine Lab). While the move itself is challenging given the fact that NOAA has occupied the CCEHBR building for over 40 years, this will ultimately lead to an ability for NCCOS to focus resources on the upkeep and maintenance of one facility (opened in 2002) versus the serious resource drain required to lease and maintain the 40+ year old CCEHBR building.

[1] Managing Research Small Infrastructure Systematically. Internal Report to NOAA Research Council. May 2016

Figure 1. NCCOS Organization Chart

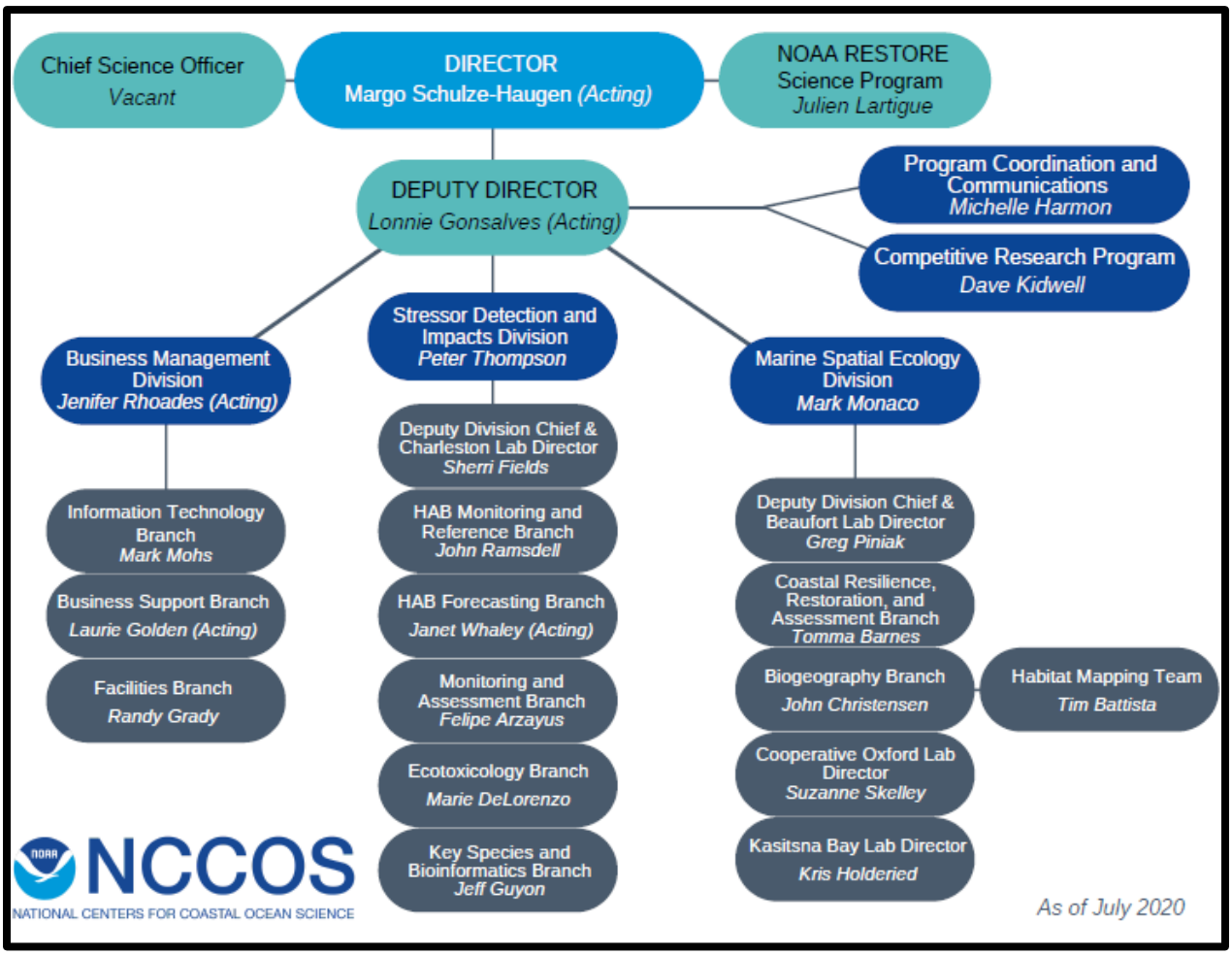


Figure 2. Location of NCCOS Facilities and Staff

Figure 3. SDI Organization Chart with Branches Working on Fate & Effects of Chemical Contaminants Program highlighted. (July, 2020)

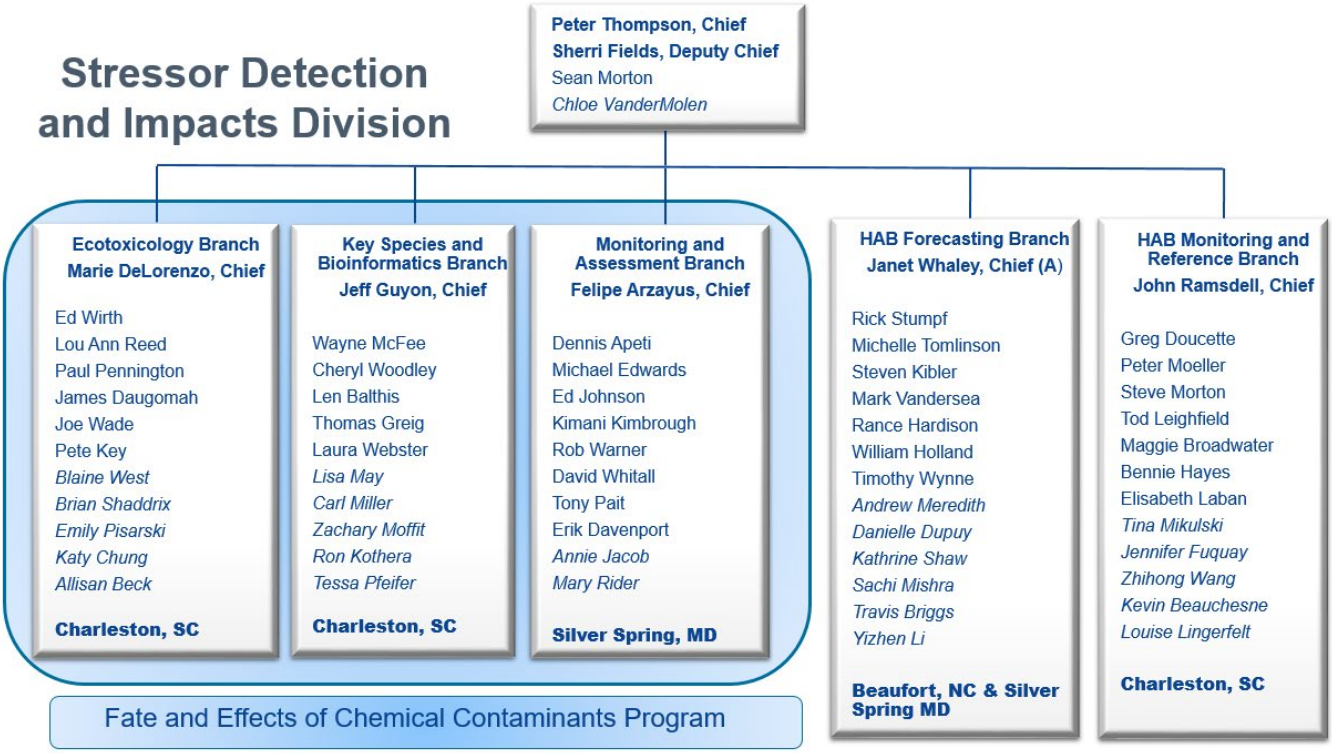
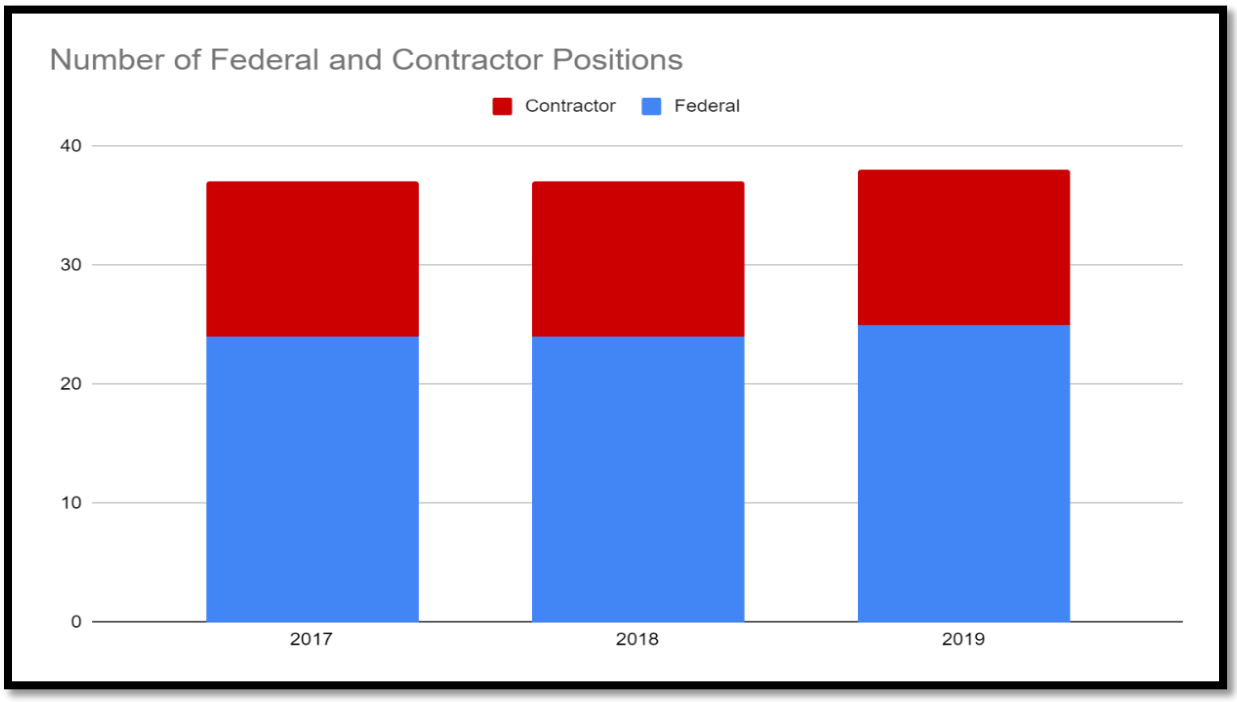


Figure 4. Numbers and Cost of Federal and Contract Personnel Supporting F&ECC Program



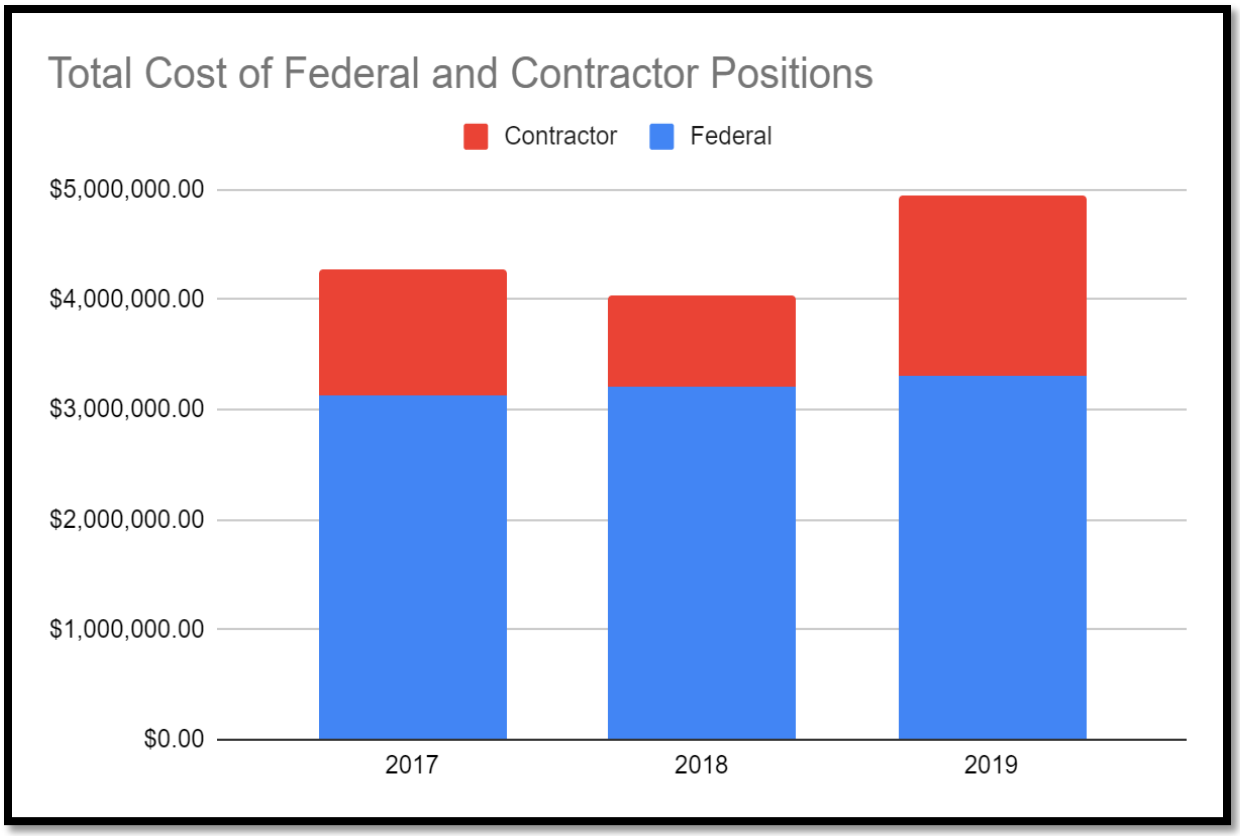


Figure 5. Total F&ECC Program Base Funds for FY 2018 and 2019 (includes federal salary and benefits).

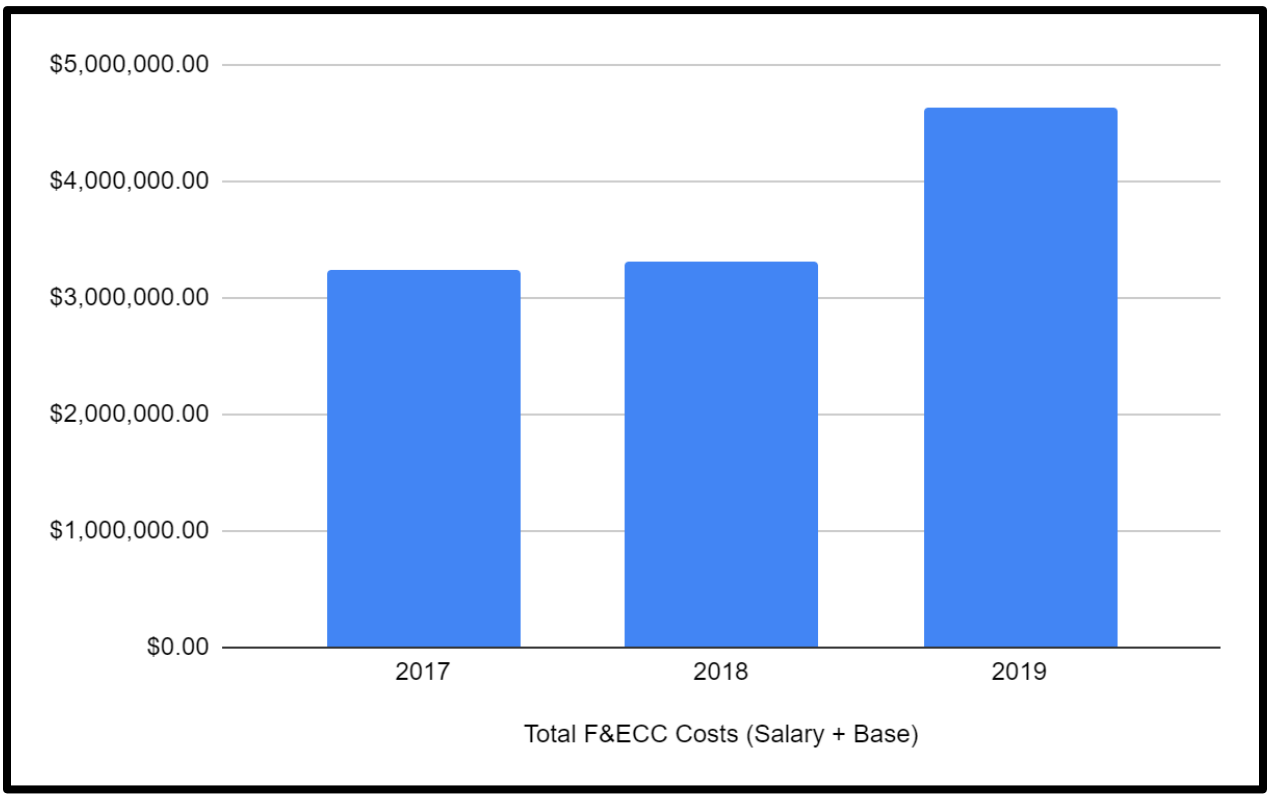


Figure 6. Base Expenditures by Branch for FY 2017 (blue), FY 2018 (red) and FY 2019 (gold)

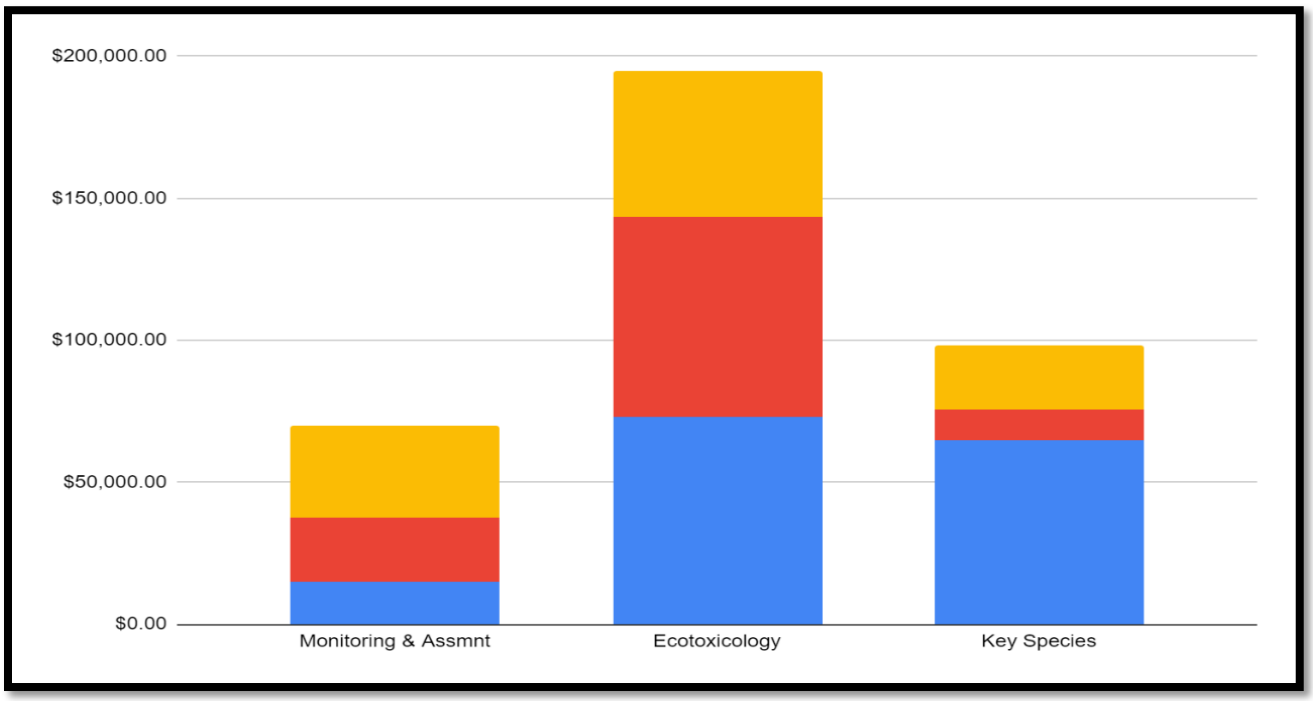


Figure 7. Discretionary Projects -- F&ECC Program

Project Title	FY
Ecological assessment of thin-layer placement of dredged sediment in Barnegat Bay, NJ	2017
Ultraviolet light-enhanced toxicity of surface oil slicks to early life stages of marine organisms	2017
Mussel Watch	2017
Field-based mesocosms: in situ deployments for assessing impacts of chemical spills in coastal areas	2018
Measuring and modelling the photo-oxidation of floating oil	2018
Compounded vulnerability of threatened shallow-water corals to toxic effects from oil spills	2018
Mussel Watch	2018
Compounded vulnerability of threatened shallow-water corals to toxic effects from oil spills Pt II	2019
Comparison of Chemical Contaminant Measures Using CLAM and POCIS Samplers in Estuarine Mesocosms	2019
Defining Protocols for Replanting as an Oil Spill Response Tactic in Coastal Marshes	2019
Mussel Watch	2019

Figure 8. Discretionary Project Funding Levels for FY 2017 (blue), FY 2018 (red), 2019 (gold)

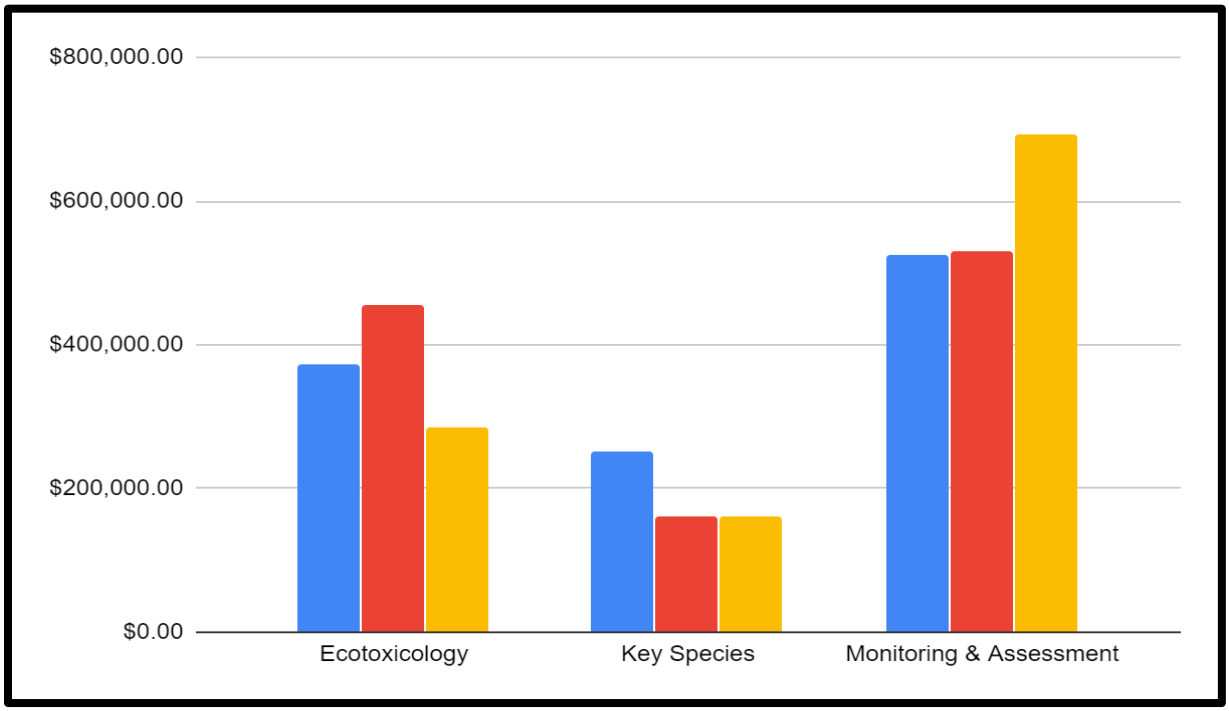
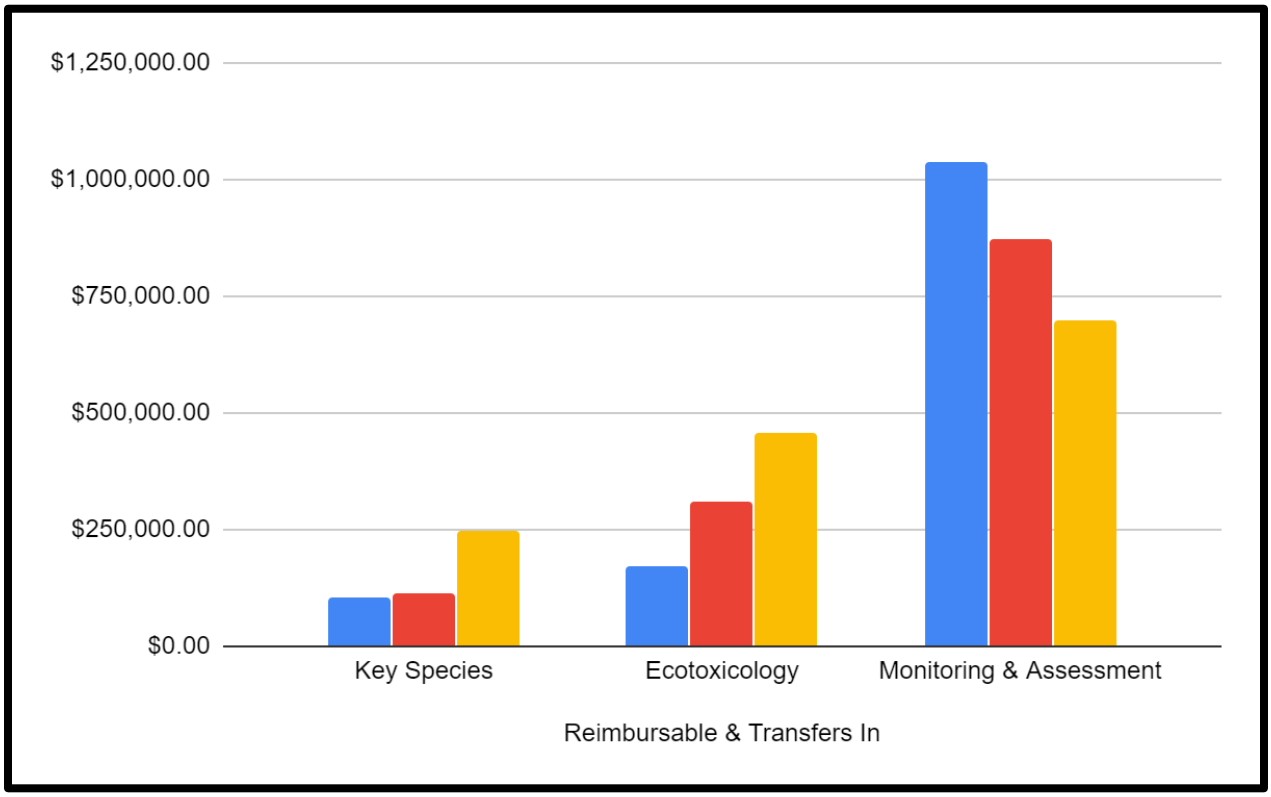


Figure 9. Reimbursable Funds and Transfers In to F&ECC Program 2017(blue), 2018 (red), 2019 (gold). Key Species represents 30% of total funds received for each year.



CHAPTER 4
Publication and Engagement Metrics

Table of Contents

Publications (from January 2016 to Present)

Chemical Contaminants Publication Summary by Branch

Branch	Publication Type					TOTAL
	Journal Articles	Book Chapters	NOAA Tech Memos	Reports	Thesis, Dissertations	
Ecotoxicology	16	0	6	1	0	23
Key Species and Bioinformatics	12	3	5	1	3	24
Monitoring and Assessment	9	0	18	5	2	34
TOTAL:	**37**	**3**	**29**	**7**	**5**	**81**

ECOTOXICOLOGY BRANCH

Journal Publications:

1. Baxter, S.E., DeLorenzo, M.E., Key, P.B., Chung, K.W., Beckingham, B., Fulton, M.H. (2018) Toxicity Comparison of the Shoreline Cleaners Accell Clean® and PES-51® in Two Life Stages of the Grass Shrimp, *Palaemonetes pugio.* Environ Sci Poll Res 25(11):10926-10936. DOI: 10.1007/s11356-018-1370-2
2. Buenaventura, N.T.,Chastain, S., Chavanich, S., Cózar, A., DeLorenzo, M., Hagmann, P., Hinata, H., Kozlovskii, N., Lusher, A.L., Martí, E., Michida, Y., Mu, J., Ohno, M., Potter, G., Ross, P.S., Shim, W.J., Song, J.K., Takada, H., Tokai, T., Torii, T., Uchida, K., Vassillenko, K., Viyakarn, V., Zhang, W. (2019) An interlaboratory comparison exercise for the determination of microplastics in standard sample bottles. Mar Poll Bull 146: 831–837.
3. DeLorenzo, M.E., Brooker, J., Chung, K.W., Kelly, M., Martinez, J., Moore, J.G., Thomas, M. 2017. Exposure of the grass shrimp, *Palaemonetes pugio*, to antimicrobial compounds affects associated Vibrio bacterial density and development of antibiotic resistance. World Biomedical Frontiers. ISSN:2328-0166. Originally published Environ Toxicol. 2016. 31(4):469-77. doi:10.1002/tox.22060.
4. DeLorenzo, M.E., Eckmann, C.A., Chung, K.W., Key, P.B., Fulton, M.H. Effects of Salinity on Oil Dispersant Toxicity in the Grass Shrimp, *Palaemonetes pugio*. 2016. Ecotoxicology and Environmental Safety. 134:256-263
5. DeLorenzo, M.E., Evans, B., Chung, K.W., Key, P.B., Fulton, M.H. 2017. Effects of Salinity on Oil Dispersant Toxicity in the Mud Snail, *Ilyannasa obsoleta*. Environ Sci Poll Res 24(26):21476-21483. DOI 10.1007/s11356-017-9784-9
6. DeLorenzo, M.E., Key, P.B., Chung, K.W., Pisarski, E., Shaddrix, B., Moore, J.G., Wirth, E.F., Pennington, P.L., Wade, J., Franco, M., Fulton, M.H. 2017. Comparative Toxicity of Two Chemical Dispersants and Dispersed Oil in Estuarine Organisms. Arch Environ Contam Toxicol 74(3): 414-430. DOI 10.1007/s00244-017-0430-9

7. Fair, P.A., Wolf, B., White, N.D., Arnott, S.A., Kannan, K., Karthikraj, R., Vena, J.E. Persistent organic pollutants in fish from Charleston Harbor and tributaries, South Carolina, United States: a risk assessment. Environmental Research 167 (2018): 598-613.
8. Frometa, J., DeLorenzo, M.E., Pisarski, E.C., Etnoyer, P.J. 2017. Toxicity of oil and dispersant on the deep water gorgonian octocoral *Swiftia exserta*, with implications for the effects of the Deepwater Horizon oil spill. Mar Poll Bull. 122:91-99.
9. Gugliotti, E.F., DeLorenzo, M.E., Etnoyer, P.J. (2019) Depth-dependent temperature variability in the Southern California bight with implications for the cold-water gorgonian octocoral *Adelogorgia phyllosclera*. J. Exp. Mar. Biol. Ecol.514-515:118-126.
10. Hart, L. B., Beckingham, B., Wells, R. S.,Alten Flagg, M., Wischusen, K., Moors, A.,et al. (2018). Urinary phthalate metabolites in common bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL, USA. GeoHealth, 2. https://doi.org/10.1029/2018GH000146
11. Heffer A., Marquart G.D., Aquilina-Beck A., Saleem N., Burgess H.A., Dawid I.B. (2017). Generation and characterization of Kctd15 mutations in zebrafish. PLoS One. 2017 Dec 7;12(12):e018916222 – 233. https://doi.org/10.1016/j.envpol.2017.04.057.
12. Pisarski, E., Chung, K., DeLorenzo, M. (2020) Lionfish (*Pterois volitans*) as biomonitoring species for oil pollution effects in coral reef ecosystems. Mar Environ Res https://doi.org/10.1016/j.marenvres.2020.104915
13. Sinkus, W., V. Shervette, J. Ballenger, L. Reed, C. Plante, and B. White. 2017. Mercury bioaccumulation in offshore reef fishes from waters of the Southeastern USA. Environmental Pollution 228: 2Fair, P.A., Wolf, B., White, N.D., Arnott, S.A., Kannan, K., Karthikraj, R., Vena, J.E. Persistent organic pollutants in fish from Charleston Harbor and tributaries, South Carolina, United States: a risk assessment. Environmental research 167 (2018): 598-613.
14. Smylie, M., C. McDonough, L. Reed, and V. Shervette. 2016. "Mercury bioaccumulation in an estuarine predator: biotic factors, abiotic factors, and assessments of fish health." Environmental Pollution 214: 169-176. https://doi.org/10.1016/j.envpol.2016.04.007
15. van den Hurk, P., Edhlund, I., Davis, R., Hahn, J.J. McComb, M.J., Rogers, E.L., Soloff, A.C., Wolf, B.J., White, N.D., Muir, D., Courtney, S., Hardiman, G., Bossart, G.D., Fair, P.A. 2017 Environmental perfluorooctane sulfonate exposure drives T cell activation in bottlenose dolphins. Journal of Applied Toxicology 37(9): 1108-1116.
16. White, N.D., Godard-Codding, C., Webb, S.J., Bossart, G.D., Fair, P.A. "Immunotoxic effects of in vitro exposure of dolphin lymphocytes to Louisiana sweet crude oil and Corexit™." Journal of Applied Toxicology 37.6 (2017): 676-682.

NOAA Tech Memos

1. Apeti, D.A., E. Wirth, A.K. Leight, A. Mason, and E. Pisaski. 2018. An Assessment of Contaminants of Emerging Concern in Chesapeake Bay, MD and Charleston Harbor, SC. NOAA Technical Memorandum NOS NCCOS 240. Silver Spring, MD. 104 pp. doi:10.25923/p4nc-7m7A1
2. Balthis, W. L., J. L. Hyland, C. Cooksey, M. H. Fulton, and E. Wirth. 2017. Integrated Assessment of Ecosystem Condition and Stressor Impacts in Submerged Habitats of the Guana Tolomato Matanzas (GTM) National Estuarine Research Reserve (NERR). NOAA Technical Memorandum NOS NCCOS 231, NOAA National Ocean Service, Charleston, SC 29412-9110. 52 pp.
3. DeLorenzo, M.E., Key, P.B., Wirth, E.F., Pennington, P.L., Chung, K.W., Pisarski, E., Shaddrix, B., Baxter, S., Fulton, M.H., 2017. Efficacy and ecotoxicological effects of shoreline cleaners in salt marsh ecosystems. NOAA Technical Memorandum NOS NCCOS 232. 110 pp.
4. Pennington, P. National Oceanic and Atmospheric Administration Marine Debris Program. (2017). Report on Marine Debris as a Potential Pathway for Invasive Species. Silver Spring, MD: National Oceanic and Atmospheric Administration Marine Debris Program.
5. Pisarski, E.C., E.F. Wirth, S.I. Hartwell, B.S. Shaddrix, D.R. Whitall, D.A. Apeti, M.H. Fulton, G. Baker. 2018. Assessment of Hydrocarbon Carryover Potential for Six Field Cleaning Protocols. NOAA Technical Memorandum NOS NCCOS 247. Silver Spring, MD. 36 pp.

6. Whitall, D, A. Ramos, D. Wehner, M. Fulton, A. Mason, E. Wirth, B. West, A. Pait, E. Pisarski, B. Shaddrix, and L. Reed. 2016. "Contaminants in queen conch (*Strombus gigas*) in Vieques, Puerto Rico." Regional Studies in Marine Science 5: 80-86.

Reports:

1. Sanger, D.M., S.P. Johnson, A.W. Tweel, D.E. Chestnut, B. Rabon, M.H. Fulton, and E. Wirth. 2020. The Condition of South Carolina's Estuarine and Coastal Habitats During 2017-2018: Technical Report. Charleston, SC: South Carolina Marine Resources Division. Technical Report No.TBD

KEY SPECIES AND BIOINFORMATICS BRANCH

Journal Publications:

1. Aki H. Ohdera, Michael J. Abrams, Cheryl L. Ames, David M. Baker, Luis P. Suescún-Bolívar, Allen G. Collins, Christopher J. Freeman, Edgar Gamero-Mora, Tamar L. Goulet, Dietrich K. Hofmann, Adrian Jaimes-Becerra, Paul F. Long, Antonio C. Marques, Laura A. Miller, Laura D. Mydlarz, Andre C. Morandini, Casandra R. Newkirk, Sastia P. Putri, Julia Samson, Sérgio N. Stampar, Bailey Steinworth, Michelle Templeman, Patricia E. Thomé, Marli Vlok, Cheryl M. Woodley, Jane C.Y. Wong, Mark Q. Martindale, William K. Fitt and Mónica Medina. (2018) Upside-down but headed in the right directions: Review of the highly versatile *Cassiopea xamachana* system. Frontiers in Ecology and Evolution 6:35. https://doi.org/10.3389/fevo.2018.00035
2. Alizad K, Hagen SC, Medeiros SC, Bilskie MV, Morris JT, Balthis L, et al. (2018) Dynamic responses and implications to coastal wetlands and the surrounding regions under sea level rise. PLoS ONE 13(10): e0205176. https://doi.org/10.1371/journal.pone.0205176
3. Andersson, Erik R., Day, Rusty D., Loewenstein, Julie M., Woodley, Cheryl M. and Schock, Tracey B. (2019) Evaluation of Sample Preparation Methods for the Analysis of Reef-Building Corals Using 1H-NMR-Based Metabolomics. Metabolites 9, 32; doi:10.3390/metabo9020032
4. Andersson ER, Stewart JA, Work TM, Woodley CM, Schock TB, Day RD. Morphological, elemental, and boron isotopic insights into pathophysiology of diseased coral growth anomalies. Scientific Reports (accepted, 2020)
5. Balthis, W. L., Hyland, J.L., Cooksey, C., Montagna, P.A., Baguley, J.G., Rocker, R.W., and C. Lewis. "Sediment Quality Benchmarks for Assessing Oil-related Impacts to the Deep-sea Benthos." Integrated environmental assessment and management 13.5 (2017b): 840-851.
6. Bryan, C.E., Bossart, G.D, Christopher, S.J., Davis, W.C., Kilpatrick, L.E., McFee, W.E. and T.X. O'Brien. 2017. Selenium protein identification and profiling by mass spectrometry: a tool to assess progression of cardiomyopathy in a whale model. Journal of Trace Elements in Medicine and Biology 44: 40-49.
7. Claro, F., Fossi, M.C., Iokeimidis, C., Baini, M., Lusher, A.L., McFee, W., McIntosh, R.R., Pelamatti, T., Sorce, M., Galgani, F., and B.D. Hardesty. "Tools and constraints in monitoring interactions between marine litter and megafauna: insights from case studies around the world." Marine pollution bulletin 141 (2019): 147-160.
8. Etnoyer, P. J., L. N. Wickes, J. D. Dubick, E. Salgado, L. Balthis, I. R. MacDonald. 2016. Decline in condition of sea fans on mesophotic reefs in the northern Gulf of Mexico: before and after the Deepwater Horizon oil spill. Coral Reefs 35(1):77-90.
9. May, L.A., Burnett, A.R., Miller, C.V., Pisarski, E., Webster, L.F., Moffitt, Z.J., Pennington, P., Wirth, E., Baker, G., Ricker, R., and C.M. Woodley. "Effect of Louisiana Sweet Crude Oil on a Pacific Coral, *Pocillopora damicornis*." Aquatic Toxicology (2020): 105454.
10. McCormack, M.A., Battaglia, F., McFee, W.E., and J. Dutton. "Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables." Environmental Research 180 (2020): 108886.
11. McDonald, T.L., Hornsby, F.E., Speakman, T.R., Zolman, E.S., Mullin, K.D., Sinclair, C., Rosel, P.E., Thomas, L., and L.H. Schwacke. "Survival, density, and abundance of common bottlenose dolphins in

Barataria Bay (USA) following the Deepwater Horizon oil spill." Endangered Species Research 33 (2017): 193-209.
12. Smith, C.R., Rowles, T.K., Hart, L.B., Townsend, F.I., Wells, R.S., Zolman, E.S., Balmer, B.C., Quigley, B., Ivanc˘ic´, M., McKercher, W., Tumlin, M.C., Mullin, K.D., Adams, J.D., Wu, Q., McFee, W., Collier, T.K. and L.H. Schwacke.2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127-142.

Book Chapters:

1. Burtscher, Martina M., May, Lisa A., Downs, Craig A. and Bartlett, Thomas (2016) Chapter 39 - Zooxanthellae viability Assay. Diseases of Coral, Wiley-Blackwell Publisher
2. May, Lisa A. and Woodley, Cheryl M. (2016) Chapter 41 - Chemiluminescent Method for Quantifying DNA Abasic Lesions in Scleractinian Coral Tissues. Diseases of Coral, Wiley-Blackwell Publishers.
3. Woodley, Cheryl M., Avadanei, Athena R. and Downs, Craig A. (2016) Chapter 40 - Quantifying Total Porphyrin Species from Scleractinian Coral Tissue Extracts, Diseases of Coral, Wiley-Blackwell Publishers.

NOAA Tech Memos:

1. Antrim, L., L. Balthis, C. Cooksey. 2018. Submarine cables in Olympic Coast National Marine Sanctuary: History, Impact, and Management Lessons. Marine Sanctuaries Conservation Series ONMS-18-01. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 60 pp.
2. Balthis, W.L., C. Cooksey, M.H. Fulton, J.L. Hyland, L.A. May, E.F. Wirth, and C.M. Woodley. "Assessment of Ecological Condition and Potential Stressor Impacts in Offshore Areas of Florida Keys National Marine Sanctuary." NOAA Technical Memorandum NOS NCCOS 254. Charleston, SC. 80 pp. doi:10.25923/vtsz-v706 (2018a).
3. Balthis, W.L., and D.L. Eslinger. 2018. Correlation and Prediction of Land-Based Pollution Impacts on Sediment Contaminant Concentrations within National Estuarine Research Reserves of the Southeastern US and Selected Chesapeake Bay Watersheds. NOAA Technical Memorandum NOS NCCOS 250. Charleston, SC. 31 pp. https://doi.org/10.25923/2wcd-7q26
4. Balthis, W.L., Hyland, J.L., Cooksey, C., Fulton, M.H., and E. Wirth. "Integrated assessment of ecosystem condition and stressor impacts in submerged habitats of the Guana Tolomato Matanzas (GTM) National Estuarine Research Reserve (NERR)." NOAA Technical Memorandum NOS NCCOS 231. Charleston, SC. (2017a)
5. Cooksey, C.L., Balthis, W.L., Fulton, M.H., Hyland, J.L. and E. Wirth. "Assessment of ecological condition and stressor impacts within Great Lakes rivers and harbors: Milwaukee estuary, Wisconsin." (2016).

Reports:

1. May, LA, CV Miller and CM Woodley. "Effect of Total Ammonia Nitrogen on Corals and Sea Urchins." 2017. Report to the Coral Reef Conservation Program, Project #1133

Theses/Dissertations:

1. Battaglia, F.M. Microplastics from the gut of a marine apex predator, the bottlenose (*Tursiops truncatus*): challenges of measurement and first results from South Carolina, USA. Masters of Science Thesis in Marine Biology, College of Charleston, Charleston, SC (2019).
2. Bayless, A.L. An in-depth characterization of water quality and its potential threats to reef organisms at two National Parks in St. Croix, USVI. Masters of Science Thesis in Marine Biology, College of Charleston, Charleston, SC (2020).

3. Pfiefer, T. Microplastics in stranded bottlenose dolphin (*Tursiops truncatus*), harbor porpoise (*Phocoena phocoena*) and long-beaked common dolphin (Delphinus capensis) in the United States. Masters of Science Thesis in Marine Biology, College of Charleston, Charleston, SC (2020).

MONITORING AND ASSESSMENT BRANCH

Journal Publications:

1. Amos, Helen M., et al. "What goes up must come down: Integrating air and water quality monitoring for nutrients." (2018): 11441-11448.
2. An Assessment and Characterization of Pharmaceuticals and Personal Care Products (PPCPs) along the Great Lakes Basin Coastal Zone: Relationship to Land-use and Point Sources (2020 - In Review)
3. Edwards, Michael A., et al. Great Lakes Mussel Watch Sites Land-use Characterization and Assessment. US Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, 2016.
4. Jaruga P, Coskun E, Kimbrough K, Jacob A, Johnson WE, Dizdaroglu M. 2017. Biomarkers of oxidatively induced DNA damage in dreissenid mussels: A genotoxicity assessment tool for the Laurentian Great Lakes. Environmental Toxicology 32:2144–2153. https://doi.org/10.1002/tox.22427
5. Pait, Anthony S., et al. "An Assessment of Chemical Contaminants in the Waters Around Cocos Island, Guam Using Polyethylene Passive Water Samplers (NOAA Technical Memorandum NOS NCCOS 261)." (2019).
6. Whitall, David, et al. "Contaminants in queen conch (*Strombus gigas*) in Vieques, Puerto Rico." Regional Studies in Marine Science 5 (2016): 80-86.
7. Whitall, David, et al. "Excess Nutrients in Vatia Bay, American Samoa: Spatiotemporal Variability, Source Identification and Impact on Coral Reef Ecosystems." (2019).
8. Whitall, David R., et al. "Southeast Florida Reef Tract Water Quality Assessment." (2019).
9. Quantifying the effects of hurricanes Irma and Maria on coastal water quality in Puerto Rico using moderate resolution satellite sensors. Remote Sensing 2020,12:964-979. http://dx.doi.org/10.3390/rs12060964

NOAA Tech Memos:

1. Apeti, Dennis A., et al. "An Assessment of Contaminants of Emerging Concern in Chesapeake Bay, MD and Charleston Harbor, SC." (2018).
2. Apeti, D. A., G. G. Lauenstein, W. E. Johnson Kimbrough, K. L. and Mason, A. 2017. Mussel Watch sampling procedures and site descriptions for Oregon State. NOAA Technical Memorandum NOS NCCOS 100
3. Apeti, Dennis A., et al. "Mussel Site Description and Sampling Procedures for Washington State." (2018).
4. Apeti, D.A., Rider, M., Jones, S. and Wirth, E., 2020. An Assessment of Contaminants of Emerging Concern in the Gulf of Maine. NOAA Technical Memorandum NOS NCCOS. Silver Spring, MD (under review)
5. Edwards, M. A., Jacob, A., Kimbrough, K., Johnson, W., & Davenport, E. D. (2016). Great Lakes Mussel Watch Sites Land-use Characterization and Assessment. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 208, 138pp
6. Hartwell, S. Ian, Douglas H. Dasher, and Terri Lomax. "Characterization of benthic habitats and contaminant assessment in Kenai Peninsula fjords and bays." (2017).
7. Hartwell, S. Ian, Doug Dasher, and Terri Lomax. "Characterization of metal/metalloid concentrations in fjords and bays on the Kenai Peninsula, Alaska." Environmental monitoring and assessment 191.5 (2019): 264.
8. Hartwell, S. Ian, Doug Dasher, and Terri Lomax. "Characterization of organic contaminants in fjords and bays on the Kenai Peninsula Alaska." Environmental monitoring and assessment 191.7 (2019): 427.
9. Hartwell, S. Ian, et al. "An analysis of chemical contaminants in sediments and fish from Cocos Lagoon, Guam." (2017).

10. Hartwell, S. Ian, et al. "Bioeffects assessment in Kvichak and Nushagak Bays, Alaska: characterization of soft bottom benthic habitats, fish body burdens and sediment contaminant baseline assessment." (2017)." Regional Studies in Marine Science 24 (2018): 343-354.
11. Hartwell, S. Ian, et al. "Characterization of Benthic Habitats and Contaminant Assessment in Arctic Lagoons and Estuaries." (2018).
12. Jaruga P, Coskun E, Kimbrough K, Jacob A, Johnson WE, Dizdaroglu M. 2017. Biomarkers of oxidatively induced DNA damage in dreissenid mussels: A genotoxicity assessment tool for the Laurentian Great Lakes. Environmental Toxicology 32:2144–2153. https://doi.org/10.1002/tox.22427
13. Kimbrough, Kimani L., et al. "Great Lakes Mussel Watch: Assessment of Contaminants of Emerging Concern." (2018).
14. Mason, Andrew L. "An Integrated Assessment of Oil and Gas Release into the Marine Environment at the Former Taylor Energy MC20 Site." (2019).
15. Mason, Andrew L., and David R. Whitall. "A Baseline Chemical Contaminants Assessment of Sediment from the Nu'uuli Pala Lagoon, American Samoa." (2019).
16. Pait, Anthony S., et al. "An Assessment of Chemical Contaminants in the Waters around Cocos Island, Guam Using Polyethylene Passive Water Samplers (NOAA Technical Memorandum NOS NCCOS 261)." (2019).
17. Pait, Anthony S., et al. "Measurement of Turbidity, Suspended Sediments and Nutrients in Three Rivers that Drain to the Achang Preserve from the Manell Watershed, Guam." (2019).
18. Rider, M., Apeti, D.A., Jacob, A., Kimbrough, K., Davenport, E., Bower, M., Coletti, H. and Esler, D., 2020. A Synthesis of Ten Years of Chemical Contaminants Monitoring in National Park Service - Southeast and Southwest Alaska Networks. A collaboration with the NOAA National Mussel Watch Program. NOAA Technical Memorandum NOS NCCOS x. Silver Spring, MD. (Under review).

Reports:

1. Great Lakes Restoration Initiative Interagency Agreement Final Report: Bioaccumulation Study at Manistique River AOC FY13 (2016)
2. Great Lakes Restoration Initiative Interagency Agreement Final Report: NOAA Mussel Watch FY 13 (2016)
3. Great Lakes Restoration Initiative Interagency Agreement Final Report: NOAA Mussel Watch FY 14 (2017)
4. Hummel, Steph., Gerald Ankley, Lyle Burgoon, Steve Corsi, Christine Custer, Kimani Kimbrough, Heiko Schoenfus, Sarah A. Zack, and Elizabeth Murphy (anticipated 2020). Contaminants of Emerging Concern in the Great Lakes: GLRI Integrated Phase II Group Summary Report. Report submitted to EPA Region-5 Great Lakes National Program Office, 9APR2020.
5. Villeneuve, Daniel L., Steven R. Corsi, Christine M. Custer, W. Edward Johnson, Stephanie L. Hummel, Heiko L. Schoenfuss, Edward J. Perkins, Sarah A. Zack, Elizabeth Murphy (anticipated 2020) Contaminants of Emerging Concern in the Great Lakes Science to Inform Management Practices for Protecting the Health and Integrity of Wildlife Populations from Adverse Effects. GLRI Action Plan I, Focus Area 1, Goal 5. Report submitted to EPA Region-5, Great Lakes National Program Office, 17 Dec 2019 (final review complete)

Theses/Dissertations:

1. An Assessment and Characterization of Legacy and Emerging Contaminants in the Great Lakes Basin Coastal Zone (Dissertation - 2020)
2. A Multi-matrix Assessment of Legacy and Current-use Pesticides (CUPs) Occurrence and Distribution in the Lower Maumee and Ottawa Riverine System (Dissertation Section - 2020)

Conferences (from January 2016 to Present)

PRESENTATIONS

2016

1. McFee, WE. 2016. An overview of marine species and marine debris. The National Marine Animal Stranding Conference. September 6-9, 2016, Shepardstown, WV.
2. C. Woodley: *Old munitions impacts on corals*. SETAC Munitions chemical impacts on corals.
3. Jaruga, P., Coskun, E., Jacob, A., Kimbrough, K., Johnson, W.E., Dizdaroglu, M. "Measurement of biomarkers of oxidative DNA damage in zebra mussels by GC-MS/MS to evaluate the impact of environmental contaminants on aquatic life", 21st INTERNATIONAL MASS SPECTROMETRY CONFERENCE, Toronto, Ontario, Canada, Aug 20–26, 2016.
4. Warner, R.A. Development of water quality products derived from NOAA operational satellite sensor (VIIRS) data. National Water Quality Monitoring Conference

2017

1. Baxter, S., DeLorenzo, M.E., Key, P.B., Fulton, M.H., Beckingham, B. Toxicity comparison of the shoreline cleaners Accell Clean® SWA and PES-51 in two life stages of the grass shrimp, *Palaemonetes pugio*. Southeastern Estuarine Research Society (SEERS), Myrtle Beach, SC (4/15/17).
2. Evans, B, DeLorenzo, M.E., Chung, K.W., Key, P.B., Fulton, M.H. Effects of Salinity on the Toxicity of Oil Spill Dispersants in the Eastern Mud Snails. Southeastern Estuarine Research Society (SEERS), Myrtle Beach, SC (4/15/17).
3. DeLorenzo, M.E. Comparative Toxicity of Two Oil Spill Dispersants in Estuarine Organisms: Mesocosm and Laboratory Exposures. Presenter and Panelist Sanibel-Captiva Conservation Foundation, "Conservation Forum: Dispatches from the Gulf", Sanibel, FL 3/23/17.
4. DeLorenzo, M.E. Comparative Toxicity of Oil Spill Mitigation Products in Estuarine Organisms. NOAA Science of Oil Spills Class., Charleston, SC 2/15/17.
5. DeLorenzo, M.E., Key, P.B., Wirth, E.F., Pennington, P.L., Chung, K.W., Pisarski, E., Shaddrix, B., Fulton, M.H. Comparative Toxicity of Three Shoreline Cleaner Products in Estuarine Organisms: Mesocosm and Laboratory Exposures. Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, LA, 2/6/17.
6. Evans, B, DeLorenzo, M.E., Chung, K.W., Key, P.B., Fulton, M.H. Effects of Salinity on the Toxicity of Oil Spill Dispersants in the Eastern Mud Snails. Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, LA, 2/6/17. *Best Student Poster Presentation.
7. Key, P.B., DeLorenzo, M.E., Wirth, E.F., Pennington, P.L., Fulton, M.H. Comparative Toxicity Chemical Dispersants and Weathered Oil in Saltmarsh Mesocosm Systems. Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, LA, 2/6/17.
8. DeLorenzo, M.E. Comparative Toxicity of Three Shoreline Cleaner Products in Estuarine Organisms". Fort Johnson Seminar Series 2/3/17.
9. DeLorenzo, M.E. Impacts of climate change on the ecotoxicology of chemical contaminants in estuarine organisms". College of Charleston MES program seminar 1/31/17.
10. Hart, LB, Flagg, MA, Wischusen, A., Wells, RS, McFee, WE, Kucklick, J, Pisarski, E, Wenzel, A, Wirth, E and B Beckingham. 2017. Pilot Study of Phthalate Metabolite Concentrations in Bottlenose Dolphins (Tursiops truncatus) from Sarasota Bay, FL. 22nd Bienniel Marine Mammal Conference, Nova Scotia, CN, October 23, 2017.
11. McFee, WE. 2017. Plastic prevalence and effects in marine mammals. Our World, Kiawah Island, SC, March 2, 2017.
12. Boggs, A., Schock, T., Galligan, T., Moray, J. McFee, W., Schwacke, L. and J. Kucklick. 2017. Steroid mapping whale blubber using liquid chromatography tandem mass spectrometry. High Performance Liquid Phase Separation and Related Techniques (HPLC) Conference, Prague Czech Republic, June 19, 2017.

13. Bharat Chandramouli, H.J. Butler,, J. Cosgrove, E. Johnson, E. Davenport, K. L. Kimbrough, M. Mills. 2017.Mussel Watch and Metabolomics: Connecting exposure and effect in Great Lake bivalves
14. Jaruga, P., Coskun, E., Jacob, A., Kimbrough, K., Johnson, W.E., Dizdaroglu, M. "Oxidatively induced DNA damage in aquatic animals as a biomarker to evaluate the impact of environmental genotoxins", 6th EU-US Conference on Repair of endogenous DNA damage, University of Udine, Italy, Sep 24th-28th 2017.

2018

1. Key, P.B., Chung, K.W., West, B., DeLorenzo, M.E. Developmental and reproductive effects in grass shrimp (*Palaemonetes pugio*) following acute larval exposures to thin oil sheens and ultraviolet light. Society of Environmental Toxicology and Chemistry meeting, Sacramento, CA 11/7/18
2. DeLorenzo, M.E., Key, P.B., Chung, K.W., Pennington, P.L., Pisarski, E., Wirth, E., Fulton, M.H. Multi-stressor effects of ultraviolet light, temperature, and salinity on oil toxicity in estuarine species. Society of Environmental Toxicology and Chemistry meeting, Sacramento, CA 11/8/18
3. Pennington, P.L. Key, P.B., DeLorenzo, M.D., Wirth, E.F., West, B., Daugomah, J.W., Dubick, J.D. 2018. Field-based mesocosms: in situ deployments for assessing impacts of chemical spills in coastal areas. Invited seminar speaker for the Environmental Health Sciences Fall 2018 Seminar Series, University of South Carolina, Arnold School of Public Health. October 17, 2018.
4. DeLorenzo, M.E. Multi-stressor effects of ultraviolet light, temperature, and salinity on oil toxicity in estuarine species, One NOAA Science Seminar 8/22/18.
5. Aaby, K., Hausman, D., Pennington, P.L., Pisarski, E., DeLorenzo, M.E. Effects of Ultraviolet (UV) Radiation on Crude Oil Toxicity in the Estuarine Species, *Cyprinodon variegatus*. Southern Division of the American Fisheries Society, San Juan, PR 3/10/18
6. Mbuya, Christina, Charles Jagoe, Paul Pennington, Marie DeLorenzo. 2018. Biomarkers to evaluate UV-enhanced toxicity of oil sheens to estuarine organisms. NOAA Educational Partnership Program with Minority-Serving Institutions Cooperative 9th Biennial Education and Science Forum. Howard University, Washington, D.C. March 18-21, 2018
7. T. Phan, T. D. Thomason, E. Johnson, A. Jacob, K. Kimbrough, A.H. Ringwood.Cellular Biomarker Responses of Freshwater Bivalves to Chlorpyrifos
8. Jaruga, P., Coskun, E., Kimbrough, K., Jacob, A., Johnson, W.E., Dizdaroglu, M. "OXIDATIVELY-INDUCED DNA DAMAGE AS BIOINDICATOR FOR ENVIRONMENTAL GENOTOXICITY", 4th International Congress on Occupational & Environmental Toxicology (ICOETox2108), 24 - 26 October 2018 in Matosinhos – Porto, Portugal, invited talk.
9. Jaruga, P., Coskun, E., Kimbrough, K., Jacob, A., Johnson, W.E., Dizdaroglu, M., "The impact of environmental contaminants on aquatic life; measurement of biomarkers of oxidatively induced DNA damage in dreissenid mussels by GC-MS/MS", Society of Environmental Toxicology and Chemistry North America 39th Annual Meeting, 4–8 November 2018, Sacramento, California, invited talk.
10. Apeti, D., E. Wirth, A. Leight Prevalence and Distribution of PFAS in US Coastal Waters: National Status and Trends, Mussel Watch Data, Federal Information Exchange on PFAS, 2018
11. Hartwell, I, D. Apeti, T. PaitBioeffects Assessment in Kvichak and Nushagak Bay, Alaska: Characterization of Soft Bottom Benthic Habitats, Sediment Contaminant Baseline, and Animal Body Burden Assessment, SETAC Sacramento, 2018
12. Warner, R.A. Higher-resolution satellite data for monitoring water quality in near-shore tropical environments. ASLO 2018 Ocean Science Conference
13. Warner, R.A. NOAA Coral Reef Watch Near Real-Time Satellite Ocean Color Tools for Land-based Sources of Pollution and Coral Reef Management. AGU/ASLO Ocean Science Conference

2019

1. Pennington, P.L., Whitall, D.R., Wirth, E.F., Key, P.B., DeLorenzo, M. Comparison of Chemical Contaminant Measures Using CLAM, POCIS, and PED Samplers in Estuarine Mesocosms, SETAC 2019, Toronto, CA
2. P. Pennington, P. Key, E. Wirth, B. West, K. Chung, J. Wade, M. DeLorenzo, Effects of oil spill mitigation products on the microbial community and water quality in estuarine mesocosm systems. PRIMO 20 Conference, Charleston, SC 5/20/19
3. G. Scott, R. Alyassein, C. Horton, M. DeLorenzo, P. Sandifer, D. Porter, J. Ferry, M. Smith, M. Uyaguari, Interactions of climate change on the ecotoxicology of emerging contaminants and resulting effects on oceans and human health. PRIMO 20 Conference, Charleston, SC 5/20/19
4. P. van den Hurk, I. Edhlund, R. Davis, J. Hahn, M. McComb, E. Rogers, M. DeLorenzo, Lionfish (Pterois volitans) as a biomonitoring species for oil pollution effects in coral reef ecosystems. PRIMO 20 Conference, Charleston, SC 5/20/19
5. Scott, G.I., Chatterjee, S., Horton, C., Ferry, J., Putnam, S., Smith, M., Sandifer, P.A., Brooks, B., DeLorenzo, M., Morton, S., Leighfield, T. Oceans and Human Health: A One Health Concept Whose Time Has Come. Carolinas SETAC meeting, Charleston, SC, 3/14/19
6. Wirth, E., Pisarski, E, Leight, A.K., Mason, A., Apeti, D. As Assessment of Contaminants of Emerging Concern in the Charleston Harbor, SC. Carolinas SETAC meeting, Charleston, SC, 3/14/19
7. C. Jean, M.E. DeLorenzo, P.B. Key, K.W. Chung, E.F. Wirth. Multi-stressor effects on ultraviolet light, temperature, and salinity on the toxicity of Deepwater horizon oil in the larval grass shrimp. Southeastern Estuarine Research Society Spring Meeting, Wilmington, NC. 3/8/2019.
8. White, N.D., Chung, K.W., Pisarski, E., DeLorenzo, M.E. An assessment of the impact of crude oil and UV light exposure on fertilization and early development in the variegated sea urchin, *Lytechinus variegatus*. Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, LA, 2/6/19
9. DeLorenzo, M.E., Key, P.B., Chung, K.W., Pennington, P.L., Pisarski, E., West, B., Wirth, E. Chronic developmental and reproductive effects in estuarine species following acute larval exposures to thin oil sheens and ultraviolet light. Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, LA, 2/6/19
10. Cheryl M. Woodley, Lisa A. May and Margaret W. Miller. Effects of Phenoxyethanol on Two ESA Caribbean Coral. Primo 20, May 2019
11. Battaglia, F., Beckingham, B. and W. McFee. 2019. Challenges of isolating and enumerating microplastics within the gut of a marine apex predator, the bottlenose dolphin (*Tursiops truncatus*). SETAC, November 2019, Toronto, CN
12. Apeti, D., M. Rider, The NOAA's National Mussel Watch Program Coastal & Estuarine Research Federation (CERF), Mobile, AL 2018
13. Warner, R.A. Advanced Coastal Monitor: Autonomy and Modularity in Marine Survey Vehicles. NOAA Emerging Technologies Conference.

2020

1. Wirth, E.F., Moore, D.M., Kucklick, J., Key, P., DeLorenzo, M. Lotufo, G. Kennedy, A., Peter, K. Technical Review Board presentation "Ecotoxicity of Fluorine-Free Firefighting Foams" (ER20-A1-1518). Strategic Environmental Research and Development Program (SERDP), Arlington, VA February 19, 2020.
2. Key, P., Chung, K., Collins, C., DeLorenzo, M. Toxicity of Common Environmental Contaminants on Two Estuarine Species Following Multi-Stressor Impacts. Gulf of Mexico Oil Spill and Ecosystem Sciences Meeting, 2/3/2020-2/6/2020, Tampa, FL.
3. Ted-Style Talk and Roundtable Discussion: DeLorenzo, M.E. Impacts of Climate Change on the Ecotoxicology of Chemical Contaminants in Estuarine Organisms. NOS Climate Connections Workshop, 11/20-21/2019, Silver Spring, MD
4. Jaruga, P., Kimbrough, K., Jacob, A., Johnson, W.E. "Contaminants Contributing to Oxidatively Induced DNA Damage of Exposed Dreissenid Mussels in the Detroit River", SETAC SciCon, SETAC EUROPE 30th Annual Meeting, May 3-7, 2020.

POSTERS

2016

1. Shervette, V., K. Garlick, K. Kirkland, F. Parker, and L. Reed. 2016. "Conservation Biogeography of Freshwater Fishes: Community Dynamics and Shifts in Response to 1,000-Year Rainfall Event." SC Floods Conference.
2. Taylor, C., V. Shervette, L. Reed. 2016. "Mercury Bioaccumulation in three Drum (*Sciaenidae*) species from coastal SC." Joint Meeting South Carolina Chapter-American Fisheries Society and the South Carolina Fisheries Worker's Association.
3. Jacob, Kimbrough, Johnson, Davenport, Edwards. 2016. PAH monitoring in the Great Lakes using dreissenid mussels, SETAC
4. Hartwell, I, D. Apeti, T. Pait. Characterization of Soft Bottom Benthic Habitats, Sediment Contaminant Baseline, and Animal Body Burden Assessment in Bristol Bay, Alaska. NPRB-2016 Science Symposium, Anchorage, Alaska.
5. Warner, R.A. Four coral health projects in collaboration with NOAA's Educational Partnership Program. International Coral Reef Symposium.
6. Warner, R.A. New VIIRS Satellite Ocean Color Products for Management of Land-Based Sources of Pollution over Coral Reefs. International Coral Reef Symposium.
7. Warner, R.A. Collaborative effort to develop a forecasting product that integrates water quality, physiological and optical properties to address the stress response of coral reef ecosystems. National Water Quality Monitoring Conference.

2017

1. Wirth, E., Pisarski, E., Fulton, M. Evaluation of the Oil Removal Efficiency of Three Shoreline Cleaner Products. Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, LA, 2/6/17
2. Garlick, K., K. Kikland, F. Parker, L. Reed, and V. Shervette. 2017. Mercury Bioaccumulation Trends in Fishes of Edisto River: Preliminary Findings. SC American Fisheries Society Annual Meeting, Hickory Knob, SC. http://scafs.org/events.php
3. Parker, P., V. Shervette, and L. Reed. 2017. Spatial and Temporal Variation in Mercury Bioaccumulation of a Commonly Consumed Freshwater Fish Redbreast Sunfish, *Lepomis auritus*. SC American Fisheries Society Annual Meeting, Hickory Knob, SC. http://scafs.org/events.php
4. Baer, J., Woodley, C.M., Pennington, P.L. 2017. Investigating Genotype Vigor in *Acropora cervicornis*. ASLO 2017 Aquatic Sciences Meeting, Honolulu, Hawaii, February 26 - March 3, 2017.
5. Characterization of Soft Bottom Benthic Habitats, Sediment Contaminant Baseline, and Animal Body Burden Assessment in Bristol Bay, Alaska NPRB-2017 Science Symposium, Anchorage, Alaska.

2018

1. Horton, C., DeLorenzo, M.E., Scott, G.I. Bacterial Interactions with Coastal Pollutants and the Potential for Development of Antibiotic Resistance. SC Water Resources Conference, Columbia, SC 10/17/18
2. Pisarski, E.C., E.F. Wirth, S.I. Hartwell, B.S. Shaddrix, D.R. Whitall, D.A. Apeti, M.H. Fulton, G. Baker. Assessment of Hydrocarbon Carryover Potential for Six Field Cleaning Protocols. Society of Environmental Toxicology and Chemistry meeting, Sacramento, CA 11/8/18
3. Jacob, Kimbrough, Johnson, Davenport, Edwards Linear mixed model analysis of mussel metabolomics data SETAC
4. Michael A. Edwards, Annie Jacob, Erik Davenport, Kimani Kimbrough, Ed Johnson, and Marc Mills. Great Lakes Mussel Watch: Emerging Contaminant Monitoring and Assessment in the Maumee and Milwaukee Riverine System SETAC

2019

1. Wirth, E.F., Rios, C. Shaddrix, B.S., Pennington, P.L., Finkelstein, K. The verification of a benthic injury dose-response model for polychlorinated biphenyls, SETAC 2019, Toronto, CA
2. Pisarski, E.C., Wirth, E.F., Thrift-Viveros, D., Childs, C.R. Analysis of Floating Oil Exposed to Ultraviolet Light Under Different Environmental Conditions, SETAC 2019, Toronto, CA
3. P. Key, P. Pennington, K. Chung, M. DeLorenzo. Assessment of oil spill effects and restoration methods for smooth cordgrass in salt marsh ecosystems. 2019 CERF 25th Biennial Conference, Mobile, AL, 5 Nov 2019.
4. Beers, D., DeLorenzo, M., Key, P., Watson, A., Sancho, G., Chung, K., Pisarski, E., Comparing the impacts of ultraviolet (UV) light enhanced toxicity of surface oil sheens on the survival, growth, and development of three different larval fish species. PRIMO 20 Conference, Charleston, SC 5/20/19
5. C. Horton, G. Scott, M. DeLorenzo, Bacterial Interactions with Coastal Pollutants and the Potential for Development of Antibiotic Resistance. PRIMO 20 Conference, Charleston, SC 5/20/19
6. Horton, C., DeLorenzo, M.E., Scott, G.I. Bacterial Interactions with Coastal Pollutants and the Potential for Development of Antibiotic Resistance. Carolinas SETAC meeting, Charleston, SC 3/15/19 (3rd place best student poster)
7. Beers, D., DeLorenzo, M.E., Key, P.B., Watson, A., Sancho, G., Chung, K.W., Pisarski, E. Examining the impacts of ultraviolet (UV) light and surface oil sheens on the survival, growth, and development of red drum (*Sciaenops ocellatus*). Carolinas SETAC meeting, Charleston, SC 3/15/19 (1st place best student poster)
8. Dziobak, M., Wells, R.S., Pisarski, E.C., Wirth, E., Hart, L.B. Sex, age, and hormone correlates of phthalate exposure among common bottlenose dolphins (*Tursiops truncatus*) from Sarasota, Florida. World Marine Mammal Conference, Barcelona, Spain 12/9/2019
9. May, L.A., Burnett, A.R., Miller, C.V., Pisarski, E., Webster, L.F., Moffitt, Z.J., Pennington, P., Wirth, E., Baker, G., Ricker, R. Effect of Louisiana Sweet Crude Oil on Scleractinian Corals. PRIMO 20 Conference, Charleston, SC 5/20/19
10. Lisa A. May, Athena R. Burnett, Carl V. Miller, Emily Pisarski, Laura F. Webster, Zachary J. Moffitt, Paul Pennington, Edward Wirth, Greg Baker, Robert Ricker, Natasha White and Cheryl M. Woodley. Effect of Louisiana Sweet Crude Oil on Scleractinian Corals - accepted for Primo 20 – May 2019
11. Michael A. Edwards, Annie Jacob, Erik Davenport, Kimani Kimbrough, Ed Johnson, James Hunter & Donghee Kang Great Lakes Mussel Watch: Chemicals of Emerging Concern (CECs) Monitoring and Assessment in the Maumee and Milwaukee Riverine System. IGLAR
12. Michael A. Edwards, Annie Jacob, Erik Davenport, Kimani Kimbrough, Ed Johnson, James Hunter & Donghee Kang. Great Lakes Mussel Watch: Chemicals of Emerging Concern (CECs) Monitoring and Assessment in the Maumee and Milwaukee Riverine System. Chesapeake CSAWWA Student Poster Competition
13. Rider, M., D. Apeti. Magnitude and distribution of contaminants of emerging concern in our coastal waters: a national Mussel Watch Program assessment. SETAC
14. Warner, R.A.NOAA Applications Using Autonomous Vehicles and Other Emerging Technologies. NOAA Emerging Technologies Conference
15. W. Edward Johnson, Kimani Kimbrough, Felipe Arzayus, Michael Edwards and Annie Jacob Contaminant Monitoring and Assessment by Great Lakes Mussel Watch Great Lakes AOC Conference

2020

1. Zavell, M., M.E. DeLorenzo, K. Chung. Multi-Climate Stressor Effects and Louisiana Sweet Crude Oil (LSC) Sheen Toxicity in Larval Eastern Oysters, *Crassostrea virginica*, Gulf of Mexico Oil Spill and Ecosystem Sciences Meeting, 2/3/2020-2/6/2020, Tampa, FL

Technologies Transferred to Operations/Application (from January 2016 to Present)

Field Deployed Mesocosms
NCCOS Leads: Pennington, Key, Daugomah, West
Summary: Field mesocosm cages SOP (project still ongoing, we have started to transfer technology and will provide training to ORR staff)

Invertebrate Sample Collection
NCCOS Leads: Daugomah, West
Summary: National Benthic Inventory collection transfer to North Carolina Museum of Natural sciences

Zebrafish Course
NCCOS Leads: Beck
Summary: Zebrafish course

Collaborations with Non-NOAA Entities, Such as Feds (e.g. USACE), States etc. (from January 2016 to Present)

Reimbursables
Name of Organization: SC Department of Natural Resources
Purpose of Collaboration: SCECAP - annual assessment of coastals condition
Role of NCCOS Staff: Provide contaminant monitoring with SC coastal waters for holistic estuarine quality assessment

Name of organization: Department of Interior
Purpose of Collaboration: Conducted research at Mississippi Canyon 20 site and provided results on oil and gas releases to DOI/USGS, and as a result the Federal On Scene Coordinator issued a containment order a few days after receiving our report.
Role of NCCOS Staff: field research, analysis and scientific advice.

Name of organization: National Park Service, Alaska Network
Purpose of Collaboration: Assessment of Chemical Contamination in NPS Southeast and Southwest Alaska Network of Parks
Role of NCCOS Staff: development, planning, implementation, reporting

Name of Organization: Gulf of Alaska Long Term Monitoring Program
Purpose of Collaboration: Assessment of Chemical Contamination in NPS Southeast and Southwest Alaska Network of Parks
Role of NCCOS Staff: development, planning, implementation, reporting

Non Reimbursables
Name of organization: ORR/Marine Debris Program
Purpose of collaboration: Analysis of dolphin microplastics
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Southern California Bight Regional Monitoring Survey
Purpose of collaboration: Toxicology Committee member
Role of NCCOS Staff: Help to prepare the Bight '18 Toxicity Summary Report.

Name of organization: University of South Carolina, Arnold School of Public Health

Purpose of collaboration: Conduct a joint bioremediation study of oiled marsh ecosystems
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: College of Charleston, Department of Biology
Purpose of collaboration: Conduct nutrient experiments on marsh grasses as a replanting strategy for restoration of oiled marshes.
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Florida A&M University, School of the Environment
Purpose of collaboration: NOAA CCME mentor
Role of NCCOS Staff: Graduate Faculty

Name of organization: Texas A&M University, Corpus Christi
Purpose of collaboration: NOAA CCME mentor
Role of NCCOS Staff: Graduate Faculty

Name of organization: College of Charleston, Department of Biology
Purpose of collaboration: Instructor for graduate course "Aquatic Toxicology"
Role of NCCOS Staff: Adjunct Graduate Faculty

Name of organization: College of Charleston, Masters Program in Environmental Studies
Purpose of collaboration: Graduate Student Advisor
Role of NCCOS Staff: Adjunct Graduate Faculty

Name of organization: College of Charleston, Graduate Program in Marine Biology
Purpose of collaboration: Graduate Student Advisor
Role of NCCOS Staff: Adjunct Graduate Faculty, Secretary 2017-2019, Admissions Committee 2019-present

Name of organization: College of Charleston, Graduate Program in Marine Biology
Purpose of collaboration: Graduate Student Advisor
Role of NCCOS Staff: Adjunct Graduate Faculty, Secretary 2017-2019, Admissions Committee 2019-present

Name of organization: National Marine Mammal Foundation
Purpose of collaboration: Dolphin Health Assessments
Role of NCCOS Staff: Participated with National Marine Mammal Foundation on LCP Natural Resource Damage Assessment (NRDA) project supporting NOAA Office of Research and Restoration in Brunswick, GA Boat operation, Animal handling and logistical support, Dolphin Photo ID (Boat operator, photographer, data analysis)

Name of organization: US Army Corps
Purpose of collaboration: Ecological assessment of beneficial use of dredged sediment in Barnegat Bay, NJ
Role of NCCOS Staff: Benthic sampling field crew, grain size analysis

Name of organization: Coastal Response Research Center, Response Oil Assay Workshop
Purpose of collaboration: contribute expertise and exchange of information
Role of NCCOS Staff: invited participant

Name of organization: American Samoa Coral Reef Advisory Group
Purpose of collaboration: Nu'uuli, Vatia, Faga'alu and Fagatele assessments
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: American Samoa Community College

Purpose of collaboration: Nu'uuli, Vatia, Faga'alu and Fagatele assessments
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: National Park of American Samoa
Purpose of collaboration: Vatia assessment
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: American Samoa Environmental Protection Agency
Purpose of collaboration: Vatia and Fagatele assessments
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Florida Department of Environmental Protection
Purpose of collaboration: SEFCRI Water quality assessment
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Puerto Rico Department of Natural Resources
Purpose of collaboration: Vieques Conch Contaminants
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Interagency Working Group on Coordinated Water/Air Monitoring
Purpose of collaboration: Synthesize existing data and formulate plan for enhance collaboration between air and water monitoring programs
Role of NCCOS Staff: synthesis and reporting

Name of organization: Southern California Coastal Water Research Project
Purpose of collaboration: Assessment of Chemical Contamination in Southern California Bight
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Channel Island National Marine Sanctuary (CINMS)
Purpose of collaboration: Assessment of Chemical Contamination and Benthic Infaunal Characterization in sediment from CINMS
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Washington Department of Fish & Wildlife
Purpose of collaboration: Assessment of Chemical Contamination in Puget Sound
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Gulf of Maine Gulf Watch Program
Purpose of collaboration: Assessment of Chemical Contamination in Gulf of Maine
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: Guam EPA
Purpose of collaboration: Assessment of chemical contaminants in Cocos Lagoon Guam
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: USVI DPNR, Division of Coastal Zone Management
Purpose of collaboration: Assessment of chemical contaminants in Salt River, St. Croix
Role of NCCOS Staff: development, planning, implementation, reporting

Name of organization: USVI DPNR, Division of Coastal Zone Management
Purpose of collaboration: Assessment of chemical contaminants in St. Croix East End Marine Park
Role of NCCOS Staff: development, planning, implementation, reporting

Reimbursable Support from NOAA Entities Sponsors (from January 2016 to Present)

NOAA Sponsor: Coral Reef Conservation Program
Role of NCCOS Staff: development, planning, implementation, reporting
Project Titles:

1. Contaminants in marine resources of Vieques
2. Technical Support of Inception of FDEP Coral Reef Nutrient Monitoring Program
3. A Baseline Chemical Contaminants Assessment of Sediment from the Nu'uuli Pala Lagoon, American Samoa
4. Eutrophication Impacts on Coral Ecosystem Health in Vatia, American Samoa
5. Characterization of Fagatele Bay (National Marine Sanctuary of American Samoa)
6. Baseline Assessment of Faga'alu Watershed: A Ridge to Reef Assessment in Support of Sediment Reduction Activities and Future Evaluation of Their Success
7. Assessment of nutrients and turbidity in three rivers that drain from the Manell Watershed, Guam
8. Assessment of chemical contaminants in sediments and fish from Cocso Lagoon, Guam
9. An Assessment of chemical contaminants in the waters around Cocos Island, Guam using polyethylene passive water samplers
10. Assessment of chemical contaminants in the sediments of Salt River Bay
11. Assessment of chemical contaminants in fish from Salt River Bay
12. Assessment of contaminants in fish from the East End Marine Park
13. Assessment of contaminants and bioeffects in the East End Marine Park

Service of Individuals to Technical and Scientific Societies (from January 2016 to Present)

Name of Scientific Society: National Water Quality Monitoring Council
NCCOS Lead: Marie DeLorenzo
Role of NCCOS Staff: NOAA Representative on the Council

Name of Scientific Society: Slocum-Lunz Foundation
NCCOS Lead: Marie DeLorenzo
Role of NCCOS Staff: Board Member

Name of Scientific Society: Coastal Pesticide Advisory Committee
NCCOS Lead: Marie DeLorenzo
Role of NCCOS Staff: Chair, 2018-present, Vice President 2004 and 2016; President 2005 and 2017; Past President 2006 and 2018

Name of Scientific Society: American Indian Science and Engineering Society
NCCOS Lead: James Daugomah
Role of NCCOS Staff: 2019 National Conference, Milwaukee, WI. Participated on Panel discussion STEM careers in Government. Judged graduate/undergraduate student poster competition.

Name of Scientific Society: Regional Studies in Marine Science
NCCOS Lead: Dave Whitall
Role of NCCOS Staff: Associate Editor

Name of Scientific Society: US Coral Reef Task Force
NCCOS Lead: Dave Whitall
Role of NCCOS Staff: Technical support/guidance for the Watershed Working Group

Name of Scientific Society: Chesapeake Bay STAC
NCCOS Lead: Dave Whitall
Role of NCCOS Staff: Serves on Toxics Working Group

Name of Scientific Society: NOAA Ocean Acidification Program
NCCOS Lead: Felipe Arzayus
Role of NCCOS Staff: Founding member, former acting director

Name of Scientific Society: NOAA 'Omics Task Force
NCCOS Lead: Felipe Arzayus
Role of NCCOS Staff: Vice-chair, NOS Representative

Membership or Fellowship in Science Organizations (from January 2016 to Present)

Name of Scientific Society: Society of Marine Mammalogy
NCCOS Lead: Wayne McFee
Role of NCCOS Staff: Member

Name of Scientific Society: National Shellfish Association
NCCOS Lead: Katy Chung
Role of NCCOS Staff: Member

Name of Scientific Society: Carolinas Society of Environmental Toxicology and Chemistry
NCCOS Lead: Katy Chung
Role of NCCOS Staff: Secretary

Name of Scientific Society: Society of Environmental Toxicology and Chemistry
NCCOS Lead: Katy Chung
Role of NCCOS Staff: Member

Name of Scientific Society: Carolinas Society of Toxicology and Chemistry
NCCOS Lead: Pete Key
Role of NCCOS Staff: Past president 2015-2016

Name of Scientific Society: Society of Toxicology and Chemistry
NCCOS Lead: Pete Key
Role of NCCOS Staff: Journal article reviewer and SETAC Short Course Committee

Name of Scientific Society: Southeastern Estuarine Research Society
NCCOS Lead: Pete Key
Role of NCCOS Staff: Member

Name of Scientific Society: South Carolina Coastal Pesticide Advisory Council
NCCOS Lead: Pete Key
Role of NCCOS Staff: Member
Name of Scientific Society: Delta Omega Society, Mu Chapter
NCCOS Lead: Pete Key
Role of NCCOS Staff: Member

Name of Scientific Society: Society of Environmental Toxicology and Chemistry
NCCOS Lead: Paul Pennington
Role of NCCOS Staff: Member

Name of Scientific Society: Coastal and Estuarine Research Federation
NCCOS Lead: Paul Pennington
Role of NCCOS Staff: Member

Name of Scientific Society: Carolinas Regional Chapter -- Society of Environmental Toxicology and Chemistry
NCCOS Lead: Paul Pennington
Role of NCCOS Staff: Member

Name of Scientific Society: Southeastern Estuarine Research Society
NCCOS Lead: Paul Pennington
Role of NCCOS Staff: Member

Name of Scientific Society: Southeastern Estuarine Research Society
NCCOS Lead: Marie DeLorenzo
Role of NCCOS Staff: Member

Name of Scientific Society: Carolinas Society of Environmental Toxicology and Chemistry
NCCOS Lead: Marie DeLorenzo
Role of NCCOS Staff: Member, Vice President 2016; President 2017; Past President 2018

Name of Scientific Society: Society of Environmental Toxicology and Chemistry
NCCOS Lead: Marie DeLorenzo
Role of NCCOS Staff: Member, Awards Committee, 2016-present; Diversity and Inclusion Committee, 2018-present

Name of Scientific Society: American Indian Science and Engineering Society
NCCOS Lead: James Daugomah
Role of NCCOS Staff: Member, Co-Chair on the Government Relations Council

Name of Scientific Society: Society of Environmental Toxicology and Chemistry
NCCOS Lead: Ed Wirth
Role of NCCOS Staff: Member

Name of Scientific Society: Carolinas Society of Toxicology and Chemistry
NCCOS Lead: Ed Wirth
Role of NCCOS Staff: Member

Name of Scientific Society: Society of Environmental Toxicology and Chemistry (SETAC)
NCCOS Lead: Mary Rider
Role of NCCOS Staff: Member

Name of Scientific Society: Society of Environmental Toxicology and Chemistry (SETAC)
NCCOS Lead: Felipe Arzayus
Role of NCCOS Staff: Member

Products

Name of Product: Coral Disease and Health Consortium Website: cdhc.noaa.gov
NCCOS Lead: Cheryl Woodley and Laura Webster

Name of Product: Videos: Part I Laceration Regeneration Assay; Part II Laceration Regeneration Assay Data Analysis; Coral Reef Sediment Porewater Sampling Techniques
Purpose: Training
NCCOS Lead: Cheryl Woodley and Athena Burnett

Name of Product: ChemLIMS database.
Purpose: A web-based (internal only) data tracking, archiving and reporting database for all ECOTOX chemical data
NCCOS Lead: Ed Wirth

Awards (from January 2016 to Present)

Katy Chung
- 2019 - NOS Quarterly Safety Pro Award, 4th Qtr
- 2017 - NCCOS People Committee Special Achievement Award
- 2017 - HML EHS Quarterly Safety Award, 3rd Qtr.

Pete Key
- 2019 - NCCOS Peer Recognition Special Achievement Award for Leading the Adopt-a-Highway program for NCCOS/Charleston for the last 26 years

Cheryl Woodley
- 2020 - Department of Commerce Bronze Award for Leadership with coral disease in Florida (cause currently unknown - biological or chemical)

Paul Pennington
- 2020 - Outstanding Professional Employee of the Year by the Federal Executive Association of the Greater Charleston Area for In-service accomplishments and community service

Marie DeLorenzo
- 2018 - Outstanding Professional Employee of the Year by the Federal Executive Association of the Greater Charleston Area for In-service accomplishments and community service
- 2017 - NOAA Educational Partnership Program with Minority Serving Institutions Award
- 2016 - NOAA, National Centers for Coastal Ocean Science EEO/Diversity Award

Blaine West and James Daughomah
- 2018 - NCCOS Peer Recognition Special Achievement Award for The team overcame substantial logistical and safety challenges caused by Tropical Storm Cindy and Hurricane Irma to assess bottlenose dolphin health and reproductive outcomes in the northern Gulf of Mexico, ensuring that project goals of assessing the effects of contaminants in bottlenose dolphins (*Tursiops truncatus*), a key sentinel species in the Gulf of Mexico were completed on schedule and successfully. The results of this study are an integral part of the effort to restore and improve the long-term environmental health of the Gulf of Mexico.

Joe Wade
- 2020 - Trailblazer Award from Lowcountry Youth Service in commemoration of your dedication to excellence in the field of mentoring through your work with the Beaux Affair Program."
- 2020 - NCCOS Peer Recognition Diversity and Inclusion Award for efforts in education and outreach that are making a difference in the lives of young people while advancing the goals and reputation of NCCOS in the Greater Charleston community.

Dave Whitall and Andrew Mason

- 2018 - NCCOS Innovation Award for Novel use of dietary tracers (sucralose and caffeine) to track human waste in a coral reef ecosystem (Vatia Bay, AS)

Contributions of data and expertise to national and international databases, programs, and state-of-science assessments etc. (as of January 2016)

Data Recipient (NCCOS Lead)

- NOAA ORR Chemical Aquatic Fate and Effects (CAFE) database, Ecotoxicity Data for Oil, Dispersants Shoreline Cleaners, Pesticides (DeLorenzo and Key)
- DIVER, database, regional environmental data supporting a SE NRDA (Wirth)
- NCEI (Whitall)
- DIVER, chemical contaminant data (Apeti)
- Gulf of Maine GulfWatch (Apeti)
- Florida Statewide Ecosystem Assessment of Coastal and Aquatic Resources (SEACAR) (Apeti)
- Washington Department of Fish and Wildlife (Apeti)
- NCEI Global Database on Wildlife Microplastics - Microplastics data (McFee)

Expertise Recipient (NCCOS Lead)

- Response Oil Assay working group /ORR-ERD (Wirth)
- NPS Alaska SEAN and SWAN (Apeti)
- Response Oil Assay working group /ORR-ERD (Wirth and Pisarski)

Other

- Marine Mammal Information System NCCOS Developed Database for tracking samples (McFee)
- National Benthic Inventory for Benthic inventory support all analysis including our oil toxicity work (Balthis)
- Coral Disease and Health Consortium where we lead and host. Partnership With upwards of 150 people from many organizations (Woodley)
- Marine Mammal stranding information - Basic marine mammal stranding data from SC uploaded to National Marine Mammal Stranding Database administered by NMFS (McFee)
- Marine Mammal stranding information - Basic marine mammal stranding data from SC provided to NIST National Marine Mammal Tissue Bank for samples received (McFee)
- Sediment Quality Benchmarks - DIVER, data used in the sediment quality benchmarks for oil-related impacts work (Balthis)