OMB Number: 0690-0032
Expiration Date: 08/31/2021

DEPARTMENT OF COMMERCE
RESEARCH PERFORMANCE PROGRESS REPORT (RPPR)

For instructions, please visit
http://www.osec.doc.gov/oam/grants_management/policy/documents/RPPR%20Instructions%20and%20Privacy%20Statement.pdf

AWARD INFORMATION	
1. Federal Agency: Department of Commerce / NOAA	2. Federal Award Number: NA21SEC4810005
3. Project Title: Living Marine Resources Cooperative Science Center	
4. Award Period of Performance Start Date: 09/01/2021	5. Award Period of Performance End Date: 08/31/2026
PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR	
6. Last Name and Suffix: Chigbu	7. First and Middle Name: Paulinus
8. Title: Director LMRCSC	
9. Email: pchigbu@umes.edu	10. Phone Number: 410-651-3034
AUTHORIZING OFFICIAL	
11. Last Name and Suffix: Pitula, null	12. First and Middle Name: Joseph, null
13. Title: Director of Research	
14. Email: jspitula@umes.edu	15. Phone Number: 410-621-2980
REPORTING INFORMATION	
Signature of Submitting Official: N/A	
16. Submission Date and Time Stamp:	17. Reporting Period End Date: 02/28/2023
18. Reporting Frequency: ○ Annual ● Semi-Annual ○ Quarterly	19. Report Type: ● Not Final ○ Final
RECIPIENT ORGANIZATION	
20. Recipient Name: UNIVERSITY OF MARYLAND EASTERN SHORE	
21. Recipient Address: 11868 ACADEMIC OVAL, PRINCESS ANNE, MD 21853-1295 USA	
22. Recipient DUNS: 082611302	23. Recipient EIN: 526002033

ACCOMPLISHMENTS

24. What were the major goals and objectives of this project?

Education Goals:

1. Prepare the future workforce for marine and fisheries sciences.
2. Strengthen collaborations across universities and professional networks to enhance academic programs in marine and fisheries sciences

Research Goal:

1. Develop an exemplary capacity for scientific collaborations among partner institutions in the NOAA relevant fields of marine and fisheries sciences

Administration Goals:

1. Organizational excellence for effective and efficient management of the programs and activities of the Center
2. Effectively communicate the activities and accomplishments of the Center
3. Assess and evaluate the Center's goals and objectives

25. What was accomplished under these goals?

A total of 42 fellows received training as part of LMRCSC-II Cohorts during this period including 26 (6 B.S., 11 M.S., 9 Ph.D.) in Cohort 1, and 11 (4 B.S., 4 M.S., 3 Ph.D.) in Cohort 2, and 5 (1 B.S., 2, M.S., and 2 Ph.D.) Twelve (12) students were recruited to the Center during this period. Ten began training in this period while two more will begin in January 2024 (Table 25.1 of the supplemental document).

The Center conducted seven synchronous and four asynchronous online training activities for Fellows. Of the synchronous activities, two were in person while five were conducted online. The details can be found in the supplemental document (Table 25.2). We held the in-person Annual Fellows Assembly in Baltimore September 16-20, 2023. During the assembly, all fellows participated in orientation to the Center, a seminar on NOAA relevant social science, and received the charge for their cohort project. New fellows were introduced to the Center's four research themes by teams of Center and NOAA scientists and also received professional development in personal time management, navigating the mentor-mentee relationship, and attended the poster session. Returning fellows presented posters in the poster session, received feedback from faculty and participated in a writing workshop. Other trainings included mentorship training (three sessions), scientific ethics, the USAjobs.gov platform, professional social media, data management for undergraduates, Data Carpentry.

Six Graduate Fellows participated in NERTO internships during this reporting period. One Undergraduate Fellow, Glen Collins participated in a 10-week internship at the NOAA

Woods Hole Laboratory under the mentorship of NEFSC Scientist Brian Smith. Their details can be found in Table 25.3. Three LMRCSC fellows (2 M.S., 1 B.S.) graduated during this funding period. Their details can be found in Table 25.4.

During this period, the Center held its Annual Science Meeting. The meeting was held virtually on March 31, 2024. It was attended by a total of 84 individuals including 21 LMRCSC-II Fellows, 19 Center Faculty and Staff, and 38 NOAA Scientists and Staff. An additional 6 attendees' affiliations are unknown as they connected by phone.

The Center continued to hold monthly Executive Committee meetings during which plans to execute student development and professional activities were discussed.

ACCOMPLISHMENTS *(cont'd)*

26. What opportunities for training and professional development has the project provided?

The Center conducted seven synchronous and four asynchronous online training activities for Fellows. Of the synchronous activities, two were in person while five were conducted online. The details can be found in the supplemental document (Table 25.2). They included mentorship training (three sessions), scientific ethics, the USAjobs.gov platform, professional social media, data management for undergraduates, and Data Carpentry for graduate fellows.

27. How were the results disseminated to communities of interest?

In addition to the publications and presentations reported later in this document, Dr. Schott, PI at UMCES participated in outreach to the public through collaboration with a University of Maryland Baltimore County (UMBC) artist and "bio-buggy" https://urbantells.net/2022/07/14/biobuggy/. Additionally, Fellows at IMET, Jennifer Herrara and Olivia Pares helped design and create on estuary ecology for the IMET Open House, May 4, 2023, directed to elementary students.

ACCOMPLISHMENTS *(cont'd)*

28. What do you plan to do during the next reporting period to accomplish the goals and objectives?

Education Goals: As examples, the Center will:

- Continue efforts to recruit students to the Center
- Deliver training on Center functions to faculty
- Continue to engage NOAA Scientists in order to enhance research collaborations and identify scientists to serve on graduate student thesis and dissertation committees; work with students to identify sites for NERTO.

Research Goals: As examples the Center will:

- Continue to seek leveraged funds to support students and conduct research
- Continue efforts to publish results from prior awards and present at scientific meetings.
- Begin work on the Joint Collaborative Research Project (JCRP).

Administrative Goals: As examples, the Center will:

- Continue Executive Committee and Education Committee meetings monthly.

PRODUCTS

29. Publications, conference papers, and presentations

During this period, the Center produced 19 publications in peer reviewed journals including five with student authors. Fourteen (14) were supported by leveraged funds. The list can be found in the supplemental document in Table 29.1. Additionally, ten (10) manuscripts have been submitted during this period including three that are directly funded and two with student authors. The list is available in Table 29.2.

Center scientists and fellows delivered 39 oral presentations (22 directly funded, 17 leveraged) and 14 poster presentations (10 direct, 4 leveraged). Fifteen (15) oral presentations and twelve (12) posters were delivered by cohort fellows. The lists appear in Table 29.3 and 29.4.

PRODUCTS *(cont'd)*
30. Technologies or techniques Nothing to Report
31. Inventions, patent applications, and/or licenses Nothing to Report

Attach a separate document if more space is needed for #6-10, or #24-50.

PRODUCTS *(cont'd)*

32. Other products

Three theses and two dissertations were produced. Details can be found in Table 29.5 of the supplemental document:

Two additional publications were also produced using leveraged funding:

Babcock, E.A. (2023). Bayesian surplus production models for blue sharks using the legacy BSP software. Collective Volume of Scientific Papers 80

Babcock, E.A., Harford, W.J., Gedamke, T., Anderson, S. and Goodyear, C.P. (2023) Simulation-testing model-based and design-based bycatch estimators. 2023. Collective Volume of Scientific Papers 80(6):51-79.

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

33. What individuals have worked on this project?

Sixty-six (66) individuals have worked on the project, including scientists (19) and professional staff (6). Their details can be found in Table 33.1 of the attached document.

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS *(cont'd)*

34. Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Three additional sources of funding have been obtained. The details can be found in Table 34.1 of the supplemental document.

35. What other organizations have been involved as partners?

Nineteen (19) organizations including 3 state agencies, 5 NGOs, 3 universities, and 4 federal agencies, 3 non-profit organizations, and one commercial organization were involved as collaborators in the project. The details of these collaborations can be seen in Table 35 of the attached document.

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS *(cont'd)*

36. Have other collaborators or contacts been involved?

Thirty-nine (39) NOAA Scientists and eighteen (18) scientists from other institutions have been involved in the project as collaborators during this period. Their names and involvement are listed in tables 36.1 and 36.2 in the attached document.

IMPACT

37. What was the impact on the development of the principal discipline(s) of the project?

Nothing to report.

IMPACT *(cont'd)*

38. What was the impact on other disciplines?

LMRCSC students are active in improving Diversity, Equity and Inclusion at UM-RS.

The SSU MSCI program is the pacesetting program for the other STEM graduate degrees at SSU because of the LMRCSC. Even the liberal arts graduate programs note best practices from the MSCI degree program.

At DSU, the cohort structure of the LMRCSC has expanded. For instance, students funded by other grants and who work with non-LMRCSC-associated faculty receive positive influence from center students.

39. What was the impact on the development of human resources?

Students are developing skills such as letter-writing, improving CVs, developing work plans, working with a myriad of scientists at NOAA facilities, producing posters and giving research talks.

Center Fellows are better prepared than many of their counterparts because of the investment in their research and travel. The data management course helps them access data training that did not exist 10 years ago at some partner institutions. As a result of their exposure, these students are excited and confident about their employment prospects.

IMPACT *(cont'd)*

40. What was the impact on teaching and educational experiences?

Students across the Center have access to courses at other Center institutions. This access broadens the diversity of courses available to our students. During this period, we have begun building materials and planning activities to improve the quality of training in the LMRCSC research areas by making it more continuous process. It began with the Annual Fellows Assembly in Fall when new cohort students were introduced to the research areas, and will continue through synchronous and asynchronous engagement throughout the year. These activities will make the experience of LMRCSC-II Fellows more relevant to future NOAA mission careers.

41. What was the impact on physical, institutional, and information resources that form infrastructure?

HU: The Center provides a more robust research engagement in Marine and Environmental Science (MES) with the funding and support of MS students. Because of this, the department will work with other departments to seek funding for a Climate Science Center.

UMCES: The support for Dr. Schott affords him the capacity to create and maintain relationships with local MSIs, k-12 schools, and to engage in at least 12 informal education activities each year.

UM-RS: Support increases the critical mass of fisheries scientists, improving our ability to do NOAA relevant work and train students

IMPACT *(cont'd)*

42. What was the impact on technology transfer?

Research results have been published, and presented at scientific meetings and stock assessment working groups.

43. What was the impact on society beyond science and technology?

At the Center level, the session organized by the LMRCSC at AFS 2023 nicely communicated the mission, and scope, and provided specific examples to fisheries professionals around the country.

DSU: Aquaculture and the aquaculture facility at DSU has contributed to student outreach activities.

HU: With the collaboration with Chesapeake Bay Foundation (CBF), Oyster Alliance, and Shored up, the students and faculty have had several opportunities to discuss their research with the community on and off campus.

UMCES: LMRCSC-II Fellows at UMCES participate at least 2 times per year communicating ocean and estuary science to the public in Baltimore, MD eastern shore and Solomons Island MD.

IMPACT *(cont'd)*

44. What percentage of the award's budget was spent in foreign country(ies)?

None

CHANGES/PROBLEMS

45. Changes in approach and reasons for change

Nothing to report.

CHANGES/PROBLEMS *(cont'd)*

46. Actual or anticipated problems or delays and actions or plans to resolve them

Reduced funds distributed for cohorts 2 and 3 will impact the number of students funded, and eliminates the ability to hire a Research Scientist at HU and a Social Science Lead at UMES.

Two partners also report administrative challenges caused by internal university issues:

DSU: DSU College of Agricultural Science and Technology lost 3 fiscal personnel during the past 6 months, impacting spending. One fiscal personnel has been hired.

SSU: Institutional changes in procurement and hiring have created more than 6 months delays in receiving purchases; posting positions requires a new multitiered process; research equipment for current MS project is stuck at a vendor because of repeated institutional failures to provide shipping information. Consequently, multiple LMRCSC-II essential activities are at a standstill.

47. Changes that had a significant impact on expenditures

Nothing to report.

CHANGES/PROBLEMS *(cont'd)*

48. Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to Report

49. Change of primary performance site location from that originally proposed

Nothing to Report

PROJECT OUTCOMES

50. What were the outcomes of the award?

The Implementation Plan identifies measures of success in the areas of Administration, Education and Training, and Research. The details of these measures are provided in the attached document in Appendices 1-3. Highlights from this reporting period include:

- 41 total students, 38 Underrepresented Minority (URM) students trained in the Center
- 38 URM students pursuing higher education in NOAA mission fields
- 2 URM students graduated in NOAA mission fields
- 39 collaborations with NOAA Scientists
- The Center leveraged $3.42 in funding for research and education

DEMOGRAPHIC INFORMATION FOR SIGNIFICANT CONTRIBUTORS (VOLUNTARY)

Gender:

- ◯ Male
- ◯ Female
- ◯ Do not wish to provide

Ethnicity:

- ◯ Hispanic or Latina/o Not
- ◯ Hispanic or Latina/o Do not
- ◯ wish to provide

Race:

American Indian or Alaska Native Asian

- ◯ Black or African American
- ◯ Native Hawaiian or other Pacific Islander
- ◯ White
- ◯ Do not wish to provide

◯

Disability Status:

- ◯ Yes
  - [ ] Deaf or serious difficulty hearing
  - [ ] Blind or serious difficulty seeing even when wearing glasses
  - [ ] Serious difficulty walking or climbing stairs
  - [ ] Other serious disability related to a physical, mental, or emotional condition
- ◯ No
- ◯ Do not wish to provide

Attach a separate document if more space is needed for #6-10, or #24-50.

Supplemental Text to the LMRCSC Semiannual Report

Text and tables are arranged using the same numbering system in the RPPR form:

25. What was accomplished under these goals?

a. **Major Activities**:

i. Education Activities:

Student Recruitment Activities: During this period, the Center continued to recruit new students for this award via targeted recruitment at partner institutions and digital advertisement. The Center had a recruitment exhibit at the 153rd Annual Meeting of the American Fisheries Society. The Center presented available opportunities to interns in six different summer internship programs including REU programs at UMES, SSU, UMCES, and Maryland Sea Grant, the Geoscience Bridge Program at UMES, NOAA IN FISH Program, and Internship for Diversity and Inclusion in Marine Mammal Science at SSU.

A total of 42 fellows received training as part of LMRCSC-II Cohorts during this period including 26 (6 B.S., 11 M.S., 9 Ph.D.) in Cohort 1, and 11 (4 B.S., 4 M.S., 3 Ph.D.) in Cohort 2, and 5 (1 B.S., 2, M.S., and 2 Ph.D.) Twelve (12) students were recruited to the Center during this period. Ten (10) began training in this period while two more will begin in January 2024 (Table 25.1).

Table 25.1: Names, institutional affiliations, and degree programs of new students recruited to the LMRCSC during this period.

First	Last	URM	Partner	Degree
Myah	Bowie	Y	UMES	B.S.
Juan	Gordon	Y	SSU	B.S.
Leianna	Jones	N	UMES	B.S.
Kaila	Leonard	Y	SSU	B.S.
Veronica	Lucchese	Y	UMCES	Ph.D.
Nylah	McClain	Y	UMES	Ph.D.
Halia	Morris	Y	HU	B.S.
Ian	Santos-Rodrigues	Y	HU	M.S.
Aracelis	Jimenez	Y	UM-RS	Ph.D.
Sarah	Rawlinson	Y	UMES	B.S.
Kevin	Armstrong	Y	UMES	B.S.
Cali	Roberts	Y	UMES	M.S.

Training activities: Fellows participated in several Center-wide training opportunities. Descriptions are in Table 25.2.

Table 25.2: Training offered during this period.

Title	Date	Duration	Description	# of fellows
Mentorship Training: Communicating with Your Mentor	April 3 and 4	2 hours	The Entering Mentoring training was facilitated by CIMER-trained instructors. The learner utilized case studies and group	27 fellows attended (93% of those assigned)

			discussions to develop skills in communicating with a mentor regarding expectations and needs. The learner demonstrated understanding of the learning objectives through active participation in small and large group discussion which contributed to the group's body of knowledge.	
Mentorship Training: Developing Independence, Confidence, and Identity as a Researcher	April 10 and 11	2 hours	The Entering Mentoring training was facilitated by CIMER-trained instructors. The learner utilized case studies and group discussions to develop a deeper understanding of the research environment and improve coping skills. The learner demonstrated understanding of the learning objectives through active participation in small and large group discussion which contributed to the group's body of knowledge. This training was targeted to students who entered the program within the last year.	17 fellows attended (100% of those assigned)
Mentorship Training: Developing Mentorship Skills	April 17 and 18	2 hours	The Entering Mentoring training was facilitated by CIMER-trained instructors. The learner utilized case studies and group discussions to begin to acquire skills and practices used in mentoring undergraduate students in research environments. The learner demonstrated understanding of the learning objectives through active participation in small and large group discussion which contributed to the group's body of knowledge. This training was targeted to those who have been in the program more than one year and who are currently	19 fellows attended (100% of those assigned)

			or will soon be in the position to mentor others.	
Scientific Ethics with CITI	Asynchronous	1 hour	Fellows are introduced to the principles and responsibilities of scientific ethics using a well-regarded curriculum available through their universities. This training is assigned to all fellows upon entry to the Center.	27 Fellows completed the training during this period (82% of all Fellows have completed this activity)
USA Jobs training	Asynchronous	1 hour	Fellows are introduced to the USAjobs.gov platform and guided to create a federal resume.	16 fellows have created a federal resume during the last reported period.
Professional Social Media	Asynchronous	1 hour	Fellows are introduced to the LinkedIn platform, guided to create a profile, and invited to connect with the Center on the platform.	27 fellows have created a LinkedIn profile (81% of the current fellows).
Data Management for Undergraduates	Asynchronous	2 hours	Through 5 modules designed by Dr. Beth Babcock, undergraduate fellows are introduced to the principles of data management including spreadsheet organization, meta-data, data sharing plans, and online databases.	1 undergraduate fellow completed this training during this period. 50% of the undergraduate fellows have completed this training, and the remaining undergraduate fellows are assigned to complete it during the next reporting period.
Annual Fellows Assembly	In Person	3 days	New fellows participated in core competency training, cohort project and professional development activities	9 fellows participated in the assembly (100% of newly recruited fellows)
Writing Retreat	In Person	3 days	Fellows participated in technical writing skills such as abstracts, email, caption writing and peer review.	26 fellows participated in the writing retreat. (100% of supported fellows for this meeting)
DATA Carpentry	Online Face to Face	2 days	This two-day workshop was conducted with the DATA Carpentry organization. The workshop was led by four certified instructors with expertise in SQL, R and Excel. The learners benefited by receiving guided instruction for commonly used software	8 graduate students from the LMRCSC II funding participated. 6 graduate students from the center and partner institutions also participated in the workshop (100% of fellows assigned in this period completed

			tools. The workshop fed into skills needed by the learners for research utilizing data analysis.	the training during this period; 100% of LMRCSC II funded graduate fellows have completed this training)
December LMRCSC-II Graduate Seminar	Online - face to face	1.5 hrs	Analysis of the effects of environmental factors on catch and relative abundance for three batoid (skate/ray) species in Delaware Bay Presenter (Fernandez, Michelle)[1]; Co-Author (McCandless, Camilla)[2] Univ. of Miami, Rosenstiel School of Marine, Atmospheric, and Earth Science[1]; NOAA NEFSC, Narragansett, Rhode Island Laboratory[2] Analyzing Swordfish Habitat in Proposed Chumash National Marine Sanctuary Presenter Jordan, Jamon[1]; Hazen, Elliott[1]; Kavanaugh, Maria[2] Oregon State University[1]; NOAA SWFSC Environmental Research	20 fellows and faculty attend the session.

Table 25.3: NERTO internships completed during this reporting period

LMRCSC Fellow	Line Office	Location	Start Date	NOAA Mentor	Project Title
Fernandez, Michelle	NEFSC	Narragansett, RI	5/22/2023	Dr. Camilla McCandless	Analysis of batoid bycatch from the Delaware Bay COASTSPAN (Cooperative Atlantic States Shark Pupping and Nursery) Surveys
Jordan, Jamon	SWFSC	Monterey CA	6/26/2023	Elliott Hazen	Opportunity for EPP CSC Graduate Student: Assessing seasonal and sub-seasonal variability in

					forage habitat (occupancy) in central California
Huckaby, Kayland	SEFSC	Pascagoula, MS	5/25/2023	Glenn Zapfe and Frank Hernandez	Diet and trophic level analysis of groundfish species in the northern Gulf of Mexico
Ramirez-Joseph, Lucia	NEFSC	NOAA Greater Atlantic Regional Fisheries Office	7/13/2023	Kevin Madley	Assessment of the National Shellfish Initiative (NSI).
Clax, Savannah	NWFSC	Olympic Coast National Marine Sanctuary	6/12/2023	Jenny Waddell	Supporting Field Research and Public Engagement at Olympic Coast National Marine Sanctuary, Washington
Layeni, Amira	NOAA NOS	Hollings Marine Lab, Charleston, SC	5/15/2023	Dr. Marie DeLorenzo	Assessment of microplastic pollution in oyster reefs

Table 25.4. LMRCSC Fellows graduated during this reporting period.

Last Name	First name	Institution	Degree	Cohort #	Graduation Date	Postgraduate information
Day	Joe	SSU	M.S.	1	May 2023	Teaching Science (K-12)
Brown	Malika	UMES	B.S.	1	May 2023	Seeking graduate program
Wade	Kaitlynn	UMCES	M.S.	1	Dec. 2023	Seeking employment

ii. **Research activities**

1. The RFP for 2023-2024 TAB proposals was distributed to Center Fellows and Faculty on Oct. 7, 2022. The review process resulted in 8 collaborative research projects that are on-going.
2. The RFP for 2024-2025 was distributed to Center Fellows and Faculty on Nov. 15, 2023. Submissions are due January 31, 2024. The review process will take place during the next reporting period.

2023 – 2024 TAB Projects

1. Project Title: Ecological Assessment of On-bottom and Off-bottom Oyster Culture Technique, Environmental Health, and Oyster Grow-out Conditions
Name of Student Applicant: Emily Andrade, M.S. Student
Faculty Advisor & PI: Gulnihal Ozbay, Ph.D.
Post-doc Mentor & Co-PI: Ali Parsaeimehr, Ph.D.
NOAA LMRCSC Collaborator: Salina Parveen, Ph.D.
NOAA NMFS Collaborator, Milford Laboratory: Gary Wikfors, Ph.D.
Thematic area: SNAP: Seafood, Nutrition, Aquaculture, and Pathology
Project dates: Start: March 1, 2023 **Completion:** February 28, 2024

Project Abstract: Oyster aquaculture returned to the Delaware Inland Bays with issued shellfish leasing areas in 2018, boosting local economies, improving water quality, and providing important habitat for fish and invertebrates. Efforts to monitor and identify relationships between cage depth, oyster condition, and water nutrient levels and the pathogenic bacteria *Vibrio coralliilyticus* and *Vibrio tubiashii* responsible for the high larval oyster mortality are vital for successful management of oyster farming and restoration in Rehoboth Bay, DE. This project will analyze how nutrient and targeted pathogenic bacterial levels impact oyster aquaculture and water quality on an aquaculture farm in Rehoboth Bay, Delaware. *In-situ* water quality data and samples are collected from surface and bottom depths. Oysters collected from both depths are dried to determine the total weight of the oyster shell, meat, and liquor. Oyster Condition Index (CI) is calculated using measurements taken from oysters; low CI indicates the oyster and offspring are more vulnerable to disease and environmental stressors. Further assessments on nutrient sources and their direct impacts on the aquaculture farm will be studied.

2. Project title: A Comparative Study of the Trophic Ecology of Juvenile Weakfish in the Maryland Coastal Bays and Patuxent River, a Chesapeake Bay Tributary
Name of applicant: Angel Reyes Delgado, University of Maryland Eastern Shore (UMES)
Co-PIs: Paulinus Chigbu, UMES; Ryan Woodland, University of Maryland Center for Environmental Science (UMCES)
NOAA Collaborator: Brian Smith, Northeast Fisheries Science Center (NEFSC), Woods Hole, MA
Students: Graduate: Angel Reyes Delgado, UMES
Thematic area: Stock Assessment Support and Information, Habitats and Biological Systems
Project dates: Start: April 1, 2023; **Completion:** May 31, 2024

Project abstract: Weakfish (*Cynoscion regalis*) is a species that uses coastal rivers, lagoons, and estuaries as nurseries. They are opportunistic demersal predators that rely more on benthic prey, as they grow older, with a diet generally comprised of a diverse species of fish and small crustaceans. Weakfish have undergone large fluctuations in landings since the late 1800s primarily due to high natural mortality, and has been unable to recover since then. Their survival and growth depend on the quantity and quality of nursery habitats, including prey availability. However, no prior study has compared the trophic ecology of weakfish in the Chesapeake Bay (CB) and the Maryland Coastal Bays (MCBs). As a means of contributing to current weakfish restoration efforts and assess juvenile habitat suitability, we will compare the feeding ecology of juvenile weakfish (JW) in the MCBs and CB by analyzing fish gut contents, stable isotope signatures and fatty acid (FA) composition.

3. Project title: Estimating Fish Abundances and Relationship with Habitat using Baited Remote Underwater Video Surveys in the Biscayne Bay
Name of applicant: Chryston Best-Otubu
Co-PI: Elizabeth Babcock
NOAA Collaborator: Joe Serafy, NOAA SEFSC
Research Students: Chryston Best-Otubu
Thematic area: HaBS: Habitats and Biological Systems
Project dates: September 1st 2023-August 30th 2024.

Project Abstract: My dissertation will be a comprehensive study of the Biscayne Bay's ecosystem structure using ecosystem models. This ecosystem has undergone major anthropogenic changes due to an increasing human population, leading to water quality issues including nutrient input, rising salinity, and habitat degradation. Previous fish surveys in BB have left a large data gap in the central region, northern basins, and outer-reef regions of the bay. This study will use baited remote underwater videos (BRUVS) to measure relative abundances of fish species across all regions of the bay. I will use the BRUV data to generate species distribution models (SDM) and that these SDM will be input into the ecosystem models to estimate resilience and susceptibility.

4. Project title: The Effects of Hypoxia and Warming on Petrale Sole off the Washington Coast
Name of applicant: Savannah Clax
Co-PI: Dr. Jessica Miller, Dr. Dionne Hoskins-Brown
NOAA Collaborator: Dr. Mary Hunsicker, NWFSC
Other Collaborator: Dr. Jenny Waddell, Olympic Coast National Marine Sanctuary
Undergraduate Research Student: Savannah State University
Institution: Oregon State University and Savannah State University
Thematic area: CLIME: Climate Impacts on Marine Ecosystems
Project dates: Start: 09/2023 Completion: 6/2025

Project Abstract: Climate change continues to progress and alter water conditions, including warmer temperatures and lower levels of dissolved oxygen. These changes are expected to affect Petrale Sole (*Eopsetta jordan*i) growth and, potentially, size-at-age and reproduction. As the species is valuable to commercial fisheries and Indigenous communities, is important to understand these impacts on growth and size-at-age. The relationship between temperature, hypoxia, and growth will be assessed by combining climatologies of temperature and dissolved oxygen with otolith structural and elemental analysis of archival otoliths collected from 1960 to the present. Growth variation will then be examined in relation to spatial and temporal patterns of hypoxia and temperature and data on recruitment, spawning biomass, and body sizes. We will also collect otolith Mn: Ca data to evaluate its potential to provide a proxy for hypoxia exposure. The overall aim of the project is to better inform growth and population models as the impacts of climate change further alter ecosystems and affect fish development.

5. Project Title: Development of an sUAS Multispectral Approach to Assess *Spartina alterniflora* condition
Name of applicant: Dionne Hoskins-Brown
Co-PI: Deidre Gibson
NOAA Collaborator: Matthew Johnson, SEFSC Habitat Ecology Branch
Research Students: Shaneese Mackey, new SSU Graduate Student TBD
Institution: Savannah State University (primary), Hampton University (LMRCSC Collaborator)
Thematic area: HaBS: Habitats and Biological Systems

Project Abstract: As we experience the effects of climate change, the initial onset of the corresponding environmental change may be subtle and not perceptible using traditional methodology. Our ability to make accurate predictions of the impacts of climate change on nearshore fisheries ecosystems will rely on our ability to detect such subtle transitions in coastal habitat before they cross an ecological threshold. We propose to identify the multispectral patterns and drivers of stress indicative of the early onset of climate-related ecological changes in coastal ecosystems. This directly addresses NOAA Fisheries Ecosystem Priority 2b2.- determining what environmental changes are most influential in overall marsh health. Using a multirotor Small Uncrewed Air Systems (sUAS) equipped with an advanced, 10-band multispectral tool we will evaluate the effectiveness of indices for inexpensive and rapid assessment of the early stress effects of varying flood heights, duration, and nutrient loads on aboveground saltmarsh biomass. We will examine the effects of confounding factors like tidal height, stalk position, distance from water edge, time of year/season, senescence, plant density, and sun angle on reflectance wavelengths between 475-840nm that will be used to calculate common indices of plant health. Surveys of natural and impacted marshes will be used to assess levels of stress and if subtle differences in condition are detectable via this technique. If successful, we will develop a method for saltmarsh assessment that allows field teams to cover survey areas with fewer people, evaluate more areas in less time with less expense, and minimize invasive field assessments on vegetation in study areas.

6. Project title: sUAS Versus Traditional Monitoring Methods to Evaluate Natural and Restored Oyster Reefs
Name of applicant: Shaneese Mackey, Savannah State University

Co-PI: Dr. Dionne Hoskins-Brown, Savannah State University
NOAA Collaborator: Christian Jones, SEFSC Fisheries, Assessment, Technology, and Engineering Support (FATES) Division
LMRCSC Collaborator: Stacy Smith, Delaware University
Research Students: Shaneese Mackey (SSU); LMRCSC undergraduate from DSU (TBD)
Institution: Savannah State University
Thematic area: SASI: Stock Assessment Support and Information

Project Abstract: Traditionally, labor-intensive field methods are used to evaluate salt marsh health and oyster reef restoration. Methods using Uncrewed Aerial Systems (UAS) have been developed successfully by those looking to offer quick and affordable approaches for managers to monitor marsh habitat (Lou et al., 2021). The purpose of this study was to assess natural and restored oyster reefs and compare metrics using an APH-28 quadcopter to those measured using traditional field methods. Structural features such as percent cover, reef height, and rugosity were recorded at maximum low tide for all oyster reefs in Savannah, GA. A nonparametric ANOVA test would compare the statistical difference of the means for each method.

7. Project title: Antibiotic Resistance, and Genetic Diversity of *Shewanella* spp. Recovered from Oysters (*Crassostrea virginica*) and Seawater.
Name of applicant (PI): Tahirah Johnson, Ph.D. Student
Faculty Advisor and Co-PI: Salina Parveen
NOAA Collaborator: John Jacobs
Research Student: Tahirah Johnson
Institution: University of Maryland Eastern Shore
Thematic area: SNAP: Seafood, Nutrition, Aquaculture, and Pathology

Project Abstract: *Shewanella* are important pathogenic bacteria naturally occurring in the marine environment. Our recent studies suggest that *Shewanella* is prevalent in oysters and seawater in the mid-Atlantic region. Previous studies reported that some *Shewanella* are resistant to multiple antibiotics. This issue is of major concern since the presence of multiple antibiotic-resistant bacteria in seafood and the marine environment can jeopardize public health. Adequate information is not available on the antibiotic resistance, genetic diversity, and control of this bacterium in seafood and seawater. We will address this data gap using antibiotic susceptibility testing and whole genome sequencing. We will also evaluate the effectiveness of natural plant extracts to reduce this bacterium in seafood processing.

8. Project title: Developing a spatially explicit model of the Chesapeake Bay to project climate effects on a nonnative predator
Name of applicant (PI): Noah Tait, M.S. Student
Faculty Advisor and Co-PIs: Dr. Tunde Adebola, Dr. Eric Lewallen
NOAA Collaborator: Dr. Howard Townsend
Research Student: Noah Tait
Institution: Hampton University
Thematic Area: Stock Assessment Support and Information (SASI)

Project Abstract: The blue catfish (BC) has become an invasive apex predator in Chesapeake Bay, exerting top-down forces on trophic webs. Originally a freshwater species, BC have been observed as euryhaline generalist omnivores, capable of withstanding higher salinities than anticipated and able to use a wide variety of food sources. This project focuses on the extension of a mass-balanced ecosystem model built in Ecopath with Ecosim (EwE). EwE is a software useful for policy optimization and exploration of ecosystem trophic interactions on a spatio-temporal scale. Preliminary analyses suggest that BC diet composition shifts as salinity changes. Further modeling is needed to better understand the effects of

these compositional shifts in diet. This project aims to use Ecospace to model these effects spatio-temporally.

3. The Annual Science Meeting was held virtually on March 31. It was attended by a total of 84 individuals including 21 LMRCSC Fellows, 19 Center Faculty and Staff, 38 NOAA Scientists and Staff. An additional 6 attendees' affiliations are unknown as they connected by phone.

iii. **Administrative activities:**

1. The Center conducted its monthly Executive Committee, and Education Committee meetings.

b. **Specific Objectives**

i. **Education Goal 1.** Prepare the future workforce for marine and fisheries sciences
   1. Objective 1.1: Recruit students from under-represented groups into marine and fisheries science disciplines
   2. Objective 1.2: Increase retention and degree completion rates for students in marine and fisheries sciences programs
   3. Objective 1.3: Assess the value-added outcomes of degree programs in marine and fisheries sciences at the partner institutions

ii. **Education Goal 2.** Strengthen collaborations across universities and professional networks to enhance academic programs in marine and fisheries sciences
   1. Objective 2.1: Use relevant research-based curricula to provide students with the highest quality education in marine and fisheries sciences
   2. Objective 2.2: Use Virtual Campus technology to provide students with the opportunity to learn from some of the nation's leading scholars in marine and fisheries sciences
   3. Objective 2.3: Ensure that curricula of degree programs at partner institutions address current challenges and emergent needs within the profession
   4. Objective 2.4: Link students to professional networks and employment opportunities in marine and fisheries sciences

iii. **Scientific Research Goal 3.** Develop an exemplary capacity for scientific collaborations among partner institutions in the NOAA relevant fields of marine and fisheries sciences
   1. Objective 3.1: Integrate the Center's research agenda with NOAA Fisheries research priorities in four key thematic areas: ecosystem change and prediction, stock assessment support, habitat research and protection, and safe seafood and aquaculture
   2. Objective 3.2: Foster collaborative research programs to strengthen the research capacities of partner institutions by leveraging the significant strengths and resources of research universities as infrastructure for capacity building
   3. Objective 3.3: Develop faculty recruitment and retention practices that ensure that the collective capacity of scholars affiliated with the Center represents significant concentrations of strength in the four key research thematic areas

iv. **Administration Goal 4.** Organizational excellence for effective and efficient management of the programs and activities of the Center
   1. Objective 4.1: Establish an Administrative Structure to enhance center operations and provide supportive environment for training and mentoring

of students, and for research in marine and fisheries sciences
2. Objective 4.2: Monitor and ensure compliance with Center Award Conditions

v. **Administration Goal 5.** Effectively communicate the activities and accomplishments of the center
1. Objective 5.1: Develop infrastructure for effective and efficient internal and external communication
2. Objective 5.2: Develop an effective strategy for communication with students, faculty and administrators within the center, and increase visibility of the center through enhanced communication of its accomplishments to external stakeholders

vi. **Administration Goal 6.** Assess and evaluate the center's goals and objectives
1. Objective 6.1: Assess and evaluate center educational programs
2. Objective 6.2: Assess and evaluate center research
3. Objective 6.3: Assess and evaluate center administration

c. **Significant results:**
i. Conducted the Annual Science Meeting
ii. Delivered the Mentorship Training
iii. Recruited 9 new Fellows

29. Publications, conference papers, and presentations

Table 29.1: LMRCSC Publications in peer reviewed journals. Center students are identified with asterisk (*). Center scientists' names appear in bold.

Publications in journals	Justification
Almeida LZ, Laurel BJ, **Thalmann* HL, Miller JA**. 2024. Warmer, earlier, faster: Cumulative effects of Gulf of Alaska heatwaves on the early life history of pacific cod. Elementa: Science of the Anthropocene. 12(1).	FY16 award student, Direct
Arai K, Castonguay M, Lyubchich V, **Secor DH**. 2023. Integrating machine learning with otolith isoscapes: Reconstructing connectivity of a marine fish over four decades. Plos One. 18(5).	Leveraged
Barbour N, Robillard AJ, Shillinger GL, Lyubchich V, **Secor DH**, Fagan WF, Bailey H. 2023. Clustering and classification of vertical movement profiles for ecological inference of behavior. Ecosphere. 14(1).	Leveraged
Bender* AN, Krause DJ, Goebel ME, Hoffman JI, **Lewallen EA, Bonin CA**. 2023. Genetic diversity and demographic history of the leopard seal: A Southern Ocean top predator. Plos One. 18(8).	LMRCSC FY16
Cavole LM, **Munguia-Vega* A, Miller JA**, Salinas-de-Leon P, Marin Jarrin JR, Johnson AF, Rastoin-Laplane E, Giron-Nava A, Aburto-Oropeza O. 2023. Combining otolith chemistry and genetics to infer the population structure of yellow snapper *Lutjanus argentiventris*. Ecosphere. 14(10):e4682.	Leveraged
Ching C, **Miller JA**, Tsang Y, Fraiola K, Clilverd H, Honarvar S. 2023. Understanding amphidromy in Hawai'i: 'O'opu nākea (*Awaous stamineus*). Journal of Fish Biology.	Leveraged

Cram JA, Hollins A, McCarty AJ, Martinez G, Cui MM, Gomes ML, **Fuchsman CA**. 2024. Microbial diversity and abundance vary along salinity, oxygen, and particle size gradients in the Chesapeake Bay. Environmental Microbiology.	Leveraged
Fuchsman CA, Hays MD. 2023. Increased cyanophage infection at the bottom of the euphotic zone, especially in the fall. Environmental Microbiology. 25(12):3349-3363.	Leveraged
Krause DJ, Brownell Jr RL, **Bonin CA**, Woodman SM, Shaftel D, Watters GM. 2024. Evaluating threats to South Shetland Antarctic fur seals amidst population collapse. Mammal Review. 54(1):30-46.	Leveraged
Laurel BJ, Abookire A, Barbeaux SJ, Almeida LZ, Copeman LA, Duffy-Anderson J, Hurst TP, Litzow MA, Kristiansen T, **Miller JA** et al. 2023. Pacific cod in the anthropocene: An early life history perspective under changing thermal habitats. Fish and Fisheries.	Leveraged
Lively JA, Spitznagel MI, **Schott EJ**, Small HJ. 2023. Investigating conspecific csrv1 transmission in *Callinectes sapidus*. Journal of Invertebrate Pathology. 201.	Leveraged
Lopez-Figueroa NB, Walters TL, Laureano-Rosario AE, Digeronimo SP, Hallock P, Frischer ME, Rodriguez-Santiago AE, **Gibson DM**. 2023. Zooplankton community variability in the South Atlantic Bight (2015-2017). Journal of Plankton Research. 45(2):312-324.	Leveraged
Pelekai* KN, Hess JE, Weitkamp LA, Lampman RT, **Miller JA**. 2023. Evaluation of pacific lamprey statoliths for age estimation across their life cycle. North American Journal of Fisheries Management. 43(6):1610-1622.	FY16 award student, Direct
Perez-Perez* NM, Poach M, **Stevens B, Smith SL, Ozbay G**. 2023. Diet and temperature effects on the survival of larval red deep-sea crabs, *Chaceon quinquedens* (Smith, 1879), under laboratory conditions. Journal of Marine Science and Engineering. 11(5).	Directly supported by the FY11 Award
Rome M, Happel A, Dahlenburg C, Nicodemus P, **Schott E**, Mueller S, Lovell K, Beighley RE. 2023. Application of floating wetlands for the improvement of degraded urban waters: Findings from three multi-year pilot-scale installations. Science of The Total Environment. 877:162669.	Leveraged
Schweitzer CC, **Bonin CA**, Magel C, Hurst TP, Horodysky AZ. 2023. Dysregulation of micrornas may contribute to neurosensory impairment in arctic cod (*Boreogadus saida*) following CO_2 exposure. Frontiers in Marine Science. 10.	Leveraged
Spivak AC, Pinsonneault AJ, **Hintz C**, Brandes J, Megonigal JP. 2023. Ephemeral microbial responses to pulses of bioavailable carbon in oxic and anoxic salt marsh soils. Soil Biology and Biochemistry. 185:109157.	Leveraged
Tan CD, Hahner G, Fitzer S, Cole C, Finch AA, **Hintz C**, Hintz K, Allison N. 2023. The response of coral skeletal nano structure and hardness to ocean acidification conditions. Royal Society Open Science. 10(8).	Leveraged
Zhao ML, Plough LV, Behringer DC, Bojko J, Kough AS, Alper NW, Xu L, **Schott EJ**. 2023. Cross-hemispheric genetic diversity and spatial genetic structure of *Callinectes sapidus* reovirus 1 (csrv1). Viruses-Basel. 15(2).	Leveraged

Table 29.2: Publications that were in press or under review at the end of the reporting period. Center students are identified by asterisk (*). Center scientists' names appear in bold.

Publications in journals	Justification	Status
Chigbu, P., Babcock, E.A., Gibson, D.M., Hoskins-Brown. D., Jagus, R., Miller, J.A., Sexton, M.A., Smith S.L., Stevens, B., Die, D.J., Schott, E., & Young, V. (2023) Preparing a diverse future workforce in marine and fisheries science: The NOAA Living Marine Resources Cooperative Science Center. Oceanography 36(4) preprint doi:10.5670/oceanog.2024.139	Other LMRCSC activity	In press
Hays, M.D., **Fuchsman**, C.A. (submitted) SAR11 ecotypes across ocean basins change with depth due to changes in light and oxygen. ISME Communications	Leveraged	In review
Huanca-Valenzuela P., Cram, J.A. **Fuchsman**, C.A. (submitted) Comparing the microorganisms capable of using alternate reduced nitrogen sources between oxic and anoxic ocean regions. Frontiers in Marine Science	Leveraged	In review
Johnson* T, Richards GP, Jacobs J, Townsend H, Almuhaideb E, Meredith J, Rosales D, **Chigbu P, Dasilva L, and Parveen S**. 2023. Prevalence and pathogenic potential of *Shewanella* species in oysters and seawater collected from the Chesapeake Bay and Maryland Coastal Bays. Journal of Applied & Environmental Microbiology.	Cohort 1 Student	Under review
Lee, Y.-Y., Jonas, L., Hill, R., Place, A., Silsbe, G., Hunsicker, S., North, E. & **Li,** Y. (2023). Engineering whiting events in culture: A microalgae- driven calcium carbonate and biomass production process at high pH and alkalinity with the marine microalga *Nannochloropsis oceanica* IMET1. Journal of CO2 Utilization.	Leveraged	Accepted
McLellan, Sandra L., Anthony Chariton, Annachiara Condello, Jill S. McClary-Gutierrez, Melissa K. Schussman, Ezequiel M. Marzinelli, Judith M. O'Neil, **Eric J. Schott**, Jennifer L. Bowen, Joe H. Vineis, Lois Maignien, Clarisse Lemonnier, Morgan Perennou, Karen S. Gibb, Guang-Jie Zhou, Kenneth Mei Yee Leung, Marek Kirs, John F. Griffith, Joshua A. Steele, Stephen E. Swearer, Allyson L. O'Brien, Dehai Song, Shengkang Liang, Junfeng Li, Laura Airoldi, Francesco Paolo Mancuso, Paulo S. Salomon, Arthur W. Silva-Lima, Alexandria Boehm, Elton W.X. Lim, Stefan Wuertz, Emilio Fernández, Eva Teira, Ming-Ling Liao, Yun-Wei Dong, Peter Steinberg. Universal microbial indicators provide surveillance of sewage contamination in harbours worldwide. Submitted to *Biofilms and Microbiomes*	Leveraged	In review
Reustle, J.W., B. Belgrad, E. Pettis, D.L. Smee. Hurricanes pause human activities and highlight human-driven trophic cascades in estuaries. **In Review**	Leveraged	In review
Reyes Delgado* A, Smith BE. 2023. Diet Variation and Trophic Impact of Weakfish (*Cynoscion regalis*) Within Multiple Marine Habitats of the Eastern U.S. Under review in Journal of Fish Biology.	Cohort 1 Student	Under review

Schiano, S., Nesslage, G.M., Drew, K., Schueller, A.M., Woodland, R.J. and **Wilberg**, M.J., 2024. Evaluation of Alternative Harvest Policies for Striped Bass and Their Prey, Atlantic Menhaden. Canadian Journal of Fisheries and Aquatic Sciences.	Leveraged	in press
Trapp, M., Model, JFA., dos Santos, J., Lopes. E., **Schott,** E.J., Vinagre. (in revision for JIP) Seasonal variation on health parameters and reovirus infection in the blue crab *Callinectes sapidus* in Southern Brazil	Leveraged	in revision

Table 29.3: Oral presentations at professional meetings (virtual and in-person). Center students are identified by asterisk (*). Students supported under the FY16 award are marked by †. Center scientists' names appear in bold.

Oral presentations at professional meetings	Justification
Andrade*, E. Atarwala, T., **Ramos.*, J.**, Parasaeseimehr, A., **Ozbay, G**. 2023. Ecological Assessment of On- and Off-bottom Oyster Culture Grow-Out Conditions. Presented at the American Fisheries Society Meeting, Grand Rapids, MI, August, 2023.	LMRCSC Cohort 1 student
Andrade*, E., Attarwala, T., **Ramos*, J., Ozbay, G.** (2023) Ecological assessment of environmental health and oyster aquaculture grow-out conditions in Rehoboth Bay, Delaware. Coastal and Estuarine Research Federation meeting, Portland, OR, November 2023.	Cohort 1 student
Chigbu, P. 2023. A model for fostering collaborative student research in a multi-institutional Center 153rd Annual Meeting. August 19-24, 2023. Grand Rapids, MI. Oral Presentation.	Direct
Chigbu, P. 2023. The Impact of African Americans in Aquatic Sciences. Presented at American Fisheries Society 153rd Annual Meeting. August 19-24, 2023. Grand Rapids, MI. Oral Presentation.	Direct
Ching, C., Y. Tsang, **J. A. Miller**, S. Honarvar, K. Fraiola, and H. Clilverd. 2023. Understanding Amphidromy of the Native Hawaiian Goby, 'O'opu Nākea (*Awaous stamineus*). Freshwater Sciences 2023. Brisbane, Australia.	Leveraged
Czajkowski*C. 2023. Novel Approaches to Combating *Vibrio* sp. In Oysters (*Crassostrea virginica*). Presentation of her Master's Thesis. April 24, 2023. Advisor: Dennis McIntosh.	LMRCSC FY16 Student
Day, J., et al. 2023. Parentage analysis of Tamanend's bottlenose dolphins (*Tursiops erebennus*) in estuarine waters near Savannah, GA and coastal waters off North Carolina. Southeast and Mid-Atlantic Marine Mammal Symposium, April 2023, Mobile, AL. oral.	Cohort 1 Student
Fuchsman, C.A. 2023. Zooplankton and Biogeochemical Cycling in an oxygen deficient zone. Chemical Oceanography Gordon Conference. Invited Speaker: Southern New Hampshire University, New Hampshire.	Leveraged
Herrera*, J. 2023. Investigating Blue Crab Viruses and the Implications for Fishery Biosecurity. American Fisheries Society, Grand Rapids MI. Aug. 20-24, 2023. (oral)	Cohort 1 Student

Hintz C, E Hester, V Unnone, K Hintz. 2023. Beachfront Light Pollution Measures. Georgia Department of Natural Resources Spring Sea Turtle Cooperative Meeting, April 2023, Brunswick.	leveraged
Hintz, K, **C Hintz**, E Hester, D Grossman. 2023. Radiometric calibration of consumer cameras for measuring coastal light pollution. Society of Photooptic Instrumentation Engineers: Defence+Commercial Sensing May 2023. Paper 12543-16. Orlando.	leveraged
Hoskins-Brown, D. 2023. Black, Green, and Blue: An American Fisheries Identity, American Fisheries Society, Grand Rapids, MI, August 19-24, 2023	leveraged
Hoskins-Brown, D. 2023. Implementing the Cooperative Research Model Through the NOAA Living Marine Resources Cooperative Science Center, Grand Rapids, MI, August 19-24, 2023	LMRCSC service delivery model
Hoskins-Brown, D. 2023. Super Shrimp Makes the Big Move South, American Fisheries Society, Grand Rapids, MI, Aug. 19-24, 2023	leveraged
Hoskins-Brown, D. L. 2023. Current Challenges on the Landscape: Sea Level Rise, Garden Club of America, Jekyll Island, GA Nov 8, 2023	Direct
Hoskins-Brown, D. L. 2023. Using Artificial Oyster Reef Substrate and sUAS Technology to Evaluate Oyster Reef Restoration and Assessment in the Southeast, State of the Georgia Coast, Sept 21-23, 2023	Direct
Hoskins-Brown, D. 2023. Using Artificial Oyster Reef Substrate and sUAS Technology to Evaluate Oyster Reef Restoration and Assessment in the Southeast. Habitat Conservation Division All Hands Meeting, May 17, 2023 (virtual)	LMRCSC postdoctoral work, also leveraged
Howard*, K. and D. Hoskins-Brown. 2023. Understanding the Effect Terrapin Excluder Devices Have on Blue Crab (*Callinectes sapidus*) Catch in Georgia Waters. ASLO, Palma de Mallorca, Spain, June 4-9, 2023	LMRCSC graduate
Huanca-Valenzuela P., Cram, J.A. **Fuchsman, C.A**. 2023. Comparing the microorganisms capable of using alternate reduced nitrogen sources between oxic and anoxic ocean regions. Speaker: 2023 Aquatic Sciences Meeting, Palma, Spain.	Leveraged
Huckaby* K, Mullins C, White R, Sayre B, Younkin J, Witiak S. VA. 2023. Comparison Study of Coupled vs. Decoupled Aquaponic System: Crop Quantity and Quality. Presented at American Fisheries Society 153rd Annual Meeting. August 19-24, 2023. Grand Rapids, MI. Oral Presentation.	Cohort 1 Student
Johnson*, T., Richards, G., Jacobs, J., Townsend, H., Almuhaideb, E., Meredith, J., Rosales, D., **Chigbu, P., Dasilva, L., and Parveen, S**. 2023. Incidence and pathogenic potential of *Shewanella* species found in Chesapeake and Maryland Coastal Bays oysters and seawater. University of Maryland Eastern Shore Annual Research Symposium 2023. Princess Anne, MD. April 17-April 20, 2023. 2nd place award for Poster Presentation & 3MT.	Cohort 1 Student

Johnson*, T., Richards, G., Jacobs, J., Townsend, H., Almuhaideb, E., Meredith, J., Rosales, D., **Chigbu, P., Dasilva, L., and Parveen, S**. 2023. Occurrences and pathogenic potential of *Shewanella* species found in oysters and seawater from the Chesapeake and Maryland Coastal Bays. American Society of Microbiology (ASM) 2023 Conference. Houston TX. June 15-June 19, 2023.	Cohort 1 Student
Johnson*, T., Richards, G., Jacobs, J., Townsend, H., Almuhaideb, E., Meredith, J., Rosales, **D., Chigbu, P., Dasilva, L., and Parveen, S**. 2023. Prevalence of *Shewanella* species found in Oysters & Seawater from Mid-Atlantic Region. Living Marine Resources Cooperative Science Center (LMRCSC) Annual Meeting 2023. Virtual meeting. March 31, 2023.	Cohort 1 Student
Kienle S, Sperou E, Borras-Chavez R, Krause D, van der Linde K, **Bonin C**. 2023. Variability in the ecophysiology of leopard seals across the Southern Ocean (and beyond). XIII Scientific Committee on Antarctic Research Biology Symposium, 31 July - 4 August 2023, Christchurch, New Zealand	Leveraged
Krause DJ, **Bonin CA**, Goebel ME, Reiss CS, Watters GM. 2023. Crash and learn? The rapid population collapse of Antarctic fur seal colonies in the northern Antarctic Peninsula endangers genetic diversity and resilience to climate change. XIII Scientific Committee on Antarctic Research Biology Symposium, 31 July - 4 August 2023, Christchurch, New Zealand	Leveraged
Miller, J. A., Almeida, L. Z., **Thalmann*, H.**, Forney, R., Laurel, B. 2023. The potential role of enhanced selective mortality during marine heatwaves. North Pacific Marine Science Organization Annual Meeting, Seattle, WA.	Leveraged
Miller, J. A., Almeida, L.Z., **Thalmann, H**., Forney, R., and Laurel, B.J. 2023. Enhanced selective mortality during marine heatwaves. American Fisheries Society Annual Meetings, Grand Rapids, MI. Oral presentation.	Direct
Miller, J. A., Almeida, L.Z., **Thalmann, H.L**., Rogers, L., Brooks, T., Forney, R., and Laurel, B.J. 2023. Thermal effects on early life stages of Gulf of Alaska Pacific Cod: shifts in reproductive phenology, size, and growth. Alaska Marine Science Symposium, Anchorage, AK. Oral presentation.	Direct
Mingli Zhao, Donald Behringer, Louis Plough, Jamie Bojko, Andrew Kough, **Eric Schott.** 2023. Association of climate and season with prevalence of a pathogenic virus of the Atlantic blue crab across two hemispheres. Int'l Conf and Workshop on Lobster and Crab, Perth Australia. Oct. 22-28, 2023	Leveraged and LMRCSC
Norrie, C., **Miller, J.A**., Morgan, C. A., Burke, B., Beckman, B. and L. A. Weitkamp. 2023. Growth, size, and survival: The impact of growth in the early ocean and lower Columbia River estuary on early ocean survival of Interior Columbia River Spring Chinook salmon. 2023 Columbia River Estuary Conference: Reconnection. Astoria, OR	Leveraged
Pares, O*., Zhao, M., Stevens, M., and Schott, E. 2023. The artisanal *Callinectes* spp. crab fishery in Puerto Rico: multi-species abundance and reproductive state. American Fisheries Society, Grand Rapids MI. Aug. 20-24, 2023. Oral.	Leveraged and LMRCSC
Perrtree, R. et al. 2023. Low Reproduction Indicative of Healthy Dolphin Population? Southeast and Mid-Atlantic Marine Mammal Symposium, April 2023, Mobile, AL. poster.	Leveraged

Perrtree, R.M., C.A. Archer, **T.M. Cox**. 2023. Dolphin-human interactions have declined in the Savannah area; Let's keep it that way. State of the Georgia Coast, September 2023, Tybee, GA. speed talk.	Leveraged
Ramos*, J., Attarala, T., **Andrade*, E., Ozbay, G**. 2023. Population Characteristics Assessment on Blue Crabs (*Callinectes sapidus*) and Virus Identification of Callinectes sapidus Reovirus1. Coastal and Estuarine Research Federation meeting, Portland, OR, November 2023.	Cohort 2 student/leveraged
Ramos*, J., Attarwala, T., Teat, M. 2023. Population Characteristic Assessment of Blue Crab (*Callinectes sapidus*) and Virus Identification of Reovirus 1 (CsRV1) using PCR Analysis on Delaware Inland Bays. Presented at the American Fisheries Society Meeting, Grand Rapids, MI. August 2023.	LMRCSC Cohort 2 student
Reyes Delgado* A. 2023. Diet Variation and Trophic Impact of Weakfish (*Cynoscion regalis*) Within Multiple Marine Habitats of the Eastern U.S. Presented at 153rd AFS Annual Meeting. August 20-24, 2023. Grand Rapids MI, August. Oral Presentation.	Cohort 1 Student
Reyes Delgado* A. 2023. Diet Variation and Trophic Impact of Weakfish (*Cynoscion regalis*) Within Multiple Marine Habitats of the Eastern U.S. Presented at 36th AFS Annual Chapter Meeting. March 23-25, 2023. Solomons, MD. Oral Presentation.	Cohort 1 Student
Sperou ES, Krause DJ, Borras-Chavez R, Charapata P, Costa DP, Crocker DE, Smith KJ., Goebel ME, Kanatous SB, Trumble SJ, **Bonin C**, Kienle SS. 2023. Variability and phenotypic plasticity in resource use in the Antarctic apex predator, the leopard seal. XIII Scientific Committee on Antarctic Research Biology Symposium, 31 July - 4 August 2023, Christchurch, New Zealand	Leveraged
Spiessl, M. et al. 2023. Assessing management boundaries of the common bottlenose dolphin *Tursiops truncatus* via collaborative photo-identification Southeast and Mid-Atlantic Marine Mammal Symposium, April 2023, Mobile, AL. oral.	leveraged
Wade*, K., Wilberg, M., **Cullen, D.** 2023. Influence of environmental factors on distributions of Jonah and Atlantic rock crabs. Oral. American Fisheries Society, Grand Rapids MI. Aug. 20-24, 2023.	Cohort 1 Student
Zhao, Mingli, Behringer, Donald C., Plough, Louis V., Bojko, Jamie., Kough, Andrew S., **Schott, Eric** J. 2023. Cross-Hemispheric prevalence, genetic diversity and spatial genetic structure of *Callinectes sapidus* reovirus 1 (CsRV1). Society for Invertebrate Pathology Conference, July 30- Aug 2, 2023. College Park, MD.	Leveraged

Table 29.4: Poster presentations at professional meetings (virtual and in-person). Center students are identified by asterisk (*). Students supported under the FY16 award are marked by †. Center scientists' names appear in bold.

Poster presentations at professional meetings	Justification
Alvarez, C.A.*, R.M. Perrtree, **T.M. Cox**. 2023. Habitat use by Tamanend's bottlenose dolphin mothers with young-of-year near Savannah, Georgia. State of the Georgia Coast, September 2023, Tybee, GA. poster.	LMRCSC FY21 Cohort 1

Andrade*, E., Allison*, R., Bland, A., Gadde, M., Nakazwe, M., Venello, T., **Ozbay, G**. 2023. Investigating the Relationship Between Physical Water Quality Parameters and Chlorophyll-*a* in Rehoboth Bay, Delaware. Presented at the Atlantic Estuarine Research Society Meeting, Long Branch, NJ, March 2023.	LMRCSC Cohort 1 Student
Burns, W*, C Hintz, A Richards, B Menard. 2023. Developing Global Strontium Reference Material Using Cultured Sharks' Teeth. State of Georgia Coast Symposium. September 2023. Tybee Island.	LMRCSC 16 Cohort 5 student
Hawkins*, P., J.W. Reustle. 2023. Linking Biomass of Herbivorous Fishes to Varying Levels of Herbivory Pressure in Mo'orea, French Polynesia. Association for the Sciences of Limnology and Oceanography. 2023. Mallorca, Spain (Oral).	LMRCSC FY16 Student
Jamon* J, Maria K, Elliott H, Ryan F, Issac S, Nerea O. 2023. Seascape Applications: Swordfish Habitat Compression in Proposed Chumash National Marine Sanctuary. Presented at 153rd America Fisheries Society Annual Meeting. August 20th-24th. 2023. Grand Rapids, MI. Poster Presentation	Direct support
Johnson*, T., Richards, G., Jacobs, J., Townsend, H., Almuhaideb, E., Meredith, J., Rosales, D., **Chigbu, P., Dasilva, L., and Parveen, S**. 2023. Incidence and pathogenic potential of *Shewanella* species found in Chesapeake and Maryland Coastal Bays oysters and seawater. University of Maryland Eastern Shore Annual Research Symposium 2023. Princess Anne, MD. April 17-April 20, 2023. 2nd place award for Poster Presentation & 3MT.	Cohort 1 Student
Layeni, A.*and J.W. Reustle. 2023. Microplastic deposition on urbanized, temperate oyster reefs. Association for the Sciences of Limnology and Oceanography. 2023. Mallorca, Spain (Poster).	Cohort 2 Student
Lemaire, C*, C Hintz, D. Hoskins-Brown, J Doerr, J Carroll. 2023. Exploring whether carbonate chemistry should be considered in site selection for Eastern Oyster (*Crassostrea virginica*). State of Georgia Coast Symposium. September 2023. Tybee Island.	LMRCSC 16 Cohort 5 student; FY 21 Cohort 1
Ramirez-Joseph*, L. and J.W. Reustle. 2023. Assessing the strength of top-down community regulation on urbanized, temperate oyster reefs. Association for the Sciences of Limnology and Oceanography. 2023. Mallorca, Spain (Poster).	Cohort 1 Student
Ramos*, J., Attarwala, T., Paraseimehr, A., **Ozbay, G**. 2023. Population Characteristics Assessment and Virus Identifications of the Blue Crab Using PCR Analysis on the Delaware Inland Bays. Presented at the Atlantic Estuarine Research Society Meeting, Long Branch, NJ, March 2023.	Leveraged
Reeves, T*., C. Schweitzer, and **A. Horodysky**. 2023. Effect of the Environment on Pigmentation in the Grass Shrimp, *Palaemonetes pugio.* Association for the Sciences of Limnology and Oceanography. 2023. Mallorca, Spain (Poster).	Cohort 1 Student

Register, R *., and T. Adebola. 2023. Monitoring Species Diversity of Fish Species Along a Salinity Gradient in the Chesapeake Bay. Association for the Sciences of Limnology and Oceanography. 2023. Mallorca, Spain (Poster).	Cohort 2 Student
Richardson, D**., J.W. Reustle**, J. Alexander, A. Fritz, Y. Galindo, A.C.D. Davis, P.H. Barber, Peggy Fong, C.R. Fong. 2023. Linking sedimentation and algal growth to the biomass of herbivorous fishes on tropical coral reefs in Mo'orea, French Polynesia. Association for the Sciences of Limnology and Oceanography. 2023. Mallorca, Spain (Poster).	Leveraged
Smith, S., Chigbu, P., Ozbay, G., McIntosh, D., Blank, G. 2023. Fisheries, Aquaculture and Aquatic Chemistry: Diversity in Estuarine Research at Delaware State University. Presented at the ASLO Meeting, Palma de Mallorca, Spain, June 2023.	Leveraged
Tait, N.*, T. Adebola. 2023. Exploring Fisheries Policy Options to Control Invasive Catfish in Chesapeake Bay Using Ecopath with Ecosim. Association for the Sciences of Limnology and Oceanography. 2023. Mallorca, Spain (Poster).	Cohort 1 Student
Thalmann*, H.L., Laurel, B.J., and **Miller, J.A**. 2023. Juvenile Pacific Cod nursery growth and foraging in response to marine heatwaves in the Gulf of Alaska. 5th International Symposium on Effects of Climate Change on the World's Ocean. Bergen, Norway. Poster	LMRCSC FY16 Student
Wilson*, A. 2023. Age and Growth of Lane Snapper in the Gulf of Mexico. Presented at the ASLO Aquatic Sciences Meeting 2023. Mallorca, Spain. Poster Presentation, June 4-9, 2023.	LMRCSC FY16 t student

Table 29.5: Theses and dissertations produced by Center Fellows.

Author	Title
Day, J. 2023. Genetic Analysis of Tamanend's Bottlenose Dolphins (*Tursiops erebennus*) Former scientific name: common bottlenose dolphins (*Tursiops truncatus*)	Cohort 1 student
Smalls, J. 2023. Abundance, Antibiotic Resistance, Genetic Diversity of Vibrio spp. and Diversity of Microbial Communities in Blue Crabs and Seawater from the Maryland Coastal Bays	Cohort 1 student
Tait, N. Dec. 2023. Exploring Fisheries Policy Options for Controlling Invasive Blue Catfish in Chesapeake Bay using Ecopath with Ecosim	Cohort 1 student
Wade, K. 2023. Effects of environmental variables and changes in seasonal patterns on spatial distributions of Jonah crabs (Cancer borealis) and Atlantic rock crabs (*Cancer irroratus*) in Georges Bank and the Mid-Atlantic Bight, USA.	Cohort 1 student
Wilson, A. T. 2023. Age, Growth, and Genetic Diversity of Lane Snapper, a Data Limited Species. Doctoral Dissertation. University of Miami. Marine Biology and Ecology. https://miami.primo.exlibrisgroup.com/permalink/01UOML_INST/444g86/alma991031954518002976	LMRCSC 2016 grant student

What individuals worked on this project?

Table 33.1: Individuals who worked on LMRCSC during this reporting period.

Last name	First Name	Total number of months worked during this time period	Project Role	Contribution to project (briefly describe)	State, U.S. territory, and/or country of residence	Collaborated with individual in a foreign country	Travelled to foreign country
Smith	Stacy	10	PD/PI	PD for DSU	Delaware, USA	no	no
McIntosh	Dennis	10	Faculty	Mentored graduate students, not funded	Delaware, USA	no	no
Ozbay	Gulnihal	10	Faculty	Mentored graduate students, not funded	Delaware, USA	no	yes
Andrade	Emily	10	Graduate Student (research assistant)	Research/Wrote TAB	Delaware, USA	no	no
Ramos	Juan	10	Graduate Student (research assistant)	Research	Delaware, USA	no	yes
Tait	Noah	10	Graduate Student (research assistant)	Student transitioned from FY16 program, and continues to conduct his ecosystem modeling work	Virginia, USA	no	yes
Layeni	Amira	10	Graduate Student (research assistant)	Conducted MS thesis research	Virginia, USA	no	yes
Joseph	Lucia	10	Graduate Student (research assistant)	Conducted MS thesis research	Virginia, USA	no	yes
Santos	Ian	4.5	Graduate Student (research assistant)	Conducted MS thesis research	Virginia, USA	no	

Reeves	T'Kiyah	10	Undergrad. Student	Student transitioned from FY16 program, and is working on macroinvertebrate research	Virginia, USA	no	yes
Register	Reese	3	Undergrad. Student	Conducted Senior Thesis research	Virginia, USA	no	yes
Morris	Halia	4.5	Undergrad. Student	Conducted Senior Thesis research	Virginia, USA	no	
Gibson	Deidre	10	PD/PI	PD of HU LMRCSC - Mentoring students, reporting, and meetings	Virginia, USA	no	yes
Lewallen	Carolina	5	Faculty	Graduate coordinator for LMRCSC graduate students	Virginia, USA	yes	yes
Reustle	Joseph	10	Faculty	Advisor for two LMRCSC graduate students	Virginia, USA	no	yes
Miller	Jessica	2	Co PD/PI	Programmatic and fiscal management of award, facilitation of student progress, recruiting and retention activities	Oregon, USA	no	no
Cohn	Leanne	10	Graduate Student (research assistant)	Conducted MS thesis research	Oregon, USA	no	no
Jordan	Jamon	10	Graduate Student (research assistant)	Conducted MS thesis research	Oregon, USA	no	no
Clax	Savannah	10	Graduate Student (research assistant)	Conducted MS thesis research	Oregon, USA	no	no
Day	Joe	4	Graduate Student (research assistant)	Took classes, performed research, defended thesis	Georgia, USA.	no	no
Lemaire	Cloe	10	Graduate Student (research assistant)	Took classes, performed research, defended thesis	Georgia, USA.	no	no

Hoskins-Brown	Dionne	6	Co PD/PI	Supervised students and staff, wrote proposals, performed research	Georgia, USA	no	no
Gordon	Juan	6	Undergrad. Student	Took classes	South Carolina, USA	no	
Leonard	Kaila	6	Graduate Student (research assistant)	Took classes, developed research topic	Georgia, USA	no	
Schott	Eric	2.5	Co PD/PI	LMRCSC-UMCES Program Director	Maryland, USA	yes	yes
Pares	Olivia	10	Graduate Student (research assistant)	Invertebrate fisheries and corals	Maryland, USA	no	
Herrera	Jennifer	10	Graduate Student (research assistant)	Invertebrate fishery and biosecurity	Maryland, USA	no	
Garcia	David	10	Graduate Student (research assistant)	Phyto- and zooplankton in ocean food web	Maryland, USA	no	
Wade	Kaitlynn	10	Graduate Student (research assistant)	Recruitment of reef fish	Maryland, USA	no	
Lucchese	Veronica	4	Graduate Student (research assistant)	Recruitment of reef fish	Maryland, USA	no	
Babcock	Elizabeth	0.5	PD/PI	PD for UM-Rosenstiel	Florida, USA	yes	yes
Die	David	0.2	Co PD/PI	Co-PI for UM-Rosenstiel	Florida, USA	yes	yes
Best-Otubu	Chryston	10	Graduate Student (research assistant)	Working on dissertation on ecosystem modeling for Biscayne Bay	Florida, USA	no	no
Fernandez	Michelle	10	Graduate Student (research assistant)	Working on dissertation on ecosystem modeling	Florida, USA	no	no

Jimenez	Aracelis	4	Graduate Student (research assistant)	Working on dissertation on social aspects of shark interactions with fisheries	Florida, USA	no	no
Jones	Daenen	6	Graduate Student (research assistant)	Working on dissertation on impacts of parasites on fisheries	Florida, USA	no	no
Tilghman	Ida	10	Other Professional	Administrative activities	Maryland, USA	no	no
Sexton	Margaret	10	Faculty	Trained students, center administration	Maryland, USA	no	no
Steffanson	Magnus	1	Faculty	DRS	Massachusetts, USA	no	no
Chigbu	Paulinus	10	PD/PI	Trained students, center administration	Maryland, USA	no	no
Dasilva	Ligia	10	Faculty	Trained students	Maryland, USA	no	no
Kessie	Alexander	10	Other Professional	Administrative activities	Maryland, USA	no	no
Young	Victoria	10	Faculty	Trained students, center administration	Georgia, USA	no	no
Nuzback	Kara	5	Other Professional	Center communications	Maryland, USA	no	no
Daniels	Christopher	3.5	Other Professional	Boat operation	Maryland, USA	no	no
Ahemedaltayb	Abdal Hafiz	7	Staff Scientist	Trained students, center research activities	Maryland, USA	no	no
Potter	Amelia	1	Faculty	Taught course for Geoscience Bridge Program	Maryland, USA	no	no
Ishaque	Ali	2	Faculty	Trained students	Maryland, USA	no	no
Sneade	April	1	Faculty	Taught course for Geoscience Bridge Program	Maryland, USA	no	no
Rose	Lang	1	Other Professional	Boat operation	Maryland, USA	no	no
Scott	Cy'Anna	2	Other Professional	Trained students, center administration	Maryland, USA	no	no
Hicks	Leah	1.5	Geoscience Bridge Program Intern	Participated in classes and training activities	Delaware, USA	no	no

Curry	Alexandria	1.5	Geoscience Bridge Program Intern	Participated in classes and training activities	Illinois, USA	no	no
Rawlinson	Sarah	1.5	Geoscience Bridge Program Intern	Participated in classes and training activities	Texas, USA	no	no
Britton	Alleyah	1.5	Geoscience Bridge Program Intern	Participated in classes and training activities	Maryland, USA	no	no
Brown	Malika	3	Undergrad. Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Clovis	Nina	7	Undergrad. Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Collins	Glen	10	Undergrad. Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Bowie	Myah	4	Undergrad. Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Jones	Leianna	4	Undergrad. Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Ahmed	Tebyan	10	Graduate Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Reyes Delgado	Angel	10	Graduate Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Roberts	Cali	3	Graduate Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Wilburn	Imani	6	Graduate Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Huckaby	Kayland	10	Graduate Student	Took classes, performed research	Maryland, USA	no	no

			(research assistant)				
Johnson	Tahirah	10	Graduate Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Silver	Ashley	10	Graduate Student (research assistant)	Took classes, performed research	Maryland, USA	no	no
Smalls	Jasmine	6	Graduate Student (research assistant)	Took classes, performed research	Maryland, USA	no	no

34. Changes to Active other support

Table 34.1: Changes to Active Other Support

PD/PI or key personnel name	Description of support	Source of support	Description of change
Gibson	Racial Equity grant	NSF	Additional funding
Eric Schott	Support for an outreach coordinator 2023-2025	France Merrick Fund	new grant
Eric Schott	novel Blue crab culture method	MD Industrial Partnerships	new funding

35. What other organizations have been involved as partners?

Table 35: Organizations that have been involved as partners

Type of partner organization	Name	Location	Partners contribution to the project
Commercial	DE Cultured Seafood	Sussex County, DIB	Boat Captain/Oyster Leases
Federal	Olympic Coast National Marine Sanctuary (OCNMS)	Port Angeles, WA	Research collaboration, data sharing, NERTO mentors
Federal	NOAA SEFSW	Miami, FL	Mentoring students
Federal	NOAA NWFSC	Seattle, WA	Mentoring students
Federal	NOAA NEFSC	Rhode Island	Mentoring students
NGO	Waterfront Partnership of Baltimore	Baltimore	Co-production and funding of water quality study
NGO	National Aquarium	Baltimore	co-production of biodiversity study
NGO	Environmental justice journalism initiative	Baltimore	Support URM contacts and awareness of fishery science
NGO	South Baltimore Gateway Partnership	Baltimore	co-production of Middle branch science

NGO	Baltimore UnderGround Science Space	Baltimore	co-production of biodiversity study
Non-Profit	CBF	Hampton, VA	Assisting new faculty and students connect to the regional oyster network.
Non-Profit	Shored Up	Hampton, VA	Assisting new faculty and students connect to the regional oyster network.
Non-Profit	Chesapeake Oyster Alliance	Hampton, VA	Assisting new faculty and students connect to the regional oyster network.
State government	MD DNR	Annapolis, MD	Co-advised MS student in ecosystem services
State government	MD DNR	Annapolis, MD	Operation of a water quality sonde in Baltimore Harbor
Federal Commission	Gullah Geechee Cultural Heritage Corridor Commission	Beaufort, SC	Included LMRCSC faculty as subawardee on NOAA grant
State government	GADNR	Brunswick, GA	Nets & gear, committee membership
private industry	BF Consultants	McDonough, GA	evaluation services and participation
State government	SCDNR	Charleston, SC	Grant development
State government	Florida Fish and Wildlife Commission	Jacksonville, FL	Research collaboration
State government	Florida FWC	Miami, FL	Helped student access data
State University	Virginia Tech	Hampton, VA	Providing Aquaculture opportunities for HU students
University	Coppin State	Baltimore	Co-production of STEM education proposals
University	Morgan State	Baltimore	Co-production of STEM education proposals

36. Have other collaborators or contacts been involved?

Table 36.1: NOAA scientists who have collaborated with the Center during this reporting period.

Last name	First name	Title/Affiliation	Description of involvement
Ailloud	Lisa	SEFSC	Collaborator
Alade	Larry	NEFSC	NERTO mentor for A. Silver
Allman	Robert	SEFSC	NERTO mentor for Daenen Jones
Antoun	Helena	SEFSC	O. Pares NOAA mentor, NERTO mentor
Barnett	Beverly	SEFSC	NERTO mentor for Daenen Jones
Browder	Joan	SEFSC	NOAA mentor for Chryston Best-Otubu

Craig	Kevin	SEFSC	K. Wade NERTO advisor
DeLorenzo	Marie	NOAA NCCOS, Hollings Marine Lab Charleston, SC	MS committee and NERTO mentor
Denson	LaTreese	SEFSC	Collaborator
Doerr	Jennier	SEFSC/Galveston	NERTO mentor
Feist	Blake	NWFSC	NERTO mentor for Leanne Cohn
Galaska	Michael	NWFSC	D. Garcia Prieto NERTO mentor
Harvey	Chris	NWFSC	committee member for Leanne Cohn
Hazen	Eliott	SWFSC	NERTO mentor and committee member for Jamon Jordan
Hernandez	Frank	SEFSC	NERTO Mentor to Kayland Huckaby
Leo	Jennifer	SEFSC Habitat Ecology Branch	Grant Collaborator, NERTO mentor
Johnson	Matthew	SEFSC Habitat Ecology Branch	Grant Collaborator, student mentor
Hill	Ron	SESFC Panama City	Committee member for Shaneese Mackey
MacPherson	Matthew	SEFSC Social Science Research Group Branch	Grant Collaborator
Stoffle	Brent	SEFSC Social Science Research Group Branch	Grant Collaborator
Blake	Suzana	SEFSC Social Science Research Group Branch	Grant Collaborator
Hunsicker	Mary	NWFSC	NERTO mentor and committee member for Savannah Clax
Jacobs	John	NEFSC/Cooperative Oxford Lab	NERTO mentor
Jewett	Libby	NEFSC	Speaker/participant in 2023 Annual Assembly
Kaplan	Isaac	NWFSC	NERTO mentor for Chryston Best-Otubu
Karnauskas	Mandy	SEFSC	Collaborator
Madley	Kevin	Greater Atlantic Regional Fisheries Office	MS committee and NERTO mentor
McCandless	Cami	NEFSC	NERTO mentor for Michelle Fernandez
McCarthy	Kevin	SEFSC	Collaborator
Passerotti	Michelle	NEFSC	NERTO mentor for Michelle Fernandez
Richards	Paul	SEFSC	Collaborator
Julie	Rose	NEFSC	Advisor for Schott on bivalve ecosystem services
Schirippa	Michael	SEFSC	Collaborator
Serafy	Joe	SEFSC	PhD Committee member for Chryston Best-Otubu
Shambaugh	James	NWFSC	D. Garcia Prieto NERTO mentor
Shank	Burton	NEFSC	K. Wade NOAA advisor
Meseck	Shannon	NEFSC	NERTO mentor for Jen Herrera
Shertzer	Kyle	SEFSC	K. Wade NERTO advisor

Smith	Brian	NEFSC	NERTO mentor to Angel Reyes Delgado
Thorson	James	AFSC	Collaborator
Townsend	Howard	Oxford NOAA Chesapeake Bay Office	MS committee and NERTO mentor
Walter	John	SEFSC	Collaborator
Wikfors	Gary	NEFCS/Milford Lab	TAB collaborator
Wren	Johanna	PIFSC	NERTO mentor and committee member for Jennifer Wong-Ala
Zapfe	Glen	SEFSC	NERTO Mentor to Kayland Huckaby

Table 36.2: Other collaborators involved in Center activities during this reporting period.

Last name	First name	Title/Affiliation	Description of involvement
Aquafeda	Mike	Aquaculture Specialist, Rutgers Haskin Shellfish Research Laboratory	Contributor to training provided at Annual Fellow Assembly
Bachvaroff	Tsvetan	Associate Professor, UMCES	Grant collaborator
Brown	Donzell	Exec. director, EJJI.org	Outreach collaborator
Burge	Colleen	UC Davis Bodega Marine Laboratory	Research Scientist Supervisor, PHD committee O. Pares
Casey	Mark	Oyster Aquaculturist	Drives students, allows them to use his oyster aquaculture leases/cages for research
Council	Tanner	Chesapeake Oyster Alliance Manager	Assisting new faculty and students connect to the regional oyster network.
Everett	Christie	CBF Hampton Roads Director	Assisting PD with grantsmanship to create a living shoreline at HU
Fowler	Amy	Associate Professor, Geo Mason U	PhD committee member, O Pares
Lucas	Matthew	Assistant Professor, Universidad Interamericana de Puerto Rico	O. Pares NERTO collaborator
Miller	Stephen	Associate Professor, UMBC	Associate Professor, UMCES
Miller	Thomas	Professor, UMCES	PhD committee member, O. Pares
Nesslage	Genevieve	Assoc. Research Professor, UMCES	PhD committee member, K. Wade, O. Pares
Neubert	Claire	Co-owner of Shored Up	Assisting new faculty and students connect to the regional oyster network.
Parsaeimehr	Ali	Postdoctoral Researcher	Helped students with DNA/eDNA analysis, posters
Plough	Louis	Associate Professor, UMCES	Grant collaborator
Alber	Merryl	Professor, UGA	Grant collaborator
Watts	Josiah	100Miles	Grant collaborator
Gambill	Jill		Grant collaborator

Shannon	Jackie	Oyster restoration manager	Assisting new faculty and students connect to the regional oyster network.
Waddell	Jenny	Research Coordinator, OCNMS	Research collaboration, data sharing, NERTO mentor
Wilberg	Michael	Professor, UMCES	PhD committee member, K. Wade

Appendix 1: Student Funding and Progress

First	Last	URM (y or n)	Cohort #	Degree	Partner	Tuition	Stipend	Travel	NERTO	One-time Research Support	Professional Development
Tebyan	Ahmed	Y	1	M.S.	UMES	$21,657	$41,374	$522	$0	$0	$0
Cesar	Alvarez	Y	1	B.S.	SSU	$9,531	$13,067	$0	$0	$0	$1,073
Emily	Andrade	Y	1	M.S.	DSU	$5,808	$25,385	$2,527	$0	$0	$288
Chryston	Best-Otubu	Y	1	Ph.D.	UM-RS	$9,240	$21,475	$0	$0	$0	$1,059
Myah	Bowie	Y	2	B.S.	UMES	$4,449	$7,000	$756	$0	$0	$0
Malika	Brown	Y	1	B.S.	UMES	$8,898	$14,000	$0	$0	$0	$0
Savannah	Clax	Y	2	M.S.	OSU	$9,942	$23,750	$0	$9,451	$0	$1,508
Nina	Clovis	Y	1	B.S.	UMES	$13,347	$14,000	$522	$0	$0	$0
Leanne	Cohn	Y	1	M.S.	OSU	$11,494	$16,250	$0	$0	$0	$0
Glen	Colins	Y	1	B.S.	UMES	$29,592	$29,312	$8,830	$0	$0	$0
Joe	Day	Y	1	M.S.	SSU	$0	$12,500	$0	$0	$0	$0
Michelle	Fernandez	Y	1	Ph.D.	UM-RS	$19,580	$31,000	$0	$16,795	$89	$1,054
David	Garcia Prieto	Y	1	Ph.D.	UMCES	$4,140	$33,215	$0	$0	$0	$894
Juan	Gordon	Y	2	B.S.	SSU	$8,123	$0	$0	$0	$0	$1,288
Jennifer	Herrera	Y	1	Ph.D.	UMCES	$4,140	$33,129	$1,500	$0	$0	$234
Kayland	Huckaby	Y	1	Ph.D.	UMES	$23,590	$62,952	$3,305	$23,001	$0	$0
Aracelis	Jimenez	Y	3	Ph.D.	UM-RS	$0	$12,700	$0	$0	$0	$1,337
Tahirah	Johnson	Y	1	Ph.D.	UMES	$8,923	$63,227	$4,800	$0	$0	$0
Leianna	Jones	N	2	B.S.	UMES	$4,449	$7,000	$522	$0	$0	$0
Daenen	Jones	Y	2	Ph.D.	UM-RS	$40,370	$31,000	$0	$0	$0	$976
Jamon	Jordan	Y	1	M.S.	OSU	$8,461	$16,250	$356	$7,975	$0	$4,025
Lucia	Joseph	Y	1	M.S.	HU	$12,290	$19,000	$2,088	$0	$0	$958
Amira	Layeni	Y	2	M.S.	HU	$12,290	$19,000	$2,329	$0	$0	$861
Cloe	Lemaire	N	1	M.S.	SSU	$1,443	$12,500	$0	$0	$0	$1,094
Kaila	Leonard	Y	2	M.S.	SSU	$5,292	$0	$0	$0	$0	$1,178
Veronica	Lucchese	Y	2	Ph.D.	UMCES	$2,484	$9,115	$0	$0	$0	$566
Nylah	McClain	Y	2	Ph.D.	UMES	$1,779	$13,170	$0	$0	$0	$0
Halia	Morris	Y	3	B.S.	HU	$10,500	$7,000	$0	$0	$0	$981
Olivia	Pares	Y	1	Ph.D.	UMCES	$0	$27,398	$0	$0	$1,486	$0
Juan	Ramos	Y	2	M.S.	DSU	$0	$25,385	$2,815	$0	$0	$644
T'Kiyah	Reeves	Y	1	B.S.	HU	$21,000	$25,666	$0	$0	$0	$288
Reese	Register	Y	2	B.S.	HU	$21,000	$21,000	$0	$0	$0	$895
Angel	Reyes Delgado	Y	1	M.S.	UMES	$1,980	$43,034	$6,712	$0	$0	$0
Ian	Santos	Y	3	M.S.	HU	$6,145	$10,000	$0	$0	$0	$522
Michon	Shaw	Y	1	B.S.	SSU	$3,342	$0	$0	$0	$0	$0
Ashley	Silver	Y	1	Ph.D.	UMES	$9,365	$60,195	$0	$0	$0	$0
Jasmine	Smalls	Y	1	Ph.D.	UMES	$942	$32,904	$0	$0	$0	$0
Noah	Tait	N	1	M.S.	HU	$12,290	$19,000	$248	$0	$0	$882

Kaitlynn	Wade	N	1	M.S.	UMCES	$4,140	$29,118	$1,337	$0	$0	$698
Imani	Wilburn	Y	1	M.S.	UMES	$180	$28,918	$0	$0	$0	$0
Jennifer	Wong-Ala	Y	3	Ph.D.	OSU	$0	$0	$0	$0	$0	$1,234
Cali	Roberts	Y	3	M.S.	UMES	$0	$0	$0	$0	$0	$0

First	Last	URM (y or n)	Cohort #	Degree	Partner	Cohort Experience	NERTO	Ethical Conduct of Research Training	Data Management Course	NOAA Mentor
Tebyan	Ahmed	Y	1	M.S.	UMES	Fall 2023	Sum 2024	Sp 2023	Sp 2023	Fall 2023
Cesar	Alvarez	Y	1	B.S.	SSU	Fall 2023	NA	Sp 2024	Sp 2024	NA
Emily	Andrade	Y	1	M.S.	DSU	2022/2023	2022	2021	2021	Yes
Chryston	Best-Otubu	Y	1	Ph.D.	UMRS	Fall 2022	Sum 22	Fall 20	Fall 20	Yes
Myah	Bowie	Y	2	B.S.	UMES	Fall 2023	NA	Sum 2023	Sp 2024	NA
Malika	Brown	Y	1	B.S.	UMES	Fall 2022	NA	Sp 2022	Fall 2021	NA
Savannah	Clax	Y	2	M.S.	OSU	Fall 2023	23-Sep	Sp 2024	Fal 2023	Yes
Nina	Clovis	Y	1	B.S.	UMES	Fall 2023	NA	Sp 2022	Sp 2022	NA
Leanne	Cohn	Y	1	M.S.	OSU	Fall 2022	Fall 2021	Fall 2021	Fall 2021	Yes
Glen	Colins	Y	1	B.S.	UMES	Fall 2023	NA	Sp 2021	Sp 2023	NA
Joe	Day	Y	1	M.S.	SSU	Fall 2022	Sum 22	Spr 20	Fall 21	Yes
Michelle	Fernandez	Y	1	Ph.D.	UMES	Fall 2023	Sum 2022	Fall 2021	Fall 2021	Yes
David	Garcia Prieto	Y	1	Ph.D.	UMRS	Fall 2022	Sum 23	Fall 22	Fall 23	Yes
Juan	Gordon	Y	2	B.S.	SSU	Fall 2023	NA	Fall 2024	Fall 2024	NA
Jennifer	Herrera	Y	1	Ph.D.	UMCES	Fall 2023	Aug-22	Fall 2023	Sp 2023	Yes
Kayland	Huckaby	Y	1	Ph.D.	UMES	Fall 2023	Sum 2023	Sp 2023	Sp 2023	Yes
Aracelis	Jimenez	Y	3	Ph.D.	UMRS	Fall 2023	Sum 2025	Sp 2024	Fall 2023	Sp 2024
Tahirah	Johnson	Y	1	Ph.D.	UMES	Fall 2023	Sum 2022	Fall 2019	Fall 2020	Yes
Leianna	Jones	N	2	B.S.	UMES	Fall 2023	NA	Sum 2023	Fall 2023	NA
Daenen	Jones	Y	2	Ph.D.	UMRS	Fall 22	Sum 24	Fall 22	Fall 22	Yes
Jamon	Jordan	Y	1	M.S.	OSU	Fall 2023	23-Sep	Sp 2024	Sp2023	Yes
Lucia	Joseph	Y	1	M.S.	HU	Sept. 2023	23-Aug	Oct. 2022	Oct. 2022	Yes
Amira	Layeni	Y	2	M.S.	HU	Sept. 2023	23-Aug	Oct. 2022	Oct. 2022	Yes
Cloe	Lemaire	N	1	M.S.	SSU	Fall 2023	Sum 22	Fall 21	Fall 21	Yes

Kaila	Leonard	Y	2	M.S.	SSU	Fall 2023	NA	Fall 2023	Fall 2023	NA
Veronica	Lucchese	Y	2	Ph.D.	UMCES	Fall 2023	Sum 2025	Fall 2023	Fall 2023	Sp 2024
Nylah	McClain	Y	2	Ph.D.	UMES	Fall 2023	Sum 2025	Fall 2023	Fall 2023	Sp 2024
Halia	Morris	Y	3	B.S.	HU	Sept. 2023	NA	Sp 2024	Sp 2024	NA
Olivia	Pares	Y	1	Ph.D.	UMCES	Fall 2022	Sum 2022	Spr 2022	Fall 2020	Yes
Juan	Ramos	Y	2	M.S.	UMCES	Fall 2023	Sum 2022	Spr 2022	Sp 2023	Yes
T'Kiyah	Reeves	Y	1	B.S.	DSU	2023	Sum 2024	Sp 2023	Fall 2023	Sp 2024
Reese	Register	Y	2	B.S.	HU	Sept. 2023	NA	Sp 2021	Fall 2021	NA
Angel	Reyes Delgado	Y	1	M.S.	HU	Sept. 2023	NA	Oct. 2022	Oct. 2022	NA
Ian	Santos	Y	3	M.S.	HU	Sept. 2023	Sum 2024	Fall 2023	Fall 2023	Yes
Michon	Shaw	Y	1	B.S.	SSU		NA	Sp 2021	Fall 2021	NA
Ashley	Silver	Y	1	Ph.D.	UMES	Fall 2023	Sum 2021	Fall 2020	Sp 2021	Yes
Jasmine	Smalls	Y	1	Ph.D.	UMES	Fall 2022	Sum 2022	Sp 2022	Sp 2023	Yes
Noah	Tait	N	1	M.S.	HU	Sept. 2023	22-Aug	Sp 2022	Sp 2023	Yes
Kaitlynn	Wade	N	1	M.S.	UMCES	Fall 2023	Sum 2022	Sp 2023	Fall 2021	Yes
Imani	Wilburn	Y	1	M.S.	UMES	Fall 2022	Sum 2022	Sp 2020	Fall 2020	Yes
Jennifer	Wong-Ala	Y	3	Ph.D.	OSU	Fall 2023	Sum 2022	Sp 2022	Fall 2021	Yes
Cali	Roberts	Y	3	M.S.	UMES	Fall 2024	Sum 2025	Sp 2024	Fall 2024	Sp 2024

Appendix 2: Leveraged Funding

Source	Type	Start date - end date	Total amount	Current 6 month period	PI	Project title	Contribution to Center
USDA NIFA	Grant	5/15/2022-5/14/2025	$347,976	$ 3,000.00	Dennis McIntosh	DE Shellfish Aquaculture: Training To Support An Emerging Industry	Support for LMRCSC student pay for 2 months during thesis writing.
NSF EPSCor	Grant	8/1/2018-9/30/2023	$500,000	$ 6,000.00	Cherese Winstead	RII Track 1: Water Security in Delaware's Changing Coastal Environment	Support for LMRCSC student travel (Andrade, Teat, Ramos)
USDA NIFA	Grant	9/1/2020-8/2023	10,000	$ 6,000.00	UAPB/Ozbay	International student engagement with water quality science	Travel support for Juan Ramos for Ghana trip.

NOAA Sea Grant	Grant	8/1/2023-7/31/2025	60,342	None yet	Joseph Reustle	Raising Awareness of Marine Pollution in Underserved Populations (RAMP-UP)	Funds will be used to educate the HU campus and city on the issues surrounding microplastics. Teaching modules will enhance current MES courses.
NSF Office of Polar Programs	Grant	8/1/2022-7/31/2025	310,000	100,000	Carolina Lewallen	Move, adapt, or die: Examining adaptive capacity in a Southern Ocean apex predator, the leopard seal	Funds will be used to train MES and Biology students in polar research.
NSF HRD RIA HBCU-UP	Grant	8/1/2020-7/31/2024	345,000	90,000	Carolina Lewallen	The Epigenomics of dolphin skin	Funds will be used to train MES and Biology students in polar research.
DOD Office of Naval Research	Grant	12/1/2021-11/31/2023	32,000	10,000	Carolina Lewallen	Internships for Diversity and Inclusion in Marine Mammal Research	Funds are used to support HU students in research and internship participation.
NSF OCE	Grant	8/1/2022-7/31/2025	1.6M	500,000	Deidre Gibson	Association for the Science of Limnology and Oceanography-Multicultural Program	Two grants overlapped to support student travel to ASLO and OSM conferences
NSF-HRD	Grant	8/1/2019-7/31/2024	399,999	70,000	Deidre Gibson	Targeted Infusion Project: Mathematical Engagement for the Marine, Biological, and Environmental Realms of Science	These funds are used to enhance the quantitative engagement in courses in MES and Biology
NSF-OCE	Grant	8/1/2020-7/31/2024	60,500	20,000	Deidre Gibson	Cold Tongue Mixing	These funds are used to build research collaboration with HU, OSU, and U of Ghana for students.
NSF EiR	Grant	4/1/2021-3/31/2025	500,000	150,000	Deidre Gibson, CoPI	Integrated Sensor-Robot Networks for Real-time Environmental Monitoring and Marine Ecosystem Restoration in the Hampton River	These funds are used to expose students to integrated sensor networks for in situ environmental monitoring
NSF HRD Racial Equity	Grant	8/1/2023-7/31/2028	$1.3 M	300000	Deidre Gibson	Building Racial Equity in Marine Science	These funds will be used to build culturally relevant courses for HU and the LMRCSC, build eDNA research, summer bridge program, and community engagement

Private	Donation	8/1/2022-7/31/2025	$1.2M	550,000	Deidre Gibson	Supporting Student Recruitment, Student Success, Faculty and Research in Hampton University's Departments of Marine and Environmental Science and Biological Sciences	These funds are used to support departmental activities that include start up for new faculty, scholarships for students, summer bridge program, scuba training, facility upgrades, and new equipment
Pacific States Marine Fisheries Commission	Subaward	2/1/2023-6/30/2025	$380,056	35,000	JA Miller	Impacts of ocean warming on early life history of Gulf of Alaska Pacific Cod	Funds provide support for supplies and equipment used by MS student S. Calx and support research technician that provides research support to S. Calx and salary support for PI Miller
4316440	Grant	1/1/2019-4/1/23	$239,661	$22,801	Allen Place	BWF A Global Defense for Coral Reef Wildlife: Creating Carbon Negative Habitat	Supports technology to protect coral habitat
4316900	Grant	5/1/2020 - 7/31/2023	$223,586	$27,379	Allen Place	Mote - Pushing Karenia over the edge with Nature Derived Flavenoids	Control of harmful algae blooms
USDA	Grant	9/1/2021-8/31/2026	$ 247,722	$ 19,007	Allen Place	Place: USDA- UMBC Sustainable Aquaculture Systems Supporting Atlantic Salmon	
MD Dept of te Env	Grant	7/6/2022-3/31/2023	$ 94,624	$ 81,910	Allen Place	Place: MDE: Nutrient source assessment and cyanobacteria/cyantoxin production assessment	
NOAA	Grant	9/1/2020-8/31/2023	$116,000	$ 13,133	Allen Place	Place NOAA Impact of pH and Dissolved Organic Carbon on Phytoplankton Community Composition in Two New Jersey Estuaries	
NOAA	Grant	9/1/2022-8/31/2023	$1,643,762	$167,459	Allen Place	Place: HAB: NOAA: US-HABCI (US Harmful Algal Bloom Control Incubator)	
South Balt Gateway Partnership	Grant	2/2/2022-2/2/2024	$ 67,163	$ 9,000	Eric Schott	Schott: SBGP Installation & Operation of a Middle Branch Water Quality Sonde, NOTE: Intern paid in Summer & Schott paid in fall w/ conference in fall	
NSF	Grant	7/1/2017-6/30/2023	$362,497	$ 14,865	Eric Schott	Schott- NSF- Determining how variation in life history and connectivity drive	

						pathogen-host dynamics and genetic structure	
NSF	Grant	7/1/2017-6/30/2023	$31,288	$ -	Eric Schott	Schott- NSF-Determining how variation in life history and connectivity drive pathogen-host dynamics (Participant support)	
MD SeaGrant	Grant	2/1/2022-1/31/2024	$ 70,000	$ 11,710	Eric Schott	Schott: NOAA MDSG: Assessing the risk of interstate imports, aquaculture and stress to amplify virus diversity and prevalence in Maryland blue crabs	
MD SeaGrant	Grant	9/1/2022-8/31/2023	$ 6,678	$ 825	Eric Schott	Schott: NOAA: Building capacity of land based Atlantic salmon aquaculture	
DOE	Grant	10/1/2020-9/30/2023	$ 346,871	$ 79,827	Feng Chen	Chen - DOE A Highly Efficient Microalgae-Based Carbon Sequestration System To Reduce Carbon Dioxide Emission From Power	
Korean KIMST	Grant	1/1/2019-12/31/2023	$ 115,011	$ 2,250	J. Sook Chung	KIMST Agreement on International Collaborative Research on Oceans and Fisheries	
NIFA (sub to UMES)	Grant	4/1/2021-3/31/2024	$ 24,640	$ 7,861	J. Sook Chung	Chung-UMES-NIFA Understanding per and polyfluoroalkyl substances (PFAS): occurrence, fate and transport in plants and their impact on plant-insect interactions	
TEDCO	Grant	10/21/2021-2/15/2023	$ 90,000	$ 28,898	J. Sook Chung	Chung: TEDCO: Shrimp Density Optimization	
RATCLIFFE Fdn	Grant	7/1/2014-8/31/2023	$1,659,216	$ 41,249	Russell Hill	RATCLIFFE-The Ratcliffe Environmental Entrepreneurs Fellowship Program (REEF)	
DOE	Grant	10/1/2020-9/30/2023	$ 336,753	$ 36,122	Russell Hill	Hill - DOE A Highly Efficient Microalgae-Based Carbon Sequestration System To Reduce Carbon Dioxide Emission From Power	
Bailey Wildlife Fdn	Grant	1/1/2019-4/1/23	$ 188,535	$ 24,022	Yantao Li	BWF A Global Defense for Coral Reef Wildlife: Creating Carbon Negative Habitat	
MD Industrial Partnerships	Grant	8/1/2022-7/31/2023	$ 59,047	$ 1,362	Yantao Li	Li: MIPS: AlgaBT Phase II	
DOE	Grant	10/1/2020-9/30/2023	$1,102,876	$ 195,245	Yantao Li	Li - DOE A Highly Efficient Microalgae-Based Carbon Sequestration System	

						To Reduce Carbon Dioxide Emission From Power Pl	
CINAR-NOAA	Coop. agreement	2023-2025	$ 73,000	$ 18,250	Michael Wilberg	Development and implementation of approaches to support the Maryland benchmark stock assessment for eastern oyster in the Chesapeake Bay	Aquaculture and habitat
BGE	Grant	5/2023-9/2023	$ 10,000	$ 10,000	Eric Schott	Support for underrepresented minorities to participate in the IMET Summer Internship	Training URM in marine science
MD Sea Grant	Grant	9/2022-8/2023		$ 5,600	Eric Schott	Continuation of Aquaculture Hub: Building capacity of land-based Atlantic salmon aquaculture in the US	Aquaculture
France Merrick Fdn	Grant	June 2023-June 2025	$ 241,000	$ -	Eric Schott	support a new outreach program to increase community-engaged research and expand career pathways for students underrepresented in environmental science	Training URM in marine science
NSF	Grant	2/23/2021-2/22/24	$323,985	$107,985	P. Chigbu; M. Sexton	REU Site: University of Maryland Eastern Shore Research Experience for Undergrad.	Funds support summer interns
NSF	Grant	1/1/2024-1/1/2025	$ 650,000	$ 650,000	Yantao Li, Eliz. North	NSF Convergence Accelerator Track I: A new biomanufacturing process for carbon negative calcium carbonate	Carbon sequestration. Supports LMRCSC-associated faculty at UCES
Miller Foundation		1/1/2014-9/31/2024	$ 20,000	0	Russell Hill	Support for IMET summer internship	Funding for diverse summer intern
NOAA CBO	Grant	10/1/23 – 9/30/26	$450,000	~$20,000	P. Chigbu; A. Ishaque	Trophic role, energy densities and fatty acid composition of forage fishes	Funds support students & research
UMCES anonymous donor		1/1/2014-9/31/2024	$ 20,000	0	Russell Hill	Support for IMET summer internship	Funding for diverse summer intern

Appendix 3: Performance Measures

Activities	Proposed (12 months)	Accomplished (3/1/23-12/31/23)
Submission of monthly invoices to UMES	Monthly	Average time between invoices = 1.72 months
Successful execution of sub-awards (<60 days of receiving award notification from NOAA EPP)	October or earlier	
Evaluate budget to ensure center funds are expended in accordance with budgets approved by NOAA EPP and incompliance with federal and state guidelines	Every 6 months	Every 6 months
Submission of semi-annual reports	Every 6 months	Every 6 months
Submission of student tracker data	Every 6 months	Completed in September
Organize special summer programs (including REU, Geoscience Bridge Program, and Annual Fellow Assembly	3-5 annually	4 Summer programs at partner institutions provided information about the Center to participants; the Annual Fellow Assembly will be held in Fall 2023
Establish inter-institutional partnerships with other MSIs	4	None during this reporting period
# of featured articles in print or digital media per year referencing LMRCSC	At least 25 annually	8
# evaluation practices established to meet center effectiveness	At least 5	3 (Individual Student Development Plan, assessment surveys, competency rubrics)
Funding of collaborative research projects via TAB review process	11 annually	8
Peer reviewed papers	25 annually, at least 5 student authors	19 (5 student author)
Scientific presentations at conferences	25 annually, at least 5 student authors	53 (27 student presenters)

Key Success Criteria, Outcomes, Outputs, and Annual Deliverables of Center Administration

Performance Measures of Success of LMRCSC-II Education and Training Programs

Activities	Proposed (12 months)	Accomplished (3/1/23-12/31/23)
Recruit and train students	23 annually (6 B.S., 10 M.S., 7 Ph.D.). At least 75% of the students at each degree level will belong to URM communities.	A total of 42 fellows received training as part of LMRCSC-II Cohorts during this period including 26 (6 B.S., 11 M.S., 9 Ph.D.) in Cohort 1, and 11 (4 B.S., 4 M.S., 3 Ph.D.) in Cohort 2, and 5 (1 B.S., 2, M.S., and 2 Ph.D.). Thirty-eight (90%) of the students trained belong to underrepresented minority groups. Twelve (12) students were recruited to the Center during this period.
Graduates	55 total, (16 B.S., 30 M.S., 9 Ph.D.). At least 75% of the students at each degree level will belong to URM communities.	Three students graduated during this period (2 M.S. and 1 B.S.). Two graduates (1 M.S and 1 B.S.) belong to URM communities.
Graduates entering NOAA-mission workforce	3 annually	1
Graduates in NOAA mission-related post-doctoral level program	1 annually	None during this period
Leveraged funds	$3.5 Million annually	$3.42 Million
Internships for extended research visits (4 week minimum)	8-10 annually	7
Peer reviewed papers	25 annually, at least 5 student authors	19 (5 student author)
Scientific presentations at conferences	25 annually, at least 5 student authors	53 (27 student presenters)
Students will acquire quantitative and analytical skills by taking various fisheries science and related courses the Center has included in alignment with the core competency rubric.		
Students will acquire increased competence in applying Fisheries Science		The Annual Fellow Assembly introduced all fellows to these concepts ensuring that they all have

to decision making, policy and management in alignment with the core competency rubric		awareness of these topics. Future trainings and research activities will advance their competency.
Students will acquire increased skills to use large data sets, statistical analysis, computer modeling, and algorithm development, in alignment with the core competency rubric.		Data Management training was offered Dec. 7-9 to introduce students to these skills. 8 students participated. All graduates students who were enrolled in the center at that time have now completed this training.
Each semester the center will hold at least one seminar on a NOAA Priority area including but not limited to policy applications, 'omics, uncrewed systems, artificial intelligence. Each student will be required to attend a minimum of 3 of these seminars in their first two years of support.		Subject matter experts were engaged to deliver these in upcoming semesters.

Performance Measures of Success of LMRCSC-II Research

Activities	Proposed (12 months)	Accomplished (3/1/23-8/31/23)
Conduct 17-18 research projects between LMRCSC scientists and students particularly at MSIs and NOAA partners		13
NOAA Scientists serve as mentors and advisors to students	10-25 annually	39 NOAA Scientists engaged with Center Fellows as mentors and advisors during this period.
Intra-institutional partnerships in support of NOAA's Mission	4 annually	2
Use of NOAA data in research and tool development	3 annually	7
Peer reviewed papers	25 annually, at least 5 student authors	19 (5 student author)
Scientific presentations at conferences	25 annually, at least 5 student authors	53 (27 student presenters)
Inter-institutional partnerships in support of NOAA's mission	3 annually	19

Leveraged funds	$3.5 Million annually	$3.42 Million
Number of times publications are cited	Will be documented	Publications have been cited 4 times so far.
Students, faculty, and staff who receive recognition for their research	Will be documented	Two students received awards for presentations

Appendix 4 Evaluation Report

LMRCSC Annual Evaluation Report

August 2023

College of Exploration

The Living Marine Resources Cooperative Science Center (LMRCSC) was "established in October 2001 as a cooperative agreement between NOAA's Educational Partnership Program (EPP), and a collective of universities to address environmental, natural resources management and STEM workforce challenges…." The mission of the Center "is to prepare a diverse student body for careers in marine and fisheries science through exemplary academic and research collaborations." The LMRCSC was awarded additional funding with the new program beginning in 2022. The project leadership continued to contract with The College of Exploration (TCOE) to develop and implement an external evaluation of the project.

Evaluation Report from September 2022 to February 2023

In the first half of this program year, the evaluators participated in monthly executive committee calls, education committee calls, and were participant observers of the online Fellows Assembly sessions.

The evaluators also listened in online on the first six presentations by the graduate students about their research in December 2022 and January 2023.The evaluators created a short survey for the graduate student presenters, asking them to reflect on their presentation experience and think about how it went, its benefits and challenges. This survey was ready to be disseminated with results to be included in the second half of the yearly report.

The Data Carpentry course was held online on Feb 4 and 5, 2023. A survey was distributed at the end of the course and to date 10 participating students have completed it. A review of initial survey responses indicated a positive reaction to the course. Several students would have preferred it to be face- to- face but most were satisfied with the online format. Analyses of this survey's responses will be completed and included in this final report.

The survey for the Fellows assembly was the main evaluation method for the first half of the project year. The following is the report on the responses to that survey.

LMRCSC Fellows Assembly Survey Report
January 2023

The Fellow Assembly was held online during November and December 2022 at several different time periods.

Demographics

The LMRCSC Fellows Assembly survey was distributed electronically to participants at the end of the series. Seventeen respondents completed the survey and included three each from UMES, Hampton University, Oregon State, and Miami-RSMAS; two respondents each from IMET and Savannah State; and one respondent from Delaware State. Three of the respondents were undergraduates. Seven respondents were master's level and seven were doctoral students. And finally, nine of the respondents were new to LMRCSC this year, and one was a previous undergraduate who is now a graduate student. The remaining respondents included:

- Two prior undergraduates who are still undergraduate level.
- Four students who were new to LMRCSC last year, two of whom indicate they are graduate level and two provided no academic standing.

Perception of the Assembly

Item four of the survey asked respondents to rate the Fellows Assembly relative to their expectations. Of the seventeen responses, eleven selected strongly agree or agree that the Assembly fully met expectations. Five responses were neutral to the prompt, and one respondent disagreed with the prompt. Nine respondents chose to leave a narrative reaction to this prompt. One cluster of responses conveyed some disappointment that the event was virtual and not face-to-face. Nevertheless, other narrative responses suggested there was valuable content conveyed, that information was useful, and that several topics related to one student's thesis. There is a sense in the responses that students desired a more personal connection with cohort members and that this connection could have been stronger for some respondents.

Items five, six, and seven focused on the online format of the event. Twelve of the seventeen rated the online format as strongly positive or positive. Four responses were neutral, and one was negative. A follow-on item asked respondents to identify benefits of the online format as narrative responses. Several themes or clusters of responses emerged: the online format provided flexibility for students for when they viewed or participated; the online format was more environmentally sensitive in reducing air travel; this format allowed speakers from multiple locations who might otherwise not been able to travel. A few respondents noted that if they had to travel to attend in person, the Assembly would have negatively impacted their study time. Nevertheless, several respondents did express a sense of loss in not meeting other students in person.

Finally, item seven asked respondents to describe challenges with the virtual nature of the experience. Several students described the difficulty of the 2.5-hour duration and the difficulty of engaging and paying attention for that length of time and the time of day. The time of day was clearly a concern for several respondents. There were some technical difficulties, but these were not as strong for students as was the time of day and duration as challenges.

These reactions to virtual vs. in person were mixed, with expressions of both pros and cons.

Plans for a face-to-face Assembly in Fall 2023 should address more personal connection needs through in person relationship building.

Program Content Assessment

Item eight asked respondents to rate seven focused content areas that were included in the Assembly. In gross measures, the *science con*tent rated higher than the *program orientation* elements (orientation to iSpring, Student Development Plan, NERTO and TAB), although one important narrative response from one student noted that the details of the NERTO project presented in the Assembly were very strong and would have been highly beneficial to this student had these details been shared the previous year. Among the other categories which were rated (the science content), Climate Impacts on Marine Ecosystems and Social Science Integration rated the highest among respondents. The evaluator notes this positive rating for Social Science particularly as this was a system-wide struggle for the CSCs in the prior funding cycle.

Item nine asked respondents to rate a set of personal and professional benefits of the Fellows Assembly in importance from 1-5 with five being the highest rating. The item allowed multiple items to have the same rating. The following is a list of these items ranked highest to lowest by respondent score:

1. Obtaining career opportunities and pathways (70.59)
2. Developing a better understanding of NOAA's mission science and career opportunities (64.71)
3. Developing relationships with NOAA scientists (64.71)
4. Fostering cooperation and collaboration in research (58.82)
5. Obtaining an understanding of my responsibilities as a student in LMRCSC (52.94)
6. Developing relationships with other LMRCSC personnel (52.94)
7. Developing relationships with other students (47.06)
8. Developing relationships with faculty from my institution (47.06)
9. Enhancing communications skills (47.06)
10. Developing relationships with faculty from other institutions (41.18)
11. Developing time management skills (35.29)

LMRCSC Fellows Assembly Data Analysis continued

The Fellows overwhelmingly agreed that they better understood NOAA LMRCSC's goals and objectives because of the Fellows Assembly (Question 11) and that they better understood NOAA's mission science because of the Fellows Assembly (Question 12). These were seen by the evaluators as excellent outcomes from this program. However, on each of these questions, there was one lone dissenter, who did not agree with these statements.

When asked open-endedly to list the most helpful information they received during the Fellows Assembly it was noteworthy that familiarity with NOAA was listed for half of the students. They detailed understanding about NOAA research topics, hearing from NOAA scientists, and where NOAA labs are located.
Other helpful information was listed as:

- Information about various content areas
- Details about TAB and graduate seminar presentations
- How LMRCSC is organized
- Identifying a NOAA collaborator for TAB or NERTO (through Dr. Hoskins-Brown's help)

One person exclaimed “I thought it was all valuable.”

The Fellows were asked how the Assembly advanced or refined their academic goals. Many responses focused on helping them to learn about new areas of interest and focus. This Assembly helped identify their research areas and thesis topic. They stated that the Assembly “offered a direction to go” and a “platform to achieve success.” “Writing a TAB proposal won’t be as bad anymore.”

Similarly, they were asked about the Assembly’s role in helping them advance or refine career goals. They offered that the Assembly provided information and a path to NOAA careers and potential research areas. They also responded that it provided networking and meeting new people. Several people did not seem to think that the Assembly was helpful as they stated Not Applicable. One person highlighted this help by saying “It is a nice feeling knowing I am eligible for direct hire with NOAA upon completion of my degree…it is possible and not just a pipe dream.”

To Question 16, the ways that the Assembly fostered collaboration with students or faculty from other institutions, the responses were mixed. Some respondents reported that they made connections with other students while others felt that there was not much chance to interact, except for the breakouts. One person said that the Assembly “invited open participation via the online format” while another mentioned “the constraints of a virtual environment.” The evaluators have observed in multiple survey reactions, that there are two different points of view about virtual learning. But the evaluators believe that leadership should explore more ways to help the students interact with each other.

Most of the respondents to the inquiry question (Q17) about support from NOAA scientists evoked a very positive picture about their involvement. They shared that NOAA scientists gave wisdom and advice and talked about NOAA’s mission. These NOAA scientists were willing to help in the future and provide links and email addresses. This NOAA scientist-student exchange was deemed by the evaluation team as a significant achievement of the Fellows Assembly.

When asked about the single greatest benefit of the Fellows Assembly the following benefits were reported:

- Networking
- Connections, especially meeting and hearing from NOAA scientists
- Learning NOAA’s mission and areas of research
- Learning more overall; amount of information received

One especially illustrative example of the benefit from the Assembly was “I thought that learning some of the expectations from the program was really necessary. It is in writing but it isn’t always clear but hearing Dr. Chigbu tell me exactly what is expected from me gave it more meaning and was definitely clear that is was communicated to me.” This comment is testimony to the importance of this Assembly and to Dr. Chigbu’s excellent presentation about the LMRCSC.

Question 19 asked for activities or sessions that might have strengthened the Assembly. Five people made no response; six people preferred an in -person program and advocated more chance to get to know others in the program. More interaction possibilities during the sessions would be helpful too to get them to know their fellow students.

When asked about additional topics for follow-up information, several listed climate change. One person requested to be reminded of deadlines (email reminders). Other topics mentioned were healthy oceans, OAP, nutrient management, and habitat and biological systems.

Challenges encountered by the Fellows for participating in the Assembly were mostly related to time/timing and schedule issues. One person said, “Saturday night was tough.” One person had an Internet connection issue, but many Fellows said none or N/A in response to the query about challenges.

Evaluators’ Participant Observations

This Fellows Assembly was conducted on Zoom. Presentations were made from the faculty of the Center and from NOAA representatives. LMRSCSC had endeavored to present information to students and faculty alike over a period of a couple of weeks. The evaluators engaged as observers either live or as reviewers of recorded programs after the fact to obtain their own informed judgments of the efficacy of the programs. Their observations concur with the students—although this evaluation team did perceive perhaps stronger interpersonal communications among students than some of the stronger negative voices might have conveyed. For many of the participants or Fellows this was the first time that they got to meet each other and faculty from other institutions.

It was the evaluators’ perspectives that the range of presentations demonstrated the diversity of interests and focus of faculty and students. From the evaluators’ observations of the real time events, it could be seen that the participants benefited from interaction with the NOAA scientists and appreciated the overview of the Center and their upcoming course and program requirements. The sessions did seem to lack the opportunity for students to interact with each in informal ways to get to know the other students or the faculty from the other institutions.

Fellows Assembly Summary
It seemed clear that participants in the Fellows Assembly perceived a benefit to themselves from enhanced content knowledge of the core science mission areas of NOAA and connecting with NOAA scientists. They perceived enhanced understanding of the LMRCSC and connections to individuals across the Center. And as noted earlier, they have a stronger perception of the Social Science Integration area, which appears to be solidly conceptualized in the current project and as perceived by the students.

Evaluation Report March 2023-August 2023

In the second half of this project year the evaluators participated in monthly executive committee calls, engaged in education committee calls and activities, and supported efforts to address post-TAB assessment requirements.

In February and March, Peter Tuddenham and Tina Bishop completed two site visits to meet faculty and students. They attended a one-day American Shellfish Association meeting in Baltimore and were hosted by IMET’s Dr. Eric Schott. They met students from both IMET and Delaware State and watched presentations and reviewed posters by these students. They also travelled to Hampton University for a two-day site visit, meeting with Dr. Deidre Gibson, her faculty and students.

Survey work for this second half of the year included:

1. Undergraduate survey
2. Graduate survey
3. Graduate student presenter survey
4. Data carpentry supplemental survey

An additional survey was created for the LMRCSC leadership team to get a picture from the PIs about their perspectives of the program's education, research, and administration components to hep identify needed improvements in identified areas. To date, this survey has not yet been distributed to the leadership team.

Site visit summaries and synthesized survey results are included below.

National Shellfisheries Association Conference Baltimore
March 2023

Evaluators Dr. Tina Bishop and Peter Tuddenham attended the National Shellfisheries Association meeting in Baltimore on March 27, 2023. The evaluators met with Dr. Eric Schott who introduced them to students who would be presenting at this conference. Dr. Schott's students included Jennifer Herrera who presented on crab viromes and Olivia Pares who presented on crab disease.

The evaluators had a good block of time to talk with Dr. Schott and gain his perspectives on the LMRCSC program at his institution.

Emily Andrade presented; she is a master's Student at Del State in Natural Resources and works with Dr. Ozbay. Several Delaware State students presented their work in posters.

The evaluators were introduced to Louis Plough a faculty member at UMCES who has worked with LMRCSC students.

Dr. Schott organized a dinner for his IMET students and colleagues and for Dr. Gulnihal Ozbay, a faculty member of LMRCSC at Delaware State. The evaluators were invited to attend the dinner as well.

This meeting presented an excellent opportunity for IMET faculty and students to meet with Delaware State students and faculty, as well as to gain knowledge from research experts on shellfish of various types: clams, oysters, crab.

There was a session on diversity and inclusion which one of the evaluators attended.

Evaluation Site Visit Notes Hampton University
March 2023

The evaluators Peter Tuddenham and Dr. Tina Bishop of the College of Exploration made a site visit to Hampton University on March 6 and 7, 2023. Dr. Deidre Gibson organized the agenda and arranged meetings with herself, the students, and the faculty.
In addition, she arranged a meeting with the Dean and the Assistant Dean of Science at the

university.

The visit included an introductory tour of the campus and the Marine and Environmental Sciences building, dinner with Dr. Gibson and lunch with the Dean of Science and the Assistant Dean of Science.

Meetings with Faculty

The evaluators met with three faculty members who serve as professors in the Marine and Environmental Science department.

1) Dr. Tunde Adebola was new to Hampton. His focus is fish ecology, and he is developing a model for the Chesapeake Bay that incorporates social human impacts and uses ecosystem fisheries management approaches. He incorporates GIS and spatial ecology. At Hampton University and as part of LMRCSC he is currently mentoring an undergrad student and works with a newly recruited graduate student from ODU

Dr. Adebola was hired as Biology professor, and he also teaches non-LMRCSC students. He sees his mentoring role for LMRCSC to give back and to help to keep up his science research. He reported that both he as mentor and the student mentee signed an agreement with expectations and requirements.

He receives information about LMRCSC from Dr. Gibson. He said he has not had much personal exposure to NOAA. Dr. Adebola also mentioned that the career path can go both ways; some students end up at NOAA and some go back to academia.

2) Dr. Joey Ruestle is a first-year professor; came from UNC-Chapel Hill
and is developing an Ecology lab (REEL). His interest is oysters in estuaries and community ecology. This is a super dynamic system with connection to people. Funding from LMRCSC for students helps him with his lab. He teaches courses to LMRCSC students and works with graduates and helps with undergrads.

He is working with a grad student, building cages for oysters. He said that networking through LMRCSC is key for students. Students get acquainted with NOAA through this network.

He wonders sometimes if LMRCSC requirements are too much but says that students are learning how to balance. He expressed that it is great for students to get both the agency perspective and the academic perspective through LMRCSC.

He mentioned that sometimes wrong messages are going out to kids about careers in marine science. He would like to see marketing to HBCUs to present possibilities for marine sciences as well as marketing to community colleges.

His students presented at a recent fish data conference where his students met other LMRCSC students. His students wrote TABs and they are waiting to hear about them.

Dr. Ruestle presented a concern about the NERTO in that faculty can't do a field season with students if students must do their NERTO at the same time. There are time and timing issues. His research is constrained by oyster spawning time.

Dr. Ruestle told us about his interest in Native American topics as he is a member of the Lakota.

He would like to engage Native Americans in Virginia in oyster restoration. He stated the importance of indigenous knowledge as well as Western science- “Two-Eyed Seeing” with each having equal footing.

3) Dr. Carolina Lewallen
Dr. Carolina Bonin Lewallen is a marine biologist trained in population genetics and the use of molecular tools to study the ecology and behavior of marine organisms, particularly marine mammals. At Hampton University, she studies marine mammal ecology and behavior using molecular techniques to address new problems in marine science.

She has been at Hampton University since 2017 helping students as a mentor but currently, she is not mentoring any LMRCSC student. She teaches the capstone thesis course. She teaches how to interpret data and focuses extensively on scientific writing. She sees it as important to have writing class associated with student research.
She had two masters’ students and two undergrads in the lab with her. They wrote their theses on genetics of wildlife.

She works jointly in Biology and MES and teaches advanced genetics and biotech.
In general, she expressed the challenge that is it hard to get students to do research; it has become more challenging to get students to focus. They lack patience and don’t want to work hard and lack perseverance. This is more at the undergrad level than master’s degree level. These undergrads seem to be tired and very busy, and this affects their engagement in lab activities. She sees student development as an issue.
She also said that the masters’ degree program is course intensive at Hampton.

She stated that the NERTO has benefits but it is also hard to complete because there is only one summer for masters’ students to do NERTO and their own research. Because of this tension, she believes it is harder to find a NERTO mentor.

The ASLO multicultural program and its newsletter were good for recruitment. It was created by Dr. Cuker and he ran it for 30 years. She oversees masters’ recruitment. The personal networks of faculty help bring student interest. Dr. Lewallen does not see any issues with recruitment. Her prior mentees have gone to top jobs in marine mammal labs.

Dr, Lewallen highlighted that personal connections are what makes LMRCSC work. The network is important. Cross-university exchange is a good opportunity especially for undergrads.

She believes that LMRCSC needs to market to NOAA labs, to build awareness.

Discussion ensued about the possibility of a masters NERTO for 6 weeks that would be exposure to working in a NOAA lab and then a PhD NERTO for actual research. She suggested a matching service for students with labs.

Meeting with Dean and Associate Dean of Science

The evaluators and Dr. Gibson met with Dr. Isi Ero-Tolliver and Dr. Felis Jaetae Seo. Dr. Gibson and the evaluators had the opportunity to explain more about the workings of the LMRCSC. The evaluators highlighted the accomplishments of the students and the inspiration from meeting with both students and faculty on a face-to-face basis during the site visit. Dr. Ero-Tolliver presented the outstanding accomplishments of the Science Department at Hampton and

provided the evaluators with a document of highlights of the successes. The conversation was broad and included:

- discussion of how to better market Hampton and it accomplishments to NOAA.
- the importance of mentoring (Dr. Ero-Tolliver told of the importance of her mentor)
- the importance of middle school as a catalyst for career interest formulation

Meetings with Students

Current Undergrads

The evaluators met with two undergraduate students. One attributed her passion for marine science to a coastal science middle school. She grew up near the water and had wanted to do marine science since the age of 7. She wants to combine law and science and would like to be a policy analyst.

The other student has changed major interests and is new to LMRCSC. She seemed unclear of what her career direction would be. And she reported that she was not much interested in research.

One student stated that a big benefit of LMRCSC is to finish school without debt, unlike many of her friends who are encumbered with student debt.

They also benefited from the meeting for the CSCs at FAMU where they met other LMRCSC and CSC students. They were grateful for their participation in this meeting.

They were excited to be going to ASLO in Spain this summer and they would be doing poster presentations.

The Fellow Assembly was seen to be good to get information about science topics, but they viewed the sessions as being too long. They said that some scientists were engaging, and some were not that good.

One student wished that the program would grow and have more students and more faculty. They attested to the support of the faculty even though it is a small department. They said that the faculty help all students. They viewed that the LMRCSC is feasible as a program.

Graduate Students

Three graduate students met with the evaluators. One person came from the Biology major program at ODU and became an assistant for Dr. Adelbola. A second student was the daughter of a Hampton alumni and was able to carry on the legacy through the LMRCSC funding. Her desire was to get a job in a NOAA agency.

A third student was the daughter of parents who were biology and aquatic ecologists.

These two students mentioned a NOAA scientist and LMRCSC alumna who works at the Chesapeake Bay office and told the story of how this scientist found it difficult to find a position as a minority female.

The first graduate student completed his NERTO mostly virtually as it was developing software

models. He only spent a week at the LAB. His mentor was an eco-modelling expert at the Oxford Lab, where he had direct mentoring. He spoke of policy that would help his species of interest (blue catfish).

He mentioned that the balance is off with some of the intensive LMRCSC requirements. He thought the Data Carpentry course should be broken up in various ways. He said the course instructors for Data Carpentry were good. Hands-on R was helpful, and this could be in person. There were technical difficulties for students who were not tech savvy. He believed that data management skills are relevant as one must maintain one own's data.

He mentioned that it is hard to do both own research in summer and NERTO at the same time.

His suggestions included:

- Paperwork should be more streamlined. He told the story of how his offer letter never came from EPP and how that impacted his plan. He recommended that students start earlier especially if a security clearance is needed.
- Not many opportunities to interact with LMRCSC students or Faculty.
- Breakout rooms in a webinar are not enough; need to structure better interaction possibilities.

Former Undergraduates in the LMRCSC program.

The evaluators met with two former LMRCSC undergraduate students. Both were seniors. One had been funded for sophomore and junior year. His final year was not funded, which took a toll on him. He still does research though.

One mentioned that the professional development activities were good. The Forum was helpful. Now they have no networking through the program. One student is aiming to do a master's in oceanic modeling, having been on a Moorea course from UCLA.

The second student is applying for a federal job. It has been taking a long time to hear back from NOAA.

One student was a 4th generation Hampton graduate. His great grandmother and great grandfather met through Hampton University.

One student expressed satisfaction with meeting people through LMRCSC. They met people at the EPP Forum in FL. They will be going to Spain also and will give oral presentations.

Dr. Deidre Gibson PI

Dr. Gibson enthusiastically showed us around the campus; organized meetings with key faculty and students and was able to arrange an informative and productive lunch meeting with the Dean and Assistant Dean.

She conveyed the overall impression that LMRCSC had a positive impact on the campus and her students.

She did relay the following challenges:

- The NERTO requires so many weeks and it is difficult to get it to fit in to the students' schedules.

- Funding predictability and availability and timing makes it harder to recruit students.

She likes the cohort model for funding better than the old method. The cohort model is better organized and better for tracking. She conveyed that there had been a decrease in funding from year to year. She is only able to fund one undergrad and one grad student this year.

She acknowledged that students need to develop skills, such as writing. However, the increasing number of LMRCSC online activities creates additional demands which are challenging to fit in with student's other degree and program requirements.

She believed at that point that social science integration has had limited incorporation in student work. She feels that better clarification of NOAA EPP's intent about social science is needed.

While the goal of the program is for students to go into NOAA, there may be limited jobs there. She would like students to go into academia in jobs like hers.
There is good cooperation about universities and ample opportunity to exchange students, e.g., Hampton grads going to Oregon State.

The ongoing changing requirements established by NOAA EPP need to be better communicated through the LMRCSC system.

Lack of a Science Director for the last couple years has impacted the program.

We discussed the balance of offerings among the main core science areas in terms of course offerings, faculty, and students recruited. It was acknowledged that there is more limited emphasis on aquaculture and seafood safety. It is difficult for each LMRCSC university to address this balance because LMRCSC is not the only program that the universities participate in, and their research priorities differ based on faculty priorities for research and other considerations. Dr. Gibson stated that she will be working to connect with Virginia Tech to cooperate with aquaculture initiatives they are doing.

Graduate Student Presentation Series 2022-2023 Survey Results

One of the key desired outcomes for LMRCSC students as delineated in the education and training plan is to enhance professional/career development of students. Important in this professional development is the support of professional communications skills. To achieve this end, students are asked to do oral presentations at conferences, poster presentations, Fellows Assembly presentations, training workshops, and the online graduate presentation series.

For the 2022-2023 online presentation series, the evaluators created, administered and analyzed responses of graduate presenters to an eight-question survey. Nine graduate students responded.

Responding to the survey encouraged students to reflect on their presentation experience, with the goal of 1) helping them personally in future presentations and 2) continuous refinement and improvement by LMRCSC leadership for presentation and communication training methods.

The students thoughtfully articulated what they learned from their presentation experience. A couple of responses stated the importance of linking to NOAA mission goals and to link land and ocean in their research. They learned they must prepare thoroughly, have a clear

understanding of the topic, be aware of the time constraints, include real-life examples and visual aids, engage the audience, and highlight the importance of the research at the end.

They also learned to have more confidence, to respond appropriately to technical difficulties, and to serve as leader/facilitator.

When asked about what they would do differently in the future they listed:

- Make the presentation shorter.
- Spend more time practicing.
- Time the slides.
- Be more confident.
- Improve the flow to be more story-like.
- Connect land and sea.

One person preferred to do the presentation in person.

There was mixed reaction to the question about interaction with the student audience. Some felt interaction was high, while others thought it was medium or low.

When asked to tell how the presentation informed their research activities, several statements illustrated the helpfulness of the process.

1. Insightful questions offered new possible areas of research and helped thinking about data analysis and solidified the topic.
2. There was increased awareness that in order to present one must understand the topic and be clear on one's methods, results and significance.

In responses to inquiry about the benefits of doing the presentation, half of the respondents listed practicing presenting their research as the biggest benefit. It was seen to help prepare for future conference and lecture presentations and it was good to interact with other students.

One person expressed the benefit, saying" I think exposure and experience. Keeps me on my toes."

When asked to rate the online platform, 6 out of 8 rated it as excellent or very good. Most said the platform worked well and facilitated beneficial interaction with students and NERTO mentors. However, there was one rating of Fair and one person thought "Webex was a little daunting compared to other online platforms."

Challenges listed by respondents included:

- Juggling schoolwork
- Lack of preparedness
- Staying within the allotted time
- Technical difficulties
- Having access to my notes

Four of the respondents listed no challenges.

It may be advisable to try to identify the nature of the technical challenge and try to determine what those were and how to avoid that in the future.

Further comments included the recommendation to brainstorm ideas for how to get the students

to be more interactive. In this regard the suggestion was “At the end of each session, instead of asking if there are any questions have an activity where the students can comment on one thing that they found interesting about the presentation; one thing that they earned and have in on whiteboard jams.”

One respondent preferred a different time for the seminar.

One person summed up this way” It was a great experience as a presenter to practice the meeting facilitation part and I think this would be valuable for students in the future.”

Data Carpentry Course Evaluation Survey Report
March 2023

The Data Carpentry course was held online February 4 and 5, 2023 for the LMRCSC students. The evaluators created a survey to address additional feedback about the course, in addition to the survey about the course developed by the course providers. This additional survey requested feedback about course content and process that related directly to the LMRCSC program. Eleven students completed this survey.

Results

The evaluators were interested in finding out the previous experience these students had in statistics or data management. Responses to the survey revealed that the group had mixed course experience in those content areas. Four had 1-3 credit hours, five had 4-6 credit hours and two had greater than 6 hours. This indicated that students come into this program with varied statistical and data management knowledge. It is assumed then that the course participants will handle the course requirements with varying expertise and will benefit in different ways from this course experience.

When asked about the course pace, seven respondents said it was “just right” while four said the course pace was “too fast”. Although 10 students responded that the course would be useful for their career, one person was not sure. One person said “It was really, helpful. “Five students said the course was useful for meeting other students, but six said it was not useful.

When asked if the workshop content will be useful for a TAB or a NERTO they expressed positive comments. They valued R and one person said they had used R during their NERTO already. One person saw the usefulness of Open Refine for cleaning up fisheries data. Another said the ggplot lessons will be useful. Others attested to course content usefulness; it would be helpful for managing, analyzing and presenting data, particularly thesis data analysis and use in a TAB.

- The single most important skill element developed through this course was R with exposure to new software deemed to be beneficial. Combination of SQL and R
- Coding in R Studio
- How to organize data and which programs will help do that.
- Open Refine
- That R is case sensitive.
- Using ggplot in R studio and how to save those graphics for presentation.
- Coding and applying the data from excel to R or SQL

When asked about the sequencing the course in their academic program most of the respondents felt it was at an appropriate time, but one person thought it should have been

earlier.

When asked to rate the workshop overall, four rated it “excellent’, while seven said it was OK. The online effectiveness of the course was rated:

- Extremely Effective=3
- Very Effective=5
- Somewhat Effective=3

When asked to suggest ways to improve the workshop, the following recommendations were made:

- Spread the course out over more than 2 days. This was suggested by many respondents who suggested that this would help both the students and instructors. e.g., could be 5-hour sessions for 5 days.
  “Two long days of dense materials is straining and taxing.”
- Use more examples outside of Biology and in particular use information that is exclusive to LMRCSC.
- Tailor it more to marine/environmental science.
- Though logistically difficult, holding the course in person would increase interactivity with other LMRCSC Fellows. This preference for in-person was mentioned several times. One person iterated “Breakout rooms do not prove to be a sufficient substitute for face-to-face interaction.”
- Move the introduction to R at end of Day 1; then introduce SQL at the beginning of Day 2. “ I had a hard time remembering and linking together the tasks I performed in SQL to what I was trying to do in R.”

A concluding statement was that “It was very good, and I learned more than I have in other data workshops I’ve attended.”

LMRCSC Undergraduate Student Survey Spring 2023

The external evaluators refined an end of year survey for undergraduate student participants in the LMRCSC based on the substantive program revisions moving into this new, five-year funding period. The survey was circulated to LMRCSC leadership for review, and then distributed electronically to the eight undergraduate students in late April to ascertain participant perceptions of the program over this past year. Six of the eight undergraduate students provided responses, which have been summarized below. Data are summarized as follows, with a final Summary section at the end of this report.

Items one through four were demographic. The six responding students were comprised of three from UMES, two from Hampton University, and one from Savannah State University. Each of these six students are pursuing BS degrees at their respective home institution. The degree areas include Marine Science (three students), Marine and Environmental (two students) and one student in Environmental Science.

The diversity of the undergraduate degrees appropriately is narrower than the range of degree disciplines reported by the graduate students this year. But as noted in that graduate student report, it may be interesting to understand more deeply how students differentiate their disciplinary preferences as they learn the field and move from undergraduate to graduate levels. Finally, item four allowed respondents to identify the career they are most interested in pursuing. Three used the word “research” paired to either science policy or oceanography.

Two responded with marine biology and one student explicitly stated “fisheries biologist” but qualified this with “or working in law enforcement” and wasn’t really sure which direction held most draw for him/her.

Item five asked respondents to describe experiences or benefits they had attending or presenting at conferences through LMRCSC. Five of the six respondents indicated networking with other students, grad students or scientists, and one student indicated conferences fostered learning about career and research opportunities. The sensitivity and awareness of the importance of networking is notable here as it is indeed important to the career but is already an awareness of these undergraduates which can be fostered on through graduate school. Confidence building was also noted as a benefit.

Item six queried respondents on meaningful and impactful mentors who had influenced these respondents. Interestingly, only three of the six students provided a response. Of these three, two pointed to a concept of mentoring that was career and education focused—helping shape an academic project and introducing the student to the LMRCSC. One respondent named an LMRCSC Center professional as a nice person, pointing more to interpersonal and human/social support for that student. There is a gap in these undergraduates’ responses to mentoring: three simply marked “n/a” indicating that they couldn’t name a mentor. Identifying early mentors for undergraduate students is a discussion that LMRCSC leadership may wish to undertake.

In item seven, three of the five respondents were able to name a specific, organized science program other than LMRCSC in which they had participated in college. The SSU Bridge to Research in Marine Sciences REU in the Great Lakes, Woods Hole’s PEP Program, and the REU in Marine Biology at the Doris Duke Conservation Scholars Program were each named by one student.

Item eight queried students about immediate family members who were employed in science related fields. One student’s father is a psychiatrist, grandmother is a forensic chemist, grandfather is a biostatistician and oceanographer. A second student has an unnamed family member in IT. Four of the six students indicated no family members. This is a similar pattern to the graduate student data in that LMRCSC seems to be recruiting students with no other family connection to science careers—a positive attribute of the recruitment process.

Item nine asked respondents about the prospects for employment for their chosen career over the next decade. The responses were optimistic, with four selecting Very employable and two selecting Moderately employable. It is unknown for purposes of interpreting these perceptions whether student perception is at all accurate or matched to employment realities for their career tracks.

Item ten asked respondents to describe other activities that they would find interesting if offered by LMRCSC. Two students described hands-on science field experiences (boating, seining, dissections—anything in the field as one student phrased it). Two students stated that more in-person activities would be enjoyable. One student suggested visiting other centers or schools, and one student indicated that transferring to another school would be interesting, but not certain what this meant. One person wanted a workshop that focused on holistic views of science; perhaps something to consider.

Item eleven focuses on university academic experiences of these undergraduate students. This item asks respondents to name the most beneficial university course that they took over the

previous academic year and explain why they selected this course for the response. Each respondent named a different course (speech, biochem, senior thesis, ecotoxicology, data analysis, and biometry) so no clusters of courses emerged. However, there was a common theme of practical skills derived from the courses that pertained to future career needs: public speaking, thinking about the future, learning about the analytic side of the science field). While the responses are limited, this practical orientation seems consistent with other research about student career orientations to undergraduate coursework.

Item twelve asked respondents to rate their level of interaction with students or professors at other LMRCSC institutions. While programmatically this opportunity was offered by LMRCSC, for this response item, four students selected MEDIUM, one selected LOW, and one selected NONE as their response to the query. This may be an area for leadership to continue to consider.

One of the objectives of LMRCSC programming is to raise students' awareness of NOAA and NOAA EPP programs, to include the LMRCSC. Item thirteen asked students to rate their knowledge (at the close of the academic year) about the LMRCSC as a NOAA EPP network program. One respondent marked HIGH knowledge. Four respondents selected MEDIUM knowledge, and one respondent marked LOW knowledge. This seems to be a reasonable response pattern to the query as it is an ambiguous type of knowledge that is solicited here, but this area of continued awareness building about NOAA and of LMRCS as supported by NOAA is important for leadership to address.

Item fourteen asked respondents their perceptions of their greatest challenge moving forward with career-related education. Interestingly, two of the respondents described their level of motivation to work. Three noted challenges that were somewhat related to communications issues: one simply said communications. Another student described a knowledge or communications gap about transitioning from undergraduate to graduate LMRCSC programs and institutions. Leadership may want to identify good ways to focus on this transition process for the students. And a third described building connections with others because of a nervousness in speaking in groups. A final student noted work life balance, perhaps pointing to time management, as a challenge.

Item fifteen asked respondents to describe or suggest additional support structures, resources or information that they would find helpful to meeting career goals. One student noted that more in-person events, instead of virtual events, would be very helpful. One simply said "networking" although a second student wrote "have more communications with fellow students and professors" and a third wrote "continued support from my peers and mentors"—which together suggest a cluster of responses around social interactions as noted in the graduate student survey of this spring as well. This, with the comments about virtual meetings, points to the need this population of students has to reconnect and reengage in "real world" space with others. One student did offer the positive affirmation that LMRCSC's support structure has been helpful thus far to this individual.

Item sixteen asked students to project the likelihood that they would continue into graduate school to study fisheries or a related ocean topic. Four of the respondents selected Likely or Very Likely as their response, with two students selecting Neither Likely nor Unlikely—the neutral position on the provided rating scale. This response pattern is viewed as positive.

Item seventeen focused on recruitment: how was the respondent recruited to participate in LMRCSC. The responses were highly varied, as is the recruitment pathway. How individuals

hear about a program grows more varied over time as a larger set of people know about the program. One respondent heard about it in high school while touring a campus. One was invited by a faculty advisor and two by university department chairs. One simply noted he/she received an email about the program. Again, the response pool is limited, but it seems that the clear recruitment pattern points to on campus, personal contacts within universities as the primary vector.

Item eighteen asked respondents to suggest ways to support new students in the LMRCSC to promote the program/Center as a positive experience. Given the importance of this and the small set of responses, the response data are replicated here entirely:

- More interactions with other LMRCSC members in person. More physical activities in which we can participate.
- I think it would be beneficial to remind new students to not be hesitant to ask for help and to continue to reach out to them to make them feel more comfortable.
- I would encourage them to stay positive and attend the events even if they may not be enjoyable. I would also tell them to make sure to use this time as professional development. The requirements for this program are very beneficial for a learner scientist.
- More peer-to-peer interactions. More promotion for incoming students.
- Try to talk with your mentors about your personal aspirations; and
- Making them feel seen and heard by keeping track of names and keeping in touch.

Item nineteen asked respondents to discuss the primary benefits that they perceive of the LMRCSC. Three of the six responses focused on networking and making contacts to advance in their profession. Two pointed to research experiences (with one of these also noting the financial support). The final student response was that of enhanced knowledge that pushes them forward in their careers.

The final item (twenty) asked respondents to describe their greatest challenges to participation in the LMRCSC this past year. Three of the six respondents pointed to the online activities with expressions that more face to face and in person time would be greatly valued, although these thoughts are expressed here as challenges the students have faced this past year. Two of the other respondents pointed to the amount of work, as did the final respondent—although that individual also stated that “communication with mentors” had been a challenge.

Summary

It is unwarranted to draw large conclusions from such a small data set (although the responses represent six of the eight undergraduates in the program this past year). Nevertheless, considering also the responses in the graduate student survey for 2023 as well, and offering these summaries only for discussion and consideration, it seems that online/virtual activities should be examined critically. In a Center program that spans multiple states and institutions, virtual meetings and workshops are a necessity.

But balancing efficiency with student needs for social connectivity in the post-COVID era is also important. These responses (both undergraduate and graduate) describe a student population that is interested in meeting other people, peers, faculty, scientists, career mentors, NOAA personnel. They understand the necessity of virtual experiences and connections, but they want more, and they want it in person.

Second, more strongly and clearly than in years past, it is possible in these survey data to see a distinct LMRCSC Center and programming that is distinct in the minds of students, and is

appreciated for the different experiences, content, and connections that the Center provides. This is evidence of positive and effective leadership and administrative performance (one of the three evaluative legs of the program) and demonstrates a commitment to continuous quality improvement that has been undertaken by LMRCSC leadership as it evolved from the prior award into this new one.

LMRCSC Graduate Student Survey Spring 2023

The external evaluators refined an end of year survey for graduate student participants in the LMRCSC based on the substantive program revisions moving into this new, five-year funding period. The survey was circulated to LMRCSC leadership for review, and then distributed electronically to the thirty-four graduate students in late April to ascertain participant perceptions of the program over this past year. Eighteen graduate students provided detailed responses, which have been summarized below. Overall, the responses reflected a well-organized and administered LMRCSC, with students perceiving both personal and professional support from peer students, mentors and faculty members, as well as from LMRCSC personnel at the Center itself. Students could differentiate institutional activities and requirements from LMRCSC requirements and activities which evidences Center effort and administrative accomplishment. Data are summarized as follows, with a final Summary section at the end of this report.

The spring survey response from the graduate students was strong, with eighteen of the thirty-four graduate students taking time to provide feedback to their program experience for this past year. The first four items were demographic. Of this number, three are from Hampton University and three are from the University of Miami. There were four students each from Oregon State University, the University of Maryland-Eastern Shore, and the University of Maryland-Center for Environmental Science. At the time of this evaluation review the institutions seemed fairly represented in the respondent pool.

Item two asked students to select which degree they were currently pursuing. Nine of the eighteen respondents are seeking MS degrees and nine are Ph.D. students, so again the pool of respondents is nicely diversified by degree attainment.

Item three asked respondents to identify a content area or discipline in which they were seeking their degree. The responses were wide-ranging and reflected the range of unique degree or content areas in which it is possible to focus in NOAA related science areas. Several students clustered on Marine and Environmental or Estuarine Science (as a large cluster). Other students listed fisheries, resource management, fisheries, oceanography, marine biology, ecology, food microbiology, and earth and ocean sciences. It may be that an interesting follow-on question to these students about these disciplines might surface how the students were drawn to these specific areas of the wide field of marine and coastal sciences and fisheries-related research. What role did mentoring or past science experiences play in leading to the specific choices students have put forward in this survey data? For example, one student listed “trophic ecology.” That is a unique sub-discipline that rose to that individual student’s attention somehow—-was it a course, a field trip or experience, an interaction with a faculty member or a course assignment? The narrowness of that response compared to a much more general “marine biology” seems to have been shaped by something and determining that shaping force may be informative to the LMRCSC which desires to assist both NOAA and graduate students in “finding each other” in the professional science world.

Item five asked students to identify their ideal job following graduate school. Eight of the respondents, the largest cluster of similar responses, named "working for NOAA" as their ideal job. From this, there is evidence that LMRCSC recruitment efforts to enroll students who are open to NOAA employment has been successful, or at the least the LMRCSC foregrounding of NOAA to these students has been effective. Two additional students named "government agency" as a work site, and so this may also expand the NOAA links in the response data. Other responses focused on research, fisheries management of some type, or management and restoration areas.

As a follow-on question, item six asked respondents "why do you want to pursue a career related to science?" The importance of understanding motivation of students interested in science careers could be very helpful both to recruitment efforts into the LMRCSC, but also for NOAA as it seeks to attract and engage these potential scientists post-schooling. Sixteen of the respondents provided narrative for this item. Sorting the narrative into clusters of similar responses (using a knowledge mapping technique) reveals the largest group (six) of respondents perceive a conservation or stewardship focus to employment in science. An example response from this group was, "Science is awesome and can change the world. It's important for preserving, conserving, and protecting vital natural resources." The second cluster (five students) and third cluster (four students) were similar in that this set of responses linked a personal love of learning or love of science learning specifically to career choice. Ideal jobs would allow the respondent to clearly link personal content learning in science to the assigned job tasks. Portraying the NOAA career as an opportunity for life-long personal learning, as well as an opportunity to "save the planet" or otherwise engage in stewardship and conservation would resonate with these respondents. And to the degree that these are the kinds of students that LMRCSC wishes to recruit, then the evaluators believe that these two messages would resonate as recruitment strategies: *The LMRCSC is a path to life-long learning and engagement in science, and a path to careers allowing personal environmental stewardship.*

Item seven focused on mentorship and asked respondents to name and discuss a mentor who had made a meaningful and positive impact on them with respect to their education and career. In the interest of confidentiality offered to students who complete these surveys, personal names will be omitted in this summary report even though several students identified their mentors by name. The response data for this prompt allows the reader to understand the complex view of mentoring held by these student respondents. The responses fall into two difference orientations, i.e., professional related mentoring and personal related mentoring. In the professional related area of mentoring, students noted that mentors helped them learn technical skills needed for the work project or future career. Mentors enabled content growth for students from their (the mentor's) own expertise. The mentor provided a work environment or opportunities that were conducive to learning and developing as a scientist. In the personal related areas of mentoring, students described mentors as being supportive, non-judgmental and encouraging. Mentors made students "feel accepted" and safe. Students perceived that the mentors "understood" them as individual persons, with unique backgrounds and abilities to contribute. From the perspective of these student respondents, mentoring is both a professional and personal engagement between a student and an adult who is further developing in the career pathway or perhaps in personal maturity, than is the student. This mentor is thus able to foster growth and development both professionally and interpersonally for the students. The key words *support*, *help*, and *understanding* occur over and over in the way these respondents think of their mentor.

Item eight queried respondents about other family members (immediate family) who may be employed in a science related field. The importance of familial background has been found

pertinent to legacy students and career selection in other research. Of the eighteen respondents here, seven of them report affirmatively and name: siblings (three), a father, a mother, a grandmother, and a cousin. These family relationships clustering in a common career interest area are notable in that these students are likely to persist in the pipeline with that family connection and support. Nevertheless, LMRCSC has recruited the other eleven respondents who do not have a family member who is in the science field, and this is commendable, as these first generation or first scientist in a family individuals can establish new legacy structures. These individuals will likely not have the family support of the other students however and LMRCSC personnel should be aware of this surfaced issue as it considers social support structures for its students.

Item nine asked respondents to consider the employment prospects for the career they most wish to pursue over the next decade. The responses are uniformly positive in orientation, with fifteen respondents indicating very employable or moderately employable prospects in the next decade. The final three respondents indicated limited employment prospects.

Item ten asked respondents to identify and share any other sources of federal science funds which they receive to support their educations. Only one student indicated a source other than LMRCSC, which was the NOAA Hollings Scholarship.

Item eleven asked respondents to identify the most significant LMRCSC activity in which they participated over this past year. Four of the respondents (the largest cluster) noted the mentorship training; three each noted the Annual Science Meeting or the Graduate Seminar Series, and three respondents noted workshops, especially the mentor training workshops. Across the responses, there is evidence that students have perceived an activity as significant for them individually when the activity allowed them to have deeper interactions with other students. Seeing other student work, talking with students about common experiences or struggles, simply meeting others—were all valued. The social opportunities found for these young people under LMRCSC seem to cut across the science focus in a unique way and should be considered by LMRCSC leadership.

Related to this issue of social interactivity, item twelve asked students to rate the level of interactivity with students and professors at other LMRCSC institutions. Only two students selected HIGH interactivity. Nine students selected MEDIUM, and seven students selected LOW interactivity across institutions. In one sense, this is an expected and normal pattern; one would expect to interact more closely with those individuals in proximity and within one's own institution. The degree to which "across institution" connections is important to LMRCSC leadership would impact the interpretation of these data.

Item thirteen asked respondents to identify their perceived greatest challenges to completing their career-related education. Responses highlighted issues facing graduate students and pointing to the need for continuing LMRCSC support. Finding a job was identified by several students as a challenge. The largest cluster of responses (eight of seventeen) pointed to having enough time to complete the requirements (time management) and work load they were assigned. Several of the respondents in this cluster noted significant work assignments and load in the context of the thesis or dissertation. One individual used "work life balance to express the complexity of managing their responsibilities. Juggling, balancing and multitasking were all noted. Two individuals (one stated that mental health issues were key and another described confidence issues) and potentially a third student response about "work life balance" are concerns that should be noted by LMRCSC leadership. Numerous reports of students, particularly post-COVID, struggling with mental health concerns would support the honesty of

these student responses here. Completing graduate school requirements indeed poses personal and mental health stresses as reflected by these student responses.

Item fourteen asked respondents to name additional support structures, resources or information that they would perceive as helpful in meeting career goals. Eight of the fourteen responses (the largest cluster) pointed to social interactions, networking or meetings (with scientists, professors, mentors, other students) as their perceived need. Research has pointed over the years to the individual nature of graduate research and science research generally, even as the field tries to use teams and push for team formation and development. These students seem to desire social community and social network development and perceive a need for more of that beyond any other resource they named here. In fact, only one respondent suggested greater financial support. There is a perception by these students that they are obtaining this social support from LMRCSC in both this and earlier response data. But when asked as in this item, this is the need that rises in the responses.

Other resources listed included writing support, help with identifying a dissertation topic, resume creation, and lists of job-seeking organizations.

Item fifteen asked respondents to name the greatest benefit from this past year's LMRCSC. Nine of the responses (the largest cluster) named networking or connecting with other students, scientists or faculty as the primary benefit of the program. Three students each pointed to the financial support that is provided to them and the NERTO experience as primary benefits from this past year. NERTO is described as both a personal learning experience but also a resume worthy accomplishment for them.

Item sixteen, in parallel with item thirteen above, asked respondents to identify their greatest challenges from this past year in LMRCSC. Not unexpectedly, workload, time and program requirements emerge as a dominant cluster (nine of sixteen responses). There was a clear differentiation between LMRCSC related work (workshops, training, meetings) from their institutional/school related work that didn't emerge so clearly in past year evaluation reports. This suggests an evolving understanding of LMRCSC as a programmatic entity that has responsibilities to train students and is doing that and communicating that more consistently perhaps. There is not a sense from these data that the workload is out of hand or overwhelming—just difficult. But there is also a sense of gratitude for the LMRCSC funding that is provided as well, and so these go hand in hand for these students.

The final item (seventeen) asked for any suggestions that students may wish to make to potentially enhance the overall LMRCSC experience.

Once again students suggested better consideration of the demands of the requirements considering all their other time demands. They also suggest more "cohort bonding" and more in person events.

Better communication and earlier notification of events was also mentioned. They suggested issues related to NERTO, such as help finding a suitable NERTO and streamlined NERTO paperwork.

One interesting and creative suggestion was to provide students announcements—not only about LMRCSC training and workshops or institutional opportunities—but other sorts of opportunities such as SCUBA, boat captain licensure programs, diving opportunities) that would

be interesting and peripherally related to career or personal development related to marine and aquatic sciences.

Summary

The graduate student end of year response data were overall very positive reflections of student experiences this year. Students described numerous program activities that supported them. Respondents had an awareness of the LMRCSC distinct from their graduate school and institutional experiences. They reported networking and social development, financial support, opportunities to speak and present their work, and a perception of support for their work but also for themselves as individuals.

Two concluding comments from this survey attest to program success:

"I think it is pretty great as it is."

"I think y'all work extremely hard and I am super appreciative of you."

Concluding Observations for this Project Year

In addition to conclusions stated earlier in this report from survey results and personal observations, the following are some perceptions by the external evaluators and overall conclusions.

The continued ongoing development of iSpring as a platform for coordination, training and documenting of student activities and accomplishment is testament to the continued hard work and persistence of Dr. Young. It seems very helpful to have this online place for key elements of the program and it is a perfect place to list upcoming events and requirements. It is a central place for key LMRCSC personnel to maintain their students' accomplishments. This has streamlined many important facets of LMRCSC education and has helped students appreciate LMRCSC as a cohesive and collaborative learning group.

This online space, and other online training events are significantly integral to the program. The downside of online learning is that the increased number of online requirements have been described as challenging for students to fit in to their other program and degree requirements. As evidenced by student reports, more face-to-face time is desired. Opportunities for interpersonal connections with other students, faculty, NOAA scientists and LMRCSC leadership team (such as conferences) are seen to be key for effective learning and career path development. However, the extent that cross-institution interactions are necessary and promoted is a topic for leadership conversation and clarification. Cross-CSC student educational efforts have been supported by Dr. Young and education specialists from the other Centers. It will be important to ensure that there is a good process to stimulate interest to participate.

Communication of changing requirements and upcoming needs and events should be examined and improved. This was also felt by the external evaluators who often were unaware of upcoming events.

At the end of this project year the evaluators have observed continued unresolved difficulty with the team determining an ideal way for evaluating the satisfactory academic and scientific

completion of the TAB vis a vis NOAA goals and the identified LMRCSC core competencies. There is debate on how to measure this and who will do it.

Not having a Director of Science Research for such a long time has left gaps and has created several difficulties placing burden on some of the key personnel to fill in these duties.

A LMRCSC center-wide project for all the LMRCSC students had been proposed but there seemed to be some difficulty making this happen. At this point it appears to be emerging with beginning introduction to the cohort project at the Fellows Assembly in September. This collaborative project has been deemed important for solidifying cohort group identity and accomplishments.

Executive committee meetings have highlighted to the evaluators the challenges associated with funding timing by NOAA. Getting student funding for the first couple years of a program is seen to be challenging and varies by institution.

Next Steps Moving into the Next Project Year

The external evaluators plan to continue to gather feedback and, if possible, attend in-person the Fellows Assembly in September 2023. They will survey students at the conclusion of the Assembly to assess both learning of the content and the meeting process. They plan to use this opportunity to talk with students, engage with PIs and observe cohort interaction and NOAA scientist mentorship. At this time, they will also solicit feedback from students who have completed their NERTOs.

Futures plans also include plans in 2023-2024 for a visit to Delaware State, UMES, and/or IMET.

The evaluators would like to study LMRCSC viability from an organizational perspective on structure and process.

Another topic for more in depth research is the role of mentoring, particularly with underrepresented minorities, not only with academic work at the university level, but also as preparation to entering careers. Mentoring, both professionally and personally, has been reported by students as helpful. Better understanding of the important role of mentoring and its place in LMRCSC, and especially NOAA mentors, is seen to be an integral and key component of CSC programs and worthy of more study and application.