![SECOORA logo](Southeast Coastal Ocean Observing Regional Association)

Southeast Coastal Ocean Observing Regional Association (SECOORA): Delivering actionable coastal and ocean information from high-quality science and observations for the Southeast

Revised Scope of Work - Year 1

TOPIC AREA 1: Implementation and Development of Regional Coastal Ocean Observing Systems
AWARD TYPE: Cooperative Agreement
PROJECT DURATION: July 1, 2021 – June 30, 2026

This revised grant proposal is submitted in response to the Funding Opportunity Title:
Implantation of the U.S. Integrated Ocean Observing System (IOOS)
Submitted: October 21, 2021
Year 1: July 1, 2021 – June 30, 2022
Funding Request: $4,552,445

Principal Investigator:
Debra Hernandez, Executive Director
SECOORA
PO Box 13856
Charleston, SC 29422
P: 843-906-8686
E: debra@secoora.org

Associate Investigator:
Megan Lee, Business Manager
SECOORA
PO Box 13856
Charleston, SC 29422
P: 843-864-6755
E: mlee@secoora.org

Associate Investigator:
Jennifer Dorton, Deputy Director
SECOORA
PO Box 13856
Charleston, SC 29422
P: 910-443-178
E: jdorton@secoora.org

Associate Investigator:
Michael Crosby, SECOORA Board Chair
President and CEO Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, FL 34236
P: 941-388-443
E: mcrosby@mote.org

Table of Contents

Goals, Objectives, and Workplans

With the $4,552,445 funding award, SECOORA will implement Goals 1 through 4 (as identified in our original proposal) to support SECOORA's base capacity and enhance the RCOOS. Objectives and tasks are described below and included in Table 1, Milestones.

Goal 1: Continue successful operation of the SECOORA governance and management subsystem.

Objective 1.A: Maintain the SECOORA governance and operational structure through implementation of SECOORA's Bylaws and Strategic Plan.

SECOORA's Strategic Plan was updated for the 2021-2023 period. A key priority is to advance our commitment to a diverse, equitable, and inclusive organization which will further enhance our role in the region as a coordinating entity. SECOORA will leverage successful diversity and workforce training initiatives undertaken by our members and partners. SECOORA is also working with the IOOS Association, other IOOS regions, and the IOOS Program Office on workforce development initiatives to expand and diversify workforces and improve our ability to provide relevant ocean and coastal data and information to underserved or underrepresented communities. Progress is shared with the Board and members during annual meetings. The Year 1 meetings will be held Dec. 2-3, 2021 in St. Petersburg, FL and in May 2022 (location and date TBD).

Objective 1.B: Maintain SECOORA's certification as a Regional Association.

SECOORA is certified by NOAA as a RICE. SECOORA prioritizes, gathers, manages, and distributes observation data for the SE, and has the data management architecture, policies, and procedures to support these activities. SECOORA will renew its RICE certification in Year 1 (2021-2022) and maintain certification throughout Years 2-5. SECOORA's Certification web page has extensive details on our operations and policies and the site will be maintained and updated throughout the five-year period.

Objective 1.C: Annually update SECOORA's 2020-2025 RCOOS Plan.

Implementation of the RCOOS Plan occurs through four subsystems of the RCOOS: observing, DMAC, modeling and analysis, and engagement. Details of this implementation throughout the five-year period of this proposal are described in Goals 2 – 4. The SECOORA Deputy Director leads management of the RCOOS through execution of subawards with our partners and supports SECOORA's Science Committee which reviews annual updates to the Plan.

Goal 2: Maintain and augment the SECOORA observing subsystem.

Objective 2.A: Maintain existing long-term coastal and ocean observing operations.

Moorings: SECOORA real-time and non real-time moorings are operated by the University of North Carolina Wilmington (UNCW), the University of South Florida (USF), and the University of Georgia (UGA). UNCW maintains 9 real-time moorings and 1 non real-time mooring along the coasts of NC and SC. USF maintains 2 real-time moorings and 2 non real-time moorings located on the West Florida Shelf. UNCW and USF also support the FACT Animal Telemetry Network (ATN) by deploying acoustic receivers attached to existing moorings (4 on UNCW moorings, 1 on a USF mooring) to record tagged fish passage near the receivers. The receivers are recovered twice each year during mooring turnaround cruises, downloaded, and the data shared with the FACT ATN node. SECOORA supports ocean acidification and water quality monitoring at the Gray's Reef National Marine Sanctuary (GRNMS) as part of NOAA's international effort to quantify the effects of ocean acidification. UGA is responsible for the maintenance of the OA sensors on the buoy. Partners for the OA project include NOAA PMEL, NDBC, and the USCG.

All real-time moorings/instrumentation have a targeted up-time of 85%. UNCW, USF, and UGA annually update their data management plans for publication on the SECOORA Certification webpage. All

UNCW and USF real-time data is made available to SECOORA and NDBC. QARTOD required and recommended tests are conducted for all real-time data and roll-up pass/suspect/fail flags are provided with the data. Non-real-time moorings are serviced 2 times per year; data from these stations are downloaded from the sensors, quality controlled, and shared for archival with SECOORA and NOAA's NCEI. NOAA PMEL conducts QA/QC for the GRNMS OA instrumentation and hosts the OA data. A list of real-time ocean observing moorings and associated data collected by each mooring is found in Appendix 1, Table 1A. A list of non-real-time moorings and associated data collected by each mooring is found in Appendix 1, Table 1B.

High Frequency Radar (HFR): SECOORA operates 20 HFR. UNC-Chapel Hill (UNCCH) and East Carolina University's Coastal Studies Institute (CSI) operate CODAR HFR on the North Carolina Outer Banks and USF operates CODAR on the west coast of Florida. The University of South Carolina (USC), UGA Skidaway Institute of Oceanography (SkIO), Florida Institute of Technology (FIT), and the University of Miami (UM) operate WERA HFR distributed across the 4-state region.

SECOORA HFR operators will provide surface current data in near real-time with a targeted up-time of 85%. Hourly data will be provided to SECOORA and to the HFR National Network. Operational and quality metrics are routinely checked. These include assessment of daily variations in coverage and uptime using metrics such as database latency, range of coverage, and number of solutions as implemented by the National HFR Network. USC, SkIO, FIT, and UM have all received FCC operational licenses for their systems. UNCCH, CSI, and USF are awaiting final FCC certification of CODAR HFR before applying for the new operational licenses. It is anticipated that they will be able to apply for the licenses in Year 1. HFR operators annually update the HFR data management plan for publication on the SECOORA Certification webpage. Finally, in Year 1, all HFR operators will provide a list of recapitalization costs required for continued HFR operations. HFR, operators, location, and operating frequencies are in Appendix 1, Table 2.

Additional Regional HFR Activities:
ROWG Meeting: SECOORA partner, CSI, is planning the 2022 ROWG meeting. CSI will host the meeting in Manteo, NC. The dates for the event have not been identified; however, a planning team will lead the meeting agenda development and hosting efforts.
Florida Atlantic University CODAR: SECOORA member, Florida Atlantic University, operates two CODAR HFR near Miami, FL. SECOORA will provide support in Year 1 to enable the systems becoming fully operational.

Glider Operations: The SECOORA glider team includes SkIO, USF, UNCCH, and Georgia Tech. The team will fly three (3) glider shelf and event missions annually in the South Atlantic Bight and Gulf of Mexico that collect conductivity, temperature, salinity, dissolved oxygen, chlorophyll a, colored dissolved organic matter, and backscatter to characterize Gulf Stream and shelf dynamics and improve forecasting of regional coastal ocean phenomena (e.g., hurricanes, HAB events). Two gliders also include acoustic receivers to record the presence of tagged fish. Each glider mission is 30-45 days. The glider team follows data collection and data sharing methods identified in the U.S. Underwater Glider Workshop Report. Mission data are disseminated to the international scientific community via the National Glider Data Assembly Center (DAC) where they are made available to the oceanographic modeling community. The glider team annually updates the data management plans for publication on the SECOORA Certification webpage. Glider owners, manufacture year, and sensor payload are detailed in Appendix 1, Table 3.

Additional Glider Activities:
Hurricane Gliders: Two (2) missions are planned for the SECOORA domain during the 2021 hurricane season. Each mission will be 30-45 days in duration. All data will be submitted to the IOOS Glider DAC where it is shared through the Global Telecommunications Gateway and assimilated by ocean models, including those operated by NOAA, the U.S. Navy, SECOORA, and other regional association partners.
Support for Navy Gliders (deployments/recoveries): SECOORA and partners, SkIO, UNCCH, CSI, and USF will coordinate with the U.S. Navy for glider deployments and recoveries as well as glider piloting support during the 2021 Hurricane season.

Biological Data Collection: The Estuarine Soundscape Observatory Network in the Southeast (ESONS) is led by the University of South Carolina Beaufort (USCB). The ESONS observatory consists of 9 existing passive acoustic sensors deployed in South Carolina: 3 in the May River, 1 in Chechessee Creek, 1 in Colleton River, 3 in Charleston Harbor, and 1 North Inlet Winyah Bay NERR. Each station includes a passive acoustic recorder, water level loggers, and a temperature logger, all used to monitor animal behavior at multiple levels of biological complexity (from snapping shrimp to fish to marine mammals) and time scales. The project team will conduct an annual soundscape analysis to identify species, range, and seasonality in all 5 locations and the collected wav files will be shared with SECOORA for storage and visualization on a soundscape webpage that is currently under development. See Appendix 1, Table 4.

Additional Biological Data Collection:
ATN projects: The Georgia Department of Natural Resources (GA DNR) maintains 24 existing acoustic receivers in Georgia's nearshore and offshore waters. During Year 1, GA DNR will continue to service and maintain the array which is used to track the movement of tagged animals. Additionally, projects that expand the ATN data collection or data management efforts may also be supported. ATN activities are coordinated with the IOOS ATN program manager.

Objective 2.B: Expand the observing subsystem to address the region's highest priority needs as identified in the SECOORA RCOOS Plan.
Moorings: During Year 1, UNCW will co-locate a SoFar wave buoy next to the existing CAP2 meteorological buoy. UNCW and SECOORA have already worked with the IOOS Environmental Compliance Manager to complete the NEPA analysis for this site and obtained permits from USACE (NWP5, June 30, 2021) and USCG (PATON, June 30, 2021). The wave buoy was deployed in July 2021.

UNCW will work with the Port of Charleston, SC and Charleston Pilots Association to finalize the location for the Charleston Harbor buoy. It is anticipated that the Charleston Harbor buoy will be within 20 nm of the CAP2 wave buoy (see above paragraph) and the buoy will have the same design, sensor payload, and service interval as the already permitted UNCW buoys. UNCW and SECOORA will work with the NOAA IOOS Environmental Compliance Manager to complete environmental compliance requirements for this mooring. In conjunction with the NEPA process, UNCW will obtain the necessary permits from the US Army Corps of Engineers (USACE) and US Coast Guard (USCG). All planned Year 1 moorings are included in Appendix 1, Table 1A.

SECOORA partner RDSea International, Inc. will deploy two moorings on the east coast of FL in Years 2 and 3 to fill gaps in oceanographic data that were identified in the SECOORA RCOOS Plan. During Year 1, RDSea will work with stakeholders to identify and prioritize potential mooring locations, obtain bathymetry data for each location, and conduct site assessments (using a small university vessel). The potential locations will be narrowed down to finalize two mooring deployment locations. SECOORA and RDSea will work with the NOAA IOOS Environmental Compliance Manager to complete NEPA

requirements for both locations. Once the NEPA process is complete, RDSea will obtain the necessary permits from the US Army Corps of Engineers (USACE) and US Coast Guard (USCG). Finally, if either mooring location is within State of Florida waters (high tide line out to 3 nm), then additional permits may be needed from the Florida Department of Environmental Protection. During the permitting and environmental compliance process, RDSea will identify regional research vessels that can support mooring deployments/turnaround, complete the engineering design for the buoy and anchoring system, and finalize the instrumentation payload for each buoy. It is anticipated that the first buoy deployment will be Year 2.

Water Level Initiative (WLI): SECOORA will establish a real-time, regional water level network to address needs for real-time flooding information. WLI team members include representatives from the American Shore and Beach Preservation Association (ASBPA), Hohonu, Coastal Carolina University, Florida Atlantic University, Georgia Tech, and Florida International University. Year 1 activities will include establishing a network coordination structure and convening an advisory committee which includes representatives from NOAA CO-OPS, USGS, state and local government representatives and other stakeholders. SECOORA and WLI members are working with the NOAA IOOS Environmental Compliance Manager to complete the environmental compliance requirements for sensor installations (note that planned sensor deployment documentation has already been shared with the Environmental Compliance Manager). While the NEPA process is underway, team members will apply for any required state or municipal permits. This project will leverage work by IOOS, CO-OPS, and the Alaska Ocean Observing System (AOOS) to establish a regional community water level user interface. Finally, an advisory committee will be convened which will work with the WLI team to determine criteria/metrics to evaluate the lifecycle cost versus accuracy of data for the systems being installed. Locations and technical specifications for the 66 water level systems to be deployed in Year 1 are available in Appendix 1, Table 5.

Additional Observing System Expansion:
SECOORA plans to fund 2-3 Harmful Algal Bloom Projects in Year 1.
- Sargassum tracking: SECOORA partner, USF, will develop and operate a high high-resolution, web-based system to monitor and forecast pelagic Sargassum in several coastal zones of the Florida Keys and South Atlantic Bight to help local management agencies, citizens, and other stakeholders to better prepare for Sargassum inundation events. During Year 1, the project team will: develop and validate algorithms suitable for high-resolution satellite data to map and quantify Sargassum distribution and abundance; and, generate prototype high-resolution imagery products to map and quantify Sargassum distribution and abundance.
- Via a competitive mini-proposal process, SECOORA will solicit proposals for pilot projects focused on increasing HABS observing and forecasting activities. It is anticipated 1-2 proposals will be funded.

Goal 3: Implement, integrate, and expand the Data Management Cyberinfrastructure, and Modeling and Analysis subsystems.
The DMAC subsystem is an integrating and foundational subsystem of the RCOOS, that when coupled with the observing and modeling and analysis subsystems, enables the transformation of raw data into accessible and credible information for decision-makers. SECOORA works with its DMAC contractor, Axiom Data Science, to provide advanced data management support, data systems architecture, software engineering, and cyberinfrastructure operational services to meet the US IOOS DMAC data standards and requirements. Axiom has worked with SECOORA and partners to support a regional data assembly center, operated and continuously improved its functionality, and provided a regional web-based data portal (https://portal.secoora.org/) for access to ocean and coastal environmental data and information products across the US SE.

Objective 3.A: Maintain and enhance the DMAC subsystem.

Core DMAC subsystem: SECOORA will operate and improve SECOORA's core DMAC subsystem. More information on SECOORA data standards and requirements and adherence to the NOAA Environmental Data Management Framework can be found in the [SECOORA Data Management and Cyberinfrastructure Plan](), which includes the Data Sharing Policy and Methods to Address IOOS Core Capabilities.

Core components of the SECOORA DMAC subsystem include the following:

- High Performance Computing (HPC)
- Data Assembly and Quality
- Implementation of Community Standards and Systems
- Modern Big Data Analysis and Machine Learning
- Data Product Support
- Integration with Other National Cyberinfrastructure
- Human Expertise and Capacity
- Annual data archival for physical oceanographic, biogeochemical, and meteorological data with NOAA's NCEI.
- Product Usage Statistics – SECOORA uses Google Analytics to track usage statistics for the data portal, webpage, and products. SECOORA will post monthly summaries of these statistics (number of sessions, page views, etc.) on the IOOS Proposal Documents [web page]().

Additional details on these subcomponents can be found here: [https://secoora.org/certification/]() - section III. Data Management and Cyberinfrastructure.

Additional Data Management Activities:

Marine Biodiversity Observing Network (ATN/MBON): The overall goal is to support the growing joint MBON and ATN initiatives to integrate acoustic animal tracking data into biodiversity monitoring, and ultimately generate data visualizations of marine biodiversity hotspots. Year 1 activities include outreach to ATN community, development of an ATN data management plan, integration of data into the [BioTrack]() project, data analysis and sharing of biodiversity maps with SECOORA, MBON, and ATN.

Curation of IOOS open-source repositories and software packages: This project supports the technical implementation of the IOOS DMAC system, including the following activities: monitoring and testing DMAC products and services, ongoing development of the IOOS data discovery and access tools, technical research and engagement with external groups (e.g., Pangeo, ESIP), and maintenance of the IOOS GitHub software and tool ecosystem. Additionally, the work supports the ongoing development and maintenance of several open-source software packages that are crucial to the IOOS DMAC enterprise.

CETACEAN Project: The goal of this project is to develop a Gulf of Mexico platform (Compilation of Environmental, Threats, and Animal Data for Cetacean Population Health Analyses: CETACEAN) that provides user-friendly access to datasets that will assist the Trustees, restoration planners, responders, and conservation managers to assess the health of cetacean stocks and the stressors that threaten them over time and space. Axiom will work with partners to develop this platform based on recommendations from the CETACEAN Steering and Executive Committees. The objective for this year is to work with stakeholders to define requirements and build a functional prototype system.

Objective 3.B: Maintain and enhance the Modeling and Analysis subsystem
3.B1. Modeling: Provide forecasts for select coastal ocean phenomena

CNAPS Model: SECOORA project team members at NCSU and Fathom Science will maintain and continue developing CNAPS to provide near-real time nowcasts/ forecasts for regional-scale marine environment conditions. In Year 1, the team will continue routine operations of CNAPS to deliver critical nowcast and forecast information to support coastal hazards (e.g., storms), water quality (e.g., oil spills, harmful algal blooms), and marine operations (e.g., navigation, fisheries) needs. CNAPS will transition to the Amazon cloud computing environment (AWS). This will reduce system downtime related to hardware failures (i.e., aging University-based high performance computing systems) or campus impacts during public emergencies (e.g., COVID-19, storms). Additionally, the project team will implement the Ensemble Data Assimilation (ENDA) capability to assimilate regional observations from satellites, moorings, glider and ship surveys, and HFR into the model. ENDA will provide a more efficient approach for both long-term hindcast and operational nowcast/ forecast data assimilation. An added benefit of ENDA is the ability to provide valuable uncertainty assessments (similar to storm track cones in hurricane forecasts) often requested by end users.

WFS Models: SECOORA partner, USF, will maintain the West Florida Shelf and Tampa Bay (WFCOM and TBCOM) daily nowcasts/forecasts of currents, temperature and salinity, and surface height fields with a targeted up-time of 90%. WFCOM downscales from the deep ocean, across the continental shelf and into the major estuaries by nesting the unstructured grid FVCOM in the GOM HYCOM, affording increasingly finer resolution upon approaching the coast. TBCOM achieves 20-m resolution by nesting FVCOM in WFCOM. TBCOM includes Tampa Bay, Sarasota Bay, the Intra-Coastal Waterway and all of the inlets connecting these with the GOM. The latest version of WFCOM includes the west FL Intra-coastal Waterway and inlets, a realistic representation of the FL Keys and inlets extending north to Biscayne Bay. Both WFCOM and TBCOM provide daily, 4.5 day (1 day hindcast, 3.5 day forecast) trajectories to assist with red tide tracking, search and rescue operations, and glider path planning. Model output is available via NOAA GOODS.

Additional Modeling Activities:
NCDIS Coastal Resilience: The goal of this project is to conduct a 40 year (1979-2019) reanalysis of coastal storm surge with the ADCIRC storm surge and tide model. Using best available atmospheric reanalysis, NOAA observed water levels, and a new data assimilation system for ADCIRC, the results will provide detailed datasets of long-term coastal water levels for use in a variety of applications, including computation of local extreme water level probability distributions over monthly to 100-yr return intervals that will be compared with the existing set of 1-degree gridded extreme water level probability distributions currently being produced from a tide gauge-based regional frequency analysis for the U.S. coastlines.

3.B2. Integrate improvements in the analysis components of the modeling and analysis subsystem to speed transformation of data into information required by users.
AI Portal: Florida Wildlife Research Institute (FWRI) and Axiom will build and demonstrate an artificial intelligence annotation data portal (AI portal). Year 1 activities include documenting data standards for AI applications; defining metadata; formatting requirements for imagery, video, and acoustic data; and resolving file storage and access solutions for common AI workflows.

Southeast Area Monitoring and Assessment Program, South Atlantic (SEAMAP-SA): SC Department of Natural Resources and Axiom will improve and expand biological data analysis tools including integration of long-term SEAMAP-SA living marine resource survey data with environmental information. The team will develop new data access, exploration, analysis, and visualization tools for the SECOORA portal.

Goal 4: Effectively implement the engagement subsystem to support product co-design and delivery.

A central goal of SECOORA is to develop, in partnership with end users, operational products that will support decision-making. Along with ongoing delivery of the regional model forecasts that fill temporal and spatial gaps in observations, SECOORA will develop and enhance products in collaboration with our partners to support their operational needs.

Objective 4.A. Engage with stakeholders to identify and respond to their needs

4.A1. Support community-driven networks focused on priority societal issues aligned with SECOORA's mission and Strategic Plan.

SECOORA partners with other national and regional networks to leverage expertise and expand observing capacity. SECOORA will remain engaged with these groups during Year 1:

- IOOS Association is a national nonprofit organization established to advance U.S. IOOS and the nation's coastal observation information needs by working with the 11 Regional Associations, US IOOS, NOAA federal agencies, and other partners. SECOORA's Executive Director currently serves as Chair of the Association.
- Regional Ocean Data Sharing efforts: SECOORA supports efforts aimed at meeting the nation's Ocean Policy and coordinating discussion to address gaps in regional data. Sea level rise and resiliency are priority issues in our four-state region. State coastal management leads support leveraging the WLI with these funds, which will be used to support user engagement and assessment, iterative product design for tools to access water level data, and additional water level sensors in underserved and flood-prone communities. The available funding will be used to support contractors. Laura Korman will be the user engagement/product development contractor. One contractor (TBD) will assist with data management and website/application development. Another TBD contractor or existing WLI PIs will be funded to install additional water level sensors with a priority on installations in underserved communities. SECOORA will work with the NOAA IOOS Environmental Compliance Manager to complete the environmental compliance requirements for sensor installations that are not already addressed in Objective 2.B.
- NOAA Southeast and Caribbean Regional Collaboration Team (SECART): a means for NOAA and partners to engage at a regional scale (NC, SC, GA, FL, Puerto Rico, and the U.S. Virgin Islands). SECOORA will support the SECART initiative to bring together NOAA and partner resources with state shellfish managers to improve forecasting shellfish closures.
- Southeast and Caribbean Disaster Resilience Partnership (SCDRP) is an affiliation of public, private, and nongovernment organizations (NGO) focused on disaster resilience. SECOORA and SECART will continue to support this community of practice to share resources, catalogue existing activities, host meetings and monthly calls, maintain a website, and submit additional funding requests to ensure sustainability of efforts.
- A new Advisory Committee will be engaged in Years 1-5 to provide guidance and feedback for the WLI team (Objective 2B).
- Southeast Ocean and Coastal Acidification Network (SOCAN) is dedicated to supporting and encouraging discussions on ocean and coastal acidification. SECOORA will continue to lead SOCAN by organizing bi-monthly virtual Town Hall style webinars, recruiting and engaging stakeholders to participate in SOCAN virtual forums, and providing monthly newsletters.
- The FACT Network is a grassroots collaboration of marine scientists from the Bahamas to the Carolinas using acoustic telemetry to better understand and conserve our region's important fish and sea turtle species. SECOORA provides support for the FACT Animal Telemetry Network (ATN) by hosting their website and sponsorship of the FACT semiannual meetings. Fisheries Data Solutions

(FACT data wrangler) leads communications, data acquisition efforts, and training.

4.A2. Maintain and enhance the SECOORA outreach and engagement subsystem to address priority issues in the region
SECOORA will continue the [Coastal Ocean Observing in Your Community](#) webinar series, website updates with [news stories](#) and extreme event pages such as the [Florida Red Tide Resources Page](#) and the [Hurricane Resources Page](#), quarterly newsletters, social media posts, and hosting and participating in workshops and meetings.

4.A3. Engage students in problem solving using ocean observing data.
The SECOORA Education and Outreach Committee provides guidance on prioritizing education and outreach needs. Annually SECOORA will support a NOAA Hollings Scholar and host two student awards: the [Data Challenge](#) and [Vembu Subramanian Ocean Scholars Award](#). SECOORA will continue providing opportunities for formal and informal educators to develop online coastal and ocean related [curriculum.](#) Additionally, SECOORA staff and PIs actively support [students in the classroom](#) through data workshops and hosting field trips to coastal monitoring stations throughout the region.

Objective 4.B: Product Development.
SECOORA is formalizing product development procedures that include iterative end user engagement so that products are co-designed with users based on their requirements. SECOORA will work with stakeholders to identify product needs and evaluate existing products to determine ongoing limitations and demands as well as potential for expanding either geographic coverage or product offerings. All proposed products fit within the identified SECOORA focus areas and provide environmental and/or economic benefit to our stakeholders. Current products include [Text a Buoy](#), the [Marine Weather Portal (MWP)](#), the [Hurricane Portal](#) and [How's the Beach](#). We anticipate future products will address water level data, acoustic data (i.e., soundscapes or summary habitat use and seasonality from fish tags), and HFR.

SECOORA will invest in the follow product development efforts:
How's the Beach Expansion: Improve provision of advisories of public health risks in shellfish and recreational swimming waters by combining three existing products, How's the Beach (UofSC), ShellCast (NCSU), and Beach Condition Reporting System (BCRS), by integration, enhancement or expansion. Models will be developed for six stakeholder-identified beach reaches and five shellfish water harvesting areas based on need and available data. Data include indicator bacteria concentration, radar-based precipitation, salinity, water temperature, and potentially other environmental data such as tributary river flow (where applicable), wind, current, and wave information. Multiple Regression and Classification and Regression Tree (CART) analyses will be used to develop these relationships.

Situational Awareness Support-tool for weather forecasters and ocean rescue groups: Using data from NC and SC buoys, this module will leverage the SECOORA DMAC subsystem to allow end users to register, administer, and view custom thresholds for any combination of in situ parameters. When user-identified thresholds are crossed, the user will receive a notice via email, text, and/or social media.

Water Level Initiative User Interface: SECOORA will leverage previously funded NOAA, AOOS, and Axiom work on the community water level initiative, and establish a water level user interface for the SE based on assessment of user needs. See Objective 4.A1. Regional Ocean Data Sharing for additional details.

Summary

The proposed $4,552,445 in funding will support the continued operation and expansion of the core RCOOS framework. As a mature RA, SECOORA must balance maintenance, filling important gaps in observations, and creating new connections to users through thoughtful expansion of products and services to build-out the RCOOS. The proposed activities will deliver stakeholders the ongoing observations and modeling products they rely on, and new integrative project components that leverage existing SECOORA efforts (observations, models, and DMAC) to create new and exciting opportunities.

Milestones and Cost Proposal

Table 1. Goals, Objectives/Milestones and Schedule

Milestones	Q1	Q2	Q3	Q4
Goal 1: Continue successful operation of the SECOORA governance and management subsystem				
Maintain the SECOORA governance and operational structure	X	X	X	X
Maintain SECOORA's certification as a RICE	X	X	X	X
Update the SECOORA RCOOS Plan	X	X	X	X
Goal 2: Maintain and augment the SECOORA observing subsystem				
Operate and maintain 12 existing real-time moorings offshore of NC, GA, and FL	X	X	X	X
Operate and maintain 3 non-real time moorings offshore of NC and FL	X	X	X	X
Operate and maintain 20 HFRs regionwide	X	X	X	X
Work with a SECOORA PI to host the 2022 ROWG meeting		X	X	X
Conduct 4 glider missions annually	X	X	X	X
Conduct 2 Hurricane Glider missions annually	X	X	X	X
Support Navy glider deployments and recoveries	X	X		X
Maintain the SC estuarine soundscape observatory using passive acoustic recorders	X	X	X	X
Maintain the Georgia coastal receiver array	X	X	X	X
Site, deploy, and maintain 1 SoFar wave buoy near an existing SC mooring	X	X	X	X
Site, deploy, and maintain Charleston Harbor, SC buoys (met and wave buoys)		X	X	X
Site and permit 2 buoys off the FL east coast		X	X	X
Site, deploy, and maintain XX water level sensors	X	X	X	X
Expand harmful algal bloom observing and forecasting	X	X	X	X
Goal 3: Implement, integrate, and expand the DMAC and Modeling and Analysis subsystems				
Maintain and enhance the SECOORA DMAC subsystem	X	X	X	X
Support the MBON/ATN through BioTrack project	X	X	X	X
Curate IOOS open-source repositories and software packages	X	X	X	X
Continued development and implementation of CETACEAN for the Gulf of Mexico	X	X	X	X
Maintain the CNAPS model, move system to Cloud	X	X	X	X
Maintain the WFS models (WFCOM and TBCOM)	X	X	X	X
Construct an interactive AI annotation data portal	X	X	X	X
Develop biological data analysis tools through integrations of SEAMAP-SA fish survey data	X	X	X	X
Goal 4: Effectively implement the Engagement subsystem to support product co-design and delivery				
Engage & support community networks (IOOS Assoc., SECART, Regional Data Sharing, SCDRP, FACT, SOCAN)	X	X	X	X
Maintain and enhance the SECOORA outreach and engagement subsystem	X	X	X	X
Engage students through SECOORA scholarship and funding opportunities	X	X	X	X
Enhance How's the Beach to include products for shellfish & recreational swimming water advisories	X	X	X	X
Develop a situational awareness tool for weather forecasters and ocean rescue	X	X	X	X
Develop a water level user interface to support water level station deployments		X	X	X

Cost Proposal. Summarized costs of this 2020-2021 effort are in Table 2. $4,552,445 support Goals 1 through 4.

Table 2. Costs by Objective, PI and Institution

Obj.	PI/Contractor	Inst.	YR 5
Goal 1	**Governance & Outreach**		
1.A – 1.C	Hernandez (Governance & Outreach)	SECOORA	$567,267
	Goal 1 Sub-total		**$567,267**
Goal 2	**Maintain and augment the SECOORA observing subsystem**		
2.A – 2.B	**Moorings**		
	Leonard (NC and SC)	UNCW	$329,362
	Weisberg (FL)	USF	$300,000
	Noakes (GA)	UGA	$38,865
	Cole (FL)	RDSea Int'l	$25,000
	Hernandez (R/V Savannah ship time)	SECOORA	$49,750
	High Frequency Radar		
	Seim (CORE)	UNC-CH	$56,021
	Muglia (DUCK, HATY, OCRA)	ECU CSI	$67,779
	Merz (VENI, RDSR, NAPL)	USF	$110,000
	Voulgaris (CSW, MBSP, GTN)	UofSC	$110,000
	Savidge/Edwards (CAT, JEK, CNS, KSC)	UGA SkIO	$110,000
	Shay (CDN, VIR, STF, NKL)	UM	$123,800
	Hernandez (operating funds for FIT, FAU, and SkIO)	SECOORA	$31,492
	ROWG Meeting Support	ECU CSI	$10,000
	Gliders		
	Edwards	UGA SkIO	$110,000
	Lembke	USF, UNC-CH, GT	$90,000
	Seim	UNC-CH	$65,000
	Zhang	GT	$40,000
	Hernandez (glider operating funds)	SECOORA	$5,000
	Navy Glider Support	UGA SkIO	$10,000
	Biological Data Collection		
	Montie - ESONS (SC)	USC-B	$20,000
	GA coastal receiver array or other ATN project	TBD	$77,500
	Water Level Stations		
	Gayes (SC and FL)	CCU	$100,000
	Elko and Glazer (NC, SC, FL)	ASBPA & Hohonu	$99,972
	Cobb and DiLorenzo (GA)	GT	$98,246
	Troxler (FL)	FIU	$100,000
	Harmful Algal Blooms		
	Hu (Sargassum tracking and forecasting)	USF	$50,000
	1-2 pilot projects	TBD	$100,000
	Goal 2 Sub-total		**$2,327,787**
Goal 3	**Implement, integrate, and expand the DMAC and Modeling and Analysis subsystems**		
3.A	*Maintain and Enhance the DMAC subsystem*		
	Core DMAC support	Axiom	$199,600
	Hammerschlag – MBON/ATN	UM	$75,000
	Fernandes - Curation of IOOS repositories and software packages	Contractor	$87,500
	CETACEAN	Axiom	$345,243
3.B	*Maintain and enhance the Modeling and Analysis subsystem*		
	He - CNAPS model	NCSU & Fathom Science	$149,983
	Blanton and Leuttich (NCDIS Coastal Resilience)	RENCI & UNC-CH	$197,500
	Weisberg – WFS models	USF	Included in Moorings budget line

Obj.	PI/Contractor	Inst.	YR 5
	McEachron – AI annotation portal	FWRI	$88,000
	Smart - SEAMAP	SC DNR	$16,506
	Goal 3 Sub-total		**$1,159,332**
Goal 4	**Effectively implement the engagement subsystem to support product co-design and delivery**		
4.A1	*Support community-driven networks focused on priority societal issues aligned with SECOORA's mission and Strategic Plan.*		
	Regional Ocean Data Sharing to support Water Level Initiative	Korman and TBD Contractors	$234,079
	SECART Shellfish Workshop	SECOORA	$4,546
	SCDRP	SECOORA	$5,000
	SOCAN	Hall (Mote) & Reimer	$27,274
	FACT Data Wrangler	Fisheries Data Solutions	$72,500
4.A2	*Maintain and enhance the SECOORA outreach and engagement subsystem to address priority issues in the region* – Costs included in Goal 1: SECOORA Governance and Outreach		
4.A3	*Engage students in problem solving using ocean observing data*		
	Vembu scholarship to support Hollings scholar	TBD	$5,000
4.B	*Product Development*		
	Porter (How's the Beach Expansion)	UofSC	$149,660
	Situational Awareness Support-tool	UNCW	Included in Moorings budget line
	Goal 4 Sub-total		**$498,059**
	GRAND TOTAL		**$4,552,445**

Appendices

Appendix 1: Asset tables

Table 1A. Real-time SECOORA oceanographic moorings.

Real Time Moorings	Operator	Deployment Month/Year	Wind Spd, Gust, Dir.	Air Temp	Barometric Pressure	Rel. Humidity	SW/LW Radiation	Water Temp	Cond/ Salinity	Currents	Waves	Water Depth	Passive Acoustic (Fish Tags)*
LEJ3 - Outer Onslow Bay	UNCW	11/2015	X	X	X	X		X	X				X
LEJ3Wave	UNCW	11/2015						X			X		
ILM3 - Outer Onslow Bay	UNCW	06/2005	X	X	X	X		X	X				X
ILM2 - Inshore Onslow Bay	UNCW	07/2005	X	X	X	X		X	X				X
ILM2Wave	UNCW	05/2008						X			X		
SUN2 - Northern Long Bay	UNCW	02/2005	X	X	X	X		X	X				
SUN2Wave	UNCW	03/2012						X			X		
CAP2 - Inshore Capers Island	UNCW	02/2005	X	X	X	X		X	X				
CAP2Wave - Inshore Capers Island**	UNCW	07/2021						X			X		
FRP2 - Inshore Fripp Island	UNCW	02/2005	X	X	X	X		X	X				
CHS2 - Charleston Harbor	UNCW	Spring 2022	X	X	X	X		X	X				

Table 1A. Real-time SECOORA oceanographic moorings continued

Real Time Moorings	Operator	Deployment Month/Year	Wind Spd, Gust, Dir.	Air Temp	Barometric Pressure	Rel. Humidity	SW/LW Radiation	Water Temp	Cond/ Salinity	Currents	Waves	Water Depth	Passive Acoustic (Fish Tags)*
CHS2 - Wave	UNCW	Spring 2022						X			X	X	
GRNMS OA mooring***	PMEL/UGA	2006						X	X				
C10 - WFS Central nearshore	USF	09/1998	X	X	X	X	X	X	X	X			
C12 - WFS Central offshore	USF	09/1998	X	X	X	X		X	X	X			X
East Coast FL #1 - permitting stage only	RDSea	Fall 2022	X	X	X	X	X	X	X	X	X		
East Coast FL #2 - Year 1 permitting stage only	RDSea	Fall 2023	X	X	X	X	X	X	X	X	X		

* Acoustic receivers internally record fish tags. Data downloaded when buoys are serviced.

**Deployed in July 2021 as part of Year 1 SECOORA effort

*** This station also includes the following sensors: pH, pCO2, DO, Chl, Turbidity

Table 1B. Non real-time SECOORA oceanographic moorings operational in Year 1

Non Real Time Station Name	Operator	Deployment Month/Year	Deployment Depth (m)	Water Temp	Cond/ Salinity	Currents	Waves	Water Level	Passive Acoustics (Fish Tags)
C15 - WFS Subsurface	USF	07/1998	10	X	X	X	X		
C11 - WFS Subsurface	USF	07/1998	20	X	X	X	X	X	
OB27M	UNCW	04/2000	30	X	X	X	X		X

Table 2: SECOORA Priority HFR

Operator	Year Installed	Vendor	Station Name/State	Station Code	Latitude (N)	Longitude (W)	Nominal Frequency (MHz)
UNCCH & CSI	2003	CODAR	Duck, NC	DUCK	36.18	-75.75	5
UNCCH & CSI	2003	CODAR	Cape Hatteras, NC	HATY	35.26	-75.52	5
UNCCH & CSI	2013	CODAR	Core Banks, NC	CORE	34.76	-76.41	5
UNCCH & CSI	2017	CODAR	Ocracoke, NC	OCRA	35.1	-75.96	5
UofSC	2012	WERA	Georgetown, SC	GTN	33.25	-79.15	5.25
UofSC	2013	WERA	Caswell Beach, NC	CSW	33.88	-78.11	5.25
UofSC	TBD 2021	WERA	Myrtle Beach State Park, SC	MBSP	33.64	-78.92	13.5
SkIO	2006	WERA	St. Catherine, GA	CAT	31.69	-81.13	5.5
SkIO	2009	WERA	Jekyll Island, GA	JEK	31.06	-81.41	13.5
SkIO	TBD 2021	WERA	Canaveral National Seashore, FL	CNS	28.93	-80.82	13.5
SkIO	TBD 2021	WERA	Kennedy Space Center	KSC	28.59	-80.58	13.5
FIT	TBD 2021	WERA	Treasure Shores Park, FL	TBD	TBD	TBD	13.5
FIT*	TBD	WERA	TBD	TBD	TBD	TBD	13.5
UM**	2008	WERA	Dania Beach, FL	STF	26.08	-80.12	12.7
UM**	2008	WERA	Virginia Key, FL	VIR	25.74	-80.15	12.7
UM**	2004	WERA	Crandon Park, FL	CDN	25.71	-80.15	16
UM**	2021	WERA	North Key Largo, FL	NKL	25.24	-80.31	12.7
USF	2003	CODAR	Redington Shores, FL	RDSR	27.83	-82.83	5
USF	2004	CODAR	Venice, FL	VEN	27.08	-82.45	5
USF	2005	CODAR	Naples, FL	NAPL	26.16	-81.81	5

*FIT siting for second HFR is still in process

**UM is in the process of changing HFR frequencies to be in compliance with FCC permits by summer 2022.

Table 3: Glider fleet available by SECOORA team members

Glider Name	Owner/ Operator	Year manufactured	Conduct-ivity	Temp	Salinity	DO	Chl-a	CDOM	Back-scatter	Water column biomass	Passive acoustic receiver (tags)	Passive acoustic receiver (soundscape)	ADCP /DVL
Franklin	SECOORA/ SkIO	2019	X	X	X	X	X	X	X		X	X*	
Angus	SkIO	2018	X	X	X	X	X	X	X		X	X*	X*
Pelagia	UNCW/ SkIO	2006	X	X	X	X	X	X	X				
Salacia	NCSU/ SkIO	2008	X	X	X								
Bass	USF	2008	X	X	X	X	X	X	X		X*	X	
Sam	USF	2008	X	X	X	X	X	X	X		X*	X	
Gansett	USF	2019	X	X	X	X	X	X	X	X	X*		
Stella	USF	2019	X	X	X	X	X	X	X	X	X*		

*Glider can be outfitted with the sensor; however, the sensor is not on the glider at all times.

Table 4. Soundscape passive acoustic monitoring

Passive Acoustic "Soundscapes" Operator	Station Locations	Number of Stations	Deployment Year	Passive acoustic recorder	Water Temp	Water Level
USC Beaufort	May River, SC	3	2013	X	X	X
USC Beaufort	Chechessee Creek, SC	1	2019	X	X	X
USC Beaufort	Colleton River, SC	1	2019	X	X	X
USC Beaufort	Charleston Harbor, SC	3	2017	X	X	X
USC Beaufort	North Inlet-Winyah Bay NERR	1	2019	X	X	X

Table 5: Year 1 water level station installation locations and partner affiliations. Project team members have worked with partners to identify water level sensor deployment locations.

Station Location	Affiliation	# of YEAR 1 Deployments	Partners
Nassau County, FL	All project partners	5-6 sensors	12 month test site co-located with NOAA NWLON water level sensor
Beaufort County, SC	ASBPA	4	Town of Hilton Head, City of Beaufort, SC Sea Grant Consortium
Horry County, SC	ASBPA	1	City of North Myrtle Beach; Horry County
Currituck County, NC	ASBPA	1	Currituck County
Dare County, NC	ASBPA	2	Town of Duck, Cape Hatteras National Seashore, NC Department of Transportation
Hyde County, NC	ASBPA	2	Hyde County, NC Center for the Advancement of Teaching
Carteret County, NC	ASBPA	2	Cape Lookout National Seashore, Town of Beaufort, Indian Beach, Carteret County
New Hanover County, NC	ASBPA	1	Town of Kure Beach
Brunswick County, NC	ASBPA	3	Town of Holden Beach, Ocean Isle Beach, Village of Bald Head Island
Pender County, NC	ASBPA	2	Surf City and Topsail Beach
Lee County, FL	ASBPA	2	Captiva Island, Sanibel Island
Georgetown County, SC	CCU-FAU	3	Georgetown County
Horry County, SC	CCU-FAU	7	Horry County, City of North Myrtle Beach
Broward County, FL	CCU-FAU	2	US Navy - NAVSEA - NSWC Carderock Division
Palm Beach County, FL	CCU-FAU	5	City of West Palm Beach
St Lucie County, FL	CCU-FAU	3	FAU's Harbor Branch Oceanographic Institute
Miami-Dade County, FL	FIU	4	Miami-Dade County, City of Coral Gables, Catalyst Miami, NOAA
Broward County, FL	FIU	1	City of Ft. Lauderdale, Catalyst Miami, NOAA
Monroe County, FL	FIU	2	Monroe County, Catalyst Miami, NOAA
Brevard County, FL	FIU	1	Indian River Lagoon National Estuary Program, Catalyst Miami, NOAA
Camden County, GA	Georgia Tech	10	City of St. Marys, Georgia Department of Natural Resources, Kings Bay Naval Base
Chatham County, GA	Georgia Tech	8	Chatham Emergency Management Agency, City of Savannah, City of Tybee, Tybee Island 4H Center
TOTAL SENSORS		**66**	