Funding Opportunity Number: NOAA-NOS-IOOS-2024-26599

Southeast Coastal Ocean Observing Regional Association (SECOORA): Phase 2 Implementation of the Infrastructure Investments and Jobs Act

Applying under Topic Areas 1 and 2

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CVs located in Appendix A

Initial period of performance: 3/1/2025 – 2/28/2028

Proposed total budget for Years 1-3:

	Year 1	Year 2	Year 3	Total
Topic Area 1	$650,545	$650,545	$650,545	$1,951,635
Topic Area 2	$364,250	$364,250	$364,250	$1,092,750
Combined Total	**$1,014,795**	**$1,014,795**	**$1,014,795**	**$3,044,385**

Project Summary

Project Title: Southeast Coastal Ocean Observing Regional Association (SECOORA): Phase 2 Implementation of the Infrastructure Investments and Jobs Act

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Topic 2 PI: Mary Conley, TNC; Catherine Edwards; SkIO, Nisse Goldberg, JU; Erin Meyer-Gutbrod, UofSC

Priorities for SECOORA for the next three years are to sustain, repair and expand critical observing infrastructure, and enhance data management, data sharing, and delivery of data products to stakeholders throughout the southeast. SECOORA is proposing work under Topic Area 1: *To support improved and enhanced coastal, ocean, and Great Lakes observing systems* and Topic Area 2: *To enhance sharing and integration of Federal and non-Federal data to inform the most pressing regional coastal and ocean management challenges.* Specific goals and objectives are detailed below:

Topic 1, Goal A: Invest in observing infrastructure for the Southeast
SECOORA's objectives are to invest in the ocean observations that support a range of needs within the southeast. Specifically, (Objective 1) SECOORA will continue the installation and maintenance of water level sensors supporting the Southeast Water Level Network. The southeast is plagued by flood events which lead to public inconveniences and safety issues. SECOORA is helping fill gaps in water level data so that communities can fully understand variations in water level at the scales needed for decision-making.

The Southeast is the only continental US region with expansive shallow-water coral reefs. Marine heatwaves and ocean acidification are negatively impacting these iconic reefs. SECOORA team members at Mote Marine Laboratory filled a gap in OA monitoring in early 2024 by deploying and operating a non real-time SeapHOx OA sensor suite in Looe Key in the Florida Keys National Marine Sanctuary. Maintaining this critical station provides critical data that will enable researchers to monitor OA and potential impacts to the adjacent coral reef ecosystems (Objective 2).

The SECOORA Regional Coastal Ocean Observing System (RCOOS) Plan identifies five locations on the east coast of Florida where buoy observations are needed. The University of North Carolina Wilmington deployed two met-ocean buoys and one co-located wave buoy to meet stakeholder needs within the region. SECOORA will continue supporting these installations as the data is valuable to shipping, navigation, pleasure boating, and NWS forecasters (Objective 3).

Marine heatwaves are periods of abnormally warm ocean temperatures, caused by sea surface temperatures greater than a seasonal threshold. SECOORA will work with our buoy operators to collect subsurface ocean temperature data to determine if increased sea surface temperatures extend deeper into the water column (Objective 4). State coastal zone managers are interested in determining how warming waters are impacting ecosystems and fisheries (range, survival, and recruitment).

Topic 1, Goal B: Recapitalize existing observing infrastructure for the Southeast
For SECOORA to continue meeting stakeholder needs for consistent, quality data that enables decision support, forecasting, and modeling, we must recapitalize in our existing infrastructure. Under this goal, SECOORA will invest in our High Frequency Radar, Glider, and Soundscape Monitoring infrastructure.

Topic 2, Goal A: Enhance sharing and integration of Federal and non-Federal data to inform the most pressing regional coastal and ocean management challenges
SECOORA will increase the visibility of regional ocean data sharing activities with a Regional Ocean Data Sharing (RODS) Web Presence that will be updated with news, information, events and opportunities supported by our RODS partners and communities of practice (CoP) (Objective 1). SECOORA will also support investments in data collection related to marine heatwaves (Objective 2) as this topical area covered both Topic 1 and Topic 2 stakeholder interests.

Critically endangered North Atlantic right whales experience high mortality rates due to ship strikes and entanglement in fishing gear. A significant unexpected mortality event beginning in 2017 has motivated the use of dynamic right whale management, a strategy that changes management based on near-real time visual and/or acoustic monitoring. Acoustic monitoring is limited in the Mid-Atlantic migration corridor and the South Atlantic Bight (SAB) calving grounds compared. SECOORA will invest in the capacity and infrastructure to develop, test, and implement autonomous vehicle (glider) passive acoustic monitoring of North Atlantic right whales in the SAB (Objective 3).

Proposed offshore projects (e.g., wind energy, sand dredging) have the potential to impact marine species and habitats across the South Atlantic. To sustain the region's rich marine diversity, it is important that the siting, construction, and operation of offshore development is done with the environment in mind. Many decision makers who review these projects often don't have the time or capacity to compile and analyze all the available information for permitting these activities. To help overcome these challenges, SECOORA will continue working with The Nature Conservancy to maintain a Southeast Marine Mapping Tool and conduct training in its use for state and federal agency personnel (Objective 4).

Topic 2, Goal B: Support Communities of Practice to address regional ocean data sharing needs
The Southeast coastal zone managers emphasized the need for Surface Elevation Table (SET) monitoring stations across to understand marsh resilience to sea level change (Objective 1). Jacksonville University is leading the SET CoP and they are working with state, federal, and academic partners to maintain a SET inventory, identify new SET locations to fill gaps, and share data across partners and with SECOORA.

Drones are being used for a variety of research purposes and coordination of research activities and lessons learned is valuable for researchers and drone operators. SECOORA will continue working with the Drones in the Coastal Zone CoP to host RFP opportunities for practitioners to attend a 3-part Drone Executive Course hosted by Duke University in Years 1 and 3 and host an in-person meeting in Year 2 (Objective 2).

Partners: NC Department of Environmental Quality, SC Department of Environmental Services, SC Department of Natural Resources, GA Department of Natural Resources, FL Department of Environmental Protection, Florida Keys National Marine Sanctuary, Duke University, Florida Atlantic University, NOAA National Weather Service, National Marine Fisheries Service and National Estuarine Research Reserve Systems, US Geological Survey, US Fish and Wildlife Service, National Park Service.

Background

The Southeast Coastal Ocean Observing Regional Association (SECOORA) is one of eleven regional associations (RAs) that comprise the National Oceanic and Atmospheric Administration (NOAA) led U.S. Integrated Ocean Observing System (IOOS). SECOORA prioritizes, gathers, manages, and distributes observation data for North Carolina, South Carolina, Georgia, and Florida, and has the data management architecture, policies, and procedures to support these activities.

SECOORA was incorporated in 2007. It is a mature 501(c)3 organization with a history of sustaining long-term observations critical for the coastal SE. Our members include a cross-section of regional interests from private industry, academia, non-governmental organizations (NGOs), and state and federal government. The results of our stakeholder engagement efforts are reflected in our Regional Coastal Ocean Observing System Strategic Operational Plan (RCOOS Plan), adopted by the SECOORA Board December 18, 2019, and which presents stakeholder identified priorities for all the RCOOS subsystems, excluding governance and management. The current RCOOS Plan covers the period 2020-2025. The Plan is under review now for a 2025-2030 update.

SECOORA integrates observations, models, data and information management, and outreach to sustain and advance an RCOOS responsive to societal needs. Our data management and cyberinfrastructure (DMAC) component transforms and delivers data and value-added products and services consistent with priorities identified through stakeholder needs assessments. SECOORA is a certified Regional Association (RA). This certification acknowledges SECOORA meets NOAA standards for DMAC and RA management. In simple terms, this means that users can have confidence that ocean and coastal data and information from SECOORA meets rigorous quality control and assurance standards. SECOORA will continue efforts to ensure a strong and sustained IOOS. SECOORA is a member of the IOOS Association, working with 10 other RAs to assure the needs and positions of on-the-ground users in the regions are adequately reflected in national policy and priority setting.

Project Description

Priorities for SECOORA for the next three years are to sustain, repair and expand critical observing infrastructure, and enhance data management, data sharing, and delivery of data products to stakeholders throughout the southeast, including underserved communities. SECOORA is proposing work under Topic Area 1: *To support improved and enhanced coastal, ocean, and Great Lakes observing systems* and Topic Area 2: *To enhance sharing and integration of Federal and non-Federal data to inform the most pressing regional coastal and ocean management challenges.* Proposed activities that fall under each topic are provided below.

Topic 1. To support improved and enhanced coastal, ocean, and Great Lakes observing systems

Goal A: Invest in observing infrastructure for the Southeast

SECOORA is enhancing and expanding its regional coastal ocean observing system to better serve stakeholder needs for flooding, biological, maritime, and coastal data.

Support the SECOORA Water Level Network: SECOORA has established a real-time, regional, cost-efficient, accurate water level network to address needs for flooding information. The southeast is plagued by flooding events (e.g., storm surge, King Tides, high tide flooding) which lead to public inconveniences

and safety issues such as road closures, and it is becoming increasingly common as sea levels rise (Sweet et al., 2019). At present the region does not have the density of water level data required to fully understand variations in water level at the appropriate spatial and temporal scales required for decision making (e.g., emergency management, habitat/environmental management, agriculture). Based on A Network Gaps Analysis for the National Water Level Observation Network, there are major spatial gaps in water level measurements from NC to the west coast of FL. Water level network team members will install sensors each year as follows:

Florida International University (FIU):

- Year 1: Install one new web camera (webcam) in the City of Miami, specifically in E.G. Sewell Park. This park is on the Miami River and is prone to flooding. FIU is currently working on an MOU with the City of Miami for the camera installation.
- Year 1 and 2: Continue to manage, repair and maintain the 8 water level stations currently installed under awards NA21NOS0120097 and NA23NOS0120081.
- Year 1 and 2: Conduct citizen science data collection during two King Tide events. 40 participants for each event will collect water quality samples and visually monitor flooding during King Tides. Additionally, FIU will transition methods to regional collaborators as requested.
- Year 1 and 2: Maintain the 8 water level sensors and the webcam at Sewell Park.
- Year 1 and 2: Continue to integrate data with SECOORA DMAC.
- Year 1 and 2: Mentor one technical support staff on the use of technologies on integrated flood observation.

Coastal Carolina University (CCU) with partners at Florida Atlantic University:

- Year 1 and 2: Engage with stakeholders regarding availability and use of water level data.
- Years1 and 2: Maintain existing 45 water level stations currently installed in SC and FL under awards NA21NOS0120097 and NA23NOS0120081.
- Years 1 and 2: install and maintain 15 new water level sensors.
- Year 1 and 2: Work with partners to cost-share, standardize and operationalize long-term water level station maintenance.

FIU and CCU have submitted the locations for the sensors to SECOORA for NOAA IOOS Environmental Compliance Manager review under award NA21NOS0120097 and NA23NOS0120081. NEPA SAC releases have been provided for those awards. Documentation for each sensor deployment, including ERMA checks, is shared with the IOOS Environmental Compliance team for their review here: https://docs.google.com/spreadsheets/d/10KN3sdkzaUR-Kf_TbC-YI0d1mcCqWH6pvWowcQVbB8o/edit?gid=814881151#gid=814881151. The new locations for the CCU water level stations will be included in the spreadsheet and the IOOS Environmental Compliance manager will be notified when new station locations are updated to the spreadsheet. The webcam to be installed by FIU will be integrated into SECOORA WebCOOS as a camera of opportunity. The installation and operation of webcams has undergone environmental compliance review for award NA23NOS0120243 with a SAC release dated 05/02/2024.

Ocean Acidification Monitoring: The Southeast is the only continental US region with expansive shallow-water coral reefs. The Florida reef tract is made up of zones of living coral reefs and associated habitats that parallel the Florida Keys. The adjacent Florida Bay lies between the Florida Everglades freshwater ecosystem and the seagrass and coral-reef ecosystems of the Keys and often feeds fresher water into the Keys, causing large seasonal variations in temperature, salinity, and turbidity on the reefs, especially those

nearshore. The lower Keys, Bahia Honda Key to Key West, harbor high biodiversity and the most abundant coral cover within the region (Burman et al. 2012). Looe Key is the second longest established Marine Protected Area (MPA) in the Florida Keys and has been studied for decades. These reefs represent one of the most vulnerable habitats to coastal ocean acidification (OA) in the US.

The Southeast currently lacks a cohesive OA monitoring approach and network. SECOORA team members at Mote Marine Laboratory have filled a gap in OA monitoring by deploying and operating non real-time SeapHOx OA sensors at one seafloor station in Looe Key in the Florida Keys. The project team deployed an OA mooring in summer 2024 that is currently producing directly measured climate-quality pH and other carbonate chemistry data products to establish a unique time series on the seafloor in the lower Florida Keys. This will provide support for the Southeast Coastal and Ocean Acidification Network (SOCAN) for OA monitoring in the FL Keys, end-user engagement, increased spatial coverage for OA monitoring; all of which will ultimately support future spatio-temporal modeling for the FL Keys and the South Atlantic Bight. The SeapHOx directly measures salinity, temperature, pH, and percent dissolved oxygen (DO%) at hourly intervals.

The SECOORA Regional Coastal Ocean Observing System (RCOOS) Plan, pages 24-26 and page 36 (http://secoora.org/wp-content/uploads/2020/01/Strategic_RCOOS-Priorities_2019_FINAL.pdf) and the SOCAN Monitoring Report (2017) identify the need to establish a long-term seafloor OA monitoring site in the Florida Keys. Stakeholders from across the southeast have expressed the need for an OA site near Looe Key at meetings held by SOCAN for actionable information about OA progression and identification of particularly vulnerable areas and species groups such as coral reefs. Once a time-series of carbonate chemistry parameters have been collected (by Year 3), the team can establish a site-specific relationship between salinity (S) and total alkalinity. Using TAlk and pH, the team will calculate time series of carbonate chemistry variables, dissolved inorganic carbon (DIC), aragonite mineral saturation state (ΩAR), Revelle Factor, and pCO2 using the program CO2SYS.

Years 1-3: Routine maintenance, validation routine system checks and cleaning of the OA sensors will be performed during all years. It is expected that cleaning should be minimal since biofouling is reduced by the shaded design of the bottom mount and anti-biofouling copper tape that will be used around the SeapHOx. It is expected that the battery life of the SeapHOx, measuring at 1-hour frequency, should be more than six months. Data will be downloaded from the SeapHOx memory card on a quarterly basis. The system will be retrieved and brought to Mote Marine Lab to remove the memory card, recondition the system, and take calibration samples; retrieval and re-deployment will take 1 to 3 days. Validation samples will be collected for DIC, TAlk, and spec pH, which measures total scale pH (pHT). Validation samples will also be collected when the system is re-deployed. Divers will be able to check if the system is functioning simply by verifying that water is pumping out of the output hose.

The installation of the OA sensor underwent Environmental Compliance review under award NA23NOS0120081 with a SAC release issued on 4/13/2023. The operation of the OA sensor is a continuation of the already approved work. SECOORA also received a US Army Corps of Engineers 10-year permit for the OA sensor 12/11/2023.

East Coast Florida Buoy Investment: The SECOORA Regional Coastal Ocean Observing System (RCOOS) Plan (http://secoora.org/wp-content/uploads/2020/01/Strategic_RCOOS-Priorities_2019_FINAL.pdf) identifies five locations where buoy observations are needed on the east coast of Florida. The University of North Carolina Wilmington (UNCW), through funding provided by SECOORA from the original BIL award NA23NOS0120081, deployed two met-ocean buoys and one co-located wave buoy to meet stakeholder needs. The Fort Pierce met/ocean buoy (FTP) is located 10 nm northeast of Ft. Pierce, FL and is near an existing CDIP wave buoy (operated by Scripps Oceanographic Institute and not part of this award). The Ponce de Leon location includes a met/ocean buoy and a co-located low cost

WaveRider buoy (PNC and PNCWave). These buoys are located 16nm northeast of the Ponce de Leon inlet. Real-time data from both locations is available via the SECOORA data portal and NDBC. The installation of buoys in both locations underwent Environmental Compliance review under award NA23NOS0120081 with a SAC release issued on 3/17/2023. SECOORA also received notice from the US Army Corps of Engineers that the buoys fall under NWP5 on 5/26/2023.

All FL buoy systems (i.e., new or refurbished platforms) will be fabricated/serviced and tested in the CORMP facility at UNCW's Center for Marine Science and then transported to Florida Atlantic University's Harbor Branch Oceanographic Institute (HBOI). Once at HBOI, platforms (new or refurbished) will undergo final testing and readied for deployment. In Year 1, UNCW will purchase one new buoy system, including CTD, meteorological sensors, communication equipment and power, to replace the FTP platform that was destroyed by a presumed vessel strike in December 2023. UNCW also will purchase a wave buoy to replace PNCWave buoy that was struck by a vessel in spring 2024. These systems will be rotated into the service cycle in the fall of Year 1. Additional spare buoy hulls and sensors will be purchased in Years 2 and 3. Team members from both institutions will participate in all recovery/deployment cruises to facilitate familiarity with system design, operation, and troubleshooting. Buoy platforms will be swapped-out annually during regularly scheduled cruises anticipated to occur in October of each year. Funds have been budgeted in Year 3 for buoy decommissioning if there is no funding available to maintain the buoys at the end of the project.

Marine Heatwave Monitoring: Marine heatwaves are periods of abnormally warm ocean temperatures, caused by sea surface temperatures greater than a seasonal threshold (usually the 90th percentile) for 5 or more days (Hobday et al. 2016). Marine heatwaves have become more frequent, severe, and long-lasting over the last 30+ years (Smale 2019, Hu 2021, Feng et al. 2023) and can be amplified by dynamics in the ocean mixed layer (Amaya et al. 2021). Sea surface temperatures (Alexander et al. 2018) and marine heatwaves (Fox-Kemper et al. 2021) are predicted to increase over the 21st Century.

Marine heatwaves may vary in physical characteristics as well as their impacts on marine biota and ecosystems such as corals, seagrasses (Smale 2019), harmful algal blooms, and marine mammals (Smith et al. 2021). They have been shown to be statistically correlated to higher temperatures and humidity in nearby coastal cities (Hu 2021). In the Gulf of Mexico region, they may have increased heat stress on coral reefs (Feng et al. 2023). In the northeast Pacific, heatwaves negatively affected fisheries multiple times in the last 10 years (National Fisherman 2019) and modeled effects led to shifts in fish habitat (Welch et al. 2023). Marine heatwaves can also lead to harmful algal blooms and individual events have caused over $800 million in direct costs and $3.1 in indirect losses (Smith et al. 2021).

To address concerns related to marine heatwaves in the southeast, SECOORA will purchase temperature sensors that can be added to existing SECOORA supported buoys in the region. There are 20 SECOORA buoys deployed in NC, SC, and FL. Most buoys have surface Conductivity-Temperature-Depth (CTD) sensors deployed 1-meter below the surface. The goal is to add sensors at least at the mid-water and bottom (1-m above the sediment) locations to track ocean temperature stratification along the east coast Continental Shelf and West Florida Shelf. The sensors will be added to existing, permitted, and NEPA approved buoys and will only provide additional data from these sites (i.e., SECOORA is not installing new buoys or subsurface moorings – all buoys are operated under the NOAA award number NA21NOS0120097 with an SAC release memo dated 5/3/22).

The locations for additional sensor will be prioritized by the SECOORA Science Committee and buoy operators. Additionally, the Science Committee will help determine if the sensors need to report in real-time or if delayed mode data is sufficient. If data must be available in real-time, this may reduce the number of sensors that can be deployed due to higher costs associated with the acquisition and data transmission for real-time data. All data (whether real-time or non real-time) from the sensors will be quality

controlled and provided to the SECOORA data management contractor for ingestion into the SECOORA data portal.

Year 2: SECOORA will purchase 23 low cost CTDs for buoy operators located at UNCW and the University of South Florida (USF) to integrate onto existing buoys. Operators will require 2 CTDs per buoy and 2 spares per buoy (1:1 deployed to sparing ratio to allow 6-month sensor swaps), allowing for 6 sites to have added instrumentation.

Year 3: SECOORA will purchase 41 low cost CTDs for buoy operators located at UNCW and USF to integrate onto existing buoys. As with Year 2, 2 CTDs per buoy and 2 spares per buoy are needed, allowing for 10 sites to have added instrumentation.

Goal B: Recapitalize existing observing infrastructure for the Southeast

Glider Recapitalization: SECOORA has supported glider operations in the southeast for over 10 years. A critical point for glider operators is having enough spare sensors, and sensors that are calibrated and well maintained, so that 7-10 glider missions can be conducted annually. Funding from this award will specifically be used for sensors upgrades/service, purchasing new sensors, and modernizing existing gliders so that glider missions supported by other IOOS awards can be achieved. The gliders are operated under the NOAA award number NA21NOS0120097 with an SAC release memo dated 5/3/22 and NA22NOS0120178 with an SAC release memos dated 6/10/22,. No glider deployments will be conducted under this BIL award.

Years 1 and 2: UGA's Skidaway Institute of Oceanography (SkIO) will upgrade glider sensors (e.g. CTD, DO) and calibrate/service sensors required for glider deployments. They will also purchase spare sensors to reduce turnaround time between glider deployments. Glider operations will not be conducted under this BIL award (i.e., NEPA evaluation not required).

High Frequency Radar (HFR) Recapitalization: HFR is one of the longest supported ocean observing technologies in the SECOORA region. Many of the original HFR were deployed in the early 2000's. A full list of HFR is found here: https://docs.google.com/spreadsheets/d/1ImeZ-FKu9PU21Ib2hGzNyX5KLVTG5Wii7ScJX1RtFXw/edit?usp=sharing. Through this BIL opportunity, SECOORA will reinvest in HFR systems to increase the resilience of the network. All the HFR identified as requiring recapitalization are operated under the NOAA award numbers NA16NOS0120028 with SAC release memo dated 3/16/16, 8/24/20 (Canaveral National Seashore HFR), and NA21NOS0120097 with an SAC release memo dated 5/3/22 which covers these systems. Note that NASA Kennedy Space Center lead the NEPA process for the Kennedy Space Center HFR installation.

Year 1: Three WERA HFR are operated by the University of South Carolina (USC). These systems (GTN, CSW, and MBSP) work in tandem to provide surface current coverage in Long Bay, SC. The following summarizes upgrades to be implemented for USC HFR systems. All upgrades will occur as part of the routine maintenance operations once the new parts have been received and tested.

- Georgetown, SC (GTN) HFR: While there have been some upgrades to the receiver units since original purchase in 2005, the main processing and control units have not been upgraded. Their exposure to the marine environment and regional flooding from numerous hurricanes has contributed to their deterioration. In addition, the manufacturer has made significant advances / improvements that, when implemented, will make the systems more reliable. USC will prioritize the replacement of: (1) the original Frequency Control Rack (FCR) unit (version 1) with a new more efficient one (version 4); (2) the main WERA Remote Terminal Unit (RTU, CPCI unit controlling

data acquisition, upgraded with the latest firmware); (3) the external low performance Power Amplifier (PA) for the Tx signal with a newer, more efficient, internal rack mounted PA; and (4) the WERA User Linux PC will be updated with latest WERA software for interfacing with the radar system and processing data prior to dissemination to IOOS.

- Caswell Beach, NC (CSW) HFR: The HFR station at Caswell Beach, NC (CSW) was originally acquired in 2007. It uses an older version of FCR and an older user PC and software for processing the data. USC will upgrade parts of the system with new, up-to-date versions that will make it compatible with the upgraded GTN station. USC will replace: (1) the original FCR unit (version 1); and (2) the WERA User Linux PC updated with latest WERA software for interfacing with radar system and processing data. USC has a new WERA RTU (CPCI control unit) upgraded with the latest firmware that will be installed during the FCR upgrade. These upgrades will make the two stations, GTN and CSW, fully compatible with interchangeable parts allowing for better routine maintenance.
- Data Server Upgrade: All data from all three stations are locally processed at the remote HFR sites and then transmitted to a server located at USC. This is the server that is used for backing up raw and processed data and for disseminating the collected surface current data to SECOORA and the HFR National Network. USC will upgrade the server to a newer version and an IT consultant will configure the system to transition from the old server to the new one.

Year 2: The University of Miami (UM) operates and maintains four WERA system radar sites (Crandon Park, Virginia Key, Dania Beach, North Key Largo). With BIL funding, UM will invest in IT infrastructure to support all four HFR and make upgrades at the Dania Beach (STF) and North Key Largo (NKL) HFR sites.

- Data Server Upgrade: UM will replace an older server used to manage raw and processed data from all four HFR. The older system is past its useful service window (it is over 10 years old). UM will replace the server with Microsystems/Aspen Data Systems server (22TB) for improved real time operations as well as processing and archiving of HFR data.
- Two old WERA on-site computers at STF and NKL will be replaced with newer computers and software. The computers will be tested before installation to make sure the new software interfaces with the two existing WERA HFR systems.
- Additionally, UM will replace and test new cable connectors at STF and NKL for improved signal quality. Note this was done recently at Crandon Park and Virginia Key improving the signal to noise ratio which ultimately improves the data quality.

Year 3: The Florida Institute of Technology (FIT) operates two WERA HFR, Treasure Shores (TSP) and Hightower Park (HTR), on the east coast of FL. FIT will repair/refurbish both WERA systems by prioritizing the following tasks:

- Purchase two full sets of spare antenna assemblies from Helzel for TSP and HTR (13.5 MHz) radars. This includes 24 receive antenna and 8 transmit antenna as well as hardware and power splitters. This will build infrastructure resilience and sparing for FIT.
- Both TSP and HFT have corrosion issues within some of the antenna coils, antennas, and wooden support studs. FIT will use spare antenna assemblies purchased from Helzel to replace compromised infrastructure.
- Repair cable damage that has occurred due to beach renourishment activities, rodent damage, and hurricanes at both TSP and HTR.
- Replace A/C units and humidifiers at both TSP and HTR since the lifespan for these items is only about 2 years and the HFR require cool conditions to operate.
- Purchase a spare WERA system PC (Remote Terminal/CPCI computer) from Helzel.

- Purchase a replacement shed which can be kept at FIT in a secure location and moved to an HFR site when needed. The HFR sheds are often damaged during tropical storms/hurricanes so a spare shed will reduce system downtime.

Year 3: SkIO operates two HFR in FL, Canaveral National Seashore (CNS) and Kennedy Space Center (KSC) and two HFR in GA, St Catherines (CAT) and Jekyll Island (JEK). SkIO will focus on purchasing supplies to repair JEK and purchase spare parts required for all sites.

- Replace A/C units and humidifiers at JEK, CNS, and KCS since the lifespan for these items is only about 2 years and the HFR require cool conditions to operate.
- Purchase a spare WERA system PC (Remote Terminal/CPCI computer) from Helzel.
- Purchase transmit and receive antennas and coils, new cable required specifically to support the repair of JEK.
- Send HFR instrumentation back to Helzel for repairs.

Estuarine Soundscape Monitoring Recapitalization: The University of South Carolina Beaufort (USCB) has established a passive acoustic network in South Carolina estuarine waters to listen to fish, marine mammal, and anthropogenic sounds. The project team has sensors installed as follows: 3 sensors in the May River, SC (MAY; 2013 – present); 1 sensor in the Chechessee Creek and 1 in the Colleton River, SC (CC and CR; 2019 - present); 3 sensors in Charleston Harbor, SC (CHS; 2017 – present). Each mooring platform consists of a passive acoustic recorder (LS1s, Loggerhead Instruments), water level logger (HOBO 100-Foot Depth Water Level Data Logger U20-001-02-Ti, Onset Computer), and a temperature logger (HOBO Water Temperature Pro v2 U22-001, Onset Computer) attached to a custom-built instrument frame (Mooring Systems). The soundscape monitoring systems originally underwent environmental compliance review under award NA16NOS0120028 with a NEPA SAC memo dated 7/12/2019. The systems are all operated under award number NA21NOS0120097 with NEPA SAC memo dated 5/3/22. BIL funding will be used to purchase new sensors to replace ageing sensors and increase sparing.

- Year 2: USCB will purchase 3 new LS1 recorders from Loggerhead Instruments and some basic spare supply items such as batteries, antifouling paint, line, and shackles.
- Year 3: USCB will purchase 6 new LS1 recorders from Loggerhead Instruments and some basic spare supply items such as batteries, antifouling paint, line, and shackles

Topic 2. To enhance associated sharing and integration of Federal and non-Federal data to inform the most pressing regional coastal and ocean management challenges.

For topic 2, SECOORA has two goals to sustain and enhance data accessibility in the region. These goals are focused on high priority coastal and ocean management issues in the region, as prioritized by the coastal zone managers in the southeast.

Goal A: Data and product development to support high priority regional management issues

Increase the visibility of regional ocean data sharing activities with a Regional Ocean Data Sharing Web Presence: SECOORA will maintain a Regional Ocean Data Sharing Program webpage (https://secoora.org/southeast-regional-ocean-data-sharing-initiative/). This will increase the level of visibility of these efforts to be more comparable to what is seen in the Mid-Atlantic and Northeast. The website updates will include upcoming events, opportunities, and reports that are relevant to the coastal zone managers in the Southeast.

- Years 1 - 3: The SECOORA Communications and Engagement Specialist will coordinate organizing and facilitating Regional Ocean Data Sharing projects, representing the efforts at NOAA meetings, and developing and implementing outreach and communications strategies targeting Coastal Zone Management Act (CZMA) managers.

Marine Heat: See description in Topic 1, Goal A.
CZMA managers in the southeast are concerned with marine heat wave impacts to fisheries recruitment and survival. Since this topic area covers both Goals, supply funds for temperature sensors are included in both Topic 1 and Topic 2.

Right Whale Research and Monitoring in the South Atlantic Bight: SECOORA will invest in the capacity and infrastructure to develop, test, and implement autonomous (glider) passive acoustic monitoring of North Atlantic right whales in the South Atlantic Bight (SAB). This project will be led by researchers at SkIO and the University of South Carolina (UofSC). See Appendix B for Environmental Compliance Questionnaire related to this effort.

Critically endangered North Atlantic right whales experience high mortality rates due to ship strikes and entanglement in fishing gear. These anthropogenic caused mortalities occur across right whale habitat, including in the northern foraging grounds, the Mid-Atlantic Bight migratory corridor, and the SAB calving ground off the coasts of South Carolina, Georgia, and Florida. A significant unexpected mortality event beginning in 2017 has motivated the use of dynamic right whale management, a strategy that changes management based on near-real time visual and/or acoustic monitoring. Despite the expansion of passive acoustic monitoring efforts and studies on the efficacy of this approach in right whales' northern foraging grounds, acoustic monitoring is much more limited in the Mid-Atlantic migration corridor and the SAB calving grounds. Methods developed in the deeper waters of the foraging grounds may not be appropriate for use in the very shallow waters of the SAB. The proposed work would include the purchase of a passive acoustic monitoring science bay for gliders and four right whale monitoring missions on the Southeast US shelf during winter calving seasons (roughly December – April). This project builds on recent test deployments of gliders outfitted with an integrated passive acoustic recording system and onboard analysis that permits identification of the vocalizations of several baleen whale species, including the endangered North Atlantic right whale, in near-real time. These observations and experiments will support and expand existing networks for right whale monitoring led by collaborators at NOAA and Woods Hole Oceanographic Institution.

- Year 1: SkIO will purchase a Teledyne Webb Slocum glider science bay equipped with passive acoustic monitoring instrumentation that can be integrated into the SECOORA and SkIO gliders. Specifically, the science bay will be equipped with a CTD (conductivity, temperature, and depth); a three-channel fluorometer to measure fluorescence of chl-a, colored dissolved organic matter (CDOM), and backscatter; a dissolved oxygen sensor; and a digital acoustic monitoring instrument (DMON2) to record and process hydrophone audio in real time.
- Years 2 - 3: SkIO and UofSC will conduct two glider missions per season with the integrated science bay to monitor North Atlantic right whales in the SAB for a total of at least four missions during winter calving seasons. Each mission, typically 14-24 days based on 2022-2023 field experiments, will test and integrate new strategies to optimize the glider flight plan for detecting right whale vocalizations in the extremely shallow operating area (<20m water depth) in the migration corridor. The SkIO team will lead glider operations, with assistance in deployment, recovery, and data collection from UofSC. Both SkIO and UofSC will coordinate operations and

piloting, including adaptive mission planning to optimize glider performance and management goals. The UofSC team will conduct expert review of the real-time data stream of acoustic pitch tracks sent to shore via Iridium satellite link. The purpose of this acoustic review is to detect baleen whale vocalizations missed by the onboard Low Frequency Detection and Classification Software, and to verify the accuracy of classified vocalizations. This expert review is conducted prior to the communication of right whale detections to NOAA and the myriad systems in place for data dissemination to the public. Right whale detections will be shared in near-real time on public platforms such as Robots4Whales, Whale Map, and Whale Alert. Detections will also be shared with the Georgia and Florida Early Warning Systems (https://myfwc.com/research/wildlife/right-whales/early-warning-system/), for potential broadcast to mariners.

Improve access to regional ecological data to help inform offshore ocean use decisions through stakeholder engagement and mapping tool refinement: Proposed offshore projects such as wind energy sites or sand dredging have the potential to impact marine species and habitats across the South Atlantic (NC, SC, GA, FL). To sustain the region's rich marine diversity, it is important that the siting, construction, and operation of offshore development is done with the environment in mind. Environmental Impact Statements are required for every offshore development project, but stakeholders reviewing these projects often don't have the time or capacity to compile and analyze all the available information. In addition, datasets are often viewed in isolation, without any interpretation to the broader regional context. To help overcome these challenges, The Nature Conservancy (TNC) worked with partners to develop a Southeast Marine Mapping Tool (https://www.maps.tnc.org/marinemap/se/#7/34.5/-76.5). A beta version of the tool was released in May 2022, providing access to synthesized regional ocean features, species and management data. Phase 2 of this project focused on engaging decision-makers and stakeholders across the region in tool refinement, ensuring it is readily accessible and provides relevant information in a digestible format. A refreshed version of the tool is scheduled for release by December 2024. Phase 3, including in this BIL proposal will focus on the following tasks:

- Years 1-3: Maintain functionality of the Marine Mapping Tool. This includes new updates to the packages used on the tool, updates on links and source metadata, and any other updates that result from the way the information is hosted and served on the tool.
- Years 1-3: Update datasets available in the tool. TNC will make sure the data on the tool represents the best data available in the region. TNC has explored options to make updates automatic; however, the analyses behind the tool and the uncertainties on the data structure from data providers, means that the data must be updated manually. As a result, to be added to the tool, data still require a level of analysis and synthesis. Different data sources have different update cycles, with species models updated every 3-5 years, but human-use data updated yearly. TNC will perform annal data updates as new data are made available.
- Years 2-3: Through the process of developing the Northeast version of the Marine Mapping Tool, TNC learned that a high level of engagement is required to ensure the tool and its datasets are used for decision-making. This includes webinars and conference presentations, targeted workshops with user groups, direct engagement with coastal zone managers, and direct conversations with users and data providers. TNC will develop and implement an engagement and training plan for the Southeast Marine Mapping Tool to help boost tool use for decision support, and report metrics on tool use to SECOORA.

Goal B: Support Communities of Practice to address regional ocean data sharing needs in the southeast

Surface Elevation Tables (SETs): SETs are used to measure the changes in elevation of wetlands, such as coastal marshes. SETs, once a long-term record has been established, help determine if a marsh is retaining enough sediment to keep up with sea level rise or if it is being "drowned". SETs have been in use by the U.S. Geological Survey and various NOAA organizations (e.g., NCCOS) for decades. Information on SET the installation and use of SET data is available here: https://www.usgs.gov/centers/eesc/science/surface-elevation-table. The Southeast coastal zone managers have requested additional SET monitoring stations across the region to increase data available on marsh resilience to sea level change. Discussions with regional experts revealed that various groups in each state install and manage SETs, including the NOAA National Estuarine Research Reserves and Sentinel Site programs, U.S Geological Survey offices, U.S. Fish and Wildlife Service, military installations, and others. Dr. Nisse Goldberg, Jacksonville University, will complete the following tasks as part of this project:

- Update an inventory and associated metadata of existing SET stations throughout the southeast region (NC, SC, GA, and FL)
- Communicate with, maintain, and expand SET Community of Practice membership
- Conduct a workshop in Year 1 for SET practitioners and coastal zone stakeholders. The SECOORA Office and Events Manager will participate on the workshop planning committee, book the meeting venue, and manage meeting logics and support.
- Update SET web content in collaboration with the SECOORA Communications and Engagement Specialist
- Facilitate and coordinate the acquisition and sharing of content associated with the SET data portal and visualization platform
- Coordinate release of funds in support of SET station maintenance/repair/new installations

Support and expand the existing Drone Community of Practice: Uncrewed Aircraft Systems (UAS), or drones, are a rapidly growing component of research, assessment, and monitoring of coastal regions within the U.S. Southeast and the Caribbean. SECOORA, with SE NERRS, SECART, Duke University and the NOAA NCCOS Beaufort Lab, hosted the Drones in the Coastal Zone virtual workshop series in October 2020 (https://secoora.org/drones-in-the-coastal-zone-workshop/), and an in person workshop in 2024. A Drones in the Coastal Zone CoP has been established to continue supporting the sharing of knowledge and best practices related to the use of drone technologies to support coastal research. Drones are not being actively flown for this award. Funding supports the CoP. The following tasks will support the CoP:

- Year 1-3: The SECOORA Communications Specialist will maintain the Drones in the Coastal Zone CoP webpage with links to projects, resources, latest news, and past and future workshop materials. The webpage is hosted on the SECOORA website.
- Year 2: SECOORA will work with the Drone CoP to host a workshop. The workshop will advance the understanding of applications of drone data to key coastal and ocean management issues. The SECOORA Office and Events Manager will participate on the workshop planning committee, book the meeting venue, and manage meeting logics and support.
- Year 1 and Year 3: SECOORA will host a competition for winners to attend a 3-part UAS executive education course offered by the Nicholas School of the Environment at Duke University to build capacity in the region for implementing the technology and understanding the data. SECOORA will sponsor 10 candidates in each year from the US Southeast region to attend. Each online course is six weeks in duration, and includes asynchronous video lectures, weekly 1.5-hour virtual synchronous sessions, projects and assessments, and inclusion into a growing online community of UAS researchers. After successful completion of all three courses, applicants will receive a certificate of completion.

Data Sharing Plan

SECOORA is committed to collecting and sharing scientifically accurate coastal and ocean data, models, and products in a timely manner, and developing a useful decision-support system. SECOORA is one of 11 NOAA IOOS regional associations. SECOORA, and its data management and communications system, is a NOAA certified Regional Association. The SECOORA Data Management team is led by Axiom Data Science ('Axiom'), and SECOORA and Axiom are the data management partners for this proposed effort. SECOORA has a mandate to follow Data Management and Cyberinfrastructure core capability requirements for IOOS Regional Associations and other IOOS grant recipients who are contributing data to the U.S. IOOS. To fulfill this mandate Axiom organizes data in a way that is easily findable and accessible via regional and national data assembly centers, allowing policy makers, researchers, managers, and the general public access to the data and information they need to make informed decisions. Axiom has considerable experience developing scientific data management infrastructure and provides experienced personnel to manage data standardization, archival, and metadata documentation. This project will use the shared data management infrastructure developed and maintained by Axiom with support from IOOS. Among this infrastructure is the Research Workspace, a web-based scientific collaboration and data management tool used by researchers to secure and centralize project data, generate standards-compliant metadata, and ultimately publish data files openly on public data portals, such as the SECOORA and MBON data portals, and archive data to NOAA's NCEI.

SECOORA will assure that all data generated under Topic 1 and Topic 2 areas is discoverable by, and accessible to, the general public in a timely fashion. As described in the proposal, under Topic 1 this project will generate physical oceanographic data (water level, water temperature and salinity) and water quality data (pH, DO) to support ocean acidification and coastal flooding applications. Additionally, HFR data (through system improvements) will continue to be collected and made available in real time via SECOORA and the HFR data centers at Scripps Institute of Oceanography and NOAA National Data Buoy Center (NDBC). Ocean temperature data from buoys (through sensor upgrades) will be made available in through the SECOORA data portal. Under Topic 2, the project will generate datasets, applications, and online tools related to marsh elevation and ocean planning. All data and online tools will be made publicly available through the SECOORA data portal, data catalog, or on the SECOORA website (e.g., CoP materials). SECOORA does not embargo real-time data (i.e., the data is open and accessible via the SECOORA data portal and data services within minutes of the data being collected). Non real-time data is quality controlled by the PI and shared via Research Workspace within 6 months of the data being downloaded from the sensor. Axiom then ingests the data into the SECOORA data portal and data catalog where it is freely accessible.

Axiom data analysts work with appropriate project team members to process physical oceanographic data sets into CF-compliant netCDF file collections and relevant biological data sets to the Darwin Core standard (https://dwc.tdwg.org/). Processing data into these open and self-describing formats will provide an additional examination of the data for any errors and inconsistencies. The result will be standardized data that is readily available for data integration, visualization, and archive submission. Axiom and project PIs have extensive experience archiving data with NCEI, from the data submission process to requesting accession numbers or DOI's tied to previous and ongoing funded research efforts.

Comprehensive metadata using the latest national and international technology and community standards will be required for new datasets generated through this award. Research Workspace includes an integrated metadata editor, allowing researchers to generate metadata conforming to the FGDC-endorsed ISO 19110 and 19115-2 and suite of standards and Ecological Metadata Language (EML). Axiom will provide technical assistance to data providers via workshops and one-on-one meetings to ensure robust and standards-compliant metadata are generated.

The Axiom data center and services are housed on highly redundant storage and compute resources at a data center in Portland, OR, and are geo-replicated using Amazon Glacier Cloud Archive Services. All databases and code repositories are routinely backed-up, and servers undergo routine maintenance to swiftly address security vulnerabilities. Servers containing source code and databases are located behind an enterprise-level firewall and are physically secure with environmental regulation systems, redundant power, and fire suppression.

All data and outputs will be openly available to the public adhering to the NOAA Data Sharing Procedural Directive. Data will be accessible free of charge through NOAA NCEI, SECOORA and MBON data portals and catalogs, and other NOAA databases. Every member in the project team understands and agrees to follow the FAIR Guiding Principles (findable, accessible, interoperable, and reusable). The complete SECOORA Data Management and Cyberinfrastructure Plan is available here: https://secoora.org/wp-content/uploads/2022/05/00_SECOORA_DMAC_Plan_2022-05-06.pdf.

Years 1 & 2 Budget Breakdown by Topic Area

Table 1: Annual Costs for Topic 1 projects by Goal

Goal	PI/Contractor & Affiliation	YR 1	YR 2	YR 3
Program Management				
Goals A and B	SECOORA Staff, Contracts, & IDC	$55,545	$50,433	$90,244
Goal A: Invest in new observing infrastructure for the Southeast				
Water Level Sensors	Tiffany Troxler, Florida International University	$75,000	$75,000	
Water Level Sensors	Paul Gayes, Coastal Carolina University	$75,000	$75,000	
OA Mooring	Emily Hall, Mote Marine Lab	$115,000	$100,000	$100,000
FL Buoys	Lynn Leonard, UNC Wilmington	$185,000	$188,000	$197,000
Marine Heat	University of South Florida and UNC Wilmington		$16,112	$39,301
Goal B: Reinvestment in existing observing infrastructure for the Southeast				
HFR Recapitalization	University of South Florida	$100,000		
HFR Recapitalization	University of Miami		$100,000	
HFR Recapitalization	Florida Institute of Technology			$80,000
HFR Recapitalization	Skidaway Institute of Oceanography			$100,000
Gilder Recapitalization	Skidaway Institute of Oceanography	$45,000	$20,000	
Soundscapes Recapitalization	University of South Carolina Beaufort		$26,000	$44,000
	Total Costs – Topic 1	**$650,545**	**$650,545**	**$650,545**

Table 2: Annual Costs for Topic 2 projects by Goal				
Goal	**PI/Contractor & Affiliation**	**YR 1**	**YR 2**	**YR 3**
Program Management				
Goals A and B	SECOORA Staff, Contractors, IDC	$98,910	$79,230	$89,490
Goal A: Data and product development to support high priority regional management issues				
Website development & updates	Regional Ocean Data Sharing webpage content updates	Covered in staff line	Covered in staff line	Covered in staff line
Marine Heat	University of South Florida and UNC Wilmington		$5,032	
Right Whale Research and Monitoring	Catherine Edwards, SkIO and Erin Meyer-Gutbrod, UofSC	$110,000	$110,000	$110,000
Southeast Marine Mapping Tool	Mary Conley, The Nature Conservancy	$25,000	$25,000	$25,000
Goal B: Support Communities of Practice to address regional ocean data sharing needs in the southeast				
SET CoP Coordination	Nisse Goldberg, Jacksonville University	$40,000	$45,000	$45,000
	SET CoP Workshop and Travel	$24,340		
	SET Data Management Contract	$15,000	$15,000	$15,000
	SET repairs, surveys, and installations	$9,000	$54,000	$37,760
Drone CoP	Drone CoP Workshop and Travel		$30,988	
	Duke University Drone Executive Courses	$42,000		$42,000
	Total Costs – Topic 2	**$364,250**	**$364,250**	**$364,250**

SECOORA Milestone Chart			
	Yr 1	**Yr 2**	**Yr 3**
Topic 1 Goal A: Invest in observing infrastructure for the Southeast			
WL: Install 1 new webcam in Miami, FL (FIU) and maintain thereafter	X	X	
WL: Maintain 8 (FIU) + 45 (CCU/FAU) water level stations	X	X	
WL: Conduct 2 citizen science King-tide events (FIU)	X	X	
WL: Integrate data with SECOORA DMAC (FIU and CCU/FAU)	X	X	
WL: Engage stakeholders re: water level data availability, use, and long-term maintenance requirements (CCU)	X	X	
WL: Install 15 new water level stations (CCU)	X	X	
OA: Routine 3-mo maintenance, validation, system checks of OA (Mote)	X	X	X
Buoys: Purchase replacement & spare parts for FTP & PNC/ PNCWave buoys (UNCW)	X	X	X
Buoys: Maintain FTP and PNC buoys (UNCW/HBOI)	X	X	X
Buoys: Integrate data with SECOORA DMAC (UNCW)	X	X	X
Marine Heat: Purchase 64 CTDs for water temp, & install on ~20 buoys (UNCW & USF)		X	X
Topic 1 Goal B: Recapitalize existing observing infrastructure for the Southeast			
Gliders: Upgrade, calibrate, and purchase spare glider sensors (SkIO)	X	X	
HFR: Upgrade GTN, CSW, and MBSP stations and USC data server (USC)	X		
HFR: Improve IT infrastructure for HFR and make upgrades at STF and NKL (UM)		X	
HFR: Repaired and refurbished TSP and HTR HFR (FIT)			X

HFR: Supplies purchased to repair JEK and spares purchased for CNS, KSC and JEK (SkIO)			X
Sound: Purchased 6 LS1 Loggerhead recorders, and supplies (USCB)			X
Topic 2 Goal A: Data and product development to support high priority regional management issues			
Outreach: Regularly updated RODS webpages (SECOORA)	X	X	X
RW: Purchased glider science bay with passive acoustic sensor (SkIO)	X		
RW: 2 glider missions completed during each calving season (SkIO)		X	X
Marine Mapping Tool: Maintained with updated datasets (TNC)	X	X	X
Marine Mapping Tool: Implemented engagement and training plan for Tool (TNC)		X	X
Topic 2 Goal B: Support Communities of Practice to address regional ocean data sharing needs in the Southeast			
SET: Updated inventory of regional SET stations (JU)	X	X	
SET: Expanded SET CoP membership (JU)	X	X	X
SET: SET CoP Workshop and final report (JU)	X		
SET: Updated webpages (SECOORA)	X	X	X
SET: Updated SET data portal (SECOORA data management contractor)	X	X	X
SET: Repaired/maintained, surveyed, newly installed SET stations	X	X	X
Drones: Updated webpages (SECOORA)	X	X	X
Drones: 10 competitively awarded Duke UAS Executive Education graduates (SECOORA)	X		X
Drones: Drone CoP Workshop and final report (SECOORA)		X	

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