Funding Opportunity Number: NOAA-NOS-IOOS-2024-2008213

Southeast Coastal Ocean Observing Regional Association (SECOORA): Inflation Reduction Act, 2022 Revision Request: Other

There are no changes to the goals, objectives, or budget.

Applying under Topic Area 2

Primary Principal Investigator: Debra Hernandez, Executive Director, SECOORA Post Office Box 13856, Charleston, SC 29422, debra@secoora.org

Co-Principal Investigator: Jennifer Dorton, Deputy Director, SECOORA Post Office Box 13856, Charleston, SC 29422, jdorton@secoora.org

Financial Representative: Megan Lee, CFO, SECOORA, SECOORA Post Office Box 13856, Charleston, SC 29422, mlee@secoora.org

Other Investigators:
Topic Area 2: Eric Montie, University of South Carolina Beaufort; Frank Lopez, North Carolina Sea Grant; Jessica Brown, Georgia Sea Grant; Laura Tiu, Florida Sea Grant; Matt Gorstein, South Carolina Sea Grant
CVs located in Appendix A

Initial period of performance: 8/1/2024 – 7/31/2029

Proposed total budget for Years 1-5: $4,570,910

Revision Request: 3/4/2024. This request is to improve alignment with current Administration priorities by clarifying that the work is in support America's need for information that supports our maritime economy and coastal community growth and development. There are no changes to the goals, objectives, or budget.

Project Summary

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. The SECOORA Regional Coastal Ocean Observing System Strategic Operational Plan (RCOOS Plan) provides the framework for our observing strategy. 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).

SECOORA primary IRA Topic 2 goals and objectives are as follows:

1. Engage with communities in the Southeastern Region to meet needs for information, especially related to Water Level, Wave, and WebCam sensors
    a. Identify community data needs via partnerships between SECOORA and the four Sea Grant offices within the region
    b. Deploy WebCams and Water Level sensors in key locations to meet community needs
    c. Participate in national Community Engagement and Technical Communities of Practice and contribute to community engagement, waves, water levels, and webcams best practice resources
    d. Archive data to regional and national data repositories based on common data management standards
    e. Invest in product development tuned to meet specific community needs
2. Contribute to the Ecosystems focus area by supporting the SECOORA Estuarine Soundscape Observatory Network (ESON)
    a. Maintain the ESON sensors and archive data to regional and national data repositories based on common data management standards
    b. Participate in Ecosystem Communities of Practice
    c. Contribute to soundscape best practice resources

Project Description

SECOORA will contribute to the Topic 2 IRA proposal led by MARACOOS that focuses on the 1) creation of national **Water Level, Waves, and WebCam** networks, 2) contribution of Passive Acoustic Monitoring data to the pan-regional **Ecosystems** effort to address ecosystem variation and change; and 3) participation in user engagement efforts conducted at the national and regional levels through Communities of Practice established for Water Level, Waves, Webcams and Ecosystems projects.

Goal 1: Engage with communities in the Southeastern Region to meet needs for information, especially related to Water Level, Wave, and WebCam sensors

SECOORA is enhancing and expanding its regional coastal ocean observing system to better serve stakeholder needs for shoreline/surfzone information and coastal flooding data. SECOORA is working with

the other Regional Associations to collectively serve the needs of communities, broaden participation and networking, and further adapt innovative technologies and techniques. The IOOS RAs are committed to filling data gaps at hyper-local levels to serve the needs of communities. This pan-regional project will use three low-cost sensor technologies to address community needs for data that support coastal resilience: water level sensors, wave buoys, and webcams. SECOORA, in its Topic 2 proposal, will support the expansion of water level sensors and webcams to strengthen existing relationships and build new partnerships in the southeast. The significance of our approach is that it will enable local stewardship of the sensors and foster a local sense of ownership for maintaining ocean observations. Note that the SECOORA Topic 1 proposal includes the deployment of wave buoys.

Objective A: Identify community data needs via partnerships between SECOORA and the four Sea Grant offices within the region.

SECOORA has established relationships with the Sea Grant offices in the southeast region: NC Sea Grant, SC Sea Grant Consortium, GA Sea Grant, and FL Sea Grant. SECOORA will hire a Community Engagement Specialist who will be the liaison with the Sea Grant teams. The Sea Grant extension agents and SECOORA Community Engagement Specialist will:

- Host outreach outreach/engagement events throughout the region to 1) identify new communities who need water level and/or webcams to help address flooding concerns, and 2) continue collaborating with communities which have already been engaged through other SECOORA-funded or Sea Grant engagement efforts.
- Work with community members to determine how best to deliver water level and camera data (see Objective E for more details)
- Work with communities to identify a station steward, where possible. The station steward could help with checking the sensor when/if it is having technical issues. The steward can receive basic training in troubleshooting and will be able to connect with the SECOORA Water Level or Web Camera Manager as needed.
- Host virtual coordination meetings within the region to track progress and discuss issues, highlight successes, etc. Virtual calls will be hosted every other month.

Objective B: Deploy WebCams and Water Level sensors in key locations to meet community needs.

Within Topic 2, SECOORA will install sensors in communities based on recommendations from the SECOORA Community Engagement Specialist and the Sea Grant extension team (Objective 1). Specifically, SECOORA will:

- Expand the water level network - targeting 4-5 new water level sensors per state (Years 2-5) for a total of 16-20 water level sensors deployed.
- Expand the web camera network by deploying 2-3 new sensors annually (Years 2-5) for a total of 10 new webcam deployments.

It should be noted that SECOORA may co-locate water level and camera sensors based on specific community data and information needs communicated by the Sea Grant extension team members.

Objective C: Participate in national Community Engagement and Technical Communities of Practice (CoP) and contribute to community engagement, waves, water level, and webcams best practice resources.

The SECOORA Water Level Manager, WebCam Manager, and Deputy Director will participate in the national Technical CoP. The SECOORA Community Engagement Specialist and at least two of the Sea

Grant team members will participate in the national Community Engagement CoP. Specific areas where SECOORA will contribute include:

- Participation in CoP virtual calls (Years 1-5) and in person CoP meetings hosted by the IOOS Association (Years 1, 2, and 4).
- Development of technical and community training resources that can be shared via a repository on the IOOS Association website.
- Development of national Standard Operating Procedures (SOPs) for each sensor type (waves, water level, webcams) developed by the Technical CoP.
- Baseline data reporting standards (e.g. sensor reporting frequency, water level datum identification) agreed to by RAs and partners.
- Development of materials, such as engagement strategies to be used when working with communities, in collaboration with the Community Engagement CoP.
- Contributing to lessons learned documents for the Technical and Community Engagement CoPs.
- Contributing to best practices and lessons learned for documents submitted to the Ocean Best Practices online repository.

Objective D: Archive data to regional and national data repositories based on common data management standards.

SECOORA will work with its data management team, Axiom Data Science, to ensure data from new water level sensors and webcams are ingested into the SECOORA data management system and metadata is created for each station. Axiom will use consistent data management practices so that the observational data follow Findability, Accessibility, Interoperability, and Reusability (FAIR) principles. Water Level data will undergo the automated suite of relevant QARTOD tests. These practices will allow for data access and product development that meets community needs and expectations and will support data ingestion into federal programs that support coastal resilience (e.g., coastal flooding risk prediction applications).

Webcam data management standards have been developed by the WebCOOS team. This team has developed initial requirements for data management, device, streaming, S3 Uploading and External S3 Indexing. The existing Technical Documentation page (https://webcoos.org/docs/) provides detailed information on the ingestion, uploading and indexing of video stream data from devices that support Real Time Streaming Protocol (RTSP) or Real Time Messaging Protocol (RTMP) so that products based on camera and other sensor data can be developed (e.g., water level graphs with visuals of flooding). These requirements will be refined and documented based on Technical CoP engagement.

The following data management tasks will be undertaken:

- Archival dataset structures and metadata for water level and cameras agreed to and updated in the SECOORA Data Management Plan.
- Water level and camera data are integrated into the SECOORA data management systems and shared via SECOORA websites and existing national data assembly centers.
- QARTOD implemented for new water level sensors.
- Water Level data submitted to NOAAs National Centers for Environmental Information (NCEI).

Objective E: Invest in product development tuned to meet specific community needs.

The Sea Grant extension team and the SECOORA Community Engagement Specialist will work with community members to identify product requirements so that water level and camara data products are designed to meet community needs. The extension staff will work with Axiom and the product development contractor to develop data products tailored to user needs. Tasks include:

- Documenting data access and visualization requirements for water level and webcam data. All documentation is shared with data managers and product developers.
- Data products (e.g. websites, mobile friendly sites, text alerts) are iteratively co-developed with community members. Ensure stakeholders and partners can access water level data via technologies and formats they need (e.g. text alert, web page, QR codes).
- Provide feedback to the SECOORA product development team so that continuous improvements to data access can be made.
- Outreach and communication materials related to sensors and data products are developed with community partners.

Goal 2. Contribute to the Ecosystems focus area by supporting the SECOORA Estuarine Soundscape Observatory Network (ESON)

The marine ecosystem is essential to the nation's economy, well-being, culture, and health. Clear and consistent data and information on coastal ocean and Great Lakes ecosystems is imperative. *Specifically, information on water column structure, heat content, biogeochemistry, and marine life, is required to meet decision-making needs of local, tribal, state, national, and international entities*. This information is critical for informing adaptation strategies related to ecosystem variation and change (EcoChg). Federal mandates, such as Magnuson-Stevens Act, Endangered Species Act, Marine Mammal Protection Act, National Marine Sanctuaries Act, Coordination of Ocean Observations and Research Act, National Environmental Policy Act, and Clean Water Act necessitate the provision of such data. State and local governments, along with community-based and non-governmental organizations, have similar information needs. SECOORA will undertake objectives A-B to contribute to this national Ecosystems effort.

Objective A: Maintain the Estuarine Soundscape Observatory Network (ESON) sensors and archive data to regional and national data repositories based on common data management standards.

Ocean sound is now a Global Ocean Observing System (GOOS) Essential Ocean Variable (EOV) that provides information on the occurrence of numerous variables including fish, marine mammals, and anthropogenic sound sources of interest for place-based management. SECOORA will work with the University of South Carolina Beaufort (USCB) to maintain the ESON network. This includes:

- Maintaining nine passive acoustic monitoring (PAM) stations established in the May River, SC (3 stations, operating from 2013 – present); Chechessee Creek and Colleton River, SC (1 station in each location, operating from 2019 - present); Charleston Harbor, SC (3 stations, operating from 2017 – present); and Trenchards Inlet near Pritchards Island, SC (1 station, operating from 2024 – present).
- Collection of organismal observations using traditional fishery surveys and bottlenose dolphin surveys for correlation with PAM data analysis.
- Performance of soundscape analysis of a subset (39,420 wav files; 2 min every 2 hours; or 12 wav files/day) of these PAM data. For each 2 min wav file, the USCB team will determine a suite of soundscape endpoints including: (a) average root mean square (rms) sound pressure levels (SPLs) of various bandwidths; (b) call detections of fish and bottlenose dolphins; and (c) detections of anthropogenic noise sources.

- Using archived and newly collected data, determine soundscape patterns of estuaries in SC and investigate how soundscape endpoints correlate with environmental data.
- Share passive acoustic monitoring (PAM) data from ESONS with Axiom for hosting on the SECOORA Soundscapes webpage and with NOAA NCEI for archive.

Objective B: Participate in Ecosystem Technical and Engagement Communities of Practice and contribute to soundscape best practice resources.

- USCB and the SECOORA Community Engagement Specialist will participate in national ecosystems workshops (Years 1, 2, and 4). Funding for travel for USCB personnel will be supported by the IOOS Association.
- USCB PAM team members will participate on the Ecosystems Technical CoP to build on and contribute PAM best practices for observing and data processing which will be shared via Ocean Best Practices.
- The SECOORA Community Engagement Specialist and USCB team will also work with the Ecosystems Engagement CoP to prioritize efforts to more effectively provide Ecosystem Change data and information to support community needs for coastal and climate resilience information using equitable service delivery best practices. Concepts will include place-based management information on ecological change that can be downscaled to meet regional information needs.

SECOORA Milestone Chart

Milestones: Goals 1 and 2	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
SECOORA Community engagement specialist hired and trained	X				
Subaward contracts executed	X				
Outreach/engagement events hosted within the region	X	X	X	X	X
Water Level and Webcam station stewards identified	X	X	X	X	X
Virtual SECOORA/Sea Grant regional coordination meetings hosted	X	X	X	X	X
Baseline data reporting standards agreed to by RAs and partners for water level, wave, and webcam data	X				
Archival dataset structures and metadata agreed to by RAs and recorded in RA Data Management Plans	X	X			
Information provided to environmental compliance contractor for NEPA analysis and for procurement of relevant state/federal permits for sensor installations	X	X	X	X	X
WL sensors and cameras installed and maintained		X	X	X	X
PAM sensors maintained	X	X	X	X	X
Milestones: Goals 1 and 2	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Participated in national CoP virtual calls (Community Engagement and Technical for Waves, Water Level, Webcams & Ecosystems)	X	X	X	X	X

Participated in national CoP meetings (Community Engagement and Technical for Waves, Water Level, Webcams & Ecosystems)	X	X		X	
Lessons learned shared and SOPs refined within CoPs (Community Engagement and Technical for Waves, Water Level, Webcams & Ecosystems)			X	X	X
Lessons learned shared via Ocean Best Practices (Waves, Water Level, Webcams & Ecosystems)			X	X	X
Data integrated into data management systems and shared via existing data assembly centers		X	X	X	X
QARTOD implemented for water level and wave data	X	X	X	X	X
Data access and visualization tools requirements for water level, wave, webcam and PAM data completed based on community needs	X	X			
Data products iteratively co-developed with community members		X	X	X	
Outreach/Communication materials developed with partners & national team members		X	X	X	
Project documentation, including sensor deployments, locations, and data management pathways (re: progress reports and metrics of success) managed by RAs	X	X	X	X	X
Contributed to the comprehensive project review (e.g. What have we learned? What are we doing well? How do we improve?)					X
Sustainability (funding) plans completed and implemented by each RA				X	X

SECOORA 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 IRA Topic 1 and Topic 2 areas are discoverable by, and accessible to, the general public in a timely fashion. As described in the proposal, under Topic 2 this project will generate physical oceanographic data (water level) and soundscape (passive acoustic monitoring) data to support coastal flooding and ecosystem applications. 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: http://secoora.org/wp-content/uploads/2022/05/00_SECOORA_DMAC_Plan_2022-05-06.pdf