

Southeast Coastal Ocean Observing Regional Association (SECOORA): Supporting Resilient Ecosystems, Communities and Economies

Program Performance Report

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Principal Investigator:

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

Associate Investigator:

Michael Crosby, SECOORA Board Chair
President and CEO
Mote Marine Laboratory and Aquarium
Sarasota, FL 34236
P: 941-388-4441
E: mcrosby@mote.org

Associate Investigator:

Megan Lee, Chief Financial Officer
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: 910-443-1708
E: jdorton@secoora.org

1) Progress and Accomplishments

Goal 1: Continue SECOORA's region-wide governance and communication structure to engage users and stakeholders in coastal observing science

Milestone A: Maintain governance and management for the RA and RCOOS: *On-Track*

Activities	Status
Effectively manage grants and contracts	The SECOORA Year 5 Descope proposal was submitted to the IOOS office 09/08/20; the first Year 5 semi-annual progress report was submitted on 12/14/20.
Ensure SECOORA's operational & governance structure enables us to achieve our vision	SECOORA held a virtual Board meeting on Dec. 1-2, 2020. The meeting covered two topics: updating the Strategic Plan for the next three years and Diversity, Equity, and Inclusion. A virtual Members and Board Meeting was held on May 24. Results from the Board election were announced, the FY 22 budget was approved, and SECOORA's revised Strategic Plan was announced.
Maintain effective communication with US IOOS and the IOOS Association	Highlights this period IOOS Program Office / IOOS Association Spring virtual meeting, including work on the IOOS Association Strategic Plan; IOOS Association June Board meeting and 2021 Caraid Award Ceremony, and monthly IOOS Program Office, IOOS Association Executive Committee, IOOS Association Outreach Committee, and RA Director calls. <ul style="list-style-type: none">• Congressional meetings: 23 virtual meetings with congressional staffers and 13 appropriations requests.• IOOS Association 'coastal climate signal' and infrastructure white papers• IOOS Spring Meeting: This virtual meeting included three sessions on Mar. 2, 5, and 9. Highlights include 1) lightning talks from all regions on plans for the next 5-years, 2) briefings from Blaise Sheridan and Matt Womble, Senate Appropriations; Nikky Teutschel and Fern Givvons, Senate Authorization; and

Activities	Status
	Derrin Babb-Brott, Ocean Science and Technology Policy, 3) updates from NOS and the IOOS Program Office, and 4) and IOOS Association Board Business meeting to approve the budget and receive committee updates.
Expand and diversify funding	SECOORA is a co-PI on the proposal, <i>Rapid floodwater extent and depth measurements using Optical UAV and SAR</i> , submitted by Dr. Leila Hashemi-Beni, NC A&T with partners from NWS, NWC, and SERFC. Dr. Hashemi-Beni has received notification that the proposal will be funded, contingent on the final appropriations to NOAA. Anticipated start date is Aug. 2021.
Update and maintain SECOORA's RCOOS Plan	SECOORA's RCOOS plan covers the period 2020 – 2025. The Science Committee will review the plan in July and work on potential updates.

Milestone B: Engage users and other stakeholders to prioritize investments: *On-Track*

Activities	Status
Improve web-based information system and web presence	SECOORA tracks website usage with Google Analytics. During the reporting period: there was a 19% increase in website sessions on secoora.org (from 45,456 to 53,949) and data portal sessions (portal.secoora.org) have decreased 40% (from 4,228 to 2,540). A new secoora.org homepage was published in March and all data pages were updated.
Identify and promote opportunities for non-members to engage in SECOORA activities and initiatives	<p>SECOORA hosted 5 webinars as part of the <i>Coastal Ocean Observing in Your Community</i> series and over 285 participants tuned in. Click here for recorded webinars.</p> <ul style="list-style-type: none"> • Dr. Ruoying He, Jennifer Dorton, and Charlton Galvarino, presented “Developing an Integrated Coastal Water Predictive Capability to Promote Resilience to Water Risk” as part of the COMT project. The presentation was specifically for NOAA and stakeholders in NC and FL. 19 attendees. • Dr. Paul Gader, the University of Florida, presented the webinar “The Trouble of Deep Learning.” 92 attendees. • Mary Conley, The Nature Conservancy, presented the webinar “Regional Ocean Data Sharing: Southeast Sand Resources Project.” 71 attendees. • Lauren Showalter and Brian Stone, Axiom Data Science, presented “Making the Data Work for You.” 72 attendees. • Katy Smith, Jill Gambill, and Nina Sassano, University of Georgia Marine Extension and Georgia Sea Grant, presented “4th Grade Curriculum: Water Shapes our Planet and our Lives.” 35 attendees.
Implement an effective outreach strategy	SECOORA’s outreach strategy is based on Strategic Plan goals. Primary marketing and outreach mechanisms are e-newsletters, e-mails, social-media, and the website. During this period subscription to the newsletter increased by 5% (from 1,284 to 1,350) and three newsletters were distributed (January , March , May); Facebook “likes” have grown 5% (from 513 to 537); and, Twitter “followers” have grown 5% (from 820 to 860). SECOORA shared approximately 105 Facebook posts and 111 Twitter “tweets”, referring a combined 716 sessions to the SECOORA website (decreasing 32% from 1,052 to 716) and 20 stories were published on the website (www.secoora.org/news).
Support citizen science opportunities	No updates on citizen science during this reporting period.
Engage students in problem solving using ocean observing data	In March, two USF undergraduate classes participated in (COVID safe) field trips to the Clam Bayou station. The students learned the importance of environmental monitoring (Twitter post). Over 345 students have been taught through this partnership since it began in 2014.

Activities	Status
	<p>The new 4th grade curriculum “Water Shapes Our Planet and Our Lives” was published online. A press release was written in collaboration with GA Sea Grant. The team presented at the Georgia Science Teachers Association on Feb. 3.</p> <p>SECOORA’s 2020 Data Challenge Winner, Douglas Cahl, University of South Carolina, developed an online tool that identifies eddies from 6km resolution WERA HFR current data (see story and explore the tool).</p> <p>In May 2021, the winners of two SECOORA Student awards were announced.</p> <ul style="list-style-type: none"> • Meet the 2021 Data Challenge Winners: 1) Cody Benton, University of North Carolina Wilmington, and 2) Jason Law, University of South Florida • Meet the 2021 Vembu Subramanian Ocean Scholars: 1) Lela Schlenker, East Carolina University and 2) Caroline Maria Tribble, University of Charleston <p>SECOORA hosted its 2nd Curriculum Request for Proposals. Proposals must demonstrate how the project will increase participation of underrepresented communities in STEAM education activities. Due date May 21; 9 proposals were submitted. Peer reviews are underway and the winner will be announced in July.</p> <p>*See page 11 for NOAA Hollings Scholars updates.</p>

Milestone C: Provide DMAC infrastructure to enable collaboration and decision-making (SECOORA and Axiom Data Science, LLC): *On-track*

Activities	Status
IOOS DMAC standards compliance and implementation of Data Management, Products, and Services. (Axiom Data Science, LLC, Showalter and Wilcox)	<p>SECOORA follows the IOOS recommended standards-based services and requirements to ingest, manage, and provide access to all our funded data streams (in-situ, remotely sensed and numerical models). See portal.secoora.org. Progress during this period:</p> <ul style="list-style-type: none"> • Maintain IOOS compliant services and applications for integration with national products. <ul style="list-style-type: none"> ○ THREDDS 4.6.15 - https://thredds.secoora.org ○ ERDDAP 2.02 - https://erddap.secoora.org ○ SECOORA ISO WAF - https://thredds.secoora.org/iso ○ NCEI Archive - https://ncei.axiomdatascience.com/secoora/ • Maintain the Glider System for the management SECOORA glider assets. The SECOORA glider data was updated for visualization in the portal (here), as well as submitted to the Glider DAC. Axiom made adjustment to automatically pick up quality control filters when a glider fails and is floating on the surface. Additionally, glider deployments now are automatically added to SECOORA portal. • Initiate the transition from the WebCAT application (http://secoora.org/webcat) to the OTT funded WebCOOS interface. Continue to host the video data through SECOORA so it is discoverable via the SECOORA Website and downloadable. • FACT Network: <ul style="list-style-type: none"> ○ Developed a visualization tool for species diversity and distribution that will be used to inform the general public and fisheries managers. The tool will be highlighted at the June FACT meeting

Activities	Status
Maintenance of DMAC infrastructure (hardware and software)	Axiom maintained continuous performance of the SECOORA data system following IOOS DMAC guidelines. Axiom completed new server builds in the data center including ordering parts, testing hardware builds, and resolving technical issues. A new Machine Learning Cluster was procured, including 4 V100's, 24K CUDA Cores and 5K Tensor Cores. Further, Axiom installed 600+ hard drives and 13 storage chassis for a next phase of storage expansion, and a new version of server boot manager for increased stability and flexibility was implemented. Technical scoping and experimentation were done with new storage technologies (Ceph, using S3 compt APIs more) for system optimization.
Establishment and release of new SECOORA Portal	Released version 2.13 of the data portal on 12/8/20. This release features improvements to time slider performance, including brush selection for time series charts and introduces a user time zone selector. Enhancements were made to the data download UX to allow users to queue multiple datasets for download, add datasets to a download 'shopping cart', and share download compilations with other users. Custom draw and measuring tools are available in the main portal map. Additionally, users can add annotations to the map view and print the image to a pdf for integration in presentations and reports. Frontend and backend work occurred to develop features for the next version 2.14 release, scheduled for late June 2021. This work includes symbology changes to sensor layer for better contrast with lighter base layers (OpenStreet Map), user settings for color bar management, user settings for coordinate management, and print charts and data views as jpg file.
QARTOD Implementation	During this performance period, basic QARTOD tests were applied to 171 real-time and historical timeseries datasets that are accessible through the SECOORA data portal. Quality flags are summarized on both the station and sensor pages for visual exploration. Documentation of the test code and thresholds are displayed on sensor pages (example) with links available to the v 1.0 version QARTOD GitHub library . QC codebases were created and merged into the ioos_qc library for the Argo Quality Control Manual for CTD and Trajectory Data tests, including location test, range test, spike test, and speed tests. The ioos_glider submodule was replaced with the updated ioos_argo submodule. The metadata attributes were updated to also include quality flags for these test types.
Address 8 requirements per NOAA IOOS Contribute Data Page	See June – December 2020 progress report for details.

Goal 2: Maintain existing core observation investments in the region

Milestone A: Maintain High Frequency Radars (HFR) distributed throughout the region

Institution/Contractor	Status
University of South Florida (USF) (Weisberg, Merz) All HFR sites On-Track	USF operates and maintains 3 CODAR HFR (Naples, Venice and Redington Shores) and 2 WERA HFR (Venice and Ft. DeSoto Park). Data are sent to SECOORA, NOAA NDBC, and CORDC for integration, display, and dissemination. Plots of the data are also posted on the USF COMPS Ocean Circulation Group website (http://ocgweb.marine.usf.edu). All radars performed well this reporting period (over 99% up time) with the exception of the Redington Shores CODAR (up-time 73.4%) due to low offshore energy conditions.

Institution/Contractor	Status
	Significant coordination efforts are underway to upgrade existing HFR equipment to meet the ITU band requirements. CODAR: USF has returned RX and TX parts and equipment to the manufacturer for upgrade. Additionally, CODAR needs to receive their FCC certification before USF can apply for permanent FCC licenses. WERA: USF has received hardware from Helzel for required CTU-104 upgrades, CPC1 computer replacements, and software modifications. Currently, upgrades to the Venice HFR are underway. Once complete, USF will upgrade Ft DeSoto.
University of Georgia (UGA), Skidaway Institute of Oceanography (SkIO) (Edwards/Savidge): CAT: Delayed JEK: Delayed	SkIO has successfully completed the frequency conversion for HFR to meet the FCC requirements. Permanent FCC licenses for CAT and JEK were issued on 4/28/21. Additionally, FCC licenses for the two new HFR (Canaveral National Seashore and Kennedy Space Center, see page 16) have been received. JEK: Significant repairs were required to resume operation of the electronics. The frequency control unit had new firmware installed featuring pre-transmission call signs required by the FCC. This site is currently generating and transferring data to a server at SkIO; however, the .ruv files are not going to CORDC. SkIO trying to resolve the problem. CAT: A new trailer for housing the WERA electronics was installed. Numerous repairs, replacements, and firmware updates were necessary for proper operation of the electronics. CAT is having the same issues with transferring .ruv files as faced with JEK.
University of Miami (UM, Shay) STF On-Track VIR Delayed CDN Delayed NKL Delayed	UM received permanent FCC licenses for all 4 HFR sites on 4/28/21. Through Hurricane Supplemental Repairs funding, UM repaired 3 WERA (STF, VIR, and CDN) which were severely damaged in 2017 due to Hurricane Irma. Currently UM is only sending data for STF to CORDC. UM personnel have finished the internal calibrations for VIR and CDN but still need to complete the external calibrations (e.g., use a differential GPS to provide accurate antenna positions). Once done, UM will re-establish data transmissions for VIR and CDN. NKL experienced vandalism during the reporting period. Someone tried to remove the cables from within the corrugated PVC pipe. UM will focus on NKL repairs once VIR and CDN are transmitting data.
University of NC - Chapel Hill (UNC-CH) (Seim) and ECU Coastal Studies Institute (CSI) (Muglia) CORE – On-Track HATY – On-Track DUCK – On-Track OCR – Delayed	UNC-CH and CSI operate the four NC CODAR HFR. UNC-CH provides operation and maintenance for CORE and overall data management support for all four stations. CSI provides operation and maintenance for HATY, DUCK, and OCR. DUCK and HATY up-time was 98% and 96%, respectively. CORE up-time was 81%. The lower stats for CORE were due to system shutdowns due to battery failure within the battery bank. Replacement batteries were installed in late-February. In early May, the A/C unit failed; however, it was quickly replaced with a spare unit. Installation of the CODAR at OCR is complete. The site was turned on in mid-March after extensive field work. The site is operating properly but returned signals are weak relative to the other NC sites. This translates into limited coverage. UNC and CSI are exploring options to improve coverage before releasing the data to CORDC. Data analysis and tool development: See previous progress report. The manuscript submission was delayed until July 2021.
University of South Carolina (Voulgaris) GTN – On Track CSW – On Track	University of South Carolina is responsible for the Georgetown, SC (GTN) and Fort Caswell, NC (CSW) WERA HFR. The permanent FCC licenses for GTN, CSW and the 3 rd planned HFR in Myrtle Beach, SC (see page 15) were obtained on 4/28/21. CSW uptime was 96% and GTN uptime was 90%. GTN: New Tx cable was installed in December. The new cable increased coverage (range) for the system. Tx split-antenna cables were

Institution/Contractor	Status
	replaced, and the array was tuned to avoid side lobes. All Tx split tables were elevated and repositioned in preparation for the turtle nesting period. In February, new active Rx antennas were installed to replace the passive antenna. All the old antennas, guides, and ground wires were removed, eliminating potential interference with turtle nesting. The active antennas introduced some noise and in March their external power supply was replaced to reduce noise interference. In May, internet issues related to Verizon 4G coverage impacted GTN. A new modem was installed which helped rectify the issue.

Milestone B: Maintain in-situ stations along the Carolina and West Florida Shelf (WFS) coasts

Institution/ Contractor	Status																																																																		
USF (Weisberg) - Coastal Ocean Monitoring and Prediction System (COMPS) moorings <i>On Track, with delays due to COVID related ship scheduling</i>	<p>Operations: Three real-time surface moorings (C10, C12, C13) were maintained, along with two non real-time subsurface moorings (C11 and C15). Data from C11 and C15 are shared with Axiom/SECOORA and archived at NCEI.</p> <p>Along with the SECOORA-funded buoys, USF maintains the NASM funded “pressure point mooring” (C22) located northeast of the Dry Tortugas. RESTORE Act funding expired for the C21 tower mooring and the station is no longer reporting. Data from C21 (until going offline) and C22 have been shared with SECOORA.</p> <p>The following table indicates up-time percentages for USF real-time moored stations.</p> <table border="1"> <thead> <tr> <th></th> <th>C10</th> <th>C12</th> <th>C13</th> <th>C21</th> <th>C22</th> </tr> </thead> <tbody> <tr> <td>Wind</td> <td>72%</td> <td>73%</td> <td>99%</td> <td>0%</td> <td>88%</td> </tr> <tr> <td>Air Pressure</td> <td>71%</td> <td>73%</td> <td>99%</td> <td>0%</td> <td>88%</td> </tr> <tr> <td>Water Temperature</td> <td>72%</td> <td>73%</td> <td>99%</td> <td>0%</td> <td>88%</td> </tr> <tr> <td>Salinity (Surface)</td> <td>72%</td> <td>73%</td> <td>99%</td> <td>0%</td> <td>88%</td> </tr> <tr> <td>Air Temperature</td> <td>69%</td> <td>16%</td> <td>99%</td> <td>0%</td> <td>87%</td> </tr> <tr> <td>Relative Humidity</td> <td>69%</td> <td>16%</td> <td>99%</td> <td>0%</td> <td>87%</td> </tr> <tr> <td>Longwave Radiation</td> <td>72%</td> <td>N/A</td> <td>N/A</td> <td>0%</td> <td>N/A</td> </tr> <tr> <td>Shortwave Radiation</td> <td>72%</td> <td>N/A</td> <td>N/A</td> <td>0%</td> <td>N/A</td> </tr> <tr> <td>ADCP</td> <td>45%</td> <td>69%</td> <td>98%</td> <td>0%</td> <td>72%</td> </tr> <tr> <td>Waves</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>0%</td> <td>N/A</td> </tr> </tbody> </table> <p>Discussion of low stats: Three issues were encountered during the reporting period:</p> <ul style="list-style-type: none"> Continued COVID related scheduling issues for research cruises and service trips caused delays in USF personnel swapping buoys that had sensors that were no longer functioning properly. C10 and C12 ADCP experienced cable and instrument bulkhead connector failures. The issue is being addressed with Teledyne RDI. C10, C12, and C22 air temperature/relative humidity sensor failures are being mitigated by purchasing more robust sensors from Campbell Scientific. <p>Data Management: USF has implemented QARTOD recommended QC tests for all near real time data. QC flags are provided to Axiom.</p>		C10	C12	C13	C21	C22	Wind	72%	73%	99%	0%	88%	Air Pressure	71%	73%	99%	0%	88%	Water Temperature	72%	73%	99%	0%	88%	Salinity (Surface)	72%	73%	99%	0%	88%	Air Temperature	69%	16%	99%	0%	87%	Relative Humidity	69%	16%	99%	0%	87%	Longwave Radiation	72%	N/A	N/A	0%	N/A	Shortwave Radiation	72%	N/A	N/A	0%	N/A	ADCP	45%	69%	98%	0%	72%	Waves	N/A	N/A	N/A	0%	N/A
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USF (Luther) - Coastal tidal & meteorological stations On-Track	<p>Operations: Sites collecting water level and meteorological parameters are Aripeka (APK), Clam Bayou (CLB), Fred Howard Park (FHP), Shell Point (SHP), and Big Carlos Pass (BCP). A full suite of water quality sensors is operated on the Clam Bayou site in partnership with YSI/Xylem.</p> <table border="1"> <thead> <tr> <th></th><th>APK</th><th>CLB</th><th>FHP</th><th>SHP</th><th>BCP</th></tr> </thead> <tbody> <tr> <td>Air Temperature</td><td>90%</td><td>100%</td><td>100%</td><td>100%</td><td>98%</td></tr> <tr> <td>Air Pressure</td><td>90%</td><td>100%</td><td>100%</td><td>100%</td><td>98%</td></tr> <tr> <td>Relative Humidity</td><td>89%</td><td>100%</td><td>100%</td><td>87%</td><td>98%</td></tr> <tr> <td>Wind (Gust, Speed, Dir)</td><td>90%</td><td>100%</td><td>100%</td><td>100%</td><td>98%</td></tr> <tr> <td>Surface Water Temperature</td><td>90%</td><td>0%</td><td>n/a</td><td>100%</td><td>98%</td></tr> <tr> <td>Precipitation</td><td>n/a</td><td>0%</td><td>n/a</td><td>n/a</td><td>98%</td></tr> <tr> <td>Water Level</td><td>90%</td><td>100%</td><td>100%</td><td>100%</td><td>98%</td></tr> <tr> <td>Water Quality</td><td>n/a</td><td>0%</td><td>n/a</td><td>n/a</td><td>n/a</td></tr> </tbody> </table> <p>Reporting Statistics: Overall the stations have reported well. The Shell Point relative humidity sensor was swapped in Jan. 2021, bringing the data back online. The CLB station includes a YSI water quality sonde that collects: SST, DO, fluorescent DO, blue-green algae, pH, chlorophyll concentration, and turbidity. The sonde was damaged during Tropical Storm Eta (Nov. 2020) and returned to YSI/Xylem for repairs; however, it has yet to be returned which accounts for the 0% reports for those parameters.</p>		APK	CLB	FHP	SHP	BCP	Air Temperature	90%	100%	100%	100%	98%	Air Pressure	90%	100%	100%	100%	98%	Relative Humidity	89%	100%	100%	87%	98%	Wind (Gust, Speed, Dir)	90%	100%	100%	100%	98%	Surface Water Temperature	90%	0%	n/a	100%	98%	Precipitation	n/a	0%	n/a	n/a	98%	Water Level	90%	100%	100%	100%	98%	Water Quality	n/a	0%	n/a	n/a	n/a
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University of North Carolina - Wilmington (UNCW) (Leonard) - Coastal Ocean Research and Monitoring Program (CORMP) mooring network All stations On-Track	<p>Operations: UNCW operates 9 real time moorings in NC and SC coastal waters. ILM2, LEJ3, and SUN2 have co-located wave buoys (i.e., 2 moorings on station) that provide spectral wave data and water temperature. Buoy stats are listed in the table below. UNCW also operates the OB27 non real-time station in Onslow Bay, NC. The station includes a VEMCO receiver, ADCP, and CTD.</p> <p>VEMCO acoustic receivers were swapped at ILM2 on 3/25/21; at ILM3 on 4/14/21; and OB27 on 5/21/21. The VEMCO on LEJ3 will be swapped when the buoy is replaced. All acoustic telemetry data is shared with FACT.</p> <p>The OB27 ADCP and CTD were serviced on 2/23/21 and 5/21/21. All the retrieved non real-time data have been shared with Axiom/SECOORA and archived at NCEI.</p> <table border="1"> <thead> <tr> <th></th><th>ILM2</th><th>ILM3</th><th>LEJ3</th><th>SUN2</th><th>CAP2</th><th>FRP2</th></tr> </thead> <tbody> <tr> <td>Air Temperature</td><td>100%</td><td>100%</td><td>47%</td><td>100%</td><td>90%</td><td>98%</td></tr> <tr> <td>Air Pressure</td><td>100%</td><td>30%</td><td>47%</td><td>100%</td><td>90%</td><td>98%</td></tr> <tr> <td>Wind Speed, Gust, Direction</td><td>100%</td><td>30%</td><td>47%</td><td>100%</td><td>90%</td><td>98%</td></tr> <tr> <td>Salinity</td><td>79%</td><td>99%</td><td>47%</td><td>100%</td><td>89%</td><td>98%</td></tr> <tr> <td>Surface Water Temperature</td><td>79%</td><td>99%</td><td>47%</td><td>100%</td><td>89%</td><td>98%</td></tr> <tr> <td>Waves (co-located buoys)</td><td>100%</td><td>N/A</td><td>84%</td><td>64%</td><td>N/A</td><td>N/A</td></tr> </tbody> </table> <ul style="list-style-type: none"> • ILM2: The CTD lost power on 3/1/21, a new buoy was deployed, restoring surface water data on 3/25/21. • ILM3: The buoy was struck by a vessel in early Dec., resulting in significant damage to the tower and topside instruments. Both anemometers were destroyed, and the barometric pressure sensor was flooded as a result of being upside-down. Due to the extent of damages, the decision was made to wait on the next turnaround 		ILM2	ILM3	LEJ3	SUN2	CAP2	FRP2	Air Temperature	100%	100%	47%	100%	90%	98%	Air Pressure	100%	30%	47%	100%	90%	98%	Wind Speed, Gust, Direction	100%	30%	47%	100%	90%	98%	Salinity	79%	99%	47%	100%	89%	98%	Surface Water Temperature	79%	99%	47%	100%	89%	98%	Waves (co-located buoys)	100%	N/A	84%	64%	N/A	N/A					
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Surface Water Temperature	79%	99%	47%	100%	89%	98%																																																	
Waves (co-located buoys)	100%	N/A	84%	64%	N/A	N/A																																																	

Institution/ Contractor	Status
	<p>cruise instead of making on-site repairs. The buoy turnaround occurred on 4/14/21 and the new system is reporting.</p> <ul style="list-style-type: none"> • LEJ3 experienced a power system failure on 3/5/21. Weather, scheduling conflicts, small boat engine failures, and UNCW dock crane outages have caused difficulties in repairing or replacing the buoy. A replacement buoy is ready for deployment, and upon completion of crane repair, the buoy will be replaced. • CAP2: Prior to the Feb. 2021 buoy replacement, CAP2 experienced cellular signal loss. The newly deployed buoy is using a different modem and is having better network connection but is still experiencing high signal interference. CORMP has consulted with USAT Corp. about possible changes to the wiring and layout of the modem to reduce the interference. • SUN2WAVE: The previously deployed buoy equipped with the Seaview Systems SVS-603 experienced a modem failure in Nov. 2020. The site did not provide wave data until a replacement buoy was deployed on 2/3/21. The modem on the previously deployed Seaview Systems SVS603 wave sensor has been repaired. <p>Data Management: All real-time data undergo extensive QA/QC' based on QARTOD requirements. Flags are archived with the data on UNCW servers and passed to Axiom.</p> <p>New Mooring: CORMP is working with SECOORA and the IOOS Environmental Compliance Coordinator to obtain approval to deploy a new Sofar Spotter wave buoy next to the CAP2 buoy. The buoy and mooring are ready to be deployed once approval from USACE and USCG is received.</p>

Milestone C: Maintain the sensors on NOAA GRNMS buoy (NDBC 41008)

Institution/Contractor	Status
UGA (Noakes) – Support to NOAA's Ocean Acidification Program, NDBC Gray's Reef National Marine Sanctuary (GRNMS) NDBC ID #41008 buoy <i>On-Track</i>	<p>Operations: The MAPCO2 on the GRNMS buoy has reported at 100% this reporting period. The next site visit will occur in June to check the system, replace spent gas, and collect bulk water samples.</p> <p>Mooring Redesign: NOAA OAP requested design concepts to streamline instrument deployment on the NDBC 3-meter buoy so that sensors are deployed from topside instead of diver mounted under the buoy. The redesign is still being circulated through the NDBC and initial comments indicate that modifications to the "through the buoy" sensor design are being considered.</p>

Goal 3: Begin to address geographic gaps in observations

Milestone A: Establish a regional glider observatory in the South Atlantic Bight (SAB)

Institution/Contractor	Status
UGA SkIO (Edwards) NC State University (He) UNC-CH (Seim) USF (Lembke) Georgia Institute of Technology (GIT, Zhang) <i>Glider operations On-Track</i>	<p>Operations: No gliders were deployed during this reporting period.</p> <p>Data Management: An SkIO student is post-processing the summer 2020 deployments with updated routines and is binning the data for easier data sharing. Full datasets for the 2020 missions have been shared with SECOORA for contribution to the NGDAC in delayed mode. UNC personnel reviewed and explored improvements to correction schemes for CTD data collected with older (G1) gliders in preparation for reprocessing of archived data.</p>

Institution/Contractor	Status
	<p>Maintenance: SkIO, USF, and SECOORA G3 gliders have all experienced failures with their forward pump. Several of the gliders experienced catastrophic water damage. The failures were a result of manufacturer design issues, and the manufacturer is redesigning the system to include mechanical stops to prevent the pumps from pushing past their operational limit. Working with the manufacturer, the SkIO, USF, and SECOORA G3 gliders will be outfitted with a relay designed to prevent recurrence of the pump failure experienced in 2020.</p> <p>Glider Path Planning: Georgia Tech is leading efforts to improve glider path planning. Accomplishments include: (1) application of an adaptive learning method to estimate the ocean flow field in glider deployments (2) developed a belief abstraction and symbolic planning method to facilitate glider navigation in an uncertain ocean flow field.</p>

Milestone B: Install a new coastal water quality and meteorological station in Charleston Harbor, SC:

Institution/Contractor	Status																
South Carolina Department of Natural Resources (Sanger) Charleston Harbor – On Track	<p>The Charleston Harbor station consists of a YSI EXO2 and supporting telemetry equipment. The site is considered a secondary NERRs site. The data are available on https://cdmo.baruch.sc.edu/ and the SECOORA Data Portal. There was a short period in Jan. when the chlorophyll fluorescence data were rated as suspect. In late May 2021, severe fouling was observed on the conductivity, DO, turbidity, and chlorophyll fluorescence probes – the data for these parameters are coded as suspect. The data for other parameters (water temperature, depth, and pH) during the same period did not appear to be affected.</p> <p>Statistics for real time data collected 12/1/2020 – 5/31/2021</p> <table border="1"> <thead> <tr> <th></th> <th>FJ</th> </tr> </thead> <tbody> <tr> <td>Water Temperature</td> <td>100%</td> </tr> <tr> <td>Salinity/Specific Conductivity</td> <td>100%</td> </tr> <tr> <td>Dissolved Oxygen</td> <td>100%</td> </tr> <tr> <td>pH</td> <td>100%</td> </tr> <tr> <td>Turbidity</td> <td>100%</td> </tr> <tr> <td>Chlorophyll Fluorescence</td> <td>99%</td> </tr> <tr> <td>Depth</td> <td>100%</td> </tr> </tbody> </table>		FJ	Water Temperature	100%	Salinity/Specific Conductivity	100%	Dissolved Oxygen	100%	pH	100%	Turbidity	100%	Chlorophyll Fluorescence	99%	Depth	100%
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Depth	100%																

Goal 4: Continue delivery of operational model forecasts and products to serve priority users

Milestone A: Enhance and operate a Coupled Marine Environmental Assessment and Prediction System for the SE

Institution/Contractor	Status
NCSU (He) - Support and enhance SABGOM model On-Track	<p>NCSU maintains the SABGOM and CNAPS ocean prediction systems, providing time- and space-continuous regional marine environment predictions on a user-interactive web portal. The team successfully completed data assimilative (DA) hindcast experiments for 2017-2019 based on the 4-dimensional variational data assimilation (4DVAR) method and they also completed the ensemble data assimilation (ENDA) method. Both DA approaches assimilate satellite sea surface height, sea surface temperature, in situ</p>

Institution/Contractor	Status
	<p>temperature, and salinity profiles from ship surveys and Argo floats.</p> <p>Nowcast/Forecast: The team tested the DA schemes in the nowcast/forecast mode. Due to its efficiency, ENDA was determined to be the better method for an operational DA nowcast/forecast. Model skill assessment: The team continues to perform model skill assessment for marine environmental variables' quantitative validations. Allahdadi et al., 2021 and Ahn et al., 2021 document wave model skill assessments. Zambon et al. (2021) focuses on Hurricane Florence and the importance of air-sea-wave coupling. Liu et al. (2021) analyzes how the ocean optical properties and solar attenuation in the water can impact ocean heat content and hurricane intensity prediction.</p>

Milestone B: Operate the WFS FVCOM ocean model

Institution/Contractor	Status
USF (Weisberg) <i>On-Track</i>	<p>In response to the discharge of wastewater from the old Piney Point fertilizer stack, USF set up a tracer model nowcast/forecast based on the daily, automated Tampa Bay Coastal Ocean Model (TBCOM). The daily updated model forecasts were used to guide local Tampa Bay Estuary Program (TBEP) and other agencies and academic institutions in their response preparations, monitoring, and field water sample collections. Model: http://ocgweb.marine.usf.edu/~liu/Tracer/. SECOORA news story: https://secoora.org/model-forecasting-piney-point-wastewater-plume-in-tampa-bay/</p>

Milestone C: Provide an early warning system for swimming beach and shellfish harvesting waters

Institution/Contractor	Status
USC (Porter) <i>On-Track</i>	<p>The project team maintains the platform howsthebeach.org and provides public access to daily estimates of swimming beach bacteria levels for Myrtle Beach, SC, Charleston, SC, Folly Beach, SC, Sarasota, FL, and Kill Devil Hills, NC. During this reporting period the team expanded their efforts to include nowcasting conditions for Surfside Beach, SC (http://howsthebeach.org/surfside/map).</p> <p>The project team is investigating the expansion of a SC shellfish management decision support tool to predict fecal coliform levels in NC shellfish harvest areas. The team is collaborating with Drs. Natalie Nelson and Shelia Saia at NC State University and Dr. A.K. Leight at NOAA NCCOS – Beaufort, NC.</p>

Milestone D: Optimize and enhance the SECOORA Marine Weather Portal (MWP)

Institution/Contractor	Status
SECOORA (Dorton), Second Creek Consulting (Galvarino) <i>Complete</i>	<p>The MWP is hosted on the SECOORA website: http://mwp.secoora.org/. The site was updated to include the SECOORA Text-a-Buoy product.</p>

Milestone E: Python Data Analysis Tools for Oceanographic Services

Institution/Contractor	Status
Independent Contractor, Filipe Pires Alvarenga Fernandes On-Track	Activities this period fall into categories. 1. Assist in development of IOOS.us documentation and demonstration sub-pages; 2. Support current and continue developing software packages; and 3. Ensure software deployment via conda-forge packages and updates. Work is reviewed by the IOOS program office. See Appendix A.

Milestone F: Special Projects

Institution/Contractor	Status
Unmanned Aircraft System (UAS) workshop Complete	The workshop is complete; however, the final report has not been published. Chris Taylor, NOAA NOS, is the lead on the UAS workshop report. The production version of the report is in review by NOS and Duke University. After their review, the report will be sent to NOAA NCCOS for internal review. The timeline for the report publication is TBD.
Hollings Scholarship On-track	The 2020 Hollings Scholar, Natalie Murphy, is a SECOORA intern. She is developing "Meet the Users" and other stories for SECOORA. Four stories were published during the reporting period: <ul style="list-style-type: none"> • NOAA Launches a New Life-Saving Rip Current Model • New Acoustic Receivers Help FACT Network Track Marine Animals • Meet the Winners of the Enhancing Regional Ocean Data Sharing Competition • Meet the Winners of the Fill Regional Product and Observational Gaps Competition SECORA and Mote Marine Laboratory submitted a 2021 Hollings Scholar opportunity to the IOOS Program Office. At this time, no one has selected this opportunity.
ROWG Meeting Support (CSI, Muglia) Complete	The virtual ROWG Meeting was hosted November 17-18. Over 100 people participated in the event.
2020 Hurricane Glider Deployments (UGA SkIO, Edwards) On-track	There were no hurricane glider deployments during this reporting period. The glider team post-processed data from all 2020 hurricane glider missions and submitted the short and long format data files to SECOORA in delayed mode. Planning for the 2021 hurricane season began in Dec. 2020.
Navy glider deployments/recoveries (SECOORA Glider team) On-track	UNC-CSI recovered one Navy glider off of the northern NC Outer Banks in Dec. 2020.
IOOS/NOPP Soundscape Observatory (USC Beaufort, Montie) On-track	The project team maintains an estuarine soundscape observatory in coastal SC. Nine mooring platforms, with passive acoustic receivers and water temperature loggers, make up the observatory: 3 in the May River, 1 in Chechesee Creek, 1 in Colleton River, 3 in Charleston Harbor, and 1 in North Inlet-Winyah Bay. The passive acoustic array is deployed where in-situ data is collected by NERRS, USGS, and USC Beaufort. All 9 stations were serviced twice (instruments swapped and moorings cleaned) during the reporting period. Using collected data, the team manually reviewed 62,037 wav files for biological sounds and noise occurrences. Data from the May River and Charleston Harbor are being used to compare anthropogenic noise levels and identify fish species for a graduate student research project. Finally, the project team is working with SECOORA and Axiom to create a soundscapes webpage for educators and public audiences. Axiom shared a wireframe (https://stage-esons.srv.axds.co/) and is

Institution/Contractor	Status
	receiving feedback from the project team.
OTN/ATN On-Track	SECOORA contracts with Joy Young, Fisheries Data Solutions, and Chris Kalinowsky, Georgia Department of Natural Resources, in support of the ATN. Progress reports from Young and Kalinowsky have been submitted to the IOOS ATN manager. These reports are included in Appendix B.
Regional Ocean Data On-track	<p>The following work associated with Regional Ocean Partnership funds was completed:</p> <ul style="list-style-type: none"> ○ Steering Committee meetings were held Mar. 12. ○ On Feb. 23, Mary Conley presented "Regional Ocean Data Sharing: Southeast Sand Resources Project" on the SECOORA Coastal Observing in Your Community webinar series. ○ After consultation with the Steering Committee, products from this project have been organized into an interactive webpage. The webpage provides links to federal and state sand resources, recommendations based on interviews with government agencies, consultants, and researchers, and facts about sand in the southeast. ● The SECOORA 2020 RFP to Enhance Regional Ocean Data Sharing funded 3 projects. These are 1-year projects which began in January. <ul style="list-style-type: none"> ○ Lead PI Joy Young (FACT Network) – <i>Incorporating acoustic telemetry data into coastal management</i>. The project team will increase the accessibility and application of telemetry data by developing a web-based data service and visualization tool to illustrate species diversity and distribution in the western Atlantic Ocean. The team is designing a web map for classroom education and integration into the fisheries assessment process. ○ Lead PI Natalie Nelson (NCSU) – <i>Creating ShellBase: The Southeast Shellfish Water Quality Database</i> – The project team is creating a water quality database for shellfish waters in NC, SC, GA, and FL. In addition to producing the database, the project team will prepare a white paper that includes recommendations on how state shellfish sanitation programs can improve their data capture and archiving procedures to facilitate open and reproducible science. ○ Lead PI Mary Conley (TNC) – <i>Increasing access to regional ecological data to help inform offshore ocean use decisions: Analysis and visualization of ocean resources in the context of offshore wind energy development</i>. This project will leverage regional-scale marine life and habitat use data in SE federal waters to provide guidance for offshore development projects that may directly impact marine ecosystems.
Compilation of Environmental, Threats, and Animal Data for Cetacean Population Health Analyses (CETACEAN), SECOORA and Axiom Data Science On-track	<p>The CETACEAN team is comprised of an Executive Committee, a Steering Committee, and an Implementation Team. Axiom representatives participate on the Implementation team (which meets weekly) and in Steering Committee meetings. Axiom is working with the CETACEAN team to develop a data platform that provides user-friendly access to datasets to assess the health of whales and dolphins and identify stressors that threaten them. The Axiom proposal to National Fish and Wildlife Foundation (NFWF) to move Gulfmap to the Cloud was funded. Gulfmap is a prototype marine mammal health and monitoring analysis platform with data stored in an Access database. The CETACEAN team will incorporate the Gulfmap data into its platform. Additional progress during this reporting period includes:</p> <ul style="list-style-type: none"> ● Development of a data catalog/portal for CETACEAN related data ● Ingestion of relevant datasets into the CETACEAN catalog

Institution/Contractor	Status
Coordination of SOCAN activities (Hall and Reimer) On-track	<p>The SOCAN Executive Team met on the following dates: 12/24/20, 1/11/21, 2/4/21, 3/4/21, and 5/12/21. The team hosted a Town Hall on April 21 with over 50 attendees. The agenda included two talks from stakeholders that focused on subsistence fishing practices in the Southeast (Noelle Boucquey, Eckerd College) and how stakeholders are impacted by acidification (Queen Quet, Gullah/Geechee). Stakeholder newsletters were sent in January, March, and May. New SOCAN members include Coastal Carolina University and the University of South Carolina – Beaufort. SOCAN started a Facebook page thus enhancing its social media presence.</p> <p>Drs. Hall and Reimer submitted an abstract to the CERF meeting (Nov 2021), and they were Co-PIs or collaborators on 3 NOAA-OAP proposals on OA and shellfish and 2 SC Sea Grant proposals on coastal OA.</p>
Southeast and Caribbean Disaster Resilience Partnership (SCDRP) On-Track	<p>The SCDRP Board developed a tiered membership structure that was approved in Nov 2020. This membership opportunity was unveiled at the January 2021 annual meeting. The backend technology has been set up to support online sign-up and payment, and a webpage devoted to membership was added to the SCDRP website (https://www.scdrp.secoora.org/membership).</p> <p>The SCDRP held a virtual winter meeting, January 26-28, 2021. Eight, 2-3 hour sessions were held over three days. There were approximately 250 registrants, with 90-150 participants attending most sessions. This meeting hosted nearly 50 speakers/panelists. All sessions are available on the SCDRP playlist under SECOORA's YouTube channel: (https://youtube.com/playlist?list=PLN1Eo26yGEtC8u8bOQPazldbyfjWMK8Yi).</p>
Additional Observations: Biology project. (SCDNR, Axiom) On-track	<p>Axiom Data Science in coordination with the SEAMAP-SA data management group at SCDNR are working to expand the data tables and code tables currently in SECOORA system to add a Tagging table (which houses tagging and recapture information for fish and elasmobranchs encountered in SEAMAP-SA surveys) and a Turtle table (which houses life history and tagging information for sea turtles encountered by the Coastal Trawl Survey). Axiom and SCDNR data management staff are developing DarwinCore headers and converting these tables to the new DarwinCore standards. The data tables and their supporting code tables will be provided on the SECOORA data portal. Axiom has implemented a prototype EAV database schema using existing data and ingested the data into the prototype. A user roles and capabilities plan has been developed to support a reporting system for user metrics, user report queries/requests, and querying of data for inclusion in the visualization system.</p>
Additional Observations Initiative On-Track	<p>SECOORA hosted a competitive mini-proposal opportunity in Year 5: Three projects were funded by the SECOORA 2020 Request for Proposals to Fill Regional Product and Observational Gaps. These are 1-year projects which began in January.</p> <ul style="list-style-type: none"> • Lead PI Laurent Cherubin – <i>Use of an autonomous underwater vehicle for cost-effective assessment of fish utilization of areas of ecological and management importance in US South Atlantic waters</i>. An AUV will survey two South Atlantic Fisheries Management Council MPAs, St Lucie Hump and Jeff's Reef, to assess the presence of seasonal fish spawning aggregations. • Lead PI Mark Luther – <i>Improving the management of marine maritime traffic in southeast US waters using machine learning</i>. The project team will develop a machine learning tool that uses observed ocean parameters (e.g., winds, surface currents, waves) to predict high cross currents which are hazardous to ships crossing the channel at the Port of Miami.

Institution/Contractor	Status
	<ul style="list-style-type: none"> Lead PI Mike Muglia – <i>Northeast North Carolina coast communities water level observation prediction system</i>. The primary goal is to help coastal managers plan for, manage, and adapt to community flooding. Six water level sensors are being installed and surveyed to NAVD88 to provide hyper-local tidal datums for NC Outer Banks communities. SECOORA worked with the IOOS Environmental Compliance Coordinator on NEPA compliance for this project.

Goal 5: Initiate new operational products to meet additional user needs

Milestone A: Implement a HAB forecasting system for the WFS.

Institution/Contractor	Status
Florida Fish and Wildlife Research Institute (FWRI) (Hubbard) On-track but sampling cruises are working at reduced capacity	<p>The bimonthly NOAA/AOML cruises that sample from Miami through the Florida Straits and along the WFS resumed but at reduced crew and science team participation due to COVID restrictions. Cruises were conducted in Dec. 2020, Feb. 2021, and April 2021. Red tide conditions remained quiet until Dec. The Dec. cruise helped map some of the first observations of cells nearshore and offshore. The Feb. and April cruises also helped characterize the developing and somewhat patchy bloom that still persists.</p> <p>Remote sensing data was provided by USF prior to and during the cruises to allow for adaptive sampling and helped determine the final cruise plan. Short-term predictive forecasts provided by USF provided understanding of the ocean circulation in critical bloom areas. Co-PIs Weisberg and Liu provided inputs for the red tide tracking jointly with FWRI, which continued using both TBCOM and WFCOM models. These were particularly important during the present reporting period as the observed red tide in the Charlotte Harbor region systematically moved north because of anomalously protracted southerly (southeasterly to southwesterly) winds. The culmination of such movement was a coalescence of <i>K. brevis</i> cells with Piney Point effluent, which may have resulted in a low-level bloom now being observed in the Tampa Bay region.</p> <p>FWRI also presented 3.5-day bloom trajectory forecasts which include a synopsis of ocean circulation, provided PI Weisberg, as well as remote sensing data as part of biweekly or weekly red tide status updates. These updates are distributed to thousands (including managers, researchers, and citizens) each week via an email list serve and the “Florida Red Tide and Other Harmful Algal Blooms” Facebook page.</p>

Goal 6: Continue building critical elements of the observing system by adding biogeochemical and marine sound sensors, and HFRs

Milestone A: Implement a regional ocean sound observing initiative to characterize and measure sources of sound production and establish acoustic baseline levels.

Institution/Contractor	Status
Mote Marine Laboratory (Locascio) On-Track	<p>A data technician was hired on 4/4/21 to work on this project. The technician is building the passive acoustic data libraries that will be used with neural networks. He has been trained on the review of acoustic data to identify and classify the species-specific variations of acoustic signals using the Raven Pro and MATLAB platforms. Several acoustic time series data sets with multiple grouper species calls are being used to build neural net training libraries.</p> <p>Black grouper calls are selected from recordings made at a spawning aggregation site in</p>

Institution/Contractor	Status
	<p>Bermuda and from Riley's Hump, an MPA in the Dry Tortugas. Red grouper calls are being selected from an acoustic time series recorded in Steamboat Lumps, an MPA in the Gulf of Mexico, and from Riley's Hump. Red Hind data are also being selected from Riley's Hump and from another acoustic time series made at a spawning aggregation site in the Caribbean.</p> <p>The black grouper library currently has 3,600 annotated files divided by call type and the red grouper library currently has 678 annotated files divided by call type. There are only 21 total calls in red hind library; however, building the library using the Riley's Hump acoustic time series is still underway.</p> <p>A transfer learning algorithm applied to the library of acoustic data will provide binary classification results. This will be useful for detecting calls and to an extent automating the library building process. Human supervision will be necessary to confirm the results as this is considered a supervised learning approach. Neural net training for detection and classification of signals will follow from mono-specific acoustic files (i.e., one target species) to poly-specific acoustic files where multiple species signals are present.</p>

Milestone B: Install and operate new HFRs

Institution/Contractor	Status
Florida Institute of Technology (FIT)/Lazarus <i>Treasure Shores – On-track</i> <i>Hightower Beach - Delayed</i>	<p>FIT made presentations to the Satellite Beach City Council for the Hightower Park HFR site (1/20/21) and to the Indian River County Commission for the Treasure Shores site (1/19/21). Both locations were approved by the relevant councils for HFR installation. The HFRs were received from Helzel in Feb. Hightower Park: The Environmental Compliance documents for Hightower Park were submitted to the IOOS Environmental Compliance Coordinator on 5/19/21. Due to concerns from a local citizen, this site will require a full site-specific environmental assessment before the location can be finalized. HFR installation is TBD. Treasure Shores: Site set-up is underway. Dr. Lazarus is working with park staff to run power to the restroom facilities as the radar, computer, and communications equipment will be placed inside of a closet. Additionally, prior to sea turtle nesting season, wooden stakes were installed along the dune line to identify antenna placement and the distance between the stakes and the restroom facility were measured to identify cable length requirements. Full installation will begin at the end of sea turtle nesting season.</p>
University of South Carolina/Voulgaris <i>On-Track</i>	<p>The University of South Carolina is in the process of installing a WERA station at Myrtle Beach State Park. The Environmental Compliance questionnaire for the proposed site was submitted to NOAA/IOOS on 12/3/20 and a determination was received from IOOS on 3/31/21. On 4/27/21 a Memorandum of Understanding (MOU) between UofSC and SC State Parks was signed. The FCC license for this site has been obtained. An electricity outlet has been installed on the site and the Rx antenna poles were erected. A new trailer (which will house the HFR) was outfitted with AC, a cable portal for the Rx and Tx cables, and a storage box was installed in the front for the cable reels. The system to be installed was procured by SECOORA and has been used previously for an NSF project. During May, personnel have cleaned and refurbished the Tx antennas and measured and cut Rx and Tx cables to the appropriate lengths for the installation. Final HFR</p>

Institution/Contractor	Status
	installation will occur at the end of turtle nesting season. Finally, in preparation for this installation, signage was created by SC State Parks, UofSC, and SECOORA which will be installed along the boardwalk to engage visitors and explain HFR.
SkIO/Savidge CNS - Delayed KSC - Delayed	SkIO is working with partners at Kennedy Space Center (KSC) and Canaveral National Seashore (CNS) to install WERA HFR at each site. The majority of hardware and infrastructure for both sites has been purchased and all WERA hardware is in the process of being tested? prior to deployment. CNS: The required research permit for CNS was approved and the associated Environmental Compliance consultations have been completed by NOAA IOOS. However, in April, CNS personnel informed SkIO that a land use agreement also must be in place before installation. The land use agreement is being drafted and attorneys on both sides will have to approve the agreement before it can be signed. It is hoped that installation can begin in November, after sea turtle nesting season. KSC: KSC requires a land-use agreement between NOAA – NASA before an HFR can be deployed. Oriana Villar, IOOS Regional Coordinator and John Hueckel, NASA KSC, are drafting the land-use agreement. KSC personnel should have a draft of the land-use agreement ready for review by July 2022. The Environmental Compliance process for this site is being led by KSC and the IOOS Environmental Compliance Coordinator is engaged in the process. Anticipated HFR deployment is winter 2021/22.
FAU HFR Support (Baxley) Complete	All CODAR supply items requested by Dr. Baxley were purchased and shipped to FAU.

2) Scope of Work

Scope of work is as described in the [Year 5 Statement of Work](#).

3) Personnel and Organizational Structure

Current lists of SECOORA Members and Board are available on our [website](#). Additionally, SECOORA personnel job descriptions and employee CVs are available on: <http://secoora.org/certification>.

4) Budget Analysis

SECOORA received a two-year no cost extension. SECOORA's April 30, 2021 financial report shows an approximate budget balance remaining as follows: Combined Year 1, 2 and 3 Report (\$232K); Year 4 Report (\$1.6M) and Year 5 Report (\$3.2 M). We are within budget, although somewhat delayed with spending. SECOORA continues to receive invoices regularly from our sub-awardees and we process them during bi-monthly administration meetings. All invoices are paid within 45 days. SECOORA draws from ASAP monthly. As a reminder SECOORA pays its monthly operational costs (i.e., payroll, etc.) and then conducts the ASAP draws in the middle of the following month for both the preceding month's operational expenses and the sub-awardee invoices.

5) References

Ahn, S., V. Neary, M. N. Allahdadi, and R. He (2021) Nearshore wave energy resource characterization along the East Coast of the United States, *Renewable Energy*. doi: [10.1016/j.renene.2021.03.037](https://doi.org/10.1016/j.renene.2021.03.037)

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Liu, Y., R. He, Z. Lee (2021) Effects of Ocean Optical Properties and Solar Attenuation on the Northwestern Atlantic Ocean Heat Content and Hurricane Intensity, *Geophysical Research Letters*, in press.

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Appendix A

Python Data Analysis Tools for Oceanographers

Progress and Accomplishments during the reporting period (Dec 1, 2020 - May 31, 2021)

The tasks were divided into:

1. Assist in the development of the IOOS.us Documentation and Demonstration sub pages;
2. Support current and continue developing important software packages to the IOOS enterprise;
3. Ensure software deployment via conda-forge packages and updates.

1) Assist in the development of the IOOS.us Documentation and Demonstration sub pages

We added a `codespell_GitHub` Action in [ioos/ioos-us #235](#) to improve the documentation readability. We also refactor the ERDDAP timeseries explorer to use a modern UI ([reproducible-notebooks/ERDDAP timeseries explorer #15](#), [#16](#), and [#24](#)).

This year IOOS will be participation in the Google Summer of Code, so we created a “first ideas page” [ioos/gsoc #1](#) to track the projects. In the IOOS Data Demo Center we added for a draft for a new SCCOOS HABs notebook ([ioos/notebooks_demos #370](#)) and fixed a few bugs with the environment, build, and publication:

- Fixed link paths [ioos/notebooks_demos #375](#);
- Added pre-commit hooks [ioos/notebooks_demos #377](#);
- Moved tests to GitHub Actions [ioos/notebooks_demos #379](#);
- Build and deploy docs via GitHub Actions [ioos/notebooks_demos #380](#);
- Removed CI indicator from README [ioos/notebooks_demos #381](#);
- Don't run on PRs b/c it will fail to deploy [ioos/notebooks_demos #382](#);
- Update base display [ioos/notebooks_demos #383](#);
- Added `pyworms` to the IOOS env [ioos/notebooks_demos #387](#);
- Removed empty cell [ioos/notebooks_demos #389](#);
- Removed outdated EDS video [ioos/notebooks_demos #396](#);
- Updated environment [ioos/notebooks_demos #397](#);
- Fixed all broken links [ioos/notebooks_demos #399](#).

2) Support current and continue developing important software packages to the IOOS enterprise

This activity can be divided into two three-sections: (a) packages from the IOOS GitHub organization, (b) packages from third party organizations that are important for IOOS, and (c) pangeo/cloud support.

a)

- Modernized the testing framework for `compliance-checker` to run on GitHub Actions ([ioos/compliance-checker #862](#), [#863](#), and [#864](#));
- Improved `erddapy`'s community communication with a Code of Conduct and list of projects that depends or are similar to it ([ioos/erddapy #166](#) and [#177](#)); Modernized the testing framework, fixed failing tests, and added support for latest iris ([ioos/erddapy #167](#), [#170](#), [#171](#),
- Modernized the testing framework for `gliderpy` and the package skeleton ([ioos/gliderpy #39](#), [#40](#), [ioos/ioos-python-package-skeleton #10](#), [#11](#), [#12](#), [#8](#));

b) The work ranged from moving from Travis-CI to GitHub Actions to fixing documentation and packaging on various software. Here is the list of Pull Request with a brief description:

- Documentation:
 - 1) Add BSD-3-License for [jobis/pyworms #3](#);
 - 2) Added DOI for [TEOS-10/GSW-Python #72](#);
 - 3) Update install instructions in [Unidata/netcdf4-python #1100](#);
 - 4) Run codespell on [Unidata/cftime #242](#).
- Testing framework migration:

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- 1) Move *netcdf4* AppVeyor/Travis-CI tests to GitHub Actions ([Unidata/netcdf4-python #1054](#), [#1057](#), and [#1058](#));
 - 2) Move [mwengren/sensor-data-ingest-mqtt-dev #1](#) tests to use *pip* instead of *conda*;
 - 3) Move *cbsyst*, *UTide*, *oceans*, *tardis*, and *branca* to GitHub Actions ([oscarbranson/cbsyst #26](#), [#27](#), [wesleybowman/UTide #93](#), [#94](#), [#95](#), [#97](#), [pyoceans/python-oceans #73](#), [#82](#), [pyoceans/tardis #29](#), and [python-visualization/branca #95](#)).
- Packaging:
 - 1) Create MANIFEST.in for [bambinos/formulae #2](#);
 - 2) Fixed [flosell/trailscraper #162](#) broken tarball;
 - 3) Make [kvos/CoastSat #201](#) a package;
 - 4) Fixed [xgcm/xgcm #288](#) version injection;
 - 5) Fixed tarball version string and publication for *folium* ([python-visualization/folium #1439](#), [#1441](#), and [#1442](#)).
- c) The *xESMF* was abandoned by the original author and the pangeo team took on the maintainer role for it ([pangeo-data/xESMF #63](#)).

3) Ensure software deployment via conda-forge packages and updates

This effort can be separated into (a) infrastructure maintenance, (b) new packages, and (c) packages updates.

- a) Removed bad builds of *openquake.engine*, *basemap*, *ldap4*, and *matplotlib* ([conda-forge/admin-requests #205](#), [#206](#), [#230](#), [#246](#), and [#248](#)); Reset *freexl* token in [conda-forge/admin-requests #243](#);
- b) Added packages: *awscli2*, *jhub-client*, *pyworms*, *formulae*, *dask-cuda*, *pystac-client*, *trailscraper*, *cloup*, *manimpango*, and *plum-py* ([conda-forge/staged-recipes #13794](#), [#14004](#), [#14050](#), [#14193](#), [#14570](#), [#14724](#), [#14939](#), [#14958](#), [#14960](#), and [#15001](#));
- c) The package updates list can be found in the Pull Requests links section at the end of the document.

Budget analysis

All the expenses are service hours, no equipment or materials were bought during this report period. The current balance is:

Total (USD)	77,880.00
Invoice #24	-19,470.00
Invoice #25	-19,470.00
Invoice #26	-19,470.00
Invoice #27	-19,470.00
Remaining balance	0

Pull Requests links

- Revert "Rebuild for geos390" [conda-forge/basemap-feedstock #75](#)
- backport 1565 [conda-forge/cartopy-feedstock #107](#)
- update with grayskull [conda-forge/cdsapi-feedstock #6](#)
- Latest version was merge but the package was not created [conda-forge/colour-science-feedstock #15](#)
- pin qtkeychain 0.12.0 [conda-forge/conda-forge-pinning-feedstock #1028](#)
- add gdal to the osx-arm64 [conda-forge/conda-forge-pinning-feedstock #1190](#)
- add netcdf4 and gsw [conda-forge/conda-forge-pinning-feedstock #1311](#)
- pin libzip [conda-forge/conda-forge-pinning-feedstock #1418](#)

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- add rasterio and fiona [conda-forge/conda-forge-pinning-feedstock #1500](#)
- let's try rust again [conda-forge/cryptography-feedstock #64](#)
- Don't hardcoded gdal version on Windows [conda-forge/fiona-feedstock #175](#)
- fix scm version [conda-forge/folium-feedstock #27](#)
- MNT: Re-rendered with conda-build 3.21.4, conda-smithy 3.9.0, and con... [conda-forge/freexl-feedstock #25](#)
- add output validation [conda-forge/freexl-feedstock #27](#)
- bump [conda-forge/gmprocess-feedstock #52](#)
- add a dev release [conda-forge/holoviews-feedstock #77](#)
- Add py39 wheels [conda-forge/jaxlib-feedstock #45](#)
- zarr support [conda-forge/libnetcdf-feedstock #118](#)
- build latest master [conda-forge/libnetcdf-feedstock #123](#)
- Add dev yaml [conda-forge/libnetcdf-feedstock #124](#)
- S3 support [conda-forge/libnetcdf-feedstock #125](#)
- libnetcdf-c matrix [conda-forge/netcdf4-feedstock #116](#)
- Remove workaround [conda-forge/netcdf4-feedstock #118](#)
- Remove test case with non-ASCII characters b/c it is 2020 and we still cannot have nice things [conda-forge/openquake.engine-feedstock #30](#)
- free numpy upper limit so we can install this [conda-forge/openquake.engine-feedstock #31](#)
- free scipy upper lim [conda-forge/openquake.engine-feedstock #32](#)
- refresh patches [conda-forge/postgresql-feedstock #84](#)
- Rebuild for pypy [conda-forge/pretrainedmodels-feedstock #1](#)
- Dev [conda-forge/pyferret-feedstock #75](#)
- add geos build matrix [conda-forge/pygeos-feedstock #26](#)
- Update recipe [conda-forge/python-ternary-feedstock #15](#)
- Build both projs [conda-forge/rasterio-feedstock #205](#)
- Noarch [conda-forge/segmentation-models-pytorch-feedstock #11](#)
- Remove patch [conda-forge/setuptools-rust-feedstock #11](#)
- Fix deps [conda-forge/splot-feedstock #6](#)
- v2020f [conda-forge/tzdata-feedstock #7](#)
- test new sdk [conda-forge/wxpython-feedstock #71](#)
- fix xarray deps [conda-forge/xesmf-feedstock #12](#)
- fix erddapy dep [conda-forge/argopy-feedstock #5](#)

Appendix B

FACT Data Wrangler Progress Report to ATN

Joy Young

Timeframe: 1 Dec 2020 – 31 May 2021

Communication

- Oral presentation on the FACT/SECOORA database and steering committee charter during the virtual FACT Network meeting on Dec 15.
- Organized a two-day virtual data workshop as part of the winter FACT meeting Dec 16 – 17.
- Participated in the Animal Tracking Network steering group virtual meeting. Chaired ATN subgroup which included leading numerous calls with ATN staff and SG members on developing a 5-year implementation plan.
- Chaired the Ocean Tracking Network International Data Management Committee virtual meeting.
- Participated in numerous conference calls that covered developing a visualization tool for telemetry and FACT Steering Committee business.
- Elected chair of the FACT Steering Committee.
- Participated in SECOORA PI and/or staff calls and gave an interview for a SECOORA web article.
- Submitted two proposals: 1) to NCOOS to support telemetry around Gray's Reef, GA (not awarded) and 2) to Sea Grant to study the movements of Greater Amberjack (outcome pending).
- Worked with OTN and ACT_MATOS staff to move two projects from FACT to ACT_MATOS and one project from OTN to FACT and identify matches amongst nodes.

Data Policy Development and Application

- Along with Axiom staff, **developed a layout to display environmental data from FACT on the SECOORA website.**
- **Led effort to create anti-discrimination language** for the FACT User Policy. The next text will be voted on by the membership after the June 2021 meeting.

Data Acquisition

- **Began the collection of telemetry data from gliders** with attached receivers. One glider project is fully reporting. Working with PIs on two other glider projects to resolve metadata issues.
- **Published environmental data from seven projects** that use receivers with integrated temperature sensors and provided the data to Axiom for ingestion into the SECOORA data portal. The data were collected from 47 sites from North Carolina to the southwest coast of Florida.
- **New collaborator at USF deployed a FACT receiver** on a deep mooring. The receiver was deployed off Tampa Bay, FL in spring 2021 by Dr. Bob Weisberg's Coastal Ocean Monitoring Program.
- Met with Diego Cardinosa (researcher) and Jon Pye (OTN) to discuss FACT membership and data management for a new array project offshore Columbia.
- Cross matching completed between the FACT, ACT_MATOS, OTN, NEP, MIGRAMAR, and SAF nodes completed during each data event. For example, in the last event matches included: 14 FACT array projects to 13 ACT_MATOS tag projects, 26 FACT array projects to 26 OTN tag projects, 6 FACT array projects to 2 Migramar tag projects, 12 ACT_MATOS array projects to 17

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FACT tag projects, 18 OTN array projects to 36 FACT tag projects, and 1 Migramar array project was matched to 1 FACT tag project.

- Uploaded data from one historic project.
- Recruited members from two new organizations.
- Recruited 8 new projects (total number of projects registered is 144).
- **The Database has grown an average of 10% in the past six months.**
- Completed one minor data processing event in February and one major event in April. Between the two events:
 - Processed data from 48 tag and array studies
 - Number of detections increased by 5% (181.9 to 191.0 million detections).
 - Number of deployments increased by 19% (10,005 to 11,889 deployments).
 - Number of tags increased by 6% (6,847 to 7,272 acoustic tags).
- Growth is expected to increase at a similar rate as more new and historic projects and organizations are added.

Quality Assurance Quality Control

- Created a Jupyter notebook to standardize outputs for temperature sensor related deployments for ingestion into the SECOORA data portal. .
- Worked with OTN staff to create a tool in Jupyter notebooks to identify false detections and detections after a suspected mortality or tag shed.
- Resolved multiple issues regarding submitted data with incorrect information. Identified missing detection files from five projects.
- Resolved multiple issues within the node including the failure of detections to load into final tables when the dates of detections fell between previously loaded detections and the non-standard receiver format produced by upgraded receiver manufacturer software.

Other

Summary plots

Appendix B

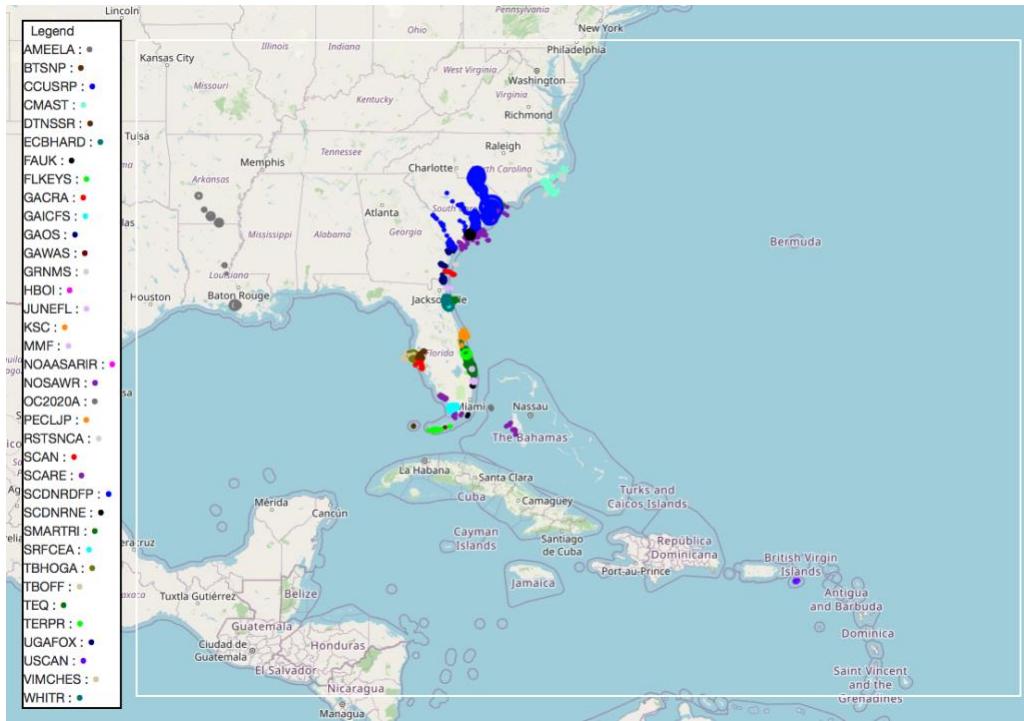


Figure 1. Map of active receivers (i.e., receivers that were downloaded in 2020 or 2021) in the FACT Network.

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Figure 2. Number of detections of animals detected within the FACT Network (>43 species) in 2020 and 2021. Common names are provided. 'no_value' means the primary network of the tagged animal (e.g. OTN tag project) does not share species information and represents multiple species.

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Number of Detections by Detection Array



Figure 3. Number of detections by arrays in the FACT Network (n=31) in 2020 and 2021.

Appendix B

Summary of Georgia Coastal Array Project Progress Report to SECOORA

Overview

Ga DNR-Coastal Resources Division partnered with the Animal Tracking Network (ATN) through (SECOORA) to maintain a Coastal Receiver Array (CRA) comprised of 24 autonomous acoustic receivers in Georgia's nearshore and offshore waters along St. Simons Island. This network 'listens' 24-hours-a-day, 7-days-a-week for the presence of marine species fitted with uniquely coded Vemco acoustic transmitters. Receivers record the presence of acoustically tagged animals that pass within ~300 meters of the receiver.

Progress Update December 1, 2020 – June 1, 2021

Due to poor weather and vessel availability, spring field operations to service and download the seafloor mounted receivers (Figure 1) have been pushed to June. Dive crew, science staff, and vessel crew are prepared to commence diver operations once a weather window allows.

Field operations to service and download nearshore receivers (8) placed on ATONs (Figure 1) in the St. Simons shipping channel were conducted in April. Maintenance of the nearshore array requires a minimum of 3 people onboard to retrieve, service, and download each receiver while safely maintaining vessel position alongside each ATON (Figure 2). This operation resulted in the successful recovery, download, and service of 5 of the 8 receivers. Two receivers were lost during winter storms. One of these moorings drifted south and washed ashore in Palm Coast, FL where it was recovered by a resident. We were able to recover the receiver and mooring. Both were in good shape and able to be reused. The two other missing moorings have not been recovered and are considered lost. All three moorings (1 recovered and 2 replacements) will be redeployed during the next service cycle. Loss of receivers attached to ATONs is to be expected as these receivers are placed in a highly volatile area that experiences powerful tidal flows, high traffic, and strong wave action during storms. Mooring equipment used to attach receivers to the ATONs are replaced as needed to minimize receiver loss.

For the 5 downloaded receivers, a total of 3,056 detections were recorded from 140 unique animals (Table 1). These detections will be uploaded to the FACT data node where tag IDs will be matched and sent to the proper owners. Any unknown IDs will continue to be checked and cross matched as researchers update the regional tag database. During this period, data sharing continued to occur. Tag and receiver information was updated, matched, and data were shared through the FACT data node. The FACT node continues to be an essential tool facilitating the matching and sharing of telemetry data throughout the Southeast region. Further development and increased use of the node by other researchers is imperative to improve the quality of telemetry studies.

The maintenance and service of project equipment continued during this update period. Mooring equipment was repaired, updated, and replaced. Continued repairs and maintenance on project small vessels were conducted and are reflected in the budget. These charges are split between all projects that utilized vessels. Additionally, project receivers were assessed and 11 of the oldest units were chosen to be sent back to Vemco for evaluation and refurbishment. These receivers are currently being inspected by Vemco and will be either refurbished or replaced.

Table 1. Summary of data collected from the nearshore, ATON-receivers.

Station	Receiver	Total Detections	Unique Transmitters
SSE03	123714	1,038	48
SSE07	123712	627	34
SSE09	131150	735	24
SSE11	131148	586	27
SSE13	100095	70	7
Total		3,056	140

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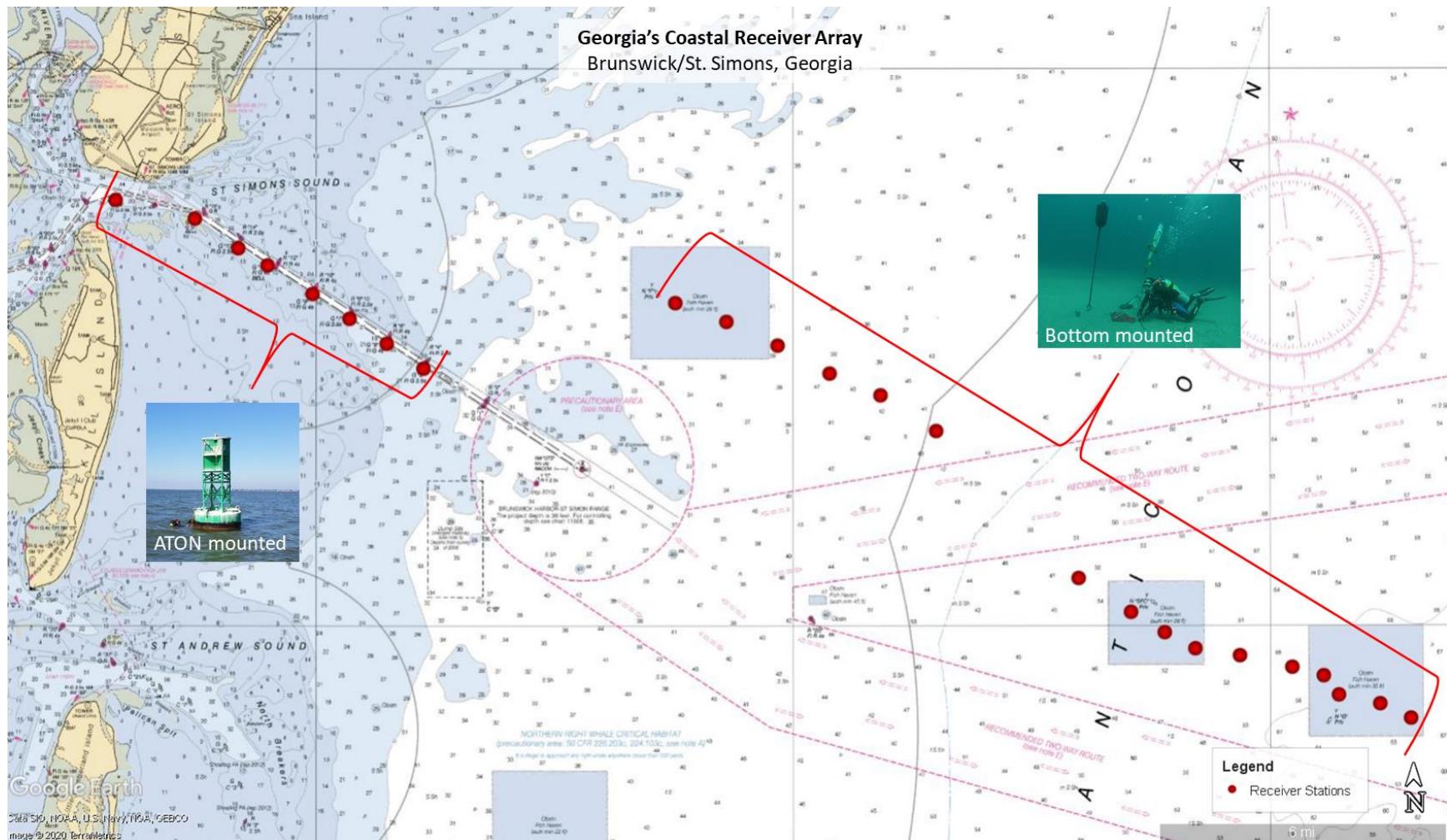


Figure 1. Georgia's CRA, offshore of St. Simons Island Georgia, consists of 8 nearshore receivers and 16 offshore receivers and ranges from 0-24 miles. Shaded boxes represent artificial reefs.

Appendix B



Figure 2. A. VR2W attached to mooring cable; B. Receiver moorings prior to deployment; C. Receiver retrieval.